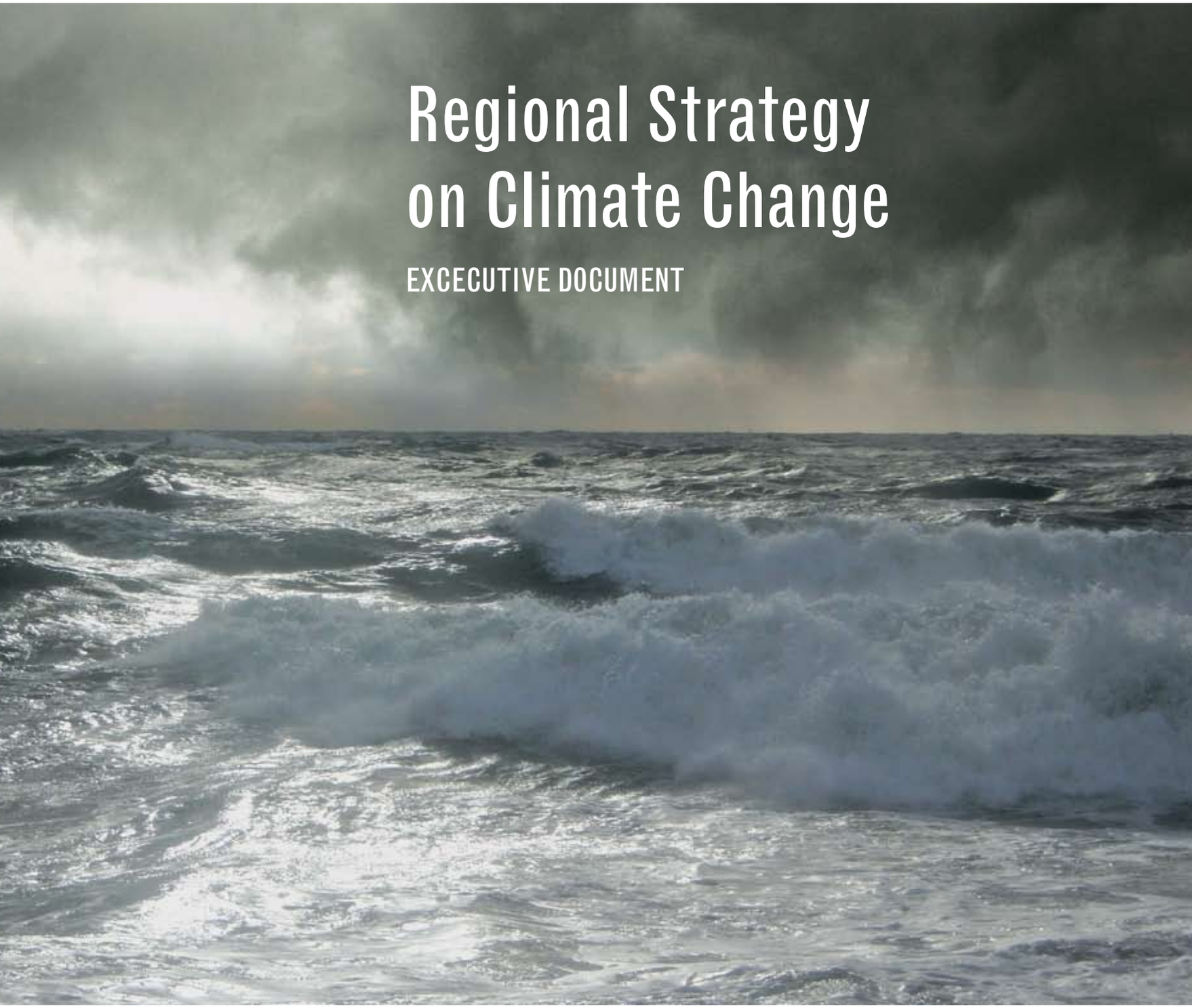

Regional Strategy on Climate Change

EXCECUTIVE DOCUMENT

Comisión Centroamericana de Ambiente y Desarrollo - CCAD
Sistema de la Integración Centroamericana - SICA

November 2010

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ACCRONYMS

ADA	Austrian Development Agency
AIACC	Assessments of Impacts and Adaptations to Climate Change
AOSIS	Alliance of Small Island States
CAC	Central American Agricultural Council
CATIE	Tropical Agricultural Research and Higher Education Center
CC	Climate Change
CCAD	Central American Commission for Environment and Development
CCJ	Central American Court of Justice
CCVAH	Council of Ministers of Housing and Settlements in Central America
CC-SICA	Consultative Committee at SICA
CDM	Clean Development Mechanism
CEAC	Electricity Council for Central America
CELADE	Latin American Demographic Center
CEPREDENAC	Regional Center for Disaster Prevention and Attention
CIMHAC	Central American Center for Integrated Meteorological and Hydrologic Activities
CONFEPESCA	Central American Federation of Artisanal Fishermen
COMISCA	Council of Ministers of Health in Central America
COP	Conference of the Parties
CRRH	Regional Committee on Water Resources
CV	Climate Variability
DANIDA	Danish Cooperation Agency
DFID	Department for International Development
ECADERT	Central American Strategy on Rural Development
ECAGIRH	Central American Strategy on Integrated Water Resource Management
ECLAC	Economic Commission for Latin America and the Caribbean
EEIS	Energy/Economic Information System at OLADE
EEP	Energy and Environment Partnership with Central America
ENSO	El Niño/La Niña Southern Oscillation
ERC	Emissions Reductions Certificates
ERCC	Regional Strategy on Climate Change
ERAS	Regional Strategy on Agriculture, the Environment and Health
FONAFIFO	National Forestry Financing Fund (Costa Rica)
GCM	General Circulation Models
GHG	Greenhouse Gas

