ECONOMICS OF CLIMATE CHANGE IN LATIN AMERICA AND THE CARIBBEAN

A GRAPHIC VIEW

Alicia Bárcena, Joseluis Samaniego, Luis Miguel Galindo, Jimy Ferrer, José Eduardo Alatorre, Pauline Stockins, Orlando Reyes, Luis Sánchez, Jessica Mostacedo

UNITED NATIONS
ECLAC
70 ECLAC FOR SUSTAINABLE DEVELOPMENT WITH EQUALITY
EUROCLIMA
EUROPEAN UNION
german cooperation
DEUTSCHE ZUSAMMENARBEIT
GOBIERNO DE ESPAÑA
MINISTERIO DE AGRICULTURA Y PESCA, ALIMENTACIÓN Y MEDIO AMBIENTE
MINISTERIO DE ASUNTOS EXTERIORES Y DE COOPERACIÓN

ECONOMICS OF CLIMATE CHANGE IN LATIN AMERICA AND THE CARIBBEAN

A GRAPHIC VIEW

Alicia Bárcena, Joseluis Samaniego, Luis Miguel Galindo, Jimy Ferrer, José Eduardo Alatorre, Pauline Stockins, Orlando Reyes, Luis Sánchez, Jessica Mostacedo

UNITED NATIONS
ECLAC
70 ECLAC FOR SUSTAINABLE DEVELOPMENT WITH EQUALITY
EUROCLIMA
EUROPEAN UNION
german cooperation
DEUTSCHE ZUSAMMENARBEIT
GOBIERNO DE ESPAÑA
MINISTERIO DE AGRICULTURA Y PESCA, ALIMENTACIÓN Y MEDIO AMBIENTE
MINISTERIO DE ASUNTOS EXTERIORES Y DE COOPERACIÓN

Alicia Bárcena
Executive Secretary

Mario Cimoli
Deputy Executive Secretary

Joseluis Samaniego
Chief, Sustainable Development and Human Settlements Division

Ricardo Pérez
Chief, Publications and Web Services Division

This study has been prepared as part of the EUROCLIMA programme, which is funded by the European Commission. The work was coordinated by Alicia Bárcena, Executive Secretary of the Economic Commission for Latin America and the Caribbean (ECLAC), Joseluis Samaniego, Chief of the Sustainable Development and Human Settlements Division of ECLAC, and Luis Miguel Galindo, Chief of the Climate Change Unit of that same division. José Eduardo Alatorre, Jimy Ferrer Carbonell, Jessica Mostacedo, Orlando Reyes, Luis Sánchez and Pauline Stockins also assisted in its preparation. Special contributions from Carlos de Miguel, Chief of the Policies for Sustainable Development Unit, and José Javier Gómez, Environmental Affairs Officer, are gratefully acknowledged.

The cooperation and contributions of the German Agency for International Cooperation (GIZ) of the Federal Ministry for Economic Cooperation and Development of Germany and of the Spanish Office for Climate Change of the Ministry of Agriculture and Fisheries, Foodstuffs and Environment and the Ministry of Foreign Affairs and Cooperation of Spain, which provided support for the research that served as the basis for this document, are gratefully acknowledged.

This document is the translation of an original which did not undergo formal editorial review.

United Nations publication
LC/TS.2017/84/Rev.1
Distribution: L

Printed at United Nations, Santiago
S.18-00475

Climate change is the planet-wide variation in the Earth's climate being brought about by natural and especially man-made causes. This is a consequence of the increasing retention of the Sun's heat in the atmosphere known as the "greenhouse effect".

Curbing this effect and thereby conserving a global public good such as the Earth's climate is one of the great challenges of the twenty-first century. Achieving this goal will involve addressing both its global causes and consequences and its varied, asymmetrical regional impacts on different countries and socioeconomic groups.

CONTENTS

"You'll feel it even more when we get to Comala. That town sits on the embers of the earth, at the very mouth of hell. They say that when people from there die and go to hell, they come back for a blanket".

Juan Rulfo, *Pedro Páramo*, p. 8.

FOREWORD

Climate change is one of the greatest challenges of the twenty-first century given its global causes and consequences and the scale of the coordinated efforts that will be needed to alleviate its negative impacts, adapt to new climate conditions and mitigate greenhouse gas emissions.

In order to meet the challenge of preserving a global public goods such as the Earth's climate, thorough-going structural changes will have to be made in order to transition from the current style of development to a more sustainable one. In order to make this transition, an overarching international agreement —one that is fair and inclusive and that acknowledges common but differentiated responsibilities— will be needed in order to make this transition possible.

At the international level, significant inroads have been made in coping with the challenges posed by climate change and sustainable development. These advances include the United Nations General Assembly's adoption of the Sustainable Development Goals in 2015, which together constitute a universal agenda for simultaneous action to achieve defined economic, social and environmental targets by the year 2030 and, in particular, Goal 13 on climate change; the Paris Agreement forged at the Conference of the Parties to the United Nations Framework Convention on Climate Change held in 2015, which sets forth specific national goals for mitigation and adaptation for the period 2020-2030; and the New Urban Agenda, which focuses on attaining qualitative improvements in urban development that will be of immense importance for the region.

The next step is to put these international agreements into practice by developing and implementing public policies that are specifically aimed at achieving a form of sustainable development capable of coping with the challenges posed by climate change.

In view of the limitations and paradoxes of the current style of development, the Economic Commission for Latin America and the Caribbean (ECLAC) is advocating a major environmental push towards transforming the current development paradigm. This effort should focus on helping to bring about far-reaching structural changes that will make it possible to plot out an increasingly low-carbon, more equal and more socially inclusive economic growth path. Designing and applying these public policies for the twenty-first century —policies that will embrace economic, social and environmental development at one and the same time within the framework of the global economy— is one of the region's greatest challenges, but it is also one of its greatest opportunities for achieving sustainable development.

The conclusion of just, inclusive international agreements based on the principle of multilateralism is the only lasting way to preserve global public goods such as the Earth's climate and of attaining global objectives such as the eradication of poverty. In order to shape such agreements, it will be necessary to continue to devise means of bringing about a convergence of regional and inter-country interests in which international cooperation is a fundamental pillar. Along these lines, the Latin American and Caribbean region and Europe have been forming increasingly strong ties through their participation in joint projects aimed at compiling information, fostering debate and establishing forums for discussion. These projects are based on an increasingly flexible and programmatic form of international cooperation that embraces the diversity of interests of the countries of the region.

This study is the result of a range of different research efforts conducted over a number of years with the financial support of the European Commission and its EUROCLIMA programme, the Spanish Office for Climate Change of the Ministry of Agriculture and Fisheries, Foodstuffs and Environment of Spain and the German Agency for International Cooperation (GIZ) of the Federal Ministry for Economic Cooperation and Development of Germany. Its aim is to present these research findings in an accessible, concise format that will contribute to the development of these public policies for the twenty-first century in Latin America and the Caribbean within the context of the global economy. It also seeks to heighten awareness of the importance of continuing to build bridges of understanding between different regions that can be used to move forward on the economic, social and environmental fronts at one and the same time.

Alicia Bárcena
Executive Secretary
Economic Commission for Latin America
and the Caribbean (ECLAC)

Christiane Bögemann-Hagedorn
Deputy Director-General for Latin America
of the Federal Ministry for Economic
Cooperation and Development
of the Government of Germany

Jolita Butkeviciene
Director of Development Coordination for Latin America
and the Caribbean of the Directorate-General for
International Cooperation and Development
of the European Commission

Fernando García Casas
Secretary of State for International Cooperation
and for Ibero-America and the Caribbean
of the Government of Spain

INTRODUCTION

The signs of climate change take many different forms: an increase in average global temperatures, rising sea levels, a shrinking cryosphere and alterations in precipitation and extreme weather event patterns.[1] The available scientific data attest to the influence that various types of human activity are having in terms of changes in the climate —changes that have significant implications for economic activity, social well-being and the environment.[2]

Viewed from an economic standpoint, climate change can be understood as being the consequence of a global negative externality that is consubstantial with the current style of development and that puts a global public good (the climate) at risk. Economic activity as a whole leads to the release of greenhouse gases into the atmosphere, but the parties responsible for those emissions are not called upon to bear any economic cost for them whatsoever. This has led to the global warming being witnessed today and, in turn, to the establishment of the United Nations Framework Convention on Climate Change (UNFCCC) as a means of coordinating an international response.

Production, energy consumption and land use patterns will all have to be modified in order to deal with climate change, and adaptive measures will have to be introduced in order to mitigate its most harmful effects. Such measures can only be devised and implemented if coherent policies are in place in all spheres of public affairs that will be effective in bringing about the huge transformations that will be needed in order to withstand the negative impacts of climate change on economic activities, ecosystems and the well-being of society. An effort has to be made to adapt to new climatic conditions and to shift towards production processes that will generate a much smaller volume of greenhouse gases while, at the same time, giving rise to higher levels of development. This will entail a structural transformation of today's development style and a transition to a more sustainable form of development that will preserve existing economic, social and environmental assets for future generations. These changes will also provide an opportunity to make better investments that will, in turn, galvanize the economy.

Climate change embodies and heightens the challenges associated with an unsustainable development style, as is demonstrated by the existence of a complex matrix of negative externalities that are undermining the foundations of today's economies and their growth. Changing this development style is the policy-based expression of a new social consensus and a deliberate shift towards developmental sustainability.

[1] See Intergovernmental Panel on Climate Change (IPCC), "Summary for Policymakers", *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, T.F. Stocker and others (eds.), Cambridge, Cambridge University Press, 2013.

[2] See N. Stern, *The Economics of Climate Change: The Stern Review*, Cambridge, Cambridge University Press, 2007.

At the international level, inroads are being made in this direction in all areas. The adoption of the Sustainable Development Goals in 2015 by the United Nations General Assembly gave voice to the countries' agreement to embrace a universal agenda of economic, social and environmental goals for the year 2030. The thirteenth of these goals calls upon the countries to "take urgent action to combat climate change and its impacts". The Paris Agreement, signed at the twenty-first session of the Conference of the Parties to the United Nations Framework Convention on Climate Change, sets out targets for mitigation and adaptation and the nationally determined contributions (NDCs) of the countries to achieving the stabilization of CO2 emissions, holding the rise in global temperatures to below 2°C and devising appropriate adaptations to new climatic conditions. In October 2016, the United Nations Conference on Housing and Sustainable Urban Development (Habitat III) framed the New Urban Agenda for improving the quality of human settlements. The Third International Conference on Financing for Development, held in Addis Ababa, provided a new opportunity for addressing implementation issues. Taken together, all these accords provide an overarching framework for building and implementing a transformative agenda at the international level. In order for this (and the NDCs) to become a reality, public policies and global and national pacts need to be framed and put into practice. Those policies and agreements must give expression to a determined, active commitment to sustainable development and must therefore necessarily address the potential economic, social and environmental implications of climate change. In order to do so, the specific manifestations of climate change in the region will have to be identified with an appropriate degree of specificity. These phenomena include the following:

(i) A temporal mismatch: Climate change is a long-term phenomenon whose effects will be more apparent during the second half of the twenty-first century, yet steps to address this phenomenon must be taken immediately. Global carbon dioxide (CO2) emissions currently stand at around 6 metric tons per year per capita. Stabilizing the climate at an increase of no more than 2°C of global temperatures by 2050 will require a reduction in these emissions to 2 metric tons annually of CO2 equivalent per capita. The infrastructure being built today, which will probably still be in use in 2050, should therefore be compatible with a low CO2 emissions growth pathway that will make it possible to bring about this reduction from 6 tons to 2 tons of CO2 equivalent per capita. Otherwise, the world may find itself trapped in a high greenhouse gas style of development that will boost global temperatures to levels above those that have been agreed upon in the interests of climate security.

(ii) An asymmetrical situation: The Latin American and Caribbean region accounts for less than 10% of global emissions and yet is extremely vulnerable to the impacts of climate change. In addition, the composition of the region's greenhouse gas emissions is different from the worldwide pattern. Emissions associated with changes in land use still account for a sizeable portion of the region's greenhouse gas emissions, although they are gradually declining, and the region has a cleaner energy matrix, although its overall emissions are climbing owing to its rising income levels and the increase in energy consumption occasioned by an expanding transport network, particularly in urban areas.

(iii) A dual inequity: The highest-income groups in Latin America and the Caribbean are responsible for the lion's share of emissions. Lower-income groups account for a smaller proportion of CO2 emissions but are more vulnerable to its impacts, as they are located in geographic areas that are more exposed to extreme weather events and have fewer resources to draw upon in order to adapt to new climatic conditions.

(iv) Unsustainable consumption patterns in today's modern economies, including those of Latin America and the Caribbean: Rising income levels in Latin America and the Caribbean in recent years, which have been bolstered by the boom in exports of renewable and non-renewable resources, have lifted large sectors of the population out of poverty and have improved their economic and social living conditions. This has given rise to new groups of consumers whose behaviour can be described by what is known as Engel's law, which states that, as income rises, the proportion of income spent on food declines, thereby creating new consumption opportunities. Along with this trend, an increase is being seen in the proportion of income spent on fuel for transport and other goods that are gradually being privatized, such as education and health services. This transition from public to private services in such areas as transportation, health, education, security and public spaces appears to reflect some level of dissatisfaction with public services and gives rise to a somewhat more socially segmented development style that hinders the attainment of climate-related goals. In order to transition to a sustainable form of development, Latin America and the Caribbean should build a radically improved public service network in the areas of transport and mobility, health, education and security that meets today's requirements in terms of quality, efficiency and the inclusion of emerging social classes in the region.

(v) A shift in the focus of response efforts away from the inescapable adaptive measures and towards the promotion of sustainable development based on resilient, low-carbon investment: Current projections for greenhouse gas emissions suggest that a 2°C rise in temperature is virtually inevitable, and it is therefore essential to put in place adaptive measures that will save human lives and prevent costly and irreversible material losses. Adaptation will entail, for example, putting a stop to deforestation, preserving biodiversity, configuring universal social protection systems and building more inclusive societies. This, in turn, will require bold steps in order to take advantage of the opportunities offered by a low-carbon form of development, as illustrated by the increasing penetration of renewable energy in the electricity grid of a number of countries, the use of urban land and land-use policies to drive innovation in mobility, waste recycling, the use of information technologies, the generation and storage of energy and the potential for managing rural activities on the basis of production technologies that reverse the degradation of the rural environment while at the same time boosting productivity.

The primary aim of this publication is to provide a concise, graphic presentation of the basic assumptions and statistical data relating to the economics of climate change in Latin America and the Caribbean. This presentation of a set of stylized facts is intended to serve as a tool for improving the design, instrumentation and evaluation of public policies for the twenty-first century that are focused on transforming the current style of development and transitioning into a more sustainable one. In addition to the preceding preface and this introduction, this study will explore nine theses regarding climate change in Latin America and the Caribbean along with seven of the challenges that it poses.

GREENHOUSE GAS EQUIVALENTS

(Percentages)

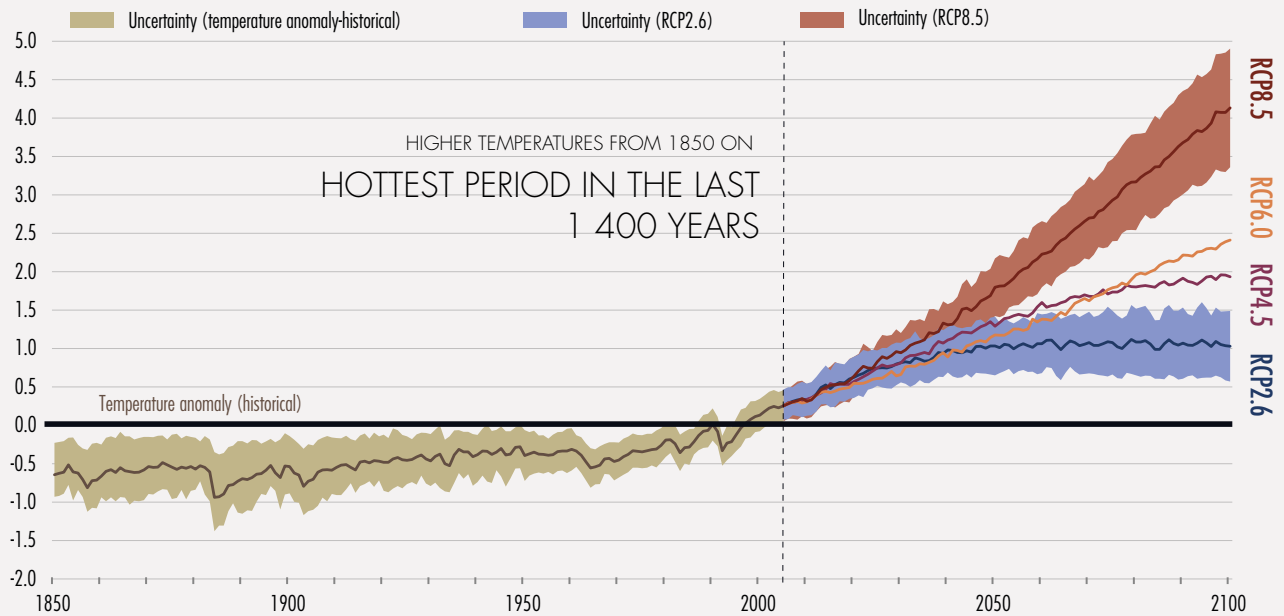
9 THESES
ABOUT CLIMATE CHANGE AND SUSTAINABLE DEVELOPMENT IN LATIN AMERICA AND THE CARIBBEAN

THESIS 1: CLIMATE CHANGE IS TAKING PLACE RIGHT NOW AND WILL INTENSIFY IN THE FUTURE. IT HAS GLOBAL ECONOMIC, SOCIAL AND ENVIRONMENTAL CAUSES AND IMPLICATIONS

MANIFESTATIONS

- INCREASES IN ATMOSPHERIC AND OCEAN TEMPERATURES
- CHANGES IN PRECIPITATION PATTERNS
- REDUCTIONS IN THE VOLUMES OF ICE AND SNOW
- RISING SEA LEVELS
- CHANGES IN EXTREME WEATHER EVENT PATTERNS

IND T.1.1 World: annual surface temperature anomaly relative to the averages for 1986-2005, 1850-2100 *(Degrees Celsius)*



In response to global warming, in 1992 the United Nations Framework Convention on Climate Change (UNFCCC) was established in an effort to limit the anomaly to 2°C or 1.5°C as of 2050 in order to stave off a significant reduction in the Earth's adaptive capacity.