GTZ	German Cooperation Agency
HDI	Human Development Index
IADB	Inter-American Development Bank
IICA	Inter-American Institute for Agricultural Cooperation
IPA	International Program for Adaptation
IPCC	Intergovernmental Panel on Climate Change
LDC	Less Developed Countries
MBC	Mesoamerican Biological Corridor
MW	Megawatts
NMHS	National Meteorological and Hydrological Services
OECD	Organization for Economic Cooperation and Development
OLADE	Latin American Energy Organization
OSPESCA	Central American Fishing and Aquaculture Organization
PACT	Protected Areas Conservation Trust (Belize)
PARLACEN	Central American Parliament
PCGIR	Central American Policy on Integrated Risk Management
PECCAC	Panel of Experts on Climate Change in Central America
PERFOR	Regional Strategic Program for Forest Eco-system Management
PES	Payments for Environmental Services
PINFOR	Forestry Incentive Program (Guatemala)
PINPEP	Incentive Program for Small Landholders in the Forestry Sectors (Guatemala)
PNMB	Project: Use of Non-wood Forest Products
REDD	Reduction of Emissions from Deforestation and Degradation
RUSI	Royal United Services Institute (Great Britain)
SICA	Central American Integration System
SIECA	Secretariat for Central America's Economic Integration
SIEPAC	Electrical Interconnection System for Central America
SICTA	Central American Agricultural Technology Integration System
TC-CC	Technical Committee on Climate Change
TNC	The Natural Conservancy
TROFCCA	Tropical Forests and Climate Change Adaptation Initiative
UCE-SICA	Energy Coordination Office at SICA
UNFCCC	United Nations Framework Convention on Climate Change
WB	World Bank
WHO	World Health Organization
WMO	World Meteorological Organization

Preamble

The world today faces one of the biggest challenges in history. A phenomenon that can determine a new way of living and developing human actions in the short term. Climate change represents a factor that is directly affecting millions of people nowadays, all species and ecosystems, and the entire society.

Based on scientific evidence, the climate phenomenon is the result of an unsustainable development model with a short-term vision; supported by the degradation, pollution and indiscriminate extraction of natural resources worldwide; in a growing dependence on fossil fuels and dynamics of economic growth based on the use of compounds which generate greenhouse gases in exchange of luxury goods and services. Such dynamics consequently produce the so called global warming and evidence an increasingly frequent climate variability and climate change with severe impact on human, material, social, economic and environmental losses worldwide.

This exclusionary and predatory development model generated and led by northern countries is expressed through climate changes as the main common problem for the future of humanity. The ones called developed countries have a great historical responsibility for the weather and therefore the consequent worsening vulnerability of current and future generations, putting at risk their right to enjoy conditions and well being equal or better than ours.

A model where the costs of environmental degradation and climate deterioration are socialized and where benefits are privatized in accordance to the richest economies and societies, and that shows its own limits from the socio-environmental perspective. The climate situation and its unequal global impact reveal the nature of the economic growth model, exposing the vulnerability and poverty that has been generated historically by the same model, increasing poverty and marginalization and the differences between and within countries and regions.

Climate change represents a multiplying and magnifying constituent of social, economic and environmental problems present in our Central American countries. Natural events magnified by climate change multiply their negative effects on the property and assets of individuals, communities and societies as a whole, affecting the life, health, production, infrastructure and quality of life of all, and increasing the relationship between vulnerability and poverty prevailing in the reality of the Central American countries.

In this regard, an important factor of the future of our societies is tied to climate and its variability. Climate changes conditions and reduces economic growth and social progress. It multiplies and magnifies regional vulnerability and environmental degradation increases, becoming a national security issue and a human security issue.

SICA countries for both their natural and geographical location, for its high levels of poverty and social deficits are at present time one of the most vulnerable regions to the climate change threat. The region is already subject to new regimes of heavy rains and storms, drought and new unknown extreme phenomena that are having an impact on public resources, the social and economic base of our countries and threatening the regional democratic governance itself.

1 Referring to the situation of "business as usual."

It is a major challenge for the SICA countries to show the level of damage already suffered by the region and at the same time, to show the political disposition, actions, use of their own resources and the efforts that each country is making to reduce and mitigate the impact of climate-related disasters, but at the same time, working to redefine its development agenda focusing on adaptation to climate variability.

This Regional Strategy on Climate Change (RSCC) is a precise example of political disposition and a shared regional vision that faces the challenge of climate change and its impact on people, livelihoods, ecosystems and regional production. The RSCC clearly spells out the orientation for the actions taken by governments of the member countries of SICA.

The RSCC reflects the commitment of current and future member countries of the Central American Integration System (SICA) to act and safeguard the regional heritage, large biodiversity, multiculturalism and diversity against the growing threat of climate change and take advantage of the opportunity to reverse the accumulated social deficit and improve the quality of life of its population.

The region confirms with the RSCC a process of collective construction and harmonization of policies of this new regional instrument, but in addition, confirms the need for cooperation and global collaboration for environmental compensation to join the increasing financial resources additional to the official development support that the SICA member countries need to promote adaptation and improve the resilience of society by reducing the high vulnerability of the population, especially in extreme poverty.

In that sense, at the same time that the region takes on its challenges and commitments regarding adaptation to climate changes, restates the need for developed countries to make progress on ambitious reductions in emissions of greenhouse gases and the achievement of an international agreement legally binding the reduction of greenhouse gases, reduction of emissions by at least 45% by 2020 and 95% for 2050. Stabilizing CO2 emissions at 350ppm. A maximum increase in temperature of 1.5 ° C.

Finally, we, the Central American Commission on Environment and Development (CCAD), formed by the Council of Environment Ministers of Central America expect that the RSCC is becoming a useful and valuable mechanism for sorting and harmonizing the additional regional support with the effort and national initiatives of the SICA member countries regarding climate change. We believe that the RSCC will constitute a tool to consolidate efforts for an environmentally sustainable regional integration based on a regional development model committed to the natural and cultural wealth of its citizens, ensuring human safety and the safety of their property against global climate change.

November, 2010.

Presentation

At a regional level since 1993, the Ministers of Foreign Affairs of Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama signed the Regional Agreement on Climate Change, giving a clear demonstration of commitment to the subject. In 2008, the Heads of State and Government of the SICA member countries met in San Pedro Sula, Honduras to establish a political commitment declaring ``… being aware that climate change is one of the most serious problems facing humanity , and that its impact threatens economic and social development, and furthermore increases the vulnerability of our populations and their livelihoods, we decide to begin a process of broad participation by all sectors of society to build a common strategy to deal with climate change impacts ... ``

From the time of this mandate and in subsequent events and processes of analysis and study during 2008 and 2009, the region, led by the Council of Ministers of Environment of the Central American Commission on Environment and Development (CCAD), began the work of collective and participatory building for the design and development of the Regional Strategy on Climate Change (RSCC).

Thus, the Council of Ministers of Environment of the CCAD in a meeting on November 20, 2009 in Guatemala City, instructs and states that the management of the final drafting process of the ERCC should be led by the Regional Technical Committee for Climate Change. From February to May 2010, the Technical Committee, with the support of the CCAD Executive Secretariat (SE-CCAD) and specialists, conceived and designed the format, structure and content of the RSCC. From May to September 2010, a comprehensive process of consultation was developed from the regional level, the Secretaries of the systems, specialized institutions and national consultations in the 8 SICA member countries.