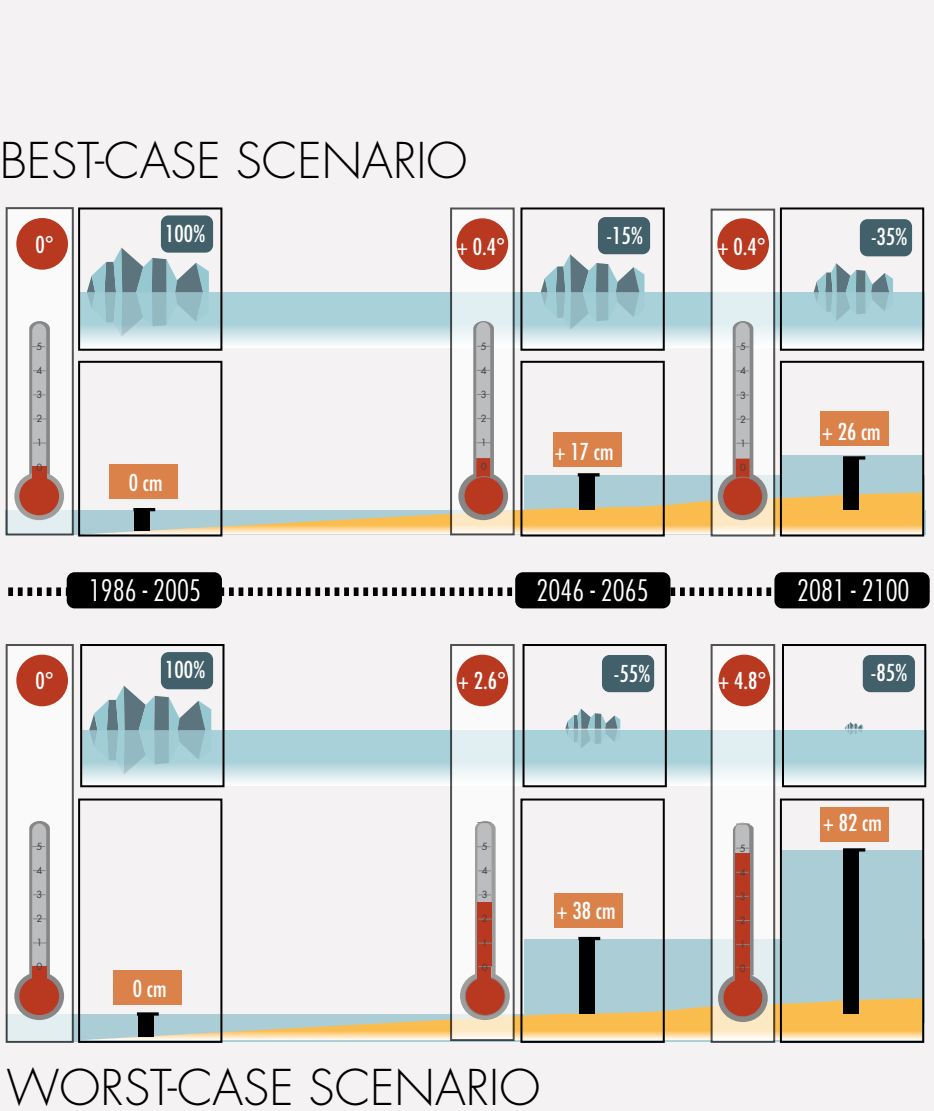
IND T.1.2 Projection of change in the mean global near-surface air temperature, reduction in the global volume of glaciers and projection of the average global rise in sea level by mid-century and by the end of the twenty-first century relative to 1986-2005
(Degrees Celsius, percentages and centimetres)

Projection of change in low- and high-end scenarios relative to 1986-2005

Average global near-surface air temperature

Reduction in global glacier volume

Projection of the average global rise in sea level



In the worst-case scenario, it is estimated that the global glacier volume could shrink by up to 85% by 2100.

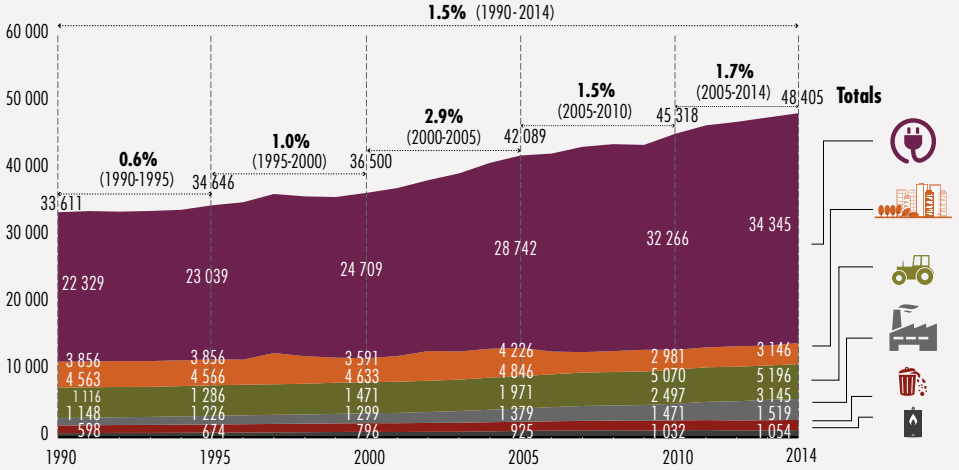
THESIS 2: CLIMATE CHANGE, WHICH HAS BEEN BROUGHT ON BY A GLOBAL NEGATIVE EXTERNALITY, IS CONSUBSTANTIAL WITH TODAY'S DEVELOPMENT STYLE

NEGATIVE EXTERNALITY

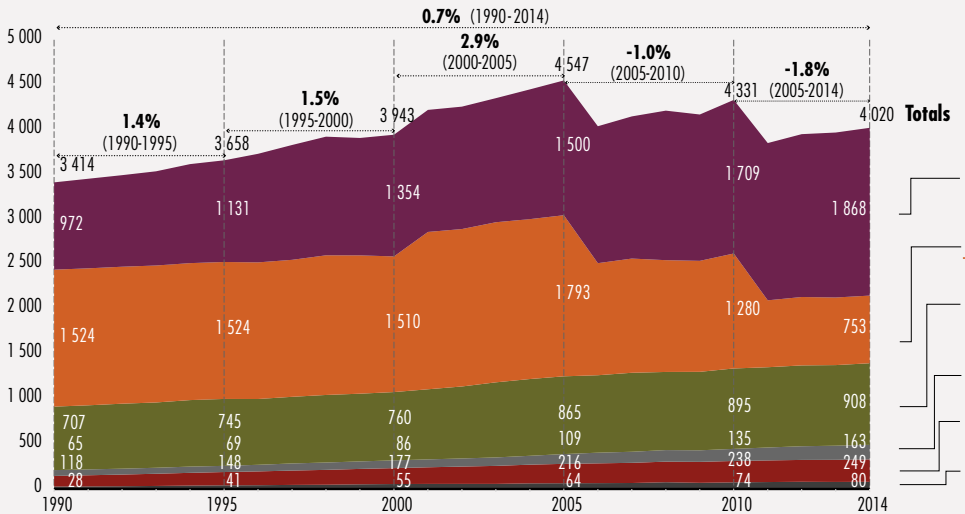
The sum total of economic activities that release greenhouse gases into the atmosphere and are not subject to any limit whatsoever (costs or penalties) are bringing about climate change.

Fossil fuels have been a strong driver of development, but their use is altering the Earth's climate. A change in the course of development is needed.

IND T.2.1 World: total emissions and emissions by greenhouse gas (GHG) sector, 1990-2014
(Megatons of CO_2 equivalent ($MtCO_2eq$) and percentages)

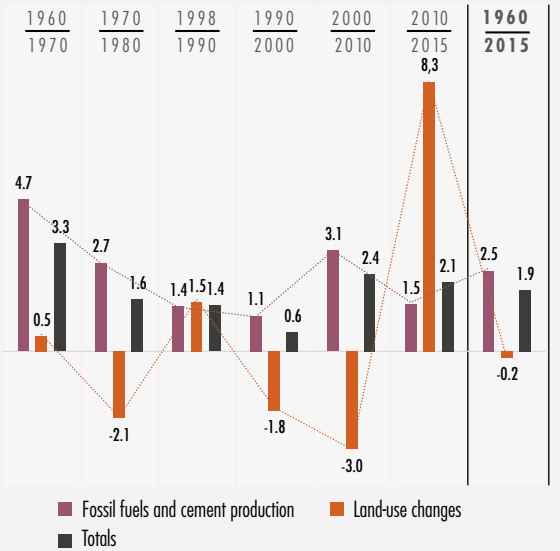


IND T.2.2 Latin America: total emissions and emissions by greenhouse gas (GHG) sector, 1990-2014
(Megatons of CO_2 equivalent ($MtCO_2eq$) and percentages)



IND T.2.3

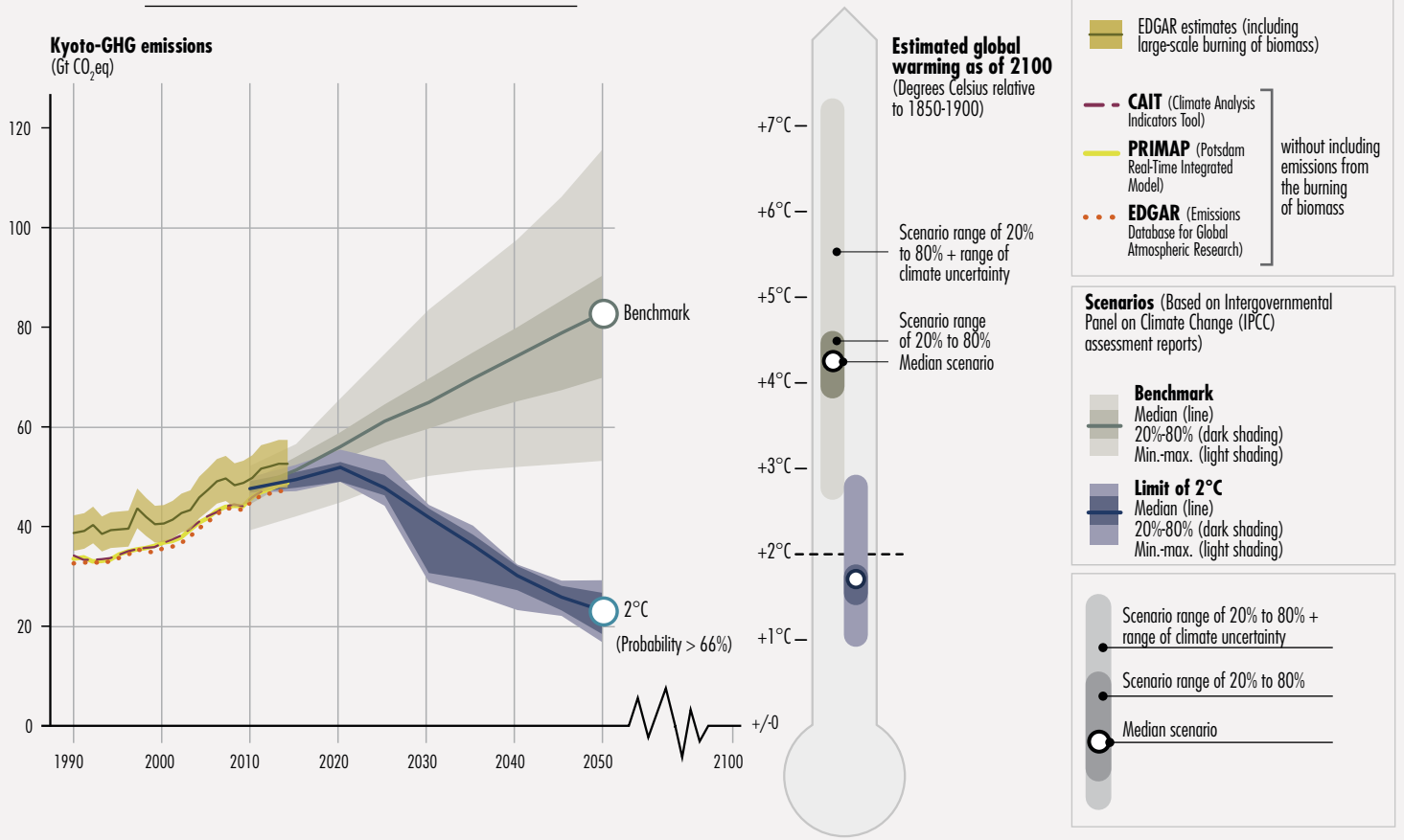
World: rate of increase in CO_2 emissions, 1960-2015
(Percentages)



THESIS 3: CLIMATE CHANGE INVOLVES A TEMPORAL MISMATCH

The current trend in levels of emissions suggests that symptoms of climate change during this century are virtually inevitable.

IND T.3.1 World: historical GHG emissions, 1990-2014, and projections to 2050 *(Gigatons of CO_2 equivalent ($GtCO_2eq$) and degrees Celsius)*



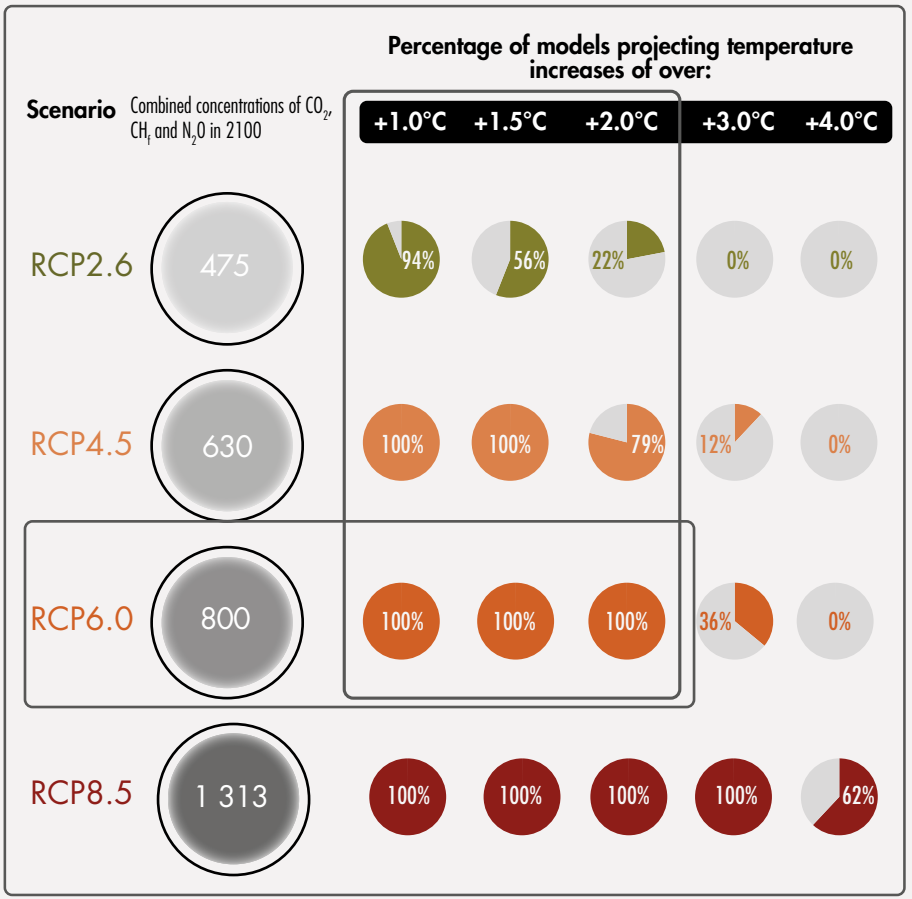
Taking action today (this generation mounts the effort) and future benefits.

IND T.3.2

Climate models for the different scenarios, with projections of the rise in average annual temperatures for 2081-2100 relative to 1850-1900
(Percentages)

CO_2 concentrations in the atmosphere are the main cause of global warming.

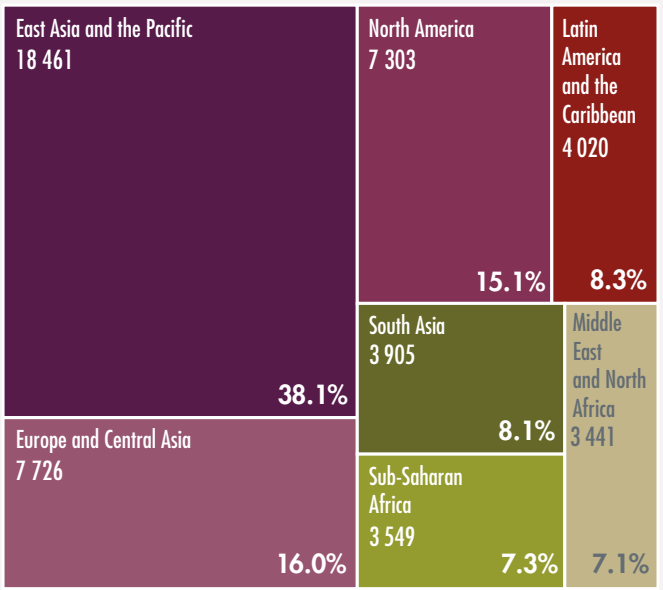
100% of climate models project a temperature increase of over 2°C under scenarios that involve CO_2eq concentrations of 800ppm.



THESIS 4: CLIMATE CHANGE IS A GLOBAL BUT HETEROGENEOUS AND ASYMMETRIC PHENOMENON THAT ENTAILS A DUAL INEQUITY

The Latin American and Caribbean region accounts for less than 10% of total global emissions of greenhouse gases yet is particularly vulnerable to the negative impacts of climate change.

A person in a rich country accounts for 38 times as much CO_2 emissions than a person living in a poor country does.

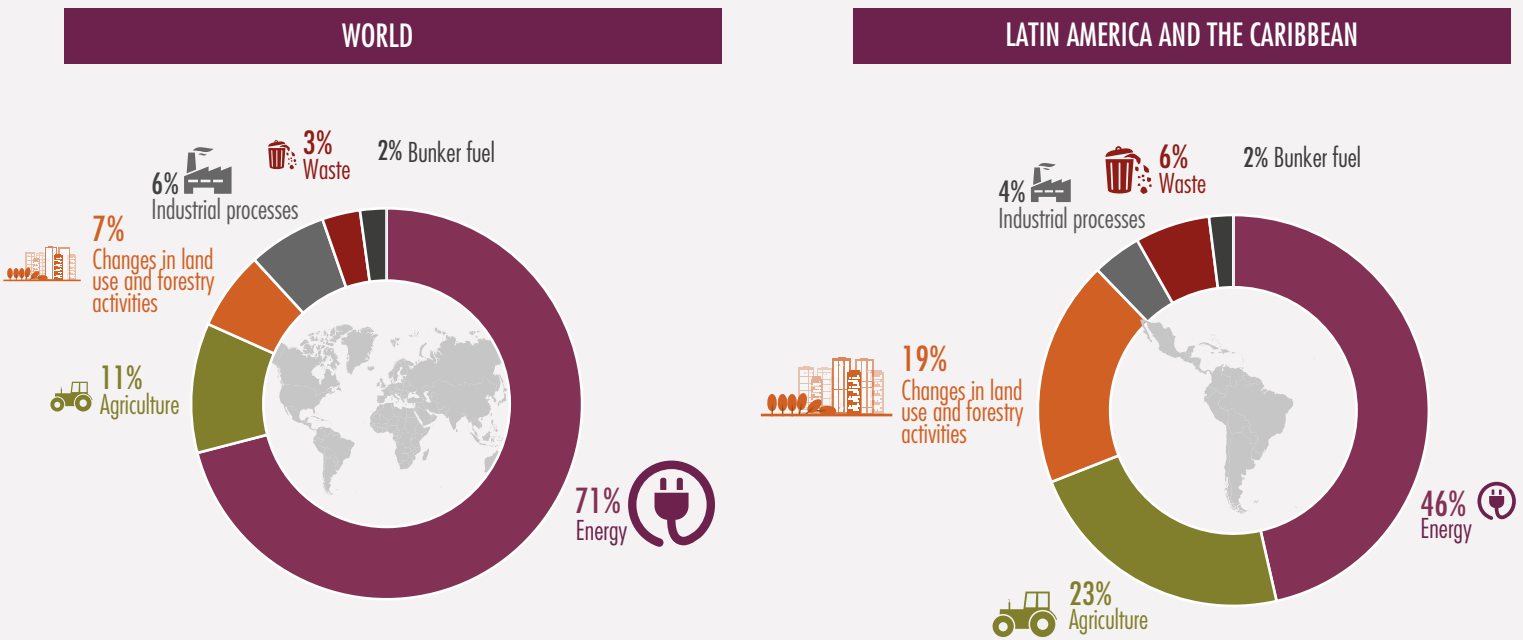


Latin America's per capita CO_2 emissions level is close to the global average and represents about **1/3 of the average per capita emissions level of Europe or the United States.**

IND T.4.1 World regions: share of world GHG emissions, 2014
(Megatons of CO_2 equivalent ($MtCO_2eq$) and percentages)

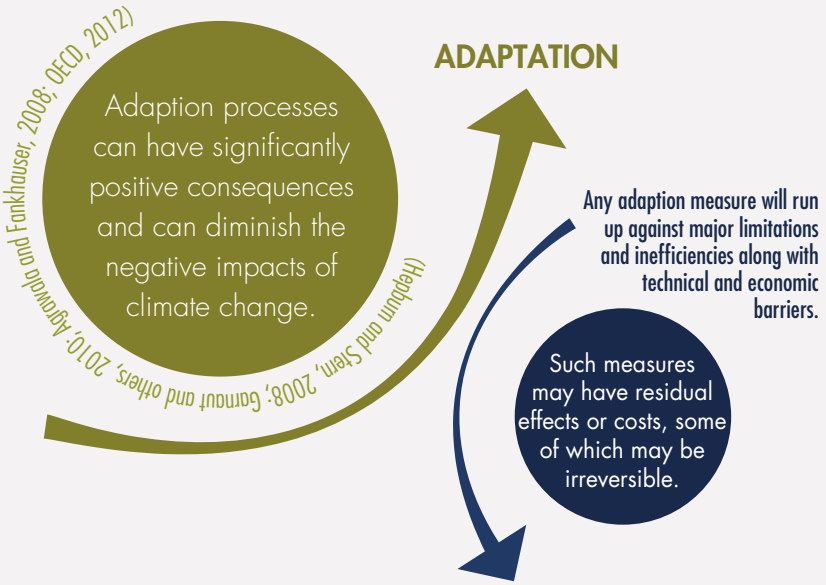
In Latin America and the Caribbean, transport is the fastest-growing source of energy demand.