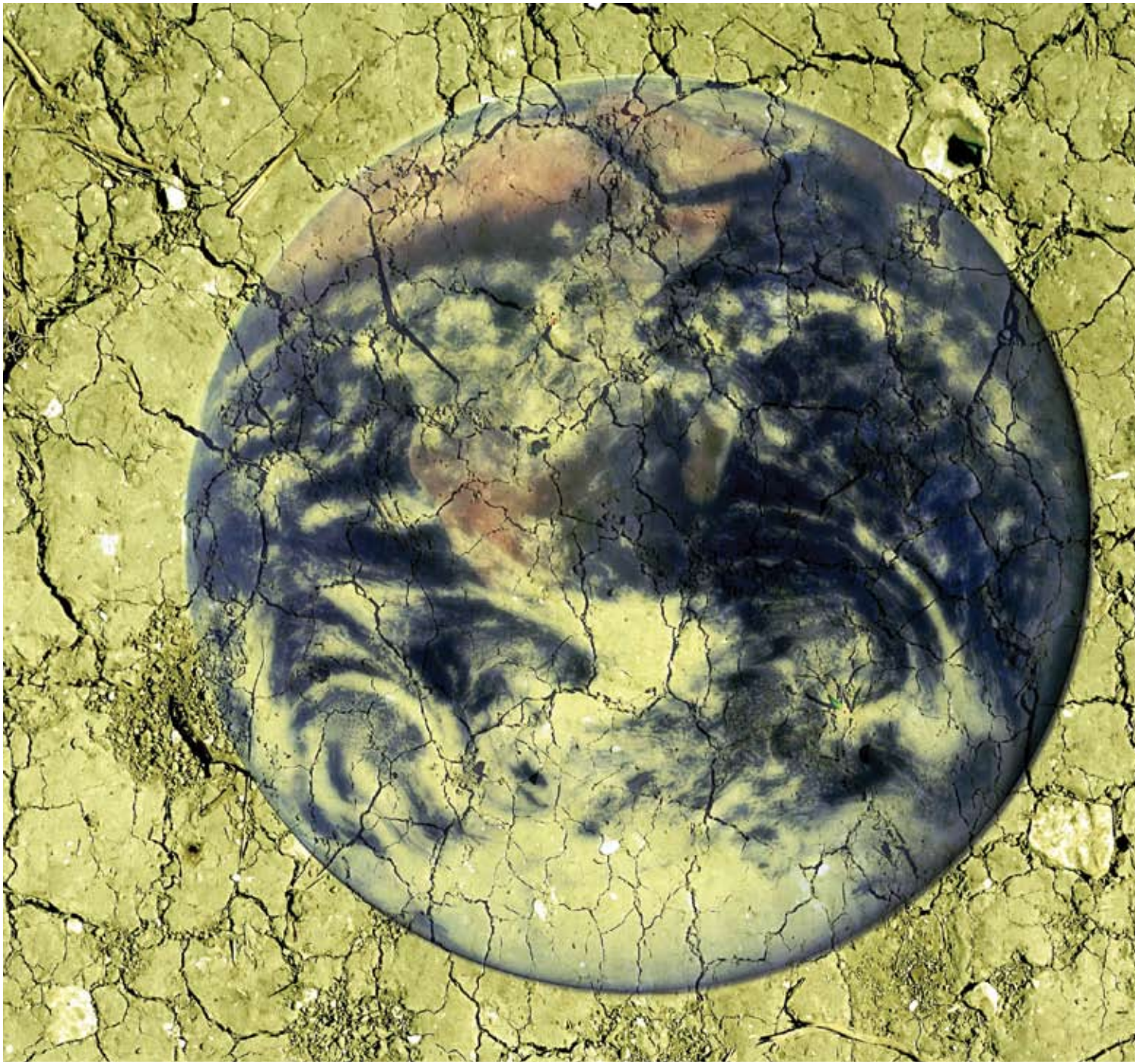
This document includes and incorporates the contributions of these consultation processes described above and also expresses a strong regional commitment at the highest level of the governments to address the threat of this global challenge together. The Regional Strategy on Climate Change (RSCC) is the result of an intense and dynamic process of preparation, consultation and input from a national to a regional level and represents a flexible tool for the orientation of the SICA member countries. The RSCC aims to become the harmonized, open and dynamic instrument for regional policy that will allow the CCAD to progress in achieving its mission to develop a system of environmental integration and cooperation to help address the threats and opportunities involving climate variability and change for the region. It also represents a guiding instrument for the regional and complementary measures and actions and added value to national efforts.

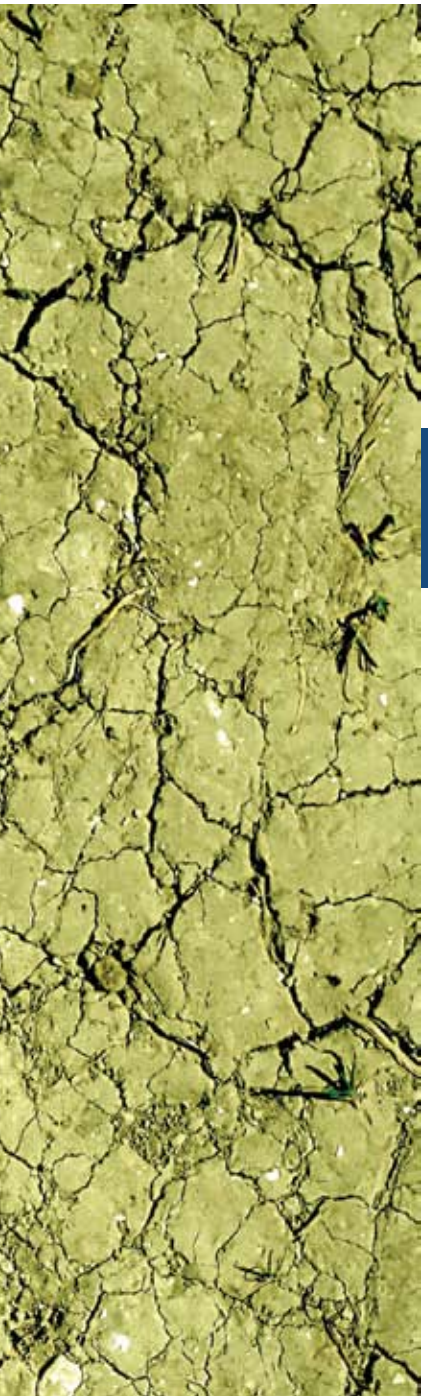
The Regional Strategy becomes a complementary tool for the efforts of national and local plans for adaptation and vulnerability reduction that the SICA member countries are taking to promote a culture of mitigation and adaptation to climate changes associated with poverty reduction, favoring transgenerational human development, and above all, seeking to protect property, life and the natural services that guarantee it.

Finally, the RSCC is framed in the context of global negotiations on climate change where the SICA member countries demand ambitious reductions in greenhouse gas emissions and the achievement of a legally binding agreement to reduce them and demand from the countries responsible for global warming, especially in developed countries under the principle of common but differentiated responsibilities, that the compensation and cooperation to address the negative impacts of climate change be additional to official development assistance, to transfer appropriate technologies that don`t create more dependency, to recognize the knowledge and ancestral wisdom of our peoples. The strategy becomes a tool for cooperation and support to local, national and regional agendas based on sufficient, timely and predictable cooperation derived from the Global Convention on Climate Change to strengthen our capabilities.

The executive RSCC document is shown below. The first chapter shows a summary of the global dynamics that characterize climate change, the origin and basis of the phenomenon from a perspective of historical responsibility and implications for life and development. The second chapter shows, from scenarios, climate projections and general trends in the region, the issues and impact that SICA member countries are receiving and may receive in the short-term and near future if the dynamics continue. Influence in lives, economy and security in general. The third chapter presents the responses that the region is producing in a political-institutional level, the action framework and strategic priorities to address the climate threat at present time.

Dr. Roberto Rodríguez Rojas
SICA - CCAD
November, 2010.





I. Climate Change Global Dynamic

Scientific evidence shows that beginning with the Industrial Revolution, human activities began to have global consequences, such as water pollution, or more recently, acid rain; gas emissions from burning fuels have had global impacts. These emissions, produced by the industrial and transportation sectors and deforestation, etc., have broken the natural equilibrium in the atmosphere, called the Greenhouse Effect. Between 1850 and 2005 the Planet emitted a total of 1.1 billion tons of carbon dioxide; 72% came from developed countries. Climate change is the result of unlimited emissions from developed countries during their industrialization processes.

The international scientific community has reached consensus that today's global warming is due to anthropogenic processes (IPCC, 2007).[2] They are quit e confident that human activities, such as burning fossil fuels and deforestation, are changing the global climate. In the last 200 years developed countries have generated an excess of carbon dioxide from their production processes and lifestyles. History is quite clear on their responsibility.

The increased concentration of greenhouse gases (GHG) from different anthropogenic activities is changing water cycles, provoking droughts, flooding, rising sea levels and glacial melting at the poles and in the mountains. These changes have huge human, social, economic and environmental implications for developing countries. Therefore, the results of climate change are the responsibility of developed countries, and they have an implied obligation to technologically and financially support poorer nations in a timely manner, since they are the most vulnerable to disasters that can be caused by climate change.

[2] IPCC. 2007a. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change –IPCC-, [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Avery, M.Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK and New York, USA. 996 p.

Natural and synthetic (industrial) GHG concentrations are increasing in the atmosphere due to anthropogenic activities (Table 1). One of the most important gases, relatively, for its contribution to global warming, is carbon dioxide (CO_2), followed by methane (CH_4) and nitrous oxide (N_2O). Increased concentrations of these gases alter the balance of solar energy that enters and leaves the atmosphere, trapping more heat with the potential to change climatic systems. It is estimated that CO_2 is the gas that has most contributed to global warming (≈70%). Concentrations of this gas are at a historic high, mainly due to burning fossil fuels (petroleum and its derivatives, gas), burning vegetation (forests, firewood, others) and deforestation.

Sources of these different GHG emissions are diverse (Table 1). In Central America changing land use and the use of petroleum derivatives for energy and transportation are the main causes of GHG emissions. Some industrial gases, such as chlorofluorocarbons, hydrofluorocarbons, hydroclorofluorocarbons, and others, have a high potential to create warming, though they are found in low concentrations in the atmosphere. They are attributed with destroying the ozone layer, which contributes to global warming.

Globally, the concentration of CO2 is approximately 385 ppm, but if the other GHG are added, the total surpasses 400 ppm of CO_2-equivalent. The maximum permitted concentration has been subject to international negotiations in order to avoid greater concentrations that could elevate global temperatures and cause catastrophic effects on small island states and most developing countries. For members of the Central American Integration System,[3] the maximum permitted concentration is 350 ppm of CO_2-equivalent. Concentrations should be reduced so that the temperature does not rise more than 1°C. The list of GHG is recognized by the UNFCCC, but it is being reviewed within the framework of recent international negotiations; no final decision has been made yet.

The IPCC's IV Report states that the average global temperature has increased 0.78 °C with respect to levels before industrialization. This increase is due to greater concentrations of GHG in the atmosphere (280 ppm before industrialization and 380 ppm in 2005). Global air temperatures have also increased sea temperatures, which increases the probability of extreme and more intense hydrometeorological events.

Studies from 2007 on emissions generated in Central America show that the eight SICA countries emit approximately 0.5% of all GHG emissions; therefore, the countries do not have any obligations to reduce their emissions. However, the region is one of the most vulnerable to climate change and its adverse effects on physical, social and economic security, due to its natural characteristics. Therefore, the region's priority is to reduce its vulnerability by increasing adaptation and promoting voluntary initiatives to contribute to global mitigation efforts.

[3] Belize, Dominican Republic, Guatemala, Honduras, El Salvador, Nicaragua, Costa Rica and Panama.

Table 1
Greenhouse gas emissions (GHG) contributing to global warming and the main sources of emissions

Greenhouse gas	Concentration in the atmosphere (pre-industrial era)[1]	Concentration in the atmosphere (2005)	Radiative forcing relative to CO_2	Main sources of GHG
Carbon dioxide (CO_2)	280 ppm[3] (180 - 300)	379 ± 0.65 ppm	1	Burning fossil fuels and changes in land use.
Methane (CH_4)	715 ppb[4] (320 - 790)	1774 ± 1.8 ppb	21	Agriculture and burning fossil fuels.
Nitrous oxide (N_2O)	270 ppb	319 ± 0.12 ppb	310	More than 1/3 of emissions are anthropogenic, mainly from agriculture, from the use of nitrogen fertilizers.
Chlorofluorocarbons (CFC)	**	251 ± 0.36 ppb	3,800	Uses in refrigeration, aerosols, foams and industrial use.
Hydrochlorofluorcarbons ($HCFC_2$)	**	169 ± 1.0 ppb	1,500	Uses in refrigeration, aerosols, foams and industrial use.
Hydrofluorocarbons (HFC)	**	18 ± 0.12 ppb	11,700	Uses in refrigeration, aerosols, foams and industrial use.
Sulfur hexafluoride (SF_6)	**	5.6 ± 0.038 ppb	23,900	Industrial gases.