The structure of emission sources in Latin America and the Caribbean is cleaner than the global average but includes a larger portion of emissions from changes in land use.



IND T.4.2 World and Latin America and the Caribbean: structure of GHG emission sources, 2014
(Percentages)

THESIS 5: ADAPTATION TO CLIMATE CHANGE: FROM INEVITABILITY TO SUSTAINABILITY

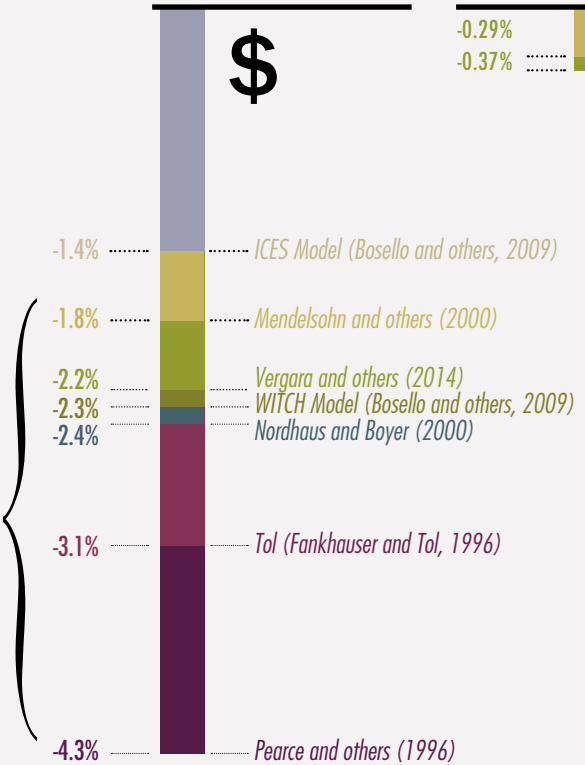


EFFICIENT ADAPTATIONS yield considerable benefits because they cost less than the expected impacts of climate change and can spur economic activity.

Adaptation processes = Any adjustment that is deliberately made in response to actual or expected changes in climatic conditions.
(Agrawala and Fankhauser, 2008; IPCC, 2007).

IND T.5.1

Latin America and the Caribbean: economic impacts of climate change in the event of a 2.5°C rise in temperature, second half of the twenty-first century
(Percentages of regional GDP)



IND T.5.2

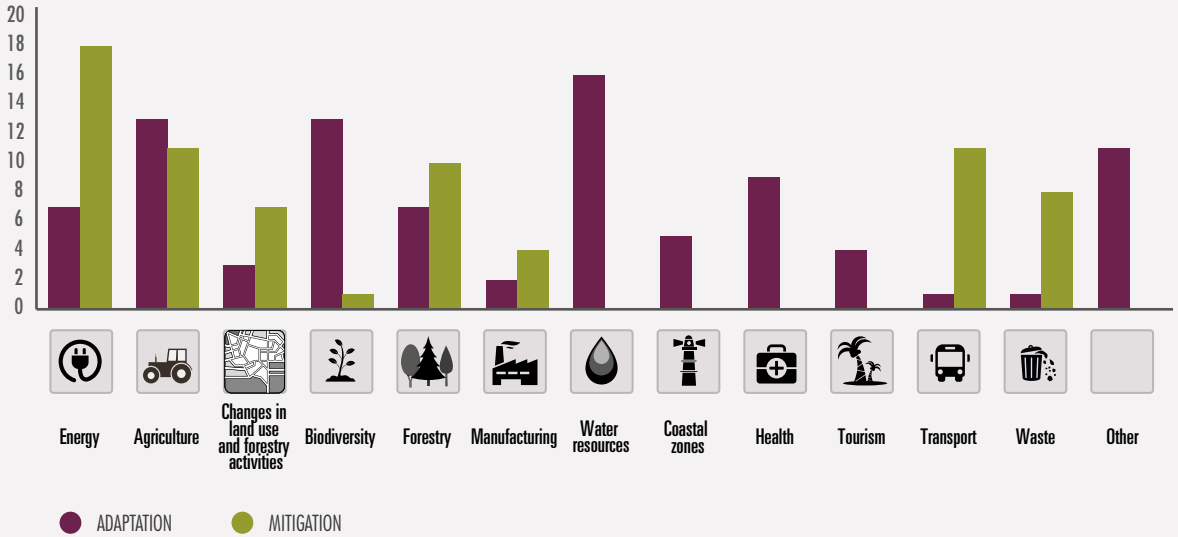
Latin America and the Caribbean: annual adaptation costs up to 2050
(Percentages of regional GDP)

Adaptation lowers risk levels, benefits the most vulnerable sectors of the population and is a driver of development.

The Latin American and Caribbean region's sustainable development strategies must incorporate timely, efficient adaptation processes that are not dependent on the existence of a global accord.

IND T.5.3

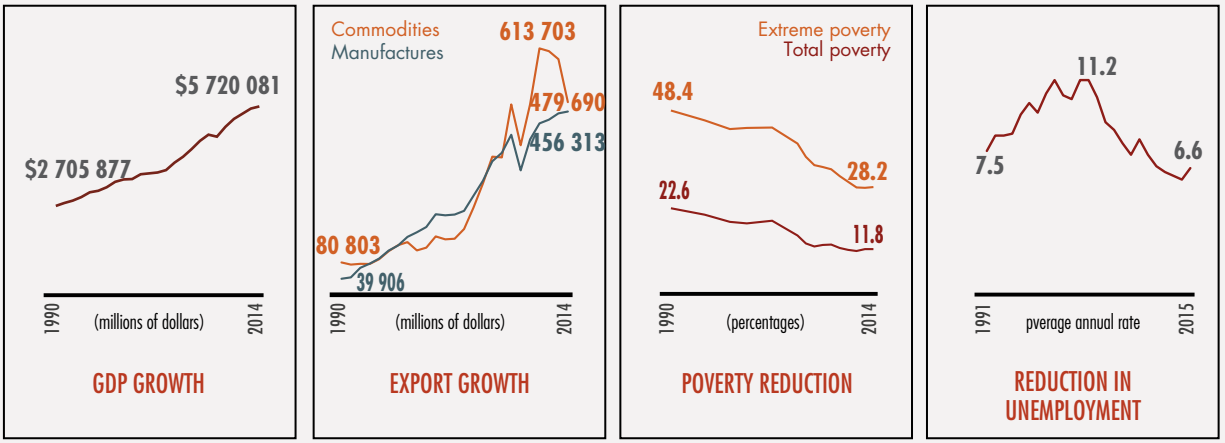
Latin America and the Caribbean: high-priority sectors for mitigation and adaptation, June 2016
(Number of countries that name the following sector in their national climate change plans and/or communications)



THESIS 6: THE UNSUSTAINABILITY OF LATIN AMERICA'S CURRENT DEVELOPMENT STYLE IS REFLECTED IN ITS CONSUMPTION PATTERNS, WHICH HAVE A DIRECT INFLUENCE IN TERMS OF CLIMATE CHANGE

The recent stagnation of its economy notwithstanding, the Latin American and Caribbean region has exhibited a great deal of economic dynamism over the last two decades thanks to the boom in exports of renewable and non-renewable resources.

IND T.6.1
Latin America and the Caribbean: context indicators



This robust economic growth entails risks and significant paradoxes, such as the generation of a complex matrix of negative externalities that may be weakening and eroding the foundations of the development model.

NEW CONSUMPTION OPPORTUNITIES/UNSUSTAINABLE CONSUMPTION PATTERNS/NEGATIVE EXTERNALITIES

UNSUSTAINABLE USE OF RENEWABLE AND NON-RENEWABLE NATURAL RESOURCES

VEHICULAR TRAFFIC AND ROAD ACCIDENTS

GREENHOUSE GAS EMISSIONS

AIR POLLUTION

ENVIRONMENTAL DEGRADATION

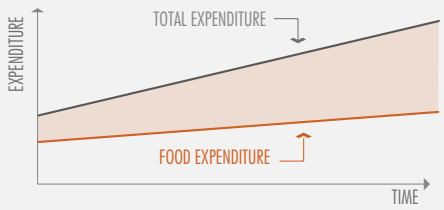
WASTE GENERATION

The flight from public services (mobility, health, education, security, public spaces) and an increasing preference for private services provide a signpost for gauging the extent of the investment needed to improve public-service production patterns.

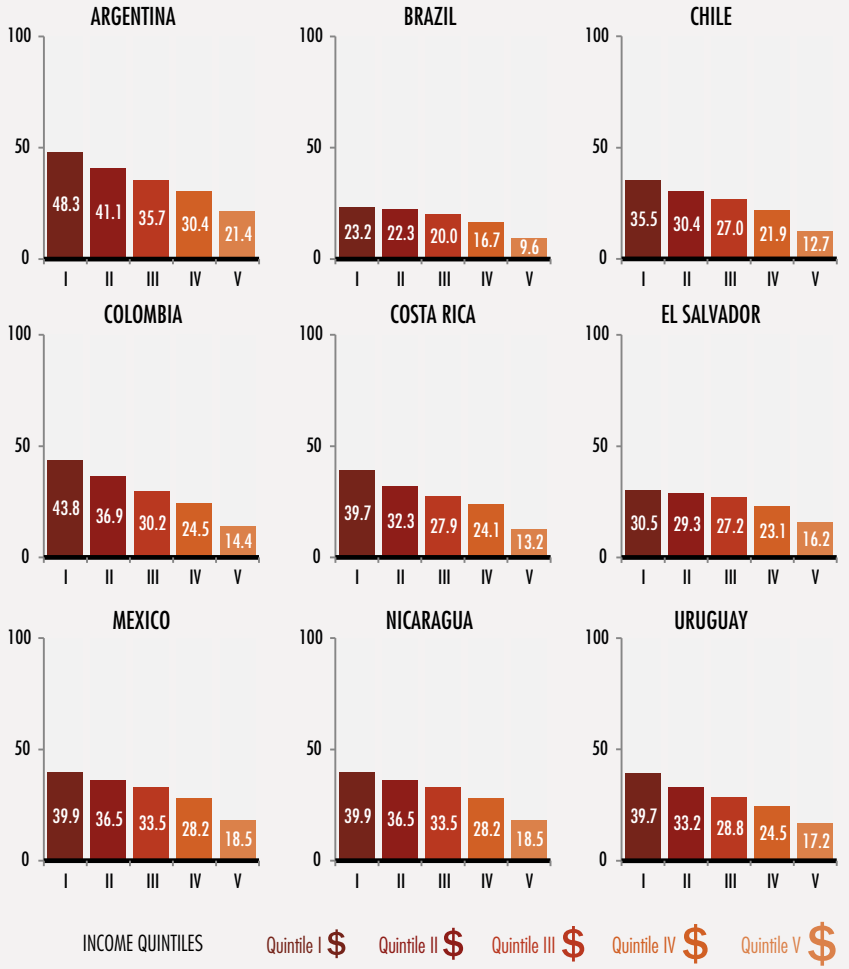
Rising income levels are associated with increased food demand.

The share of total expenditure that goes to food, measured by income quintile, decreases as income increases (Engel's law).

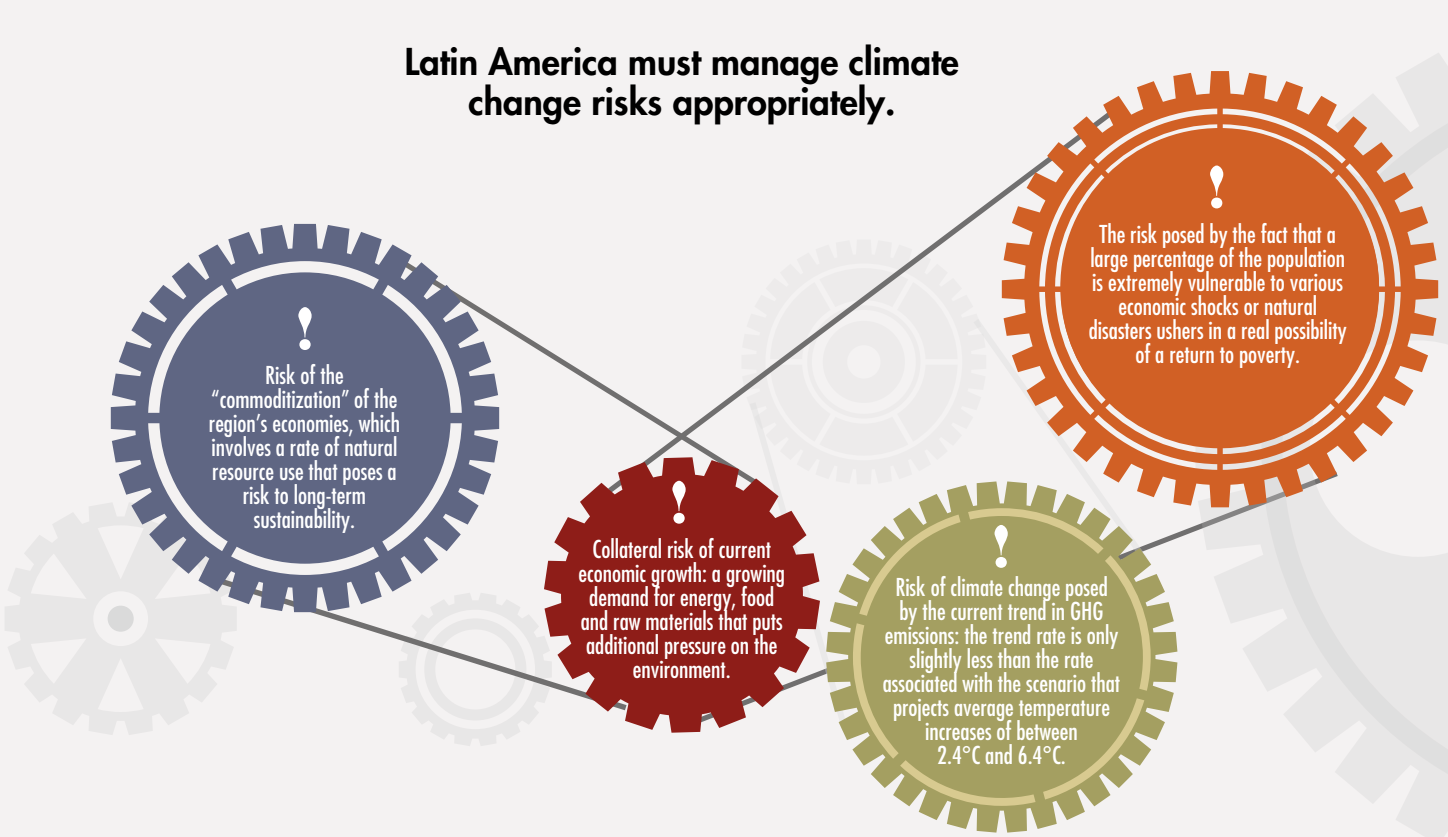
Rising income levels also open up opportunities for the consumption of new goods and services; the new consumption patterns shaped by these opportunities will play a decisive role in determining sustainable consumption options.



IND T.6.2 Latin American countries: household expenditure on food and beverages as a proportion of total expenditure, by income quintile *(Percentages)*



THESIS 7: THE SUITABLE MANAGEMENT OF CLIMATE CHANGE RISKS CAN HELP LEAD TO A MORE SUSTAINABLE FORM OF DEVELOPMENT

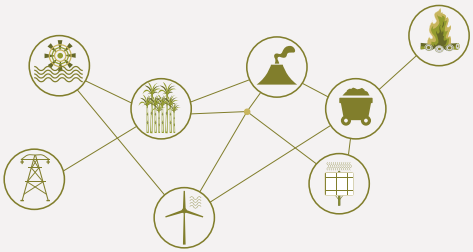


Investment in adaptation and mitigation is a form of insurance that also spurs economic growth.

Develop an investment strategy and supporting policies for making economic growth sustainable...

in order to decouple the consumption of energy and other inputs from income trends...

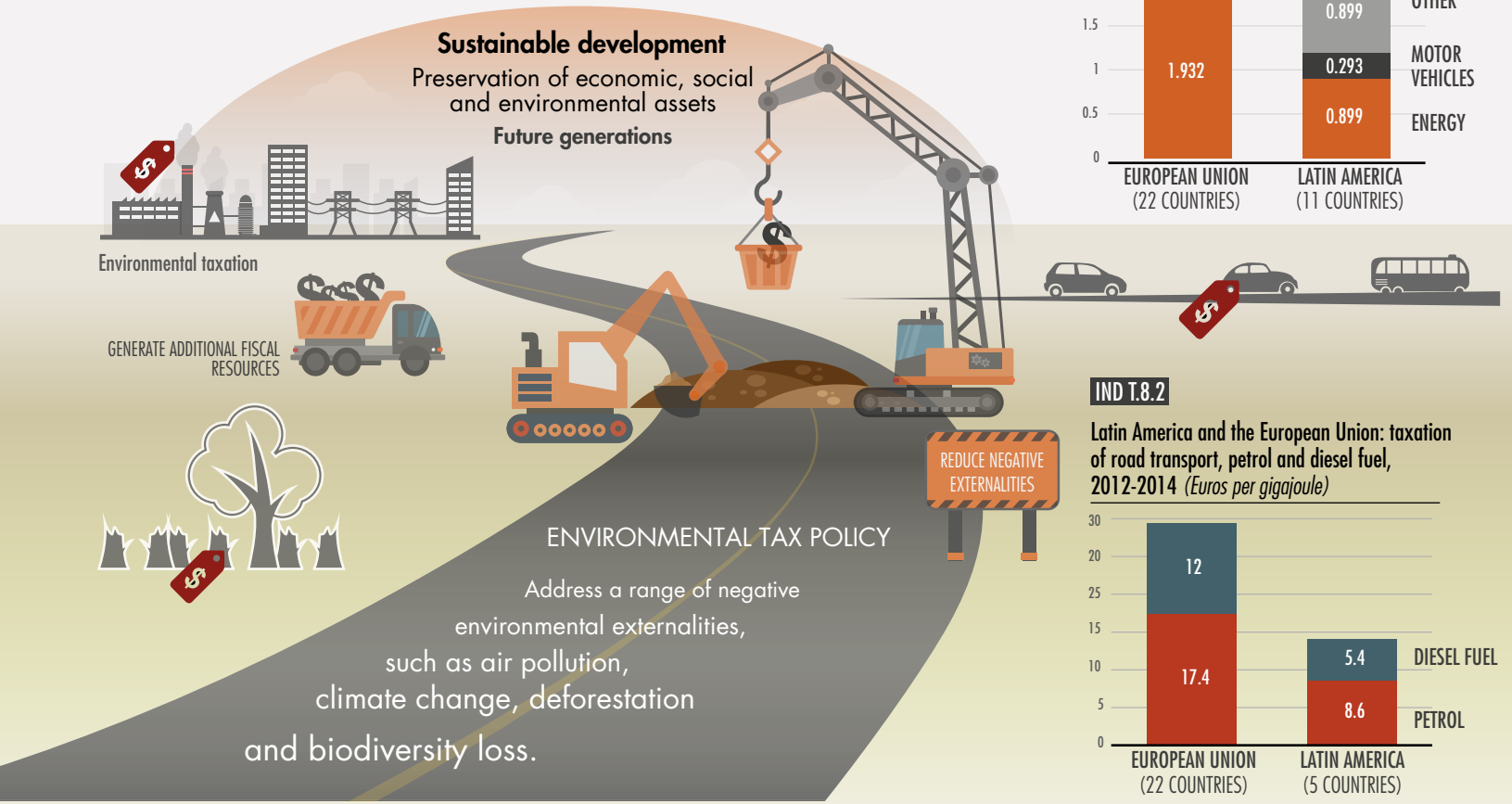
and build a suitable energy matrix on the basis of high-quality public services.