Fuente: IPCC 2007

Notes:

[1] Average and natural ranges;

[2] Gases from industry;

[3] ppm=parts per million

[4] ppb= parts per billion

II. Problematic and Impact of the Climate Change Variability on the Region

Climate and Climatic Variability; Climate Change Projections in Central America and the Caribbean

Climate characteristics

Central America is a region located in the tropical zone of the Americas, between 7° and 21° N latitude and 76° and 93° W longitude. The region is located in the trade wind belt coming from the Northeast. The land stretches quite thin between the Pacific Ocean and Caribbean Sea, with mountain chains that determine the region's precipitation patterns, to a large extent. The region has little temperature variations. Figures 1 and 2 (below) show historic temperatures and precipitation levels for several countries in the region between 1960 and 2006 (ECLAC, 2010).[4] The Caribbean Sea side experiences precipitation throughout the year.

Precipitation on the Pacific Ocean side is characterized by a dry season from November to April or May, and a rainy season lasting the rest of the year (May/June to November) with maximum precipitation levels observed in June, September and October. Due to stronger trade winds in July, the Caribbean side and southern Mexico experience stronger precipitation and the Pacific side experiences a dry period

[4] ECLAC, 2010. The Economics of Climate Change in Central America: Climate change scenarios. Economic Commission for Latin America and the Caribbean (ECLAC). Project Report.

called "the little summer" or "canicula" or "veranillo" in Spanish (Magaña, et al., 1999).[5]

The annual precipitation cycle in southern Mexico and Central America has two main divisions, higher precipitation in June, September and October, and lower precipitation in July and August. The beginning of the raining season for the Pacific Coast is around May and is associated with activity toward the northern part of Ecuador, specifically in the eastern Pacific Ocean, when sea temperatures reach 29 °C. Later, mid-year, surface temperatures decrease by 1 °C due to a reduction in solar radiation and an acceleration of the trade winds. This temperature reduction, from 29 to 28 °C also reduces convection activity, causing "the little summer" dry period in July and August. At the end of August convection increases due to decreased trade winds and more frequent and concentrated winds. The sea surface temperature reaches 28.5 °C in the eastern part of the Pacific Ocean. This temperature increase also causes more convection, and precipitation reaches its highest levels in September and October. The seasonal variations in winds and sea temperatures are phenomenon that best explain the region's precipitation patterns. On the Caribbean side, precipitation patterns are characterized by a relative decrease in rain between March/April and September/October, while maximum precipitation levels are reached in July/August and November-January. Cold fronts and tropical waves are more frequent on this side.

[5] Magaña, V., J.A. Amador & S. Medina. 1999. The midsumer drought over Mexico and Central America. Journal of Climate, 12(6): 1577-1588.

Climatic variability in Central America

Article 1, paragraph 2 of the UNFCCC states that: "Climate change means a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods." These changes are produced over time and in all climatic areas: temperature, precipitation, clouds, etc. Climatic variability refers to variations in the environment and other statistical characteristics (typical deviations, extreme values, etc.) of climate in areas and timeframes that are broader and longer than individual meteorological events. The most significant scales that present this variation are given monthly, seasonally, annually and by decade (or temporary intervals that are even longer), presenting phenomenon associated with each time period. Variability can be due to natural processes in the climatic system (internal variability) or variations due to external or anthropogenic factors (external variability).

Climatic variability in Central America and the Caribbean translates into droughts (Graph 5) and flooding from tropical storms and hurricanes (Graph 6). Central America is highly vulnerable to extreme climate. Of 248 events occurring between 1930 and 2008, the ones that occurred the most were hydrometeorological in nature (floods, tropical storms, landslides and heavy rainfall), which represented ≈85% of total events. Nine percent corresponded to droughts, 4% to forest fires and 2% to extreme temperatures (mostly lows). In Central America Honduras experienced the most events (54), and Belize the least (18), during this period. The disasters having the most impact were hydrometeorological ones associated with tropical storms and hurricanes of different scales. They mostly impacted the Caribbean side of the region. Even though Costa Rica and Panama are the countries with the lowest probability of being hit directly by a hurricane (less than 5%), indirectly they have experienced damage, such as flooding on the Pacific Coast, from outer bands of weather.

Central America's relatively dry years are associated with atmospheric anomalies, such as those caused by the El Niño Southern Oscillation (ENSO). In the last 60 years, approximately 10 cycles have been recorded, lasting between 12 and 36 months. Extreme droughts have major socio-economic impacts on the region, mainly along the Pacific Coast. This area is commonly classified as dry tropical forest or dry tropics, and extends from Costa Rica and Nicaragua, through Honduras and parts of El Salvador and Guatemala; it is frequently referred to as the "Dry Corridor" (Figure 3).

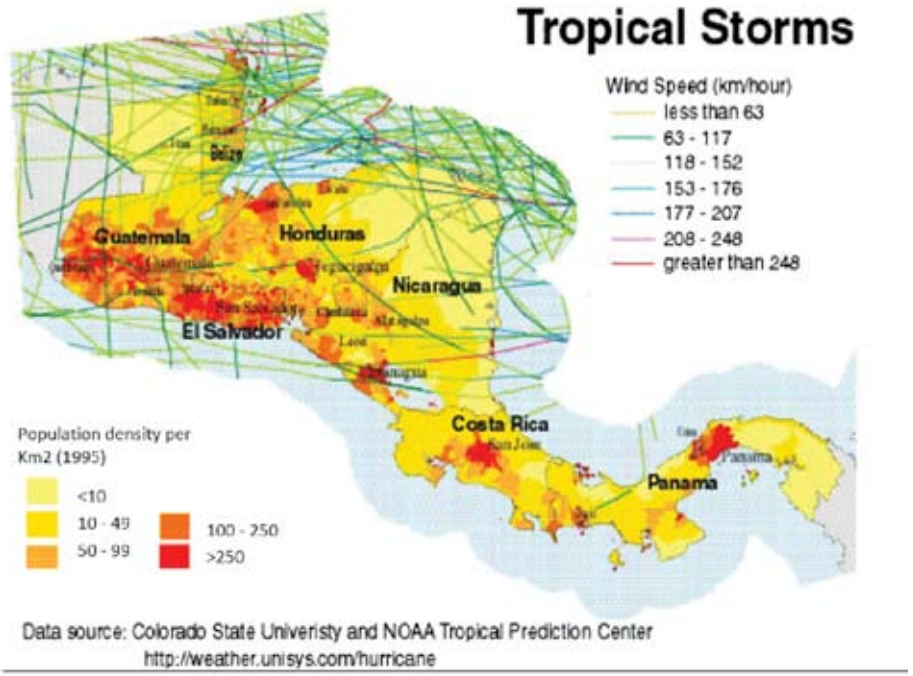
Graph 1
Areas Prone to Drought in Central America