Configure a universal social safety net that will diminish vulnerability and move forward with climate change adaptation.

THESIS 8: TAKING UP THE CHALLENGE OF THE NEGATIVE GLOBAL EXTERNALITY REPRESENTED BY CLIMATE CHANGE CALLS FOR THE APPLICATION OF NORMATIVE, FISCAL AND CORRECTIVE PUBLIC POLICIES AND/OR THE CREATION OF NEW MARKETS

Environmental tax collection in the member countries of the Organization of Economic Cooperation and Development (OECD) outstrips such receipts in Latin America. There is a great deal of room for an increase in environmental taxation in Latin America, which could temporarily help to offset the loss of other tax receipts.



IND T.8.1

Latin America and the European Union: relative environmental taxation levels, 2012
(Percentages of GDP)

IND T.8.2

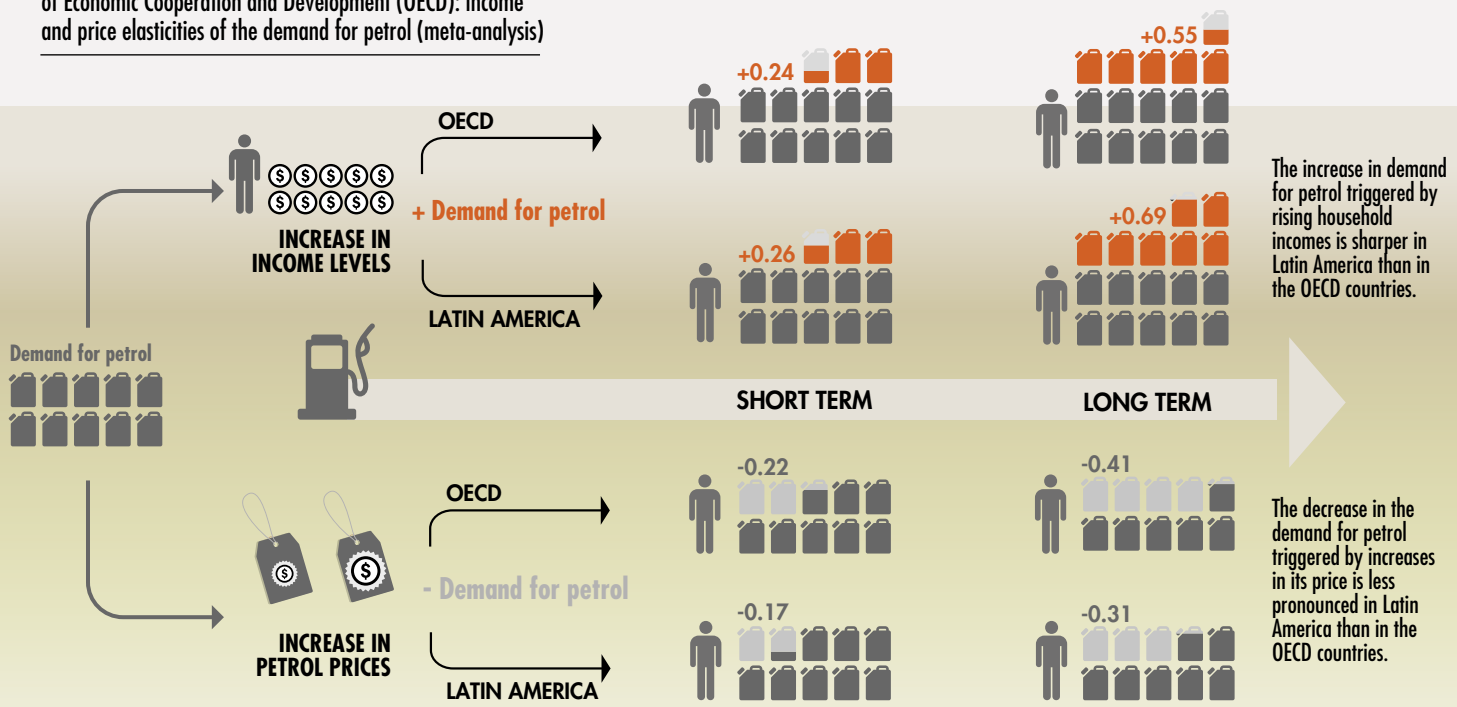
Latin America and the European Union: taxation of road transport, petrol and diesel fuel, 2012-2014 *(Euros per gigajoule)*

An example of environmental taxation. The Latin American and Caribbean region has room for improving its environmental tax policies.

The income elasticities of the demand for petrol are greater in developing countries than in the member countries of the Organization of Economic Cooperation and Development (OECD), in part because the rate of motor vehicle use in developing countries is still on the rise. At the same time, the price elasticity of petrol demand is lower in absolute terms in developing countries. This signals the absence of suitable substitutes for private transport.

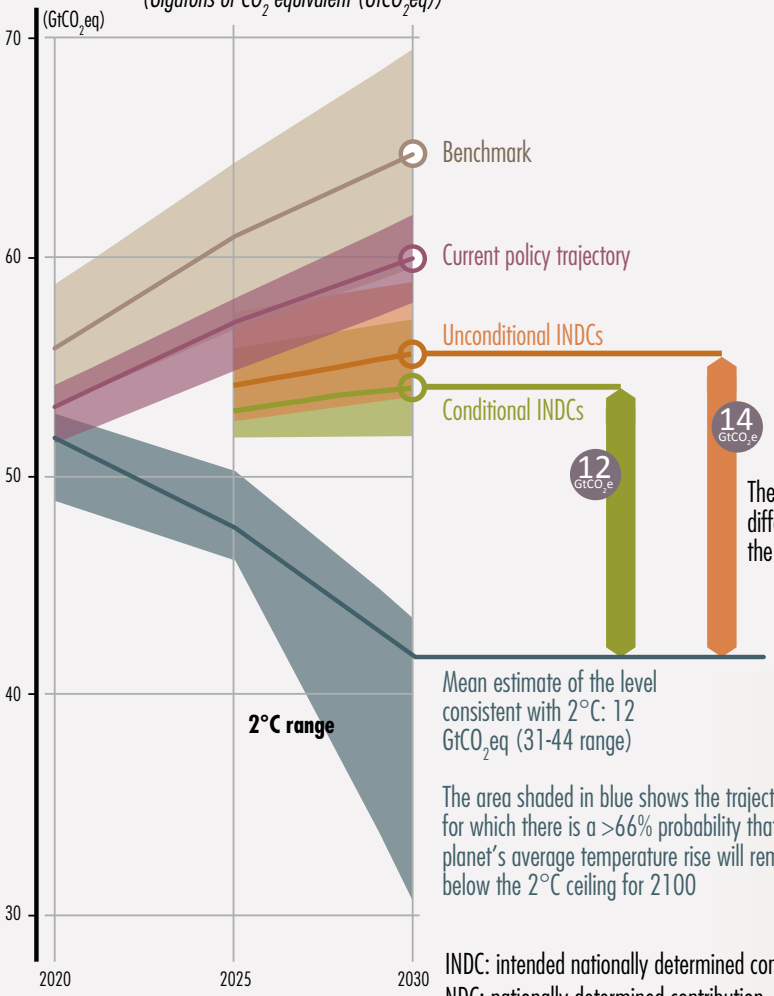
IND T.8.3

Latin America and the member countries of the Organization of Economic Cooperation and Development (OECD): income and price elasticities of the demand for petrol (meta-analysis)



THESIS 9(a): THE CLIMATE CHANGE CHALLENGE IS A SUSTAINABLE DEVELOPMENT CHALLENGE. THE SUCCESSFUL IMPLEMENTATION OF THE NATIONALLY DETERMINED CONTRIBUTIONS (NDCs) WILL LEAD TO A MORE SUSTAINABLE FORM OF DEVELOPMENT

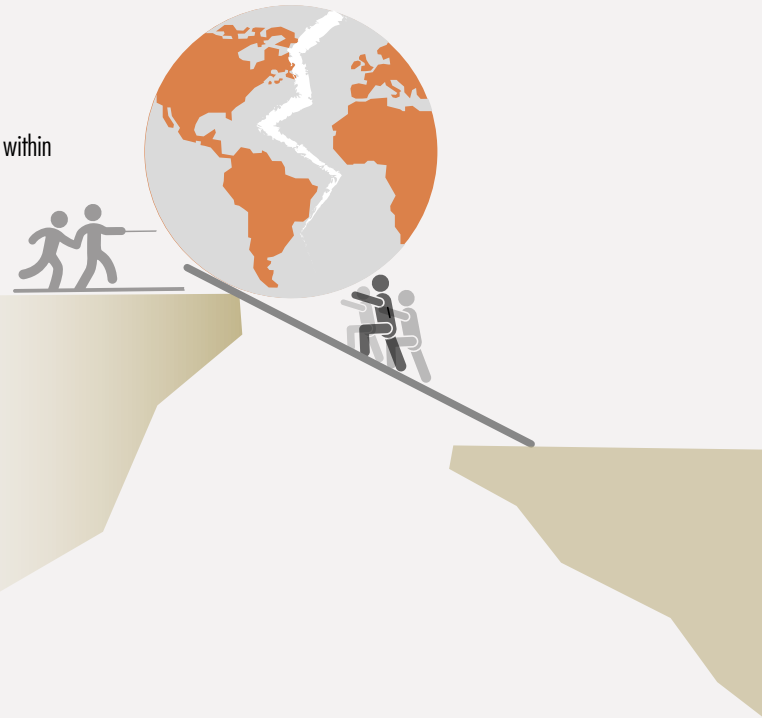
IND T.9.1 Annual global GHG emissions under different scenarios and emissions differentials in 2030
(Gigatons of CO_2 equivalent ($GtCO_2eq$))



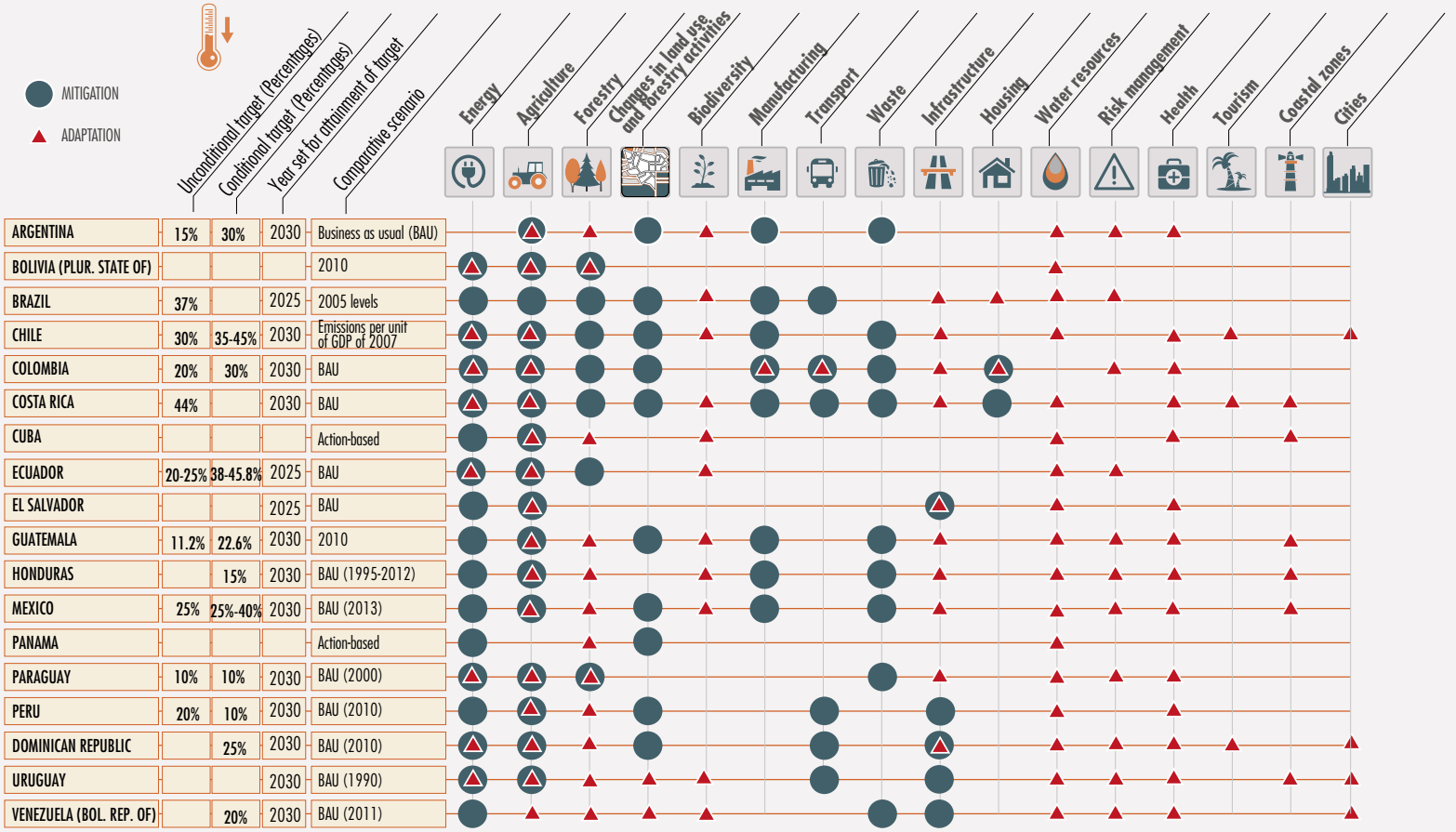
INDC: intended nationally determined contribution
NDC: nationally determined contribution

The NDC ambition levels reflected in proposed mitigation targets are not enough to stabilize the climate and have no clear-cut road map.

Existing budgets leave an ambition deficit of between 12 and 14 $GtCO_2eq$ relative to the required levels.



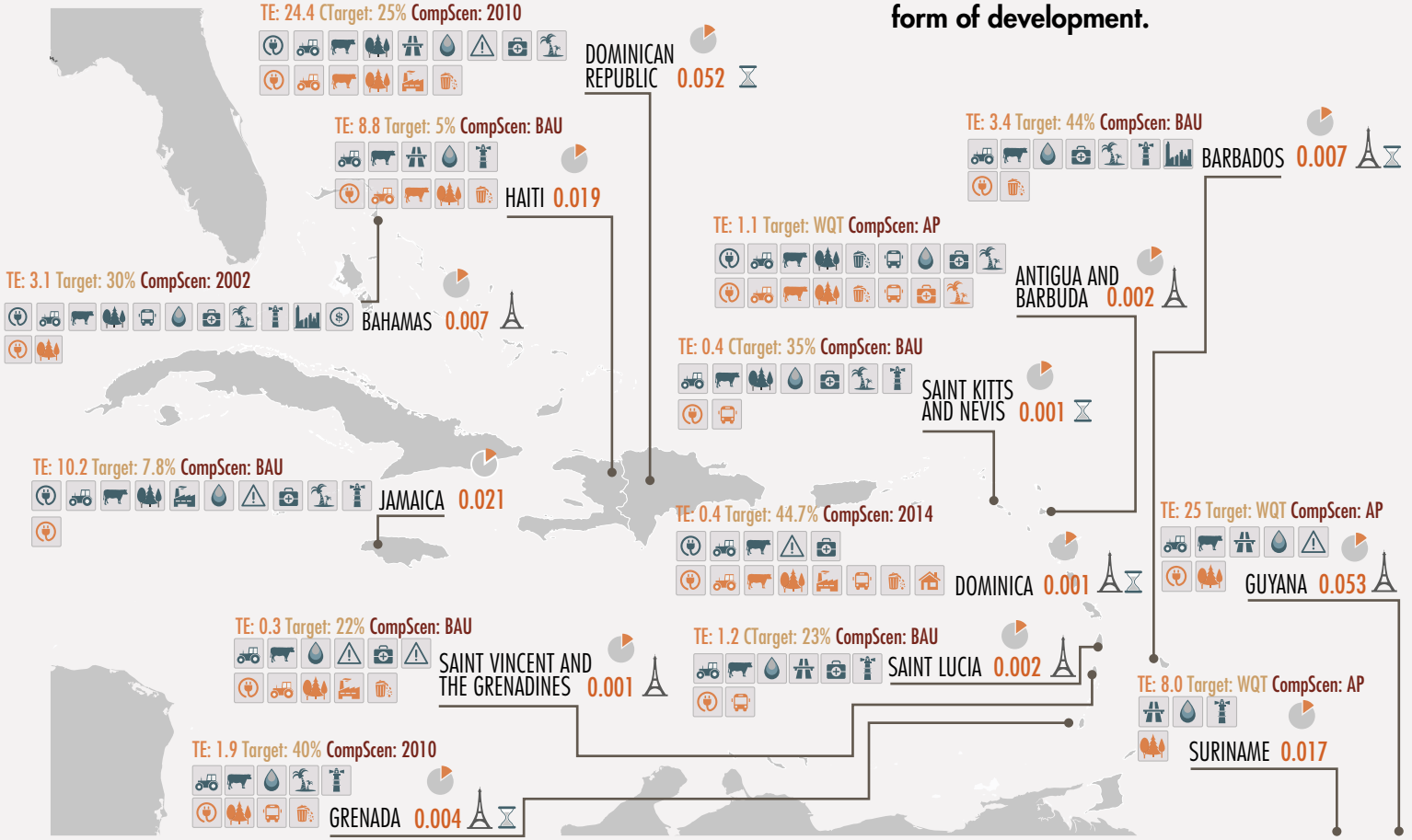
IND T.9.2 Latin American countries: unconditional and conditional targets for GHG reductions, comparative scenario and high-priority sectors for mitigation and adaptation