Source: P. Ramirez, 2007

The most drastic effects are observed along this belt, especially when ENSO is occurring. Events with the most socio-economic impacts from ENSO during the warm phase occurred in 1926, 1945-46, 1956-57, 1965, 1972-73, 1982-83, 1992-94, 1997-98, and more recently from 2009–10 (Ramírez, 1999; NOAA, 2010). In some cases cooler sea surfaces in the Caribbean Sea and Atlantic Ocean appear to be associated with these droughts, such as what happened in 2001-02. These occurrences also have important socio-economic impacts on the region (Ramírez, 2007).

Other events that occurred during 2009 and, more recently, in 2010, should be noted. In 2009 drought provoked losses in food production in Guatemala, El Salvador and Nicaragua; the situation was most extreme in Guatemala. Later, that same year, Tropical Storm Ida left thousands of victims in Nicaragua. At the beginning of

Graph 2
Tropical Storms with a Direct Impact on Central America



Source: Ramírez, P., 2007. [6]

[6] Ramírez, P. 2007. Climate, Climate Variability and Climate Change in relation with forest ecosystems in Central America, Review of experiences, actors and needs in tropical forest climate change adaptation in Central America. Consultancy Report. Tropical Forests and Climate Change Adaptation. CATIE, Turrialba.

November, weather patterns caused torrential rains that led to landslides resulting in hundreds of deaths and destroyed infrastructure and means of living for thousands of rural families. In 2010 all countries from the Dominican Republic and Belize to Panama have experienced climatic phenomenon associated with abundant precipitation at the start of a heavy rainy season, with accumulated precipitation equaling at least 20% or more of the annual average. The rain has resulted in flooding and landslides, seriously damaging human lives and public, social and private goods and infrastructure, especially in agricultural production, which is the basis for the region's diet.

Climate change projections

Several studies have been done on the evidence of climate change in the Central American region and the Caribbean. One refers to a trend analysis on precipitation and temperatures over a 40-year period between 1961 and 2003 (Aguilar, et al., 2005).[7] This study concluded that maximum and minimum temperatures increased 0.2 and 0.3 °C per decade, respectively. In addition, annual precipitation totals have not varied much, but the number of dry days have (compensated for by more intense rain on wet days). This confirms that extreme precipitation has been observed, increasing risks for erosion, flooding and landslides. Likewise, more dry days increases risks for agricultural losses due to decreased humidity at critical times for crop and forest planting, as has been observed on the Pacific Coast of Nicaragua and Honduras. Increased maximum and minimum temperatures can also negatively affect human health and pest control, as well as increase heat waves.

In Central America, ,which stretches from Guatemala and Belize to Panama (seven countries), all countries have done climate change projections and communicated them under the United Nations Framework Convention on Climate Change (UNFCCC; World Bank, 2009).[8] Projections on increased temperatures for 2030, 2050 and 2100, oscillated between 1.0 and 1.5 °C, 1.5 and 2.1 °C, and 3.0 and 3.7 °C, respectively, with slight individual variations for each country. Only in Belize is the projected temperature for 2100 between 1.0 and 3.5 °C.

IPCC projections (2007) for 2020, 2050 and 2080 show slightly higher temperatures during rainy seasons (Tables 6 and 7); however, by 2080 the increase in temperature could reach 1.0 to 5.0 °C during dry season and 1.3 to 6.6 °C in rainy season. In terms of precipitation, projections made for 2030, 2050 and 2100 for Honduras, Nicaragua, Guatemala and El Salvador show reductions in the range of -11 to -14%, -16 to -21%, and -30 to -36%, respectively (World Bank, 2009; Ramírez, 2007). IPCC projections (2007) for 2020, 2050 and 2080 indicate ranges from reductions to slight increases (Table 6).

[7] Aguilar E., et al. 2005. Changes in precipitation and temperature extremes in Central America and Northern South America, 1961-2003 ed J. Geophysical. Res. Vol. 110, D23107, doc. 10:1029/2005JD6119

[8] World Bank, 2009. Climate Change aspects in agriculture for 18 Latin American & Caribbean countries. Country Notes for each of 18 countries can be reviewed in the following web site: http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/LACEXT/0,,contentMDK:22077094~pagePK:146736~piPK:146830~theSi

For example, for 2050, decreases in precipitation (and in some cases, increases) during dry season are estimated to be -20 to +8%, and -30 to +5% during rainy season. Recent studies coordinated by ECLAC (Gay, et al., 2010) confirm gradual increases in temperature and decreases in precipitation in the region, considering scenarios A2 and B2 (Tables 7 and 8). These scenarios indicate that water resources for all types of use (domestic, agriculture, hydroelectric power generation, part of ecological cycles, etc.) will be affected and that water shortages will be more common on the Pacific side, where most of the population is concentrated.

Table 3
Projected Temperature and Precipitation Changes in Central America 2020, 2050 and 2080 [9]

Season	Changes in temp. ° C		
	2020	2050	2080
Dry	+0.4 a +1.1	+1.0 a +3.0	+1.0 a +5.0
Rainy	+0.5 a +1.7	+1.0 a +4.0	+1.3 a +6.6
	Changes in precipitation (%)		
	2020	2050	2080
Dry	–7 a +7	–12 a + 5	–20 a +8
Rainy	–10 a + 4	–15 a+ 3	–30 a +5

Source: IPCC, 2007

Table 4
Abnormalities in Average Temperature (°C)
(According to the average of three models)

Years	2050		2100	
Country * Scenario	A2	B2	A2	B2
Costa Rica	1.63	1.32	3.89	2.48
Belize	1.53	1.40	3.70	2.47
El Salvador	2.05	1.45	4.72	2.65
Guatemala	1.97	1.48	4.74	2.73
Honduras	1.83	1.42	4.20	2.53
Nicaragua	1.89	1.40	4.29	2.45
Panama	1.49	1.24	3.62	2.21
Central America	1.77	1.39	4.17	2.50

Source: ECLAC, 2010[10] (with respect to 1980-2000).

[9] IPCC. 2007. Climate Change 2007: Impact, Adaptation and Vulnerability, contribution of the Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), Chapter 13 (Latin America).