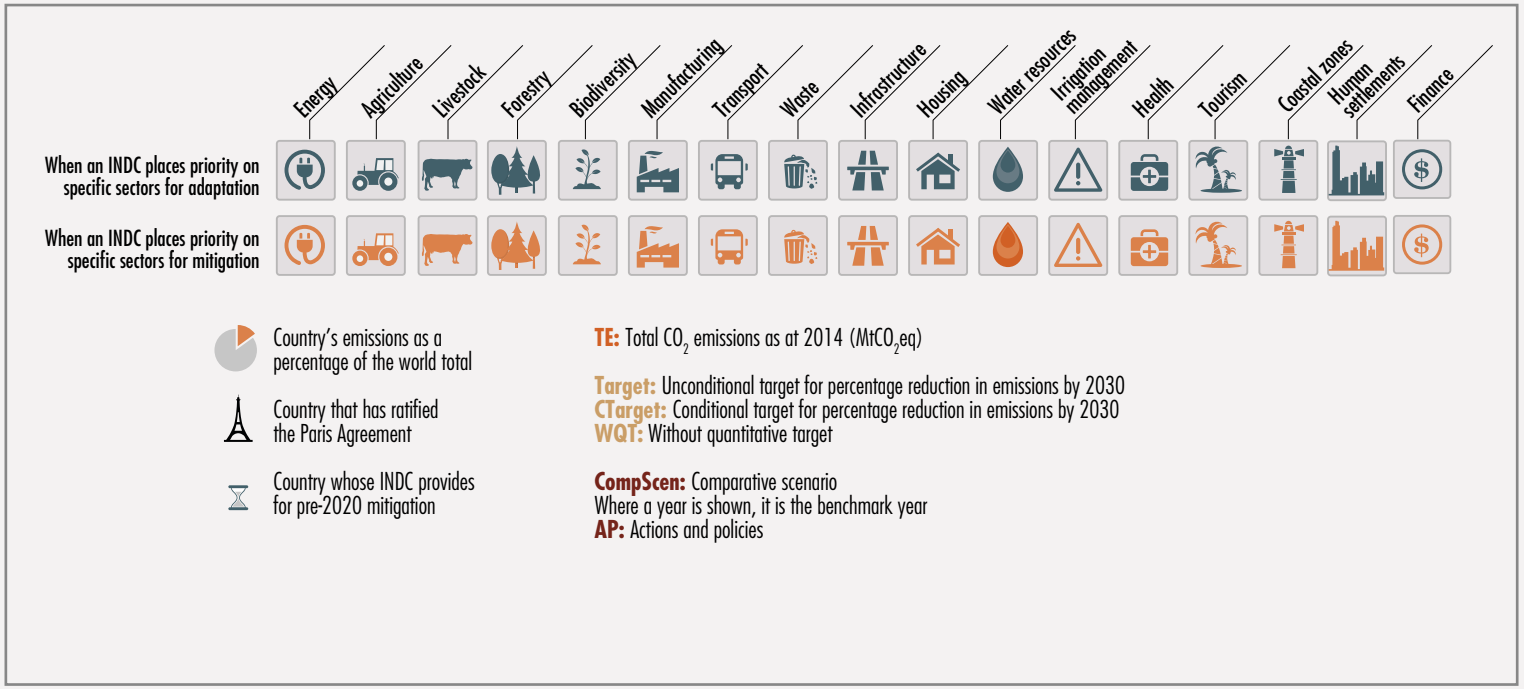
THESIS 9(b): THE CLIMATE CHANGE CHALLENGE IS A SUSTAINABLE DEVELOPMENT CHALLENGE. THE SUCCESSFUL IMPLEMENTATION OF THE NATIONALLY DETERMINED CONTRIBUTIONS (NDCs) WILL LEAD TO A MORE SUSTAINABLE FORM OF DEVELOPMENT

IND T.9.3 Caribbean countries: total CO_2 emissions, emissions reduction targets for 2030, comparative scenario and high-priority sectors for mitigation and adaptation

Implementing the NDCs will require long-term public policies and tools for making the transition to a sustainable form of development.



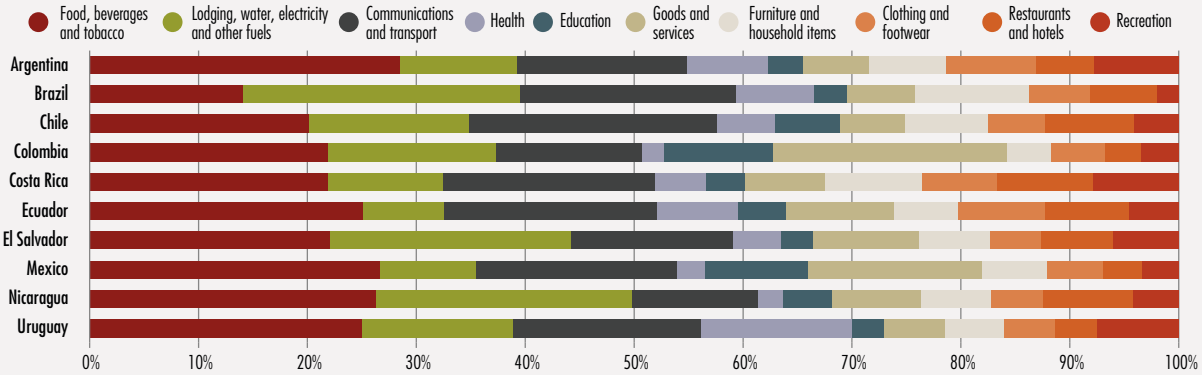
Attaining each country's NDC targets may require major changes in public policy in the economic, fiscal, environmental, regulatory, technological, investment and institutional spheres.




The Latin American and Caribbean region is especially vulnerable to the effects of climate change because
of its geographic location, climate, socioeconomic, demographic and institutional profiles and the highly climate-sensitive nature of its natural assets, such as its forests and biodiversity

7 CHALLENGES TO CLIMATE CHANGE AND SUSTAINABLE DEVELOPMENT IN LATIN AMERICA AND THE CARIBBEAN

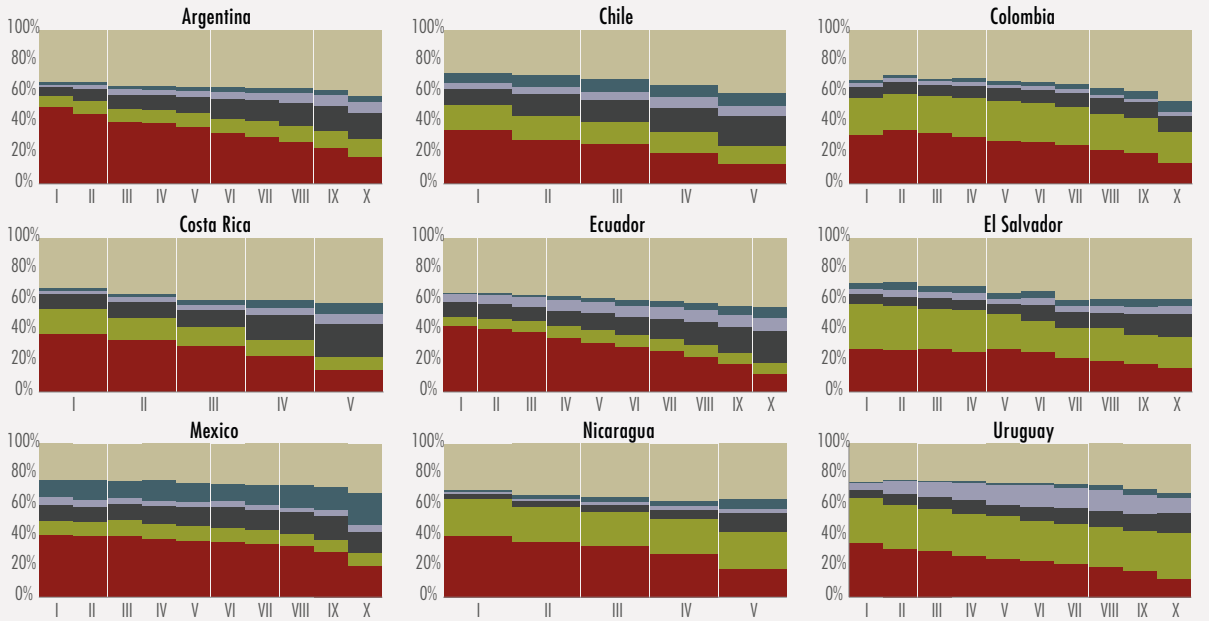
CHALLENGE 1: THE DEVELOPMENT STYLE AND ITS ASSOCIATED CONSUMPTION PATTERNS



IND C.1.1

Latin American and Caribbean countries: shares of household expenditure devoted to different items, around 2012 *(Percentages)*

IND.C.1.2 Latin American and Caribbean countries: distribution of household expenditure, by decile/quintile, around 2012 *(Percentages)*

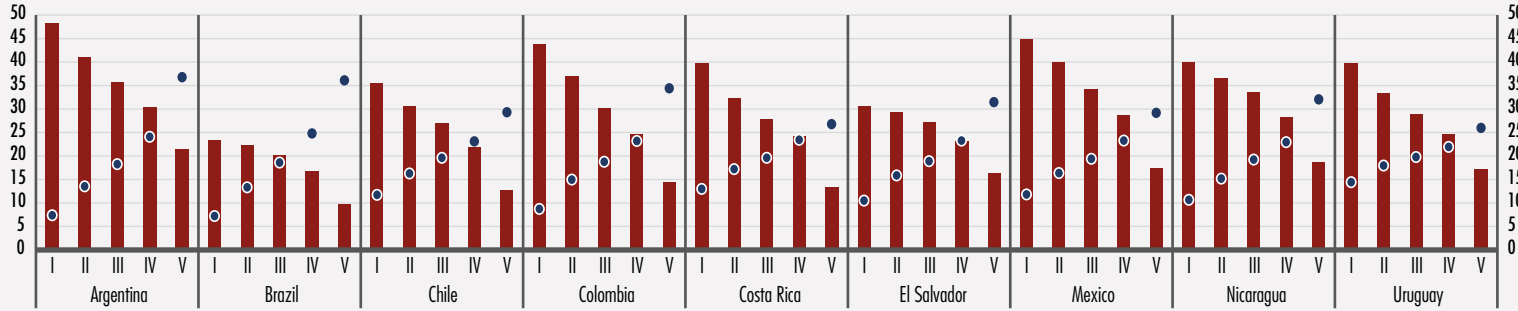


Fuel consumption increases as incomes rise. The trend in the structure of expenditure in Latin America is not sustainable over the long term because it generates a range of negative externalities which are eroding the foundations that underpin the current development style.

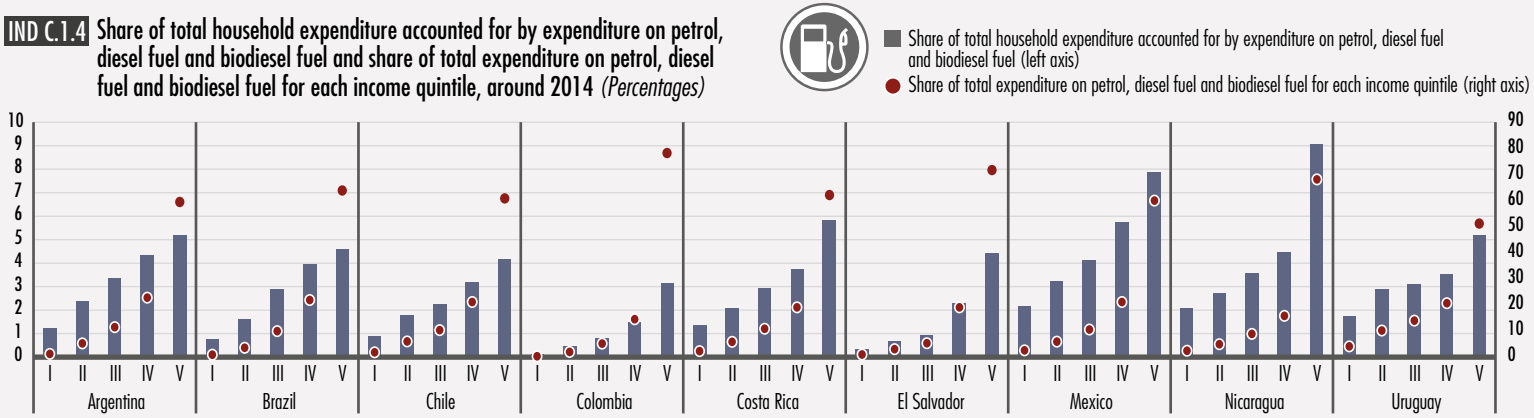
Emerging socioeconomic groups in the region are not satisfied with the existing network of public services.

The decline in the share of total expenditure, by quintile, accounted for by expenditure on food is coupled with a transition from expenditure on public-sector goods and services to wholly private-sector goods and services in such areas as education, health and transport.

IND C.1.3 Share of total expenditure accounted for by expenditure on food and share of total food expenditure for each income quintile, around 2014 *(Percentages)*



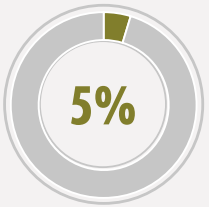
IND C.1.4 Share of total household expenditure accounted for by expenditure on petrol, diesel fuel and biodiesel fuel and share of total expenditure on petrol, diesel fuel and biodiesel fuel for each income quintile, around 2014 *(Percentages)*



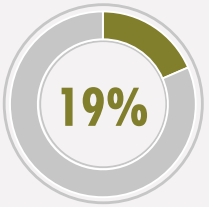
CHALLENGE 2: AGRICULTURAL ACTIVITIES

The farm sector is of strategic importance in Latin America and the Caribbean.

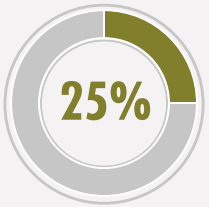
IND C.2.1 Latin America: selected context indicators for the agricultural sector, around 2015



OF THE REGION'S GDP



OF THE EMPLOYED POPULATION

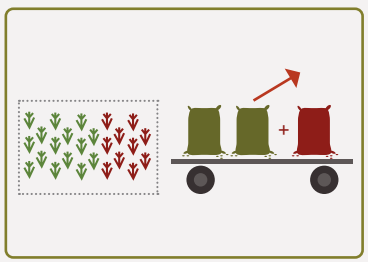


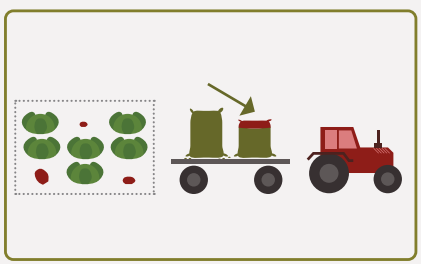
OF THE REGION'S EXPORTS

Agricultural activities are particularly sensitive to climate change, which is expected to produce changes in structure, yields and crop cycles.

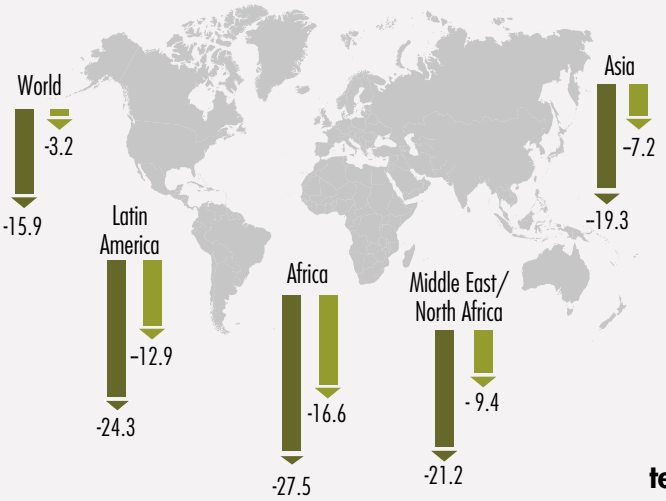
CERTAIN CROP CYCLES WILL PROBABLY SPEED UP, WHICH WILL ALTER THE PHYSICAL PROPERTIES OF THE SOIL AND THE SUPPLY OF WATER FOR IRRIGATION, LEAD TO GREATER EVAPORATION AND PLACE GREATER STRESS ON THOSE CROPS

RISING TEMPERATURES MAY INCREASE SOME CROP YIELDS BUT WILL LOWER OTHERS





Major changes in the productivity of agricultural activities are foreseen around the globe.



IND C.2.2 World regions: changes in agricultural productivity as a result of climate change
(Percentages of change in yields per hectare)

Preferred estimate without the fertilization effect of atmospheric CO_2

Preferred estimate with the fertilization effect of atmospheric CO_2

The impact will be influenced by socioeconomic, technological, geographic and climatic conditions.

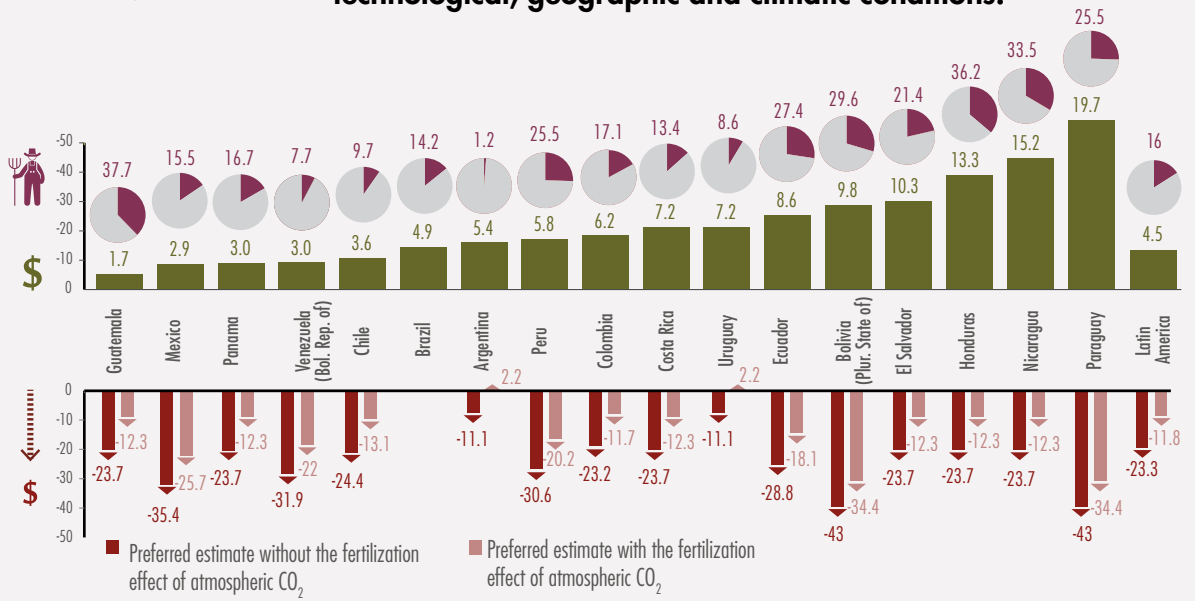
Latin American countries:

IND C.2.3
Proportion of the population employed in agriculture, around 2012
(Percentages)

IND C.2.4
Agricultural sector's share of total annual GDP, 2013
(Percentages)

IND C.2.5
Change in agricultural productivity deriving from climate change
(Percentages of change in yields per hectare)

2080



CHALLENGE 3. ENERGY PRODUCTION AND CONSUMPTION PATTERNS

AVAILABLE SUPPLIES OF ENERGY RESOURCES

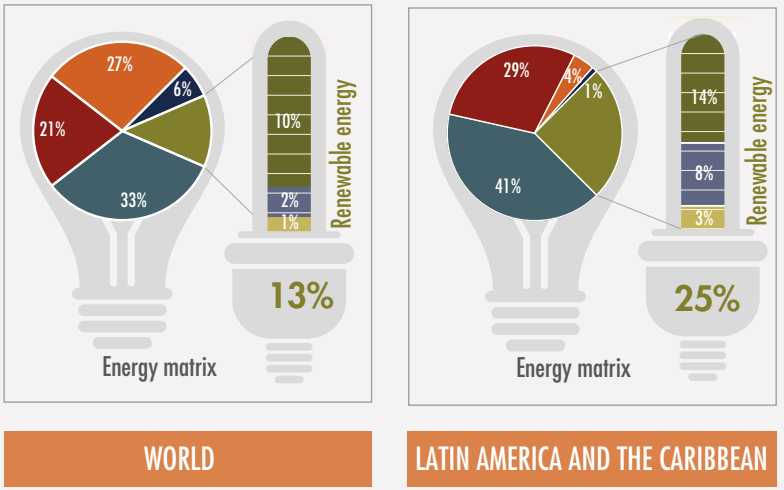
Latin America and the Caribbean have some 25% of the world's hydroelectric potential, a high wind power potential and abundant geothermal energy resources.

ENERGY SUPPLY

The Latin American and Caribbean region's energy matrix includes a large (above the world average) component of renewable energy resources.

IND C.3.1

World and Latin America: energy matrix and renewable energy consumption, 2014
(Percentages of total final consumption)

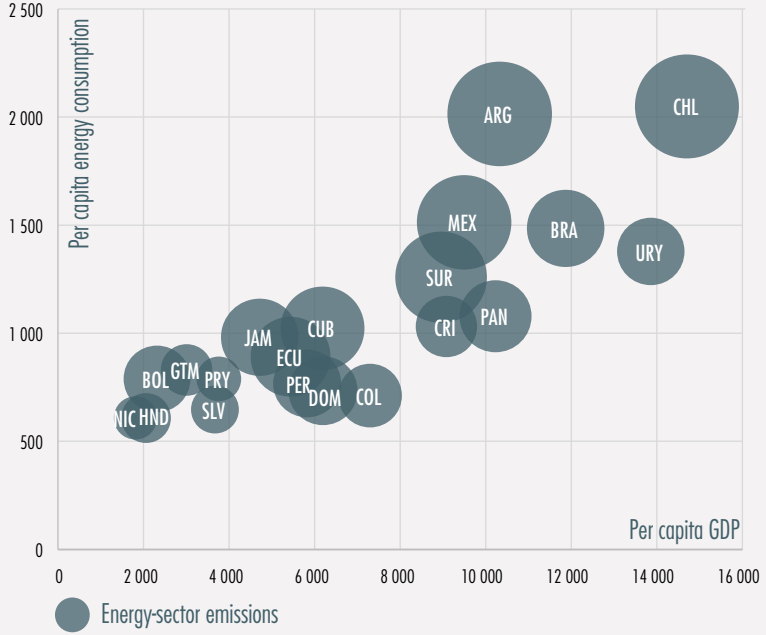


The region's energy sector is responsible for only about 5% of global greenhouse gas emissions but its electric power generation systems are highly vulnerable to climate change.

The Latin American and Caribbean region's energy sector is confronted with a dual challenge: it must cope with its electrical power generation systems' high degree of vulnerability to climate change while transitioning towards an efficient, lower-carbon energy system.

There is a strong positive association among per capita energy consumption, per capita emissions from energy use and economic growth. This translates into steady increases in the demand for energy and in CO_2 emissions.

IND C.3.2 Latin American countries: per capita GDP *(constant 2010 dollars)*, per capita energy consumption *(kg of petroleum equivalent per capita)* and energy-sector emissions *(tons of CO_2 equivalent per capita)*, 2014



In order to decouple emissions from economic development, measures have to be adopted to reduce energy demand and to steer power generation towards different energy sources.

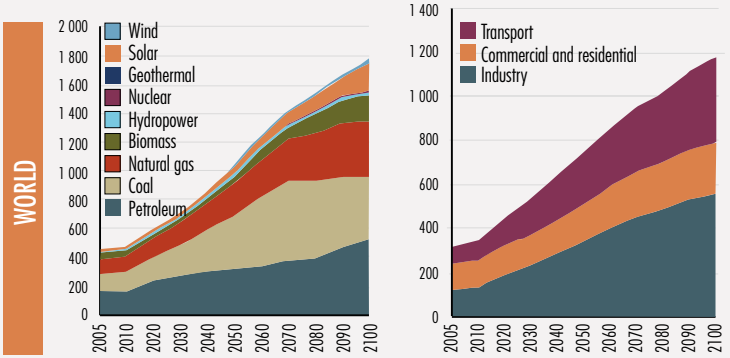
IND C.3.3

World and Latin America: projections of energy demand, by source *(Exajoules)*

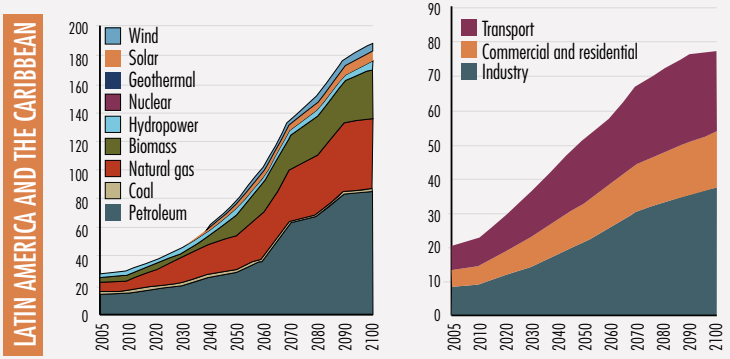
IND C.3.4

World and Latin America: projections of energy demand, by use *(Exajoules)*

The energy matrix of Latin America and the Caribbean is expected to include a large share of conventional energy sources (petroleum and natural gas) and a large biomass component.



The transport sector accounts for a large and growing share of end-use energy demand.



CHALLENGE 4: URBAN AREAS AND INFRASTRUCTURE

CITIES

CONCENTRATION OF THE POPULATION

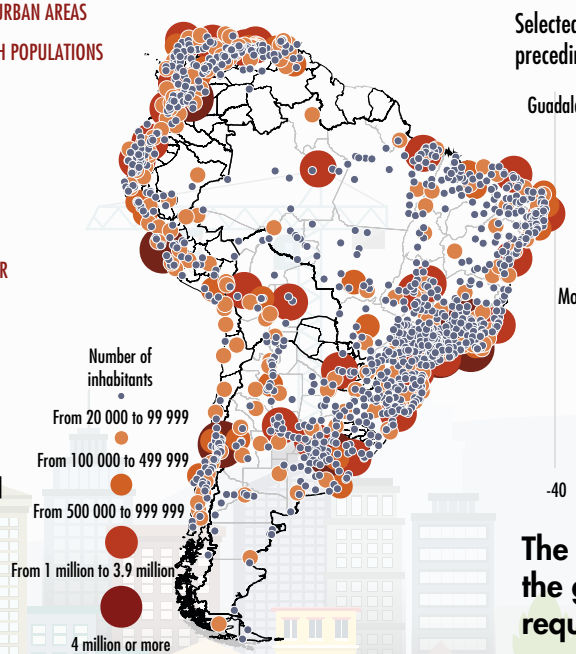
- IN LATIN AMERICA AND THE CARIBBEAN, AROUND 80% OF THE POPULATION LIVES IN URBAN AREAS
- THE REGION HAS 4 MEGACITIES WITH POPULATIONS OF OVER 10 MILLION EACH (14%)

CONCENTRATION OF PRODUCTION

- THE REGION'S CITIES ARE THE DRIVER OF ITS ECONOMIES
- BETWEEN 60% AND 70% OF THE REGION'S GDP IS ACCOUNTED FOR BY ITS URBAN CENTRES

CONCENTRATION OF CONSUMPTION

- WORLDWIDE, CITIES ACCOUNT FOR THE CONSUMPTION OF 80% OF THE ENERGY PRODUCED ON THE PLANET

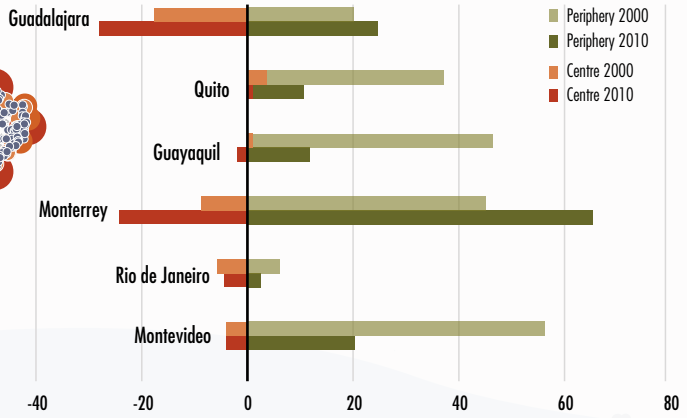


70% of greenhouse gas emissions come from cities

Most city cores are losing population as people migrate to the outskirts of urban areas.

IND C.4.1

Selected Latin American cities: net migration rates for the five-year periods preceding the 2000 and 2010 census rounds *(per 1,000 inhabitants)*

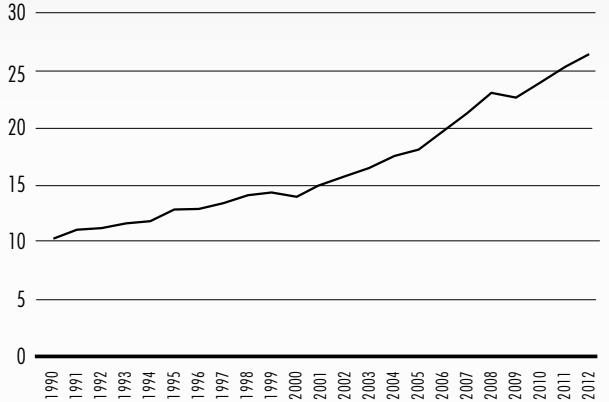


The expansion of the urban footprint interrupts the groundwater cycle, alters soil and land use, requires the expansion of public service coverage and damages ecosystems.

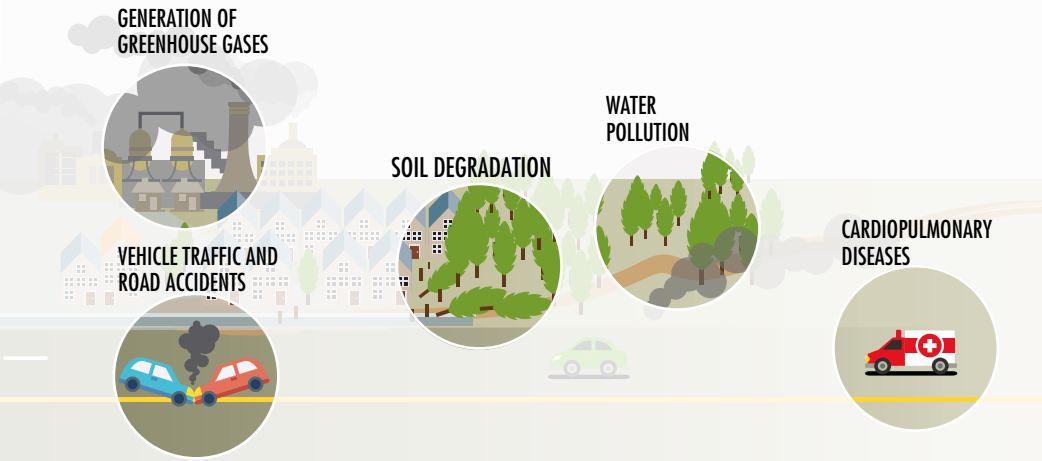
Cities are especially vulnerable to climate change and are also called upon to play a pivotal role in implementing mitigation and adaptation measures and in driving the transition towards sustainable forms of development.

Urban sprawl has spurred an expansion of demand for transport and other public services, inputs and other products and has exerted mounting pressure on natural resources and on environmental goods and services. These phenomena could also be a driver of change and innovation.

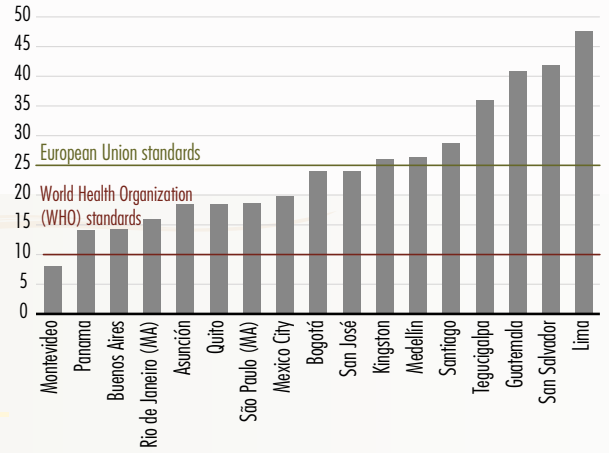
IND C.4.2 Latin America: vehicle motorization index,1990-2012
(Number of vehicles per 100 inhabitants)



NEGATIVE EXTERNALITIES



IND C.4.3 Latin American cities: concentrations of PM2.5 and health standards, 2016 *(Average annual concentrations in µg/m3)*

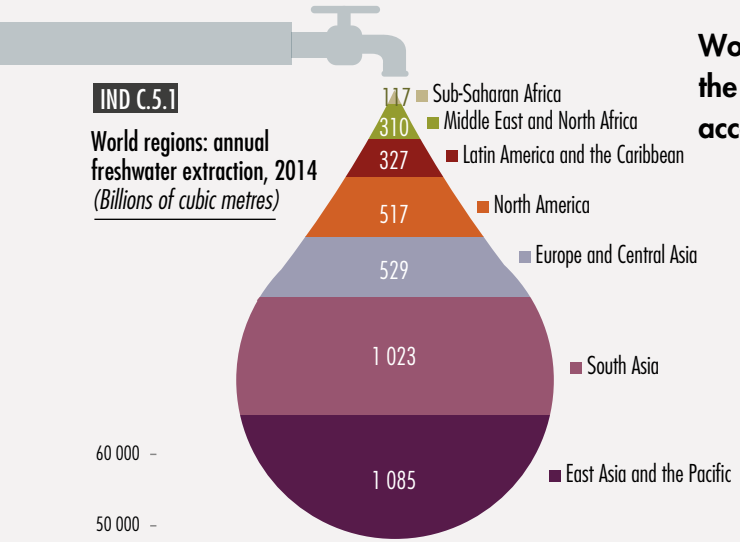


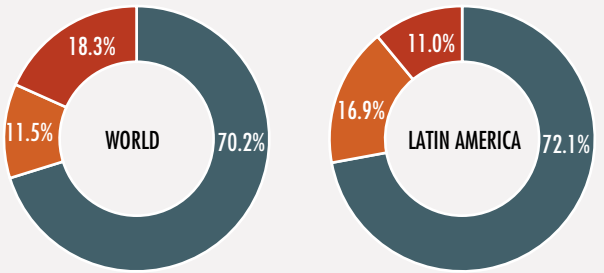
CHALLENGE 5: WATER RESOURCES

Worldwide, a total of 39 billion cubic metres of water were used by the various sectors of activity in 2014, with agriculture and industry accounting for 88% of that amount.

IND C.5.1

World regions: annual freshwater extraction, 2014
(Billions of cubic metres)





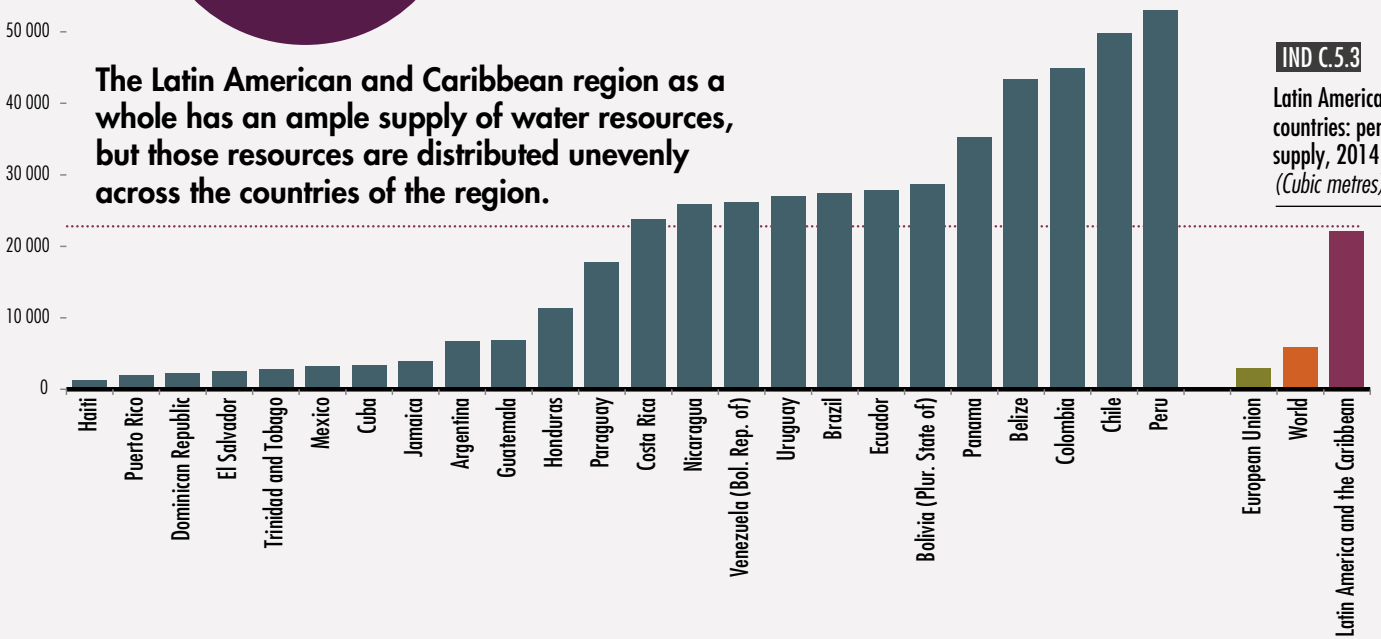
IND C.5.2

World and Latin America: distribution of water use, by sector, 2014
(Percentages)

The Latin American and Caribbean region as a whole has an ample supply of water resources, but those resources are distributed unevenly across the countries of the region.

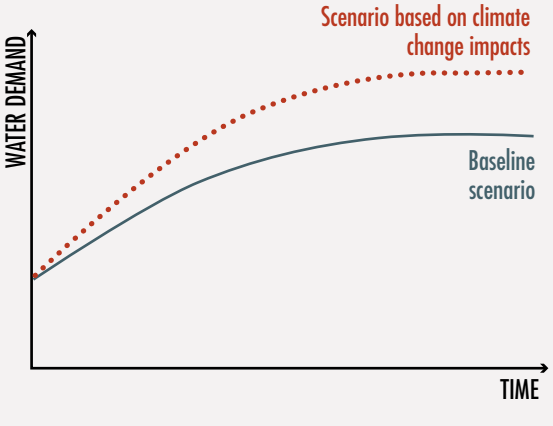
IND C.5.3

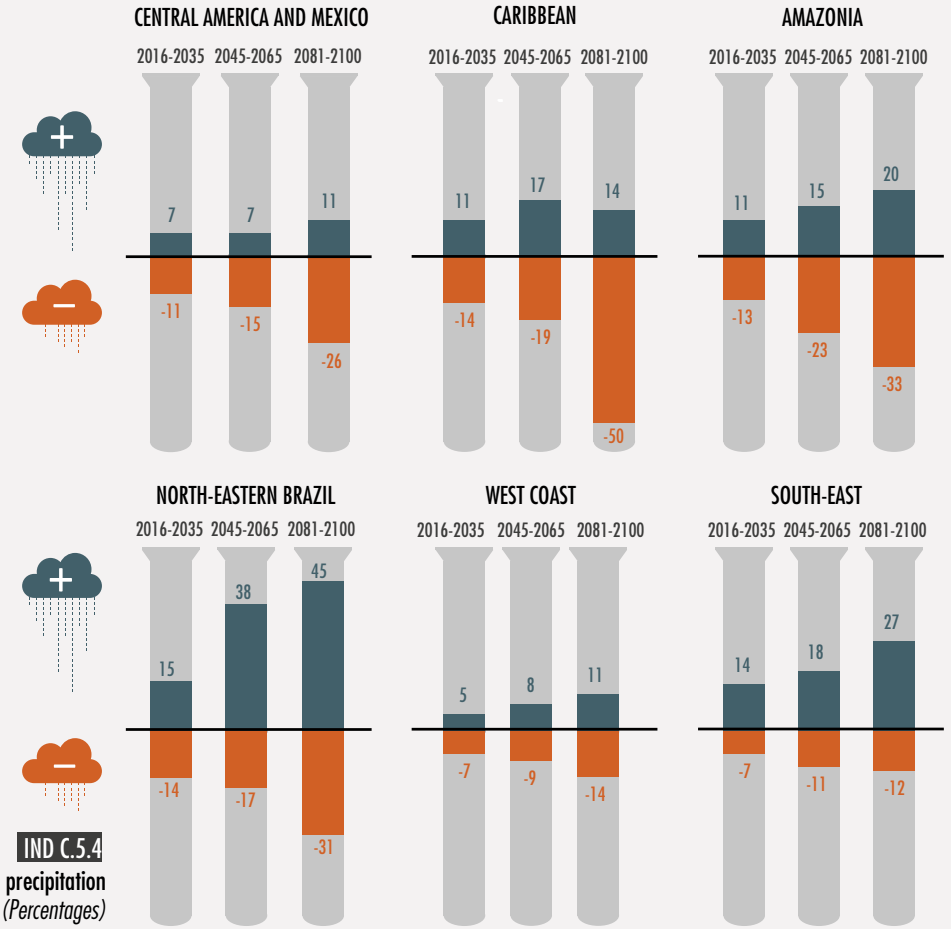
Latin American and Caribbean countries: per capita water supply, 2014
(Cubic metres)



Mexico, the Caribbean and Central America will be drier, cities in the Andean region will be subject to water stress and South America will be increasingly exposed to flooding. Humidity and water stress will be heightened.