[10] Gay, C., C. Conde, F. Estrada and B. Hernández. 2010. Climate Change Scenarios for Central America. In: The Economics of Climate Change in Central America. Economic Commission for Latin America and the Caribbean (ECLAC), Chapter 1. Mexico City, Mexico. 35 p.

In the Caribbean region, considering Haiti and the Dominican Republic as examples, projected increases in temperature for 2030 and 2050 are estimated to be around 0.8 to 1.0 °C and 1.5 to 1.7 °C, respectively. These projections are slightly lower than those for Central America, the Amazonia region and southern South America, for the same timeframe (World Bank, 2009). In the case of Haiti, precipitation is projected to be lower for 2030 and 2050, from -5.9 to -20%, and -10 to -36%, respectively. In the Dominican Republic, precipitation will decrease for 2020, by approximately -11%, and by -57% for 2100. These projections indicate water shortages for the shared island, which will affect water availability for agriculture and the population. Considering that Haiti's soil degradation is quite high (70%), adaptation measures in the agricultural and domestic sectors should consider these scenarios. In addition to these projections, other have been made indicating more intense and frequent hurricanes and rising sea levels, between 0.18 and 0.59 meters for 2100 (IPCC, 2007).

Table 5
Abnormalities in Annual Average Precipitation Levels (%)
(According to the average of three models)

Years	2050		2100	
Country * Scenario	A2	B2	A2	B2
Costa Rica	-12.48	-3.43	-23.41	-10.71
Belize	-15.26	-7.91	-22.99	-12.62
El Salvador	-15.24	-2.35	-21.85	-10.99
Guatemala	-12.72	0.08	-20.09	-7.09
Honduras	-15.67	-7.39	-18.54	-12.47
Nicaragua	-17.93	-7.72	-14.48	-17.72
Panama	-7.97	-2.36	-5.75	-2.89
Central America	-13.89	-4.44	-18.16	-10.64

Source: ECLAC, 20107 (with respect to 1980-2000).

Both Central America and the Caribbean will be affected by extreme precipitation, but General Circulation Models (GCM) cannot project these occurrences. Factors that influence climate variability and predictability in the region are still being researched.

According to the IPCC report (2007), Central America will experience reduced precipitation with more intense and more frequent droughts in both seasons. Despite the fact that the projections are for the medium to long-term, the most important issue is that the frequency of extreme climate events, such has drought and tropical storms, will tend to increase, as what has been observed over the past three decades.

Many sectors will be affected by climate change in the region; the ones that are most affected will be those that depend on climate for survival. In the case of Central America, the most vulnerable sectors are those that depend on water: potable water, hydroelectric power, agriculture (food security), health and biodiversity (terrestrial and marine/coastal). An immediate priority for the region is to study and analyze the results of future scenarios of climate change, review past experiences in terms of climate variability and apply criteria to estimate possible impacts of climate change, using historical trends and including instruments for economic evaluation. These steps will help the region establish priorities on measures to be taken and reinforce international negotiation processes.

Regional Trends Relevant to the Regional Strategy on Climate Change

Growing population

Without considering the impacts of climate change, it is estimated that the region's population will keep growing, at least until 2075. According to the State of the Region (2008), [11] between 1980 and 2008, over 28 years, the population of the seven Central American countries doubled. The region's population in 2007 was estimated at 41.3 million inhabitants. For 2010 and 2015, it is estimated to grow to 43.7 and 47.8 million, respectively (Fetzek, 2009).[12] Another demographic projection shows that Central America's population will increase from 38 million in 2005 to 68 million in 2050, reaching 73 million in 2075; the population will then decrease slowly to 69 million by 2100.

The estimated and observed population growth translates into an increased demand for resources: water, food, energy, transportation and space, among others. Due to the effects that climate change has on resources, this growth will make social challenges, like reducing poverty and better governance, more difficult to overcome. These changes may have social, political and security repercussions in the long-term (Fetzek, 2009). Uncertainties include the effects of climate change, or environmental degradation, on immigration – locally, nationally, regionally or internationally.

Cyclical and unpredictable economy

In synthesis, Central America's economic growth has followed a cyclical pattern with fluctuations within a larger trend of growth during the last decades. This permits potential long-term growth to be forecasted. Since 2004 and until 2008, the region experienced a boom in economic growth, which later slowed due to the international financial crisis.

In terms of income per capita, the GDP per capita for 2006 was between US $1,000 and $1,500 (State of the Region, 2008). According to an ECLAC study (2009) prepared for the "Economics of Climate Change in Central America" Project, economic growth would be relatively stable within similar ranges to those observed in the last two decades. Regional growth would mirror the global economy, and investment rates would be close to those from 1990 to 2008. The annual GDP growth rate per country through 2100 is estimated at 3.1 to 3.6%, with a 60% probability.

[11] State of the Region. 2008. El desafío regional de contar con personas saludables. Chapter 4. pg. 177-214.

[12] Fetzek, S. 2009. Climate-related Impacts on National Security in Mexico and Central America. First Report from the Climate and National Security in Mexico and Central America Project. Royal United Services Institute (RUSI). London. 36 p.

Table 6
Growth Projections for Central America
2008-2100

Countries	Low	Base	High
Belize	2,81	3,59	4,11
Costa Rica	2,42	3,09	3,75
El Salvador	2,26	3,22	3,88
Guatemala	2,67	3,18	3,78
Honduras	2,76	3,17	4,21
Nicaragua	2,34	3,07	3,79
Panama	2,90	3,53	4,11

Source: ECLAC 2010. Economics of Climate Change in Central America study.

Table 6 illustrates an exercise done by ECLAC considering three economic growth situations. The base scenario presents a trend similar to the one from the past few years, in terms of capital growth, stability in the financial sector and greater regional macroeconomic stability, even with an increase in energy prices, affecting growth. All of the scenarios: base, optimal and low, consider factors associated with the volatility of prices for food, energy and the financial crisis. ECLAC estimates that the optimistic scenario – of high growth rates in Central American economies – has 10% probability. The low scenario has 20% probability.

Socio-economic deficits

In terms of the region's socio-economic development, in 2006 Central America's poverty rate was approximately 45% of the population (State of the Region, 2008), with higher rates among indigenous communities, populations of African descent and women. Women had lower education levels and incomes than men in similar situations.

The 2008 State of the Region Report presents elements relevant to the socio-economic agenda. On the one hand, Central America's workforce was young - 29% were under 25 years old - and was growing 3% annually, showing greater participation from women (38% of the workforce). The region has a trend of new employment opportunities (42.3%) that are highly productive and not based on agriculture.