Climate change alters precipitation, soil humidity and run-off patterns and is accelerating glacier melt. All of these factors influence the availability of water for human consumption and for use in economic activities such as agriculture and industry.





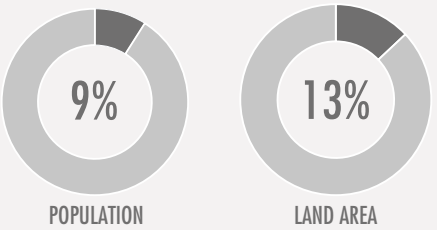
IND C.5.4

Latin American and Caribbean subregions: annual precipitation projections *(Percentages)*

(Extreme projections for an increase and a decrease in precipitation based on the full range of scenarios)

CHALLENGE 6: FORESTS AND BIODIVERSITY

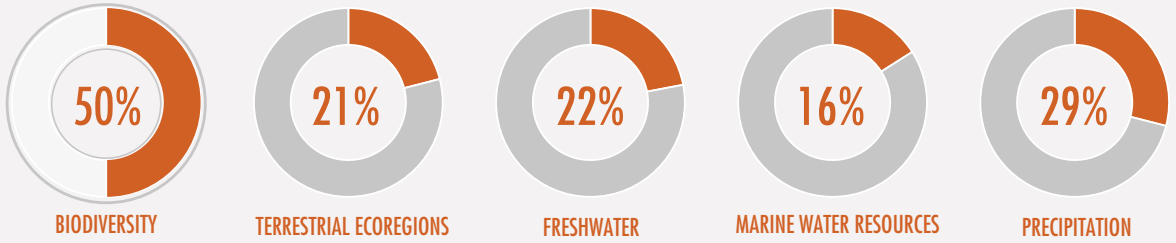
The Latin American and Caribbean region makes up 13% of the planet's land mass and is home to just 9% of the world's population, but it houses a large proportion of the planet's biological diversity.



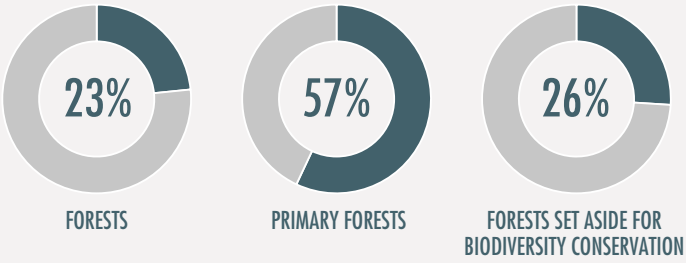
LATIN AMERICA AND THE CARIBBEAN AS A PROPORTION OF WORLD TOTALS

BIOLOGICAL DIVERSITY

CRITICAL ELEMENTS OF PLANETARY CLIMATE REGULATIO



FORESTRY RESOURCES



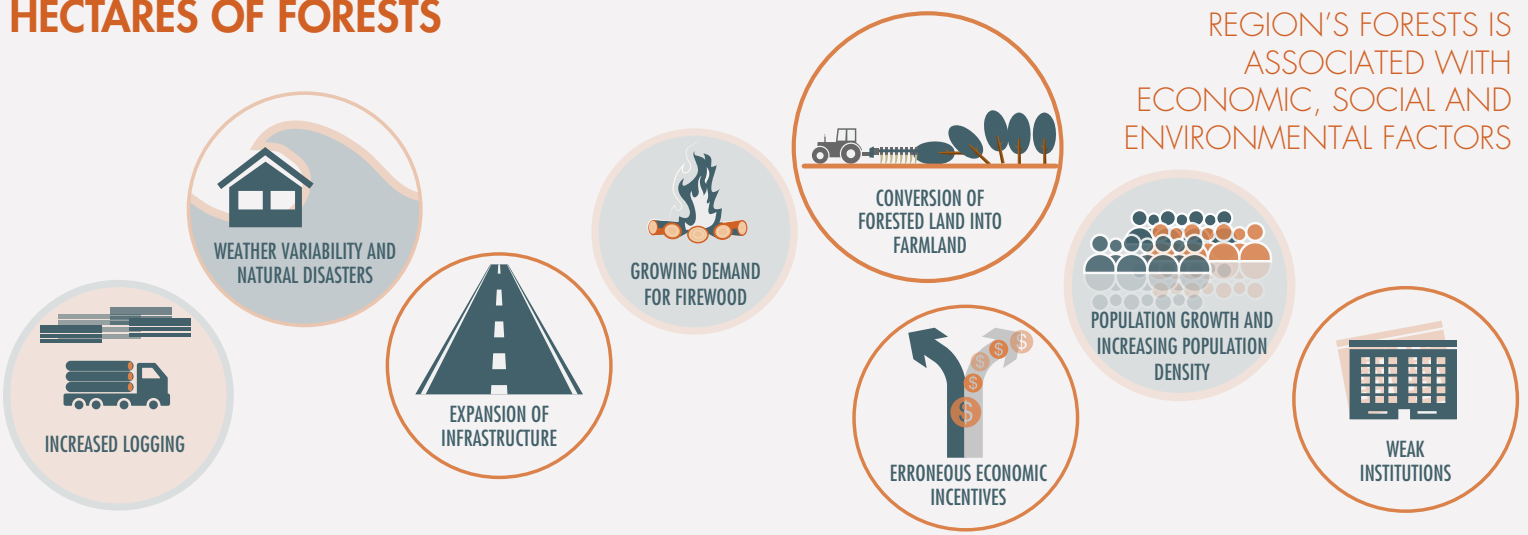
IND C.6.1 Latin America and the Caribbean as a proportion of world totals: selected indicators of physical conditions, land cover, biodiversity and forest cover.

Biodiversity loss is underestimated because countries do not include it in their environmental accounts.

The **Latin American and Caribbean region's natural wealth** is under a **constant threat of being eroded** by a complex matrix of factors and interactions. **Climate change is putting more pressure** on the environment owing to the highly sensitive nature of many of its ecosystems and species to changes in temperature, precipitation and the atmospheric concentration of carbon dioxide.

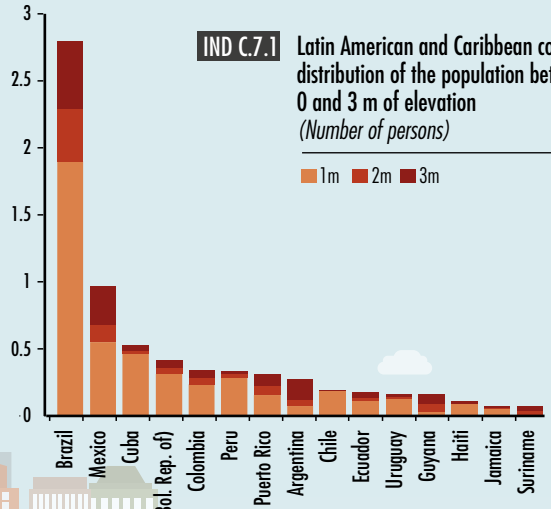
OVER THE PAST 15 YEARS, THE REGION HAS LOST **96 MILLION HECTARES OF FORESTS**

THE SHRINKAGE OF THE REGION'S FORESTS IS ASSOCIATED WITH ECONOMIC, SOCIAL AND ENVIRONMENTAL FACTORS

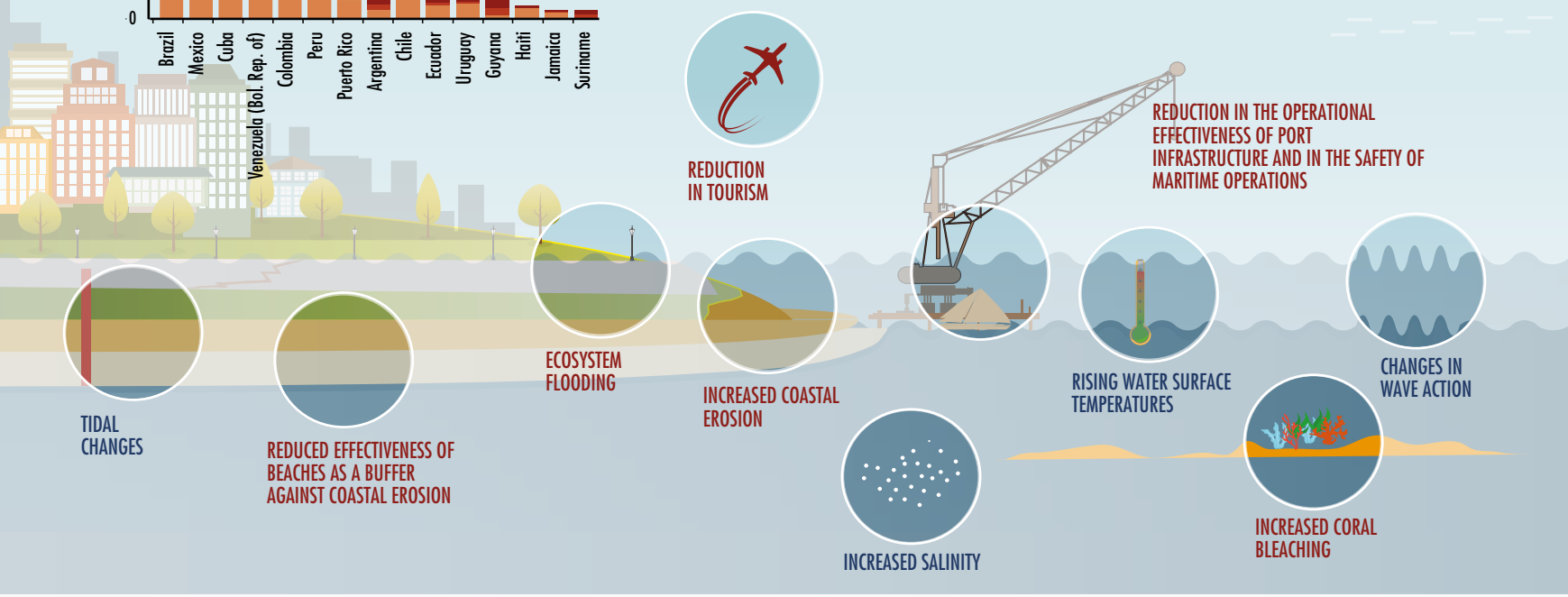


CHALLENGE 7. ALONG THE COASTS AS SEA LEVELS RISE

The coasts of Latin America and the Caribbean are exposed to the effects of climate change. Sea levels are clearly rising all along the region's coastlines.



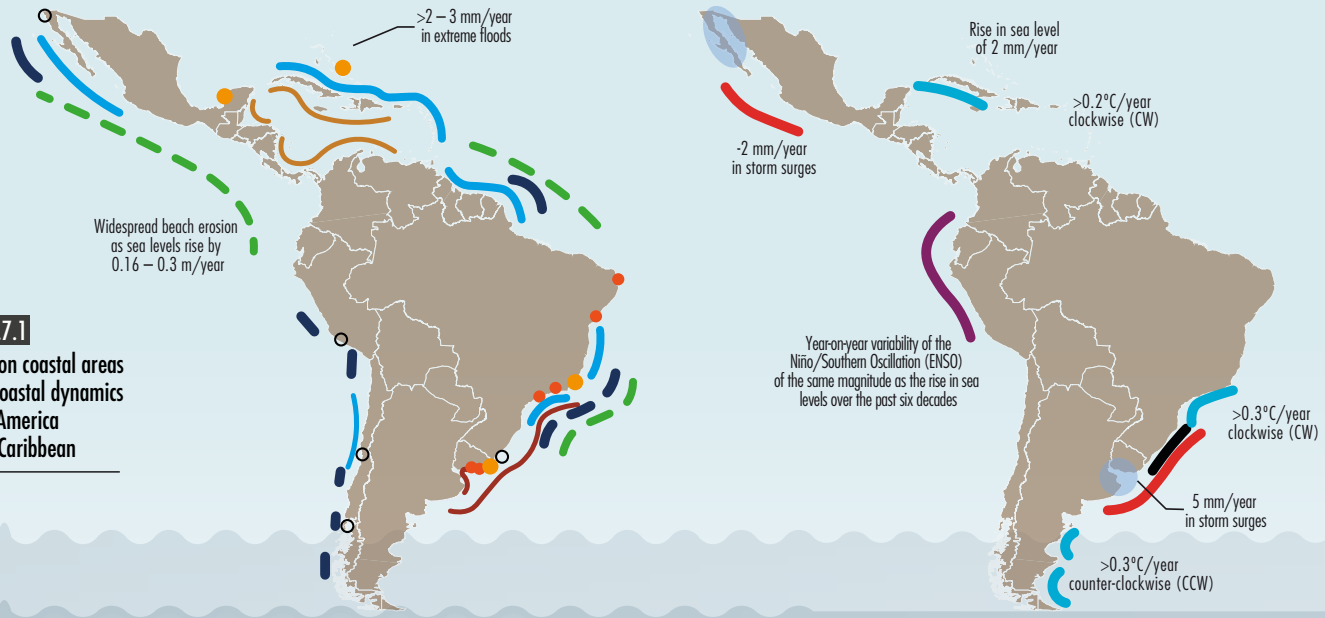
IND C.7.1 Latin American and Caribbean countries: distribution of the population between 0 and 3 m of elevation
(Number of persons)



In order to meet the challenge of adapting coastal infrastructure, environmental impact assessments will need to be reworked in order to take that factor into account. This effort will be more effective if it is coordinated at the regional level. The restoration of mangrove forests will play an important role in this connection.

A. Impacts on coastal areas

B. Coastal dynamics



MAP C.7.1

Impacts on coastal areas and on coastal dynamics in Latin America and the Caribbean

FLOODING
- Flood-prone urban areas
- Impact on infrastructure at elevations of less than 1 m
- >40% of the change in the last 60 years is attributable to the total rise in seal levels over the last 100 years (excluding hurricanes)
- >6 mm/year in extreme coastal flooding

BEACH EROSION
- Changes in the potential sedimentation rate
- Erosion brought about by beach rotation

SEAPORTS
- Possible impacts on maritime port navigation due to higher waves
- Reduction in the reliability of coastal structures

- >0.3 m/year in significant wave height (Hs) of 12 m
  <0.1 mm/year in annual average wave height
- Less of an increase detected in sea levels (approximately 1 mm/year)
- From 30% to 40% of change in 50-year floods from 1950 to 1960 and from 1998 to 2008
- Change in the direction of the mean annual energy flow (degrees Celsius/year)
- Strong trends in extreme storm surges

INDICATORS: SOURCES AND TECHNICAL NOTES

INTRODUCTION

Greenhouse gas equivalents *(percentages)*

Source: Intergovernmental Panel on Climate Change (IPCC), "Summary for Policymakers", *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, O. Edenhofer and others (eds.), Cambridge, Cambridge University Press, 2014.

THESIS 1: CLIMATE CHANGE IS TAKING PLACE RIGHT NOW AND WILL INTENSIFY IN THE FUTURE. IT HAS GLOBAL ECONOMIC, SOCIAL AND ENVIRONMENTAL CAUSES AND IMPLICATIONS

IND T.1.1 World: annual surface temperature anomaly relative to the averages for 1986-2005, 1850-2100 *(Degrees Celsius)*

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of G. Magrin and others, "Central and South America", *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, V. Barros and others (eds.), Cambridge, Cambridge University Press, 2014.

Note: Simulated time series based on multiple models from Phase 5 of the Coupled Model Intercomparison Project (CMIP5) for the period from 1850 to 2100. The annual changes in mean global surface temperatures are for 1986-2005. The projection time series and the uncertainty measurement (shaded) are given for the RCP2.6 (blue) and RCP8.5 (red) scenarios. The area shown in ochre represents the historical trend of the temperature anomaly in the models based on reconstructed historical forcings. The representative concentration pathway (RCP) scenarios are based on approximate calculations of total radiative forcing in the year 2100 in comparison to the year 1750, i.e. 2.6 W/m2 for the RCP2.6 scenario; 4.5 W/m2 for the RCP4.5 scenarios; 6.0 W/m2 for the RCP6.0 scenario and 8.5 W/m2 for the RCP8.5 scenario.

IND T.1.2 Projection of change in the mean global near-surface air temperature, reduction in the global volume of glaciers and projection of the average global rise in sea level by mid-century and by the end of the twenty-first century relative to 1986-2005
(Degrees Celsius, percentages and centimetres)

Source: Intergovernmental Panel on Climate Change (IPCC), "Summary for Policymakers", *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, T. Stocker and others (eds.), Cambridge, Cambridge University Press, 2013.

Note:

Changes in the mean global surface air temperature are based on Phase 5 of the Coupled Model Intercomparison Project (CMIP5); the anomalies have been calculated for the period 1986-2005. Using the HadCRUT4 dataset and the corresponding uncertainty estimates (confidence interval of between 5% and 95%), the warming observed for the reference period of 1986-2005 amounts to 0.61°C [0.55-0.67°C] from 1850 to 1900 and to 0.11°C [0.09-0.13°C] from 1980 to 1999, the reference period for the projections used in the Fourth Assessment Report. Probable ranges have not been assessed here for earlier reference periods because, for the most part, the literature does not offer any method for combining the relative

uncertainties for the models and observations. The addition of the changes in the projections and the observations does not account for the possible effects of deviations from the models as compared to the observations nor for the natural internal variability of the observations during the reference period.

The projections of the rise in global mean sea levels are based on 21 CMIP5 models; the anomalies have been calculated for the period 1986-2005. Where the CMIP5 results for a given atmosphere-ocean general circulation model (AOGCM) are unavailable, the estimates were calculated using the method set out in table 13.5 of chapter 13 of IPCC (2013). The contributions of swift dynamic changes in the ice sheet and anthropogenic groundwater storage are dealt with as if they occurred according to a uniform probabilities distribution and, in large part, independently of the scenario in question. This does not mean that the contributions are unrelated to the different scenarios but rather that, at our current state of knowledge, a quantitative evaluation of that relationship cannot be made. Based on current knowledge, the global mean sea level would rise more than the probable range computed for the twenty-first century only in the event of a collapse of marine sectors of the ice sheet in Antarctica. At a mean level of confidence, this extra contribution would not translate into an additional increase in sea levels of more than a few decimetres during the twenty-first century.

Calculations for 2046-2065 were based on model projections for the 5%–95% ranges. An assessment was then carried out in order to obtain the probable range after taking into account other uncertainties and different confidence levels. The confidence level is moderate for projections of changes in mean global surface temperatures in 2046-2065 because the relative level of natural internal variability is greater and because the uncertainties corresponding to forcing due to non-greenhouse gases and to the response are greater than they are for 2081-2100. The probable ranges for 2046-2065 do not take into account the possible influence of factors that give rise to the range estimated as a result of the assessment of changes in mean global surface temperatures in the short run (2016-2035), which is less than the range for the 5%-95% models, because the influence of such factors on the longer-term projections cannot be quantified given the current state of scientific knowledge.

Calculations for 2081-2100 were based on model projections for the 5%-95% ranges. An assessment was then carried out to obtain the probable range after taking into account other uncertainties and different confidence levels. The confidence level is moderate for projections of the mean global rise in sea level for both time horizons.

THESIS 2: CLIMATE CHANGE, WHICH HAS BEEN BROUGHT ON BY A GLOBAL NEGATIVE EXTERNALITY, IS CONSUBSTANTIAL WITH TODAY'S DEVELOPMENT STYLE

IND T.2.1 World: total emissions and emissions by greenhouse gas (GHG) sector, 1990-2014 *(Megatons of CO_2 equivalent ($MtCO_2eq$) and percentages)*

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of World Resources Institute (WRI), "INDC Dashboard" [online] http://cait.wri.org/indc/.

Note: The percentages represent the mean annual growth rates for each period.

IND T.2.2 Latin America: total emissions and emissions by greenhouse gas (GHG) sector, 1990-2014 *(Megatons of CO_2 equivalent ($MtCO_2eq$) and percentages)*

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of World Resources Institute (WRI), "INDC Dashboard" [online] http://cait.wri.org/indc/.

Note: The percentages represent the mean annual growth rates for each period.

IND T.2.3 World: rate of increase in CO_2 emissions, 1960-2015 *(Percentages)*

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of C. Le Quére and others, "Global Carbon Budget 2014", *Earth System Science Data Discussions*, vol. 7, No. 2, Göttingen, Copernicus Publications, 2014.

Note: The percentages represent the mean annual growth rates for each period.

THESIS 3: CLIMATE CHANGE INVOLVES A TEMPORAL MISMATCH

IND T.3.1 World: historical GHG emissions, 1990-2014, and projections to 2050 *(Gigatons of CO_2 equivalent ($GtCO_2eq$) and degrees Celsius)*

Source: United Nations Environment Programme (UNEP), *The Emissions Gap Report 2015*, Nairobi, 2015.

Note: Data for 2014 are available in the Emissions Database for Global Atmospheric Research (EDGAR) and the Potsdam Real-Time Integrated Model (PRIMAP). The six greenhouse gases covered by the Kyoto Protocol and UNFCCC are: carbon dioxide, methane, nitrous oxide, hydrofluorcarbons, perfluorocarbons and sulfur hexafluoride. They are aggregated with the 100-year time horizon global warming potentials (GWPs) given in the Second Assessment Report of IPCC.

IND T.3.2 Climate models for the different scenarios, with projections of the rise in average annual temperatures for 2081-2100 relative to 1850-1900 *(Percentages)*

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, T. Stocker and others (eds.), Cambridge, Cambridge University Press, 2013.

Note: The projections correspond to the global CMIP5 models.

THESIS 4: CLIMATE CHANGE IS A GLOBAL BUT HETEROGENEOUS AND ASYMMETRIC PHENOMENON THAT ENTAILS A DUAL INEQUITY

IND T.4.1 World regions: share of world GHG emissions, 2014 *(Megatons of CO_2 equivalent ($MtCO_2eq$) and percentages)*

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of World Resources Institute (WRI), Climate Analysis Indicators Tool (CAIT) version 2.0, Washington, D.C., 2014 [online] http://cait2.wri.org.

IND T.4.2 World and Latin America and the Caribbean: structure of GHG emission sources, 2014 *(Percentages)*

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of World Resources Institute (WRI), Climate Analysis Indicators Tool (CAIT) version 2.0, Washington, D.C., 2014 [online] http://cait2.wri.org.

THESIS 5: ADAPTATION TO CLIMATE CHANGE: FROM INEVITABILITY TO SUSTAINABILITY

IND T.5.1 Latin America and the Caribbean: economic impacts of climate change in the event of a 2.5°C rise in temperature, second half of the twenty-first century *(Percentages of regional GDP)*

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of F. Bosello, C. Carraro and E. De Cian, "Market- and policy-driven adaptation", *Smart Solutions to Climate Change: Comparing Costs and Benefits*, B. Lomborg (ed.), Cambridge, Cambridge University Press, 2010; W. Vergara and others, *El desafío climático y de desarrollo en América Latina y el Caribe: opciones para un desarrollo resiliente al clima y bajo en carbono*, Washington, D.C., Inter-American Development Bank/ Economic Commission for Latin America and the Caribbean/World Wide Fund for Nature (IADB/ECLAC/WWF), 2014.

Note: Estimates of the impacts of climate change in the event of a 2.5°C rise in temperature in Latin America are taken from Bosello, Carraro and De Cian (2010). The IDB/ECLAC/WWF impact figure comes from Vergara and others (2014) and refers to the impact as of 2050.

IND T.5.2 Latin America and the Caribbean: annual adaptation costs up to 2050 *(Percentages of regional GDP)*

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of World Bank, *The Cost to Developing Countries of Adapting to Climate Change. New Methods and Estimates*, Washington, D.C., 2010.

Note: (a) National Center for Atmospheric Research (NCAR) (wettest scenario); Commonwealth Scientific and Industrial Research

Organization (CSIRO) (driest scenario); (b) For the fisheries sector, the average range is from 0.18 and 0.36 (NCAR) and between 0.18 and 0.35 (CSIRO).

IND T.5.3 Latin America and the Caribbean: high-priority sectors for mitigation and adaptation, June 2016 *(Number of countries that name the following sector in their national climate change plans and/or communications, June 2016)*

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of national statements and plans.

THESIS 6: THE UNSUSTAINABILITY OF LATIN AMERICA'S CURRENT DEVELOPMENT STYLE IS REFLECTED IN ITS CONSUMPTION PATTERNS, WHICH HAVE A DIRECT INFLUENCE IN TERMS OF CLIMATE CHANGE

IND T.6.1 Latin America and the Caribbean: context indicators

Source: Economic Commission for Latin America and the Caribbean (ECLAC), CEPALSTAT [online database] http://estadisticas.cepal.org/cepalstat/portada.html?idioma=english.

- Latin America and the Caribbean: total annual gross domestic product (GDP) at constant prices, 1990-2014 (Millions of dollars)
- Latin America and the Caribbean: total exports of commodities and manufactures, 1990-2014 (Millions of dollars)
- Latin America: poverty and indigence, 1990-2014 (Percentages)
- Latin America and the Caribbean: annual average open unemployment rate, 1991-2015

IND T.6.2 Latin American countries: household expenditure on food and beverages as a proportion of total expenditure, by income quintile *(Percentages)*

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of household surveys from the countries of the region.

THESIS 7: THE SUITABLE MANAGEMENT OF CLIMATE CHANGE RISKS CAN HELP LEAD TO A MORE SUSTAINABLE FORM OF DEVELOPMENT

Source: Economic Commission for Latin America and the Caribbean (ECLAC), "Efectos del cambio climático en la costa de América Latina y el Caribe. Impactos", Project document LC/W.484, Santiago, Chile, 2012.

THESIS 8: TAKING UP THE CHALLENGE OF THE NEGATIVE GLOBAL EXTERNALITY REPRESENTED BY CLIMATE CHANGE CALLS FOR THE APPLICATION OF NORMATIVE, FISCAL AND CORRECTIVE PUBLIC POLICIES AND/OR THE CREATION OF NEW MARKETS

IND T.8.1 Latin America and the European Union: relative environmental taxation levels, 2012 *(Percentages of GDP)*

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of Organization for Economic Cooperation and Development (OECD) and European Economic Association (EEA) statistical data or public environmental policy instruments.

IND T.8.2 Latin America and the European Union: taxation of road transport, petrol and diesel fuel, 2012-2014 *(Euros per gigajoule)*

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of Organization for Economic Cooperation and Development (OECD), *Taxing Energy Use 2015: OECD and Selected Partner Economies*, Paris, 2015.

Note: The information shown here is for 2012 except in the cases of Chile, Colombia and Uruguay, for which the information corresponds to 2014.

IND T.8.3 Latin America and the member countries of the Organization of Economic Cooperation and Development (OECD): income and price elasticities of the demand for petrol (meta-analysis)

Source: Economic Commission for Latin America and the Caribbean (ECLAC).

Note: Estimates of these elasticities, weighted by 1 standard deviation, were arrived at using the random effects model. In all cases, the Q test rejects the null hypothesis of homogeneity of the estimates. The I2 statistic indicates that, for both long- and short-term income and price elasticities, the variation observed in the scale of the effects attributable to heterogeneity of research findings is greater than 85%.

THESIS 9: THE CLIMATE CHANGE CHALLENGE IS A SUSTAINABLE DEVELOPMENT CHALLENGE. THE SUCCESSFUL IMPLEMENTATION OF THE NATIONALLY DETERMINED CONTRIBUTIONS (NDCs) WILL LEAD TO A MORE SUSTAINABLE FORM OF DEVELOPMENT

IND T.9.1 Annual global GHG emissions under different scenarios and emissions differentials in 2030 *(Gigatons of CO_2 equivalent ($GtCO_2eq$))*

Source: United Nations Environment Programme (UNEP), *The Emissions Gap Report 2015*, Nairobi, 2015.

IND T.9.2 Latin American countries: unconditional and conditional targets for GHG reductions, comparative scenario and high-priority sectors for mitigation and adaptation *(Sectors named by countries in their national climate change plans and/or communications, June 2016)*

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of the countries' official documentation.

IND T.9.3 Caribbean countries: total CO_2 emissions, emissions reduction targets for 2030, comparative scenario and high-priority sectors for mitigation and adaptation *(Sectors named by countries in their national climate change plans and/or communications, June 2016)*

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of the countries' official documentation.

CHALLENGE 1: THE DEVELOPMENT STYLE AND ITS ASSOCIATED CONSUMPTION PATTERNS

IND C.1.1 Latin American and Caribbean countries: shares of household expenditure devoted to different items, around 2012 *(Percentages)*

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of household expenditure surveys.

IND C.1.2 Latin American and Caribbean countries: distribution of household expenditure, by decile/quintile, around 2012 *(Percentages)*

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of household expenditure surveys.

IND C.1.3 Share of total expenditure accounted for by expenditure on food and share of total food expenditure for each income quintile, around 2014 *(Percentages)*

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of household expenditure surveys.

IND C.1.4 Share of total household expenditure accounted for by expenditure on petrol, diesel fuel and biodiesel fuel and share of total expenditure on petrol, diesel fuel and biodiesel fuel for each income quintile, around 2014 *(Percentages)*

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of household expenditure surveys.

CHALLENGE 2: AGRICULTURAL ACTIVITIES

IND C.2.1 Latin America: selected context indicators for the agricultural sector, around 2015

Source: Economic Commission for Latin America and the Caribbean (ECLAC), CEPALSTAT [online database] http://estadisticas.cepal.org/cepalstat/portada.html?idioma=english.

- Latin America and the Caribbean: population, by urban and rural areas, 2015 *(Percentages)*.

Note: Includes 48 countries: Anguilla, Antigua and Barbuda, Argentina, Aruba, Bahamas, Barbados, Belize, Bolivarian Republic of Venezuela, Brazil, British Virgin Islands, Cayman Islands, Chile, Colombia, Costa Rica, Cuba, Curaçao, Dominica, Dominican Republic, Dutch-speaking Caribbean, Ecuador, El Salvador, Falkland Islands (Malvinas), French Guiana, Grenada, Guadeloupe, Guatemala, Guyana, Haiti, Honduras, Jamaica, Martinique, Mexico, Montserrat, Nicaragua, Panama, Paraguay, Peru, Plurinational State of Bolivia, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Sint Maarten (French part), Saint Vicente and the Grenadines, Suriname, Turks and Caicos Islands, Trinidad and Tobago, United States Virgin Islands and Uruguay.

- Latin America and the Caribbean: share of annual gross domestic product (GDP), by economic activity, at constant prices, 2015 (Percentages). Crop farming, stock raising, hunting, forestry and fisheries, 2015 *(Percentages)*.

- Latin America: employed population, by sector of economic activity, agriculture, 2014 *(Percentages)*.

- Latin America and the Caribbean: agricultural exports *(Percentages)*.

IND C.2.2 World regions: changes in agricultural productivity as a result of climate change *(Percentages of change in yields per hectare)*

Source: W. Cline, "Global warming and agriculture", Finance and Development, vol. 45, No. 1, Washington, D.C., International Monetary Fund (IMF), 2008.

IND C.2.3 Latin American countries: proportion of the population employed in agriculture, around 2012 *(Percentages)*

Source: Economic Commission for Latin America and the Caribbean (ECLAC), CEPALSTAT [online database] http://estadisticas.cepal.org/cepalstat/portada.html?idioma=english; on the basis of official data from the countries.

IND C.2.4 Latin American countries: agricultural sector's share of total annual GDP, 2013 *(Percentages)*

Source: Economic Commission for Latin America and the Caribbean (ECLAC), CEPALSTAT [online database] http://estadisticas.cepal.org/cepalstat/portada.html?idioma=english; on the basis of household surveys from the countries.

Note: Includes crop farming, stock raising, hunting, forestry and fisheries. The figure for Argentina was obtained from the World Bank.

IND C.2.5 Latin American countries: change in agricultural productivity deriving from climate change *(Percentages of change in yields per hectare)*

Source: W. Cline, *Global Warming and Agriculture: Impact Estimates by Country*, Washington, D.C., Peterson Institute for International Economics, 2007.

Note: The impact of climate change on agriculture was computed using a linear function for the preferred 2080 impact estimate given in Cline (2007). The impact for Latin America and the Caribbean is the simple average. It was assumed that the impact for Paraguay is the impact reported under "Other South American countries" and that the impact for Uruguay is the same as it is for Argentina. Values were obtained from the World Bank.

CHALLENGE 3: ENERGY PRODUCTION AND CONSUMPTION PATTERNS

IND C.3.1 World and Latin America: energy matrix and renewable energy consumption, 2014 *(Percentages of total final consumption)*

Source: F. Ferreira, "Energía y cambio climático en América Latina y el Caribe", document presented at the eleventh Iberoamerican Meeting on Sustainable Development (EIMA 2014), Madrid, 24-27 November 2014 [online] http://docplayer.es/9772136-Energia-y-cambio-climatico-en-america-latina-y-el-caribe.html.

IND C.3.2 Latin American countries: per capita GDP (constant 2010 dollars), per capita energy consumption (kg of petroleum equivalent per capita) and energy-sector emissions (tons of CO_2 equivalent per capita), 2014

Source: Economic Commission for Latin America and the Caribbean (ECLAC); World Bank, World Development Indicators [online database] https://data.worldbank.org/products/wdi; World Resources Institute (WRI), Climate Analysis Indicators Tool (CAIT) version 2.0, Washington, D.C., 2014 [online] http://cait2.wri.org.

Note: The size of the circles indicates the scale of the energy sector's per capita GHG emissions. Per capita GDP is given in 2010 dollars and per capita energy consumption is shown in kilograms of petroleum equivalent.

IND C.3.3. World and Latin America: projections of energy demand, by source *(Exajoules)*

Source: D. Heres, "El cambio climático y la energía en América Latina", *Project Documents* (LC/W.688), Santiago, Economic Commission for Latin America and the Caribbean (ECLAC), 2015.

IND C.3.4 World and Latin America: projections of energy demand, by use *(Exajoules)*

Source: D. Heres, "El cambio climático y la energía en América Latina", *Project Documents* (LC/W.688), Santiago, Economic Commission for Latin America and the Caribbean (ECLAC), 2015.

CHALLENGE 4: URBAN AREAS AND INFRASTRUCTURE

IND C.4.1 Selected Latin American cities: net migration rates for the five-year periods preceding the 2000 and 2010 census rounds *(Per 1,000 inhabitants)*

Source: Economic Commission for Latin America and the Caribbean (ECLAC), *Social Panorama of Latin America, 2014* (LC/G.2635-P), Santiago, 2014.

IND C.4.2 Latin America: vehicle motorization index,1990-2012 *(Number of vehicles per 100 inhabitants)*

Source: G. Magrin and others, "Central and South America", *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, V. Barros and others(eds.), Cambridge, Cambridge University Press, 2014.

IND C.4.3 Latin American cities: concentrations of PM2.5 and health standards, 2016 *(Average annual concentrations in µg/m3)*

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of World Health Organization (WHO), Global Health Observatory [online database] http://www.who.int/gho/en/.

CHALLENGE 5: WATER RESOURCES

IND C.5.1 World regions: annual freshwater extraction, 2014 *(Billions of cubic metres)*

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of World Bank, World Development Indicators [online database] https://data.worldbank.org/products/wdi.

IND C.5.2 World and Latin America: distribution of water use, by sector, 2014 *(Percentages)*

Source: G. Magrin and others, "Central and South America", *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, V. Barros and others (eds.), Cambridge, Cambridge University Press, 2014.

IND C.5.3 Latin American and Caribbean countries: per capita water supply, 2014 *(Cubic metres)*

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of World Bank, World Development Indicators [online database] https://data.worldbank.org/products/wdi.

Note: The figures for per capita water supply correspond to inland freshwater courses and renewable inland resources (inland rivers and groundwater) in each country. The figures on water use distribution

reflect the amount of water extracted from water sources for a given type of use.

The figures for agricultural water use correspond to the total volumes of water used for irrigation and stock raising; those for residential use include drinking water, municipal water use and supply and public utilities, commercial establishments and households; in the case of industry, the figures reflect total extraction for direct industrial use (e.g. refrigeration of thermoelectric plants).

IND C.5.4 Latin American and Caribbean subregions: annual precipitation projections *(Percentages)*

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, T. Stocker and others (eds.), Cambridge, Cambridge University Press, 2013.

Note: The projections refer to the global CMIP5 models. The figures shown are the averages over SREX regions, plus the Caribbean. The area mean temperature and precipitation responses are first averaged for each model over the 1986–2005 period from the historical simulations and then for the periods 2016-2035, 2046-2065 and 2081-2100.

CHALLENGE 6: FORESTS AND BIODIVERSITY

IND C.6.1 Latin America and the Caribbean as a proportion of world totals: selected indicators of physical conditions, land cover, biodiversity and forest cover

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of Food and Agriculture Organization of the United Nations (FAO), *State of the World's Forests 2016. Forests and Agriculture: Land-Use Challenges and Opportunities*, Rome, 2016.

CHALLENGE 7: ALONG THE COASTS AS SEA LEVELS RISE

IND C.7.1 Latin American and Caribbean countries: distribution of the population between 0 and 3 m of elevation *(Number of persons)*

Source: Economic Commission for Latin America and the Caribbean (ECLAC), "The effects of climate change in the coastal areas of Latin America and the Caribbean. Impacts", *Project Documents* (LC/W.484), Santiago, 2015.

MAP C.7.1 Impacts on coastal areas and on coastal dynamics in Latin America and the Caribbean

Source: G. Magrin and others, "Central and South America", *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, V. Barros and others (eds.), Cambridge, Cambridge University Press, 2014.

ECLAC

Economic Commission for Latin America and the Caribbean (ECLAC)
Comisión Económica para América Latina y el Caribe (CEPAL)
www.eclac.org