On the other hand, poverty continues to determine access to healthcare services for Central Americans, worsening differences between population groups and possibilities to improve health and quality of life. This is especially true for children, rural residents, indigenous people and women. In 2007 the infant mortality rate in the region decreased to 23 per 1,000 live births; however, in some rural areas and indigenous communities, the rate was up to four times national averages.

In terms of food security, between 1990 and 2005 the amount of planted plots of rice, beans, corn and sorghum was cut in half, while land dedicated to non-traditional crops for export doubled (State of the Region, 2008). All countries experienced an increase in the availability of basic grains; however, this was due to an increase in imports.

In SICA countries several factors have added to social vulnerability to climate change and variability. In general, there is consensus that **poverty is one of the most important factors**.

The Human Development Index (HDI)[13] differs among the countries in the region, from 0.689 to 0.846. These indices position the region's countries in different spots between 118 (the lowest HDI) to 48 (the highest HDI). In terms of socio-economic vulnerability to climate change, poverty is, and will be, one of the main issues considered to design and implement policies directed toward poverty alleviation and increasing HDI.

Environmental degradation

Central America has enormous natural wealth. Beginning at the end of the 90s, territorial development has been consolidated to manage and protect biodiversity, multiple eco-systems and environmental goods and services that Central American society provides.

In the last decade the region, as a whole, has made progress on developing environmental institutions and has taken steps toward environmental management, protection and regulation. Countries have built legal, institutional and policy frameworks considering a complex socio-environmental context. Simultaneously, there are signs of greater and more active participation from the private sector, indigenous people and rural communities. Together with international aid, these initiatives have supported efforts to recover, restore and protect natural resources in the region. However, in general, conditions for institutional and resource management are quite limited. The demand for natural resources, urban expansion, unorganized human settlements and unregulated productive activities puts pressure on these resources, increasing their irreversible loss or growing and sustained degradation.

In some cases, as shown in the 2008 State of the Region Report, even important regional eco-systems, like the Mesoamerican Biological Corridor (MBC) are not properly included in national development strategies. Pressures on the region's natural resources structurally respond to a development model based on extraction with contaminating productive practices that destroy resources. This model is the result of several factors, such as: soil structures, an absence of territorial zoning, growing populations, vulnerability, internal immigration related to poverty and vulnerability and changing habitats.

[13] The Human Development Index (HDI) is a human development indicator by country elaborated by the United Nations Development Program (UNDP). It is a statistical social indicator based on three parameters: life expectancy, education and a decent standard of living.

In 2005 the region's deforestation equaled approximately 350,000 hectares/year. In 2000 total emissions were estimated at 156.3 million tons of CO2-equivalent; of these, 43.4% were attributable to deforestation (ECLAC, 2009). Projected trends on land use for 2005 to 2100 show a loss of one-third of forests and 80% of pastureland, savannahs and brush land, mostly due to an expansion of 50% in land used for crops and livestock. Almost all of this will happen before 2050, with a risk of losing 45 gigatons of carbon sinks in total, equaling 30% of what was registered in 2005. Losses in forest cover have implications for terrestrial biodiversity since natural habitats are reduced.

Greater demands for energy

In 2009 the region's installed energy generation capacity was approximately 10,690.8 MW, of which 60.9% corresponded to renewable energy sources.[14] For the period from 2006 to 2014, the region will require an additional 5,000 to 5,700 MW of installed capacity to maintain its rhythm of economic and population growth. This represents an additional demand of approximately 5-6% in installed capacity. Based on the 2020 Central American Strategy for Sustainable Energy[15] (2020 Energy Strategy), demand for electrical power will grow from 6.328 MW in 2006 to 11.770 MW in 2010 (CEAC, 2007), a projected growth rate of 4.5%. Energy demand will grown 4.7% from 35,664 GWH to 67,583 GWH. The Strategy seeks to reduce energy production from petroleum and its derivatives and increase renewable energy. In addition, the region must maintain investment in energy projects to respond to growing demand and provide greater coverage nationally. Likewise, countries with the most GHG emissions in the region (at least four SICA members) must increase energy consumption efficiency.

Changing consumption patterns by creating a culture that promotes rational and efficient energy use, is key to short-term and immediate results. Renewable energy technologies are increasing in the region, and there is potential to increase installed capacity through wind power parks, geothermal energy and hydroelectric and biomass generation. If investment costs are reduced, solar energy could also become more prominent in the region's electricity grid.

[14] Istmo Centroamericano: Estadísticas del Subsector Eléctrico. Preliminary report on electricity production (Data updated through 2009).http://www.eclac.cl.

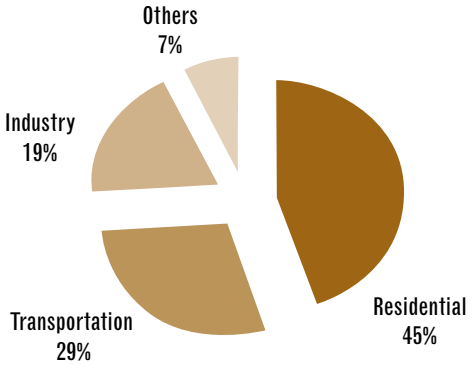
[15] Elaborated by the Sub-regional Office of ECLAC in Mexico for the Secretary General of SICA and approved on November 13, 2007 in Guatemala City, at the Third Meeting of Ministers and Energy Authorities from SICA member countries. This Strategy is the result of analyses on energy sectors in SICA countries through 2020. Its main objective is: to assure energy supplies in Central America, in terms of quality, quantity and diversified sources, which are needed to guarantee sustainable development, considering social equality, economic growth, governance and environmental compatibility. The Strategy establishes goals in five main areas: access to energy by low-income households, rational and efficiency energy use, renewable sources of energy, biofuels for transportation and climate change.
http://www.sica.int/busqueda/Noticias.aspx?IDItem=20152&IDCat=3&IdEnt=749&Idm=1&IdmStyle=1

Cuadro 7
Energy indicators in Central America

	2006	2008	2020	2023
Installed capacity (MW)	9,369.1	10,271.0	7,000 (Additional)	9,500 (Additional)
Maximum demand (MW)	6,327.0	6,674.0	11,770.0	14,455.0 - 17,020.0
Net generation (GWh)	36,380.2	39,398.7	68,000.0	
Electrical coverage	81.0 %	83.7%	90%	-
Losses	16.2 %	16 %	12%	-
Renewable energy	61 %	63 %	71 %	-
CO_2 emissions (metric tons)	38	40	92 (120 projected)	-

Fuente: CEPAL 2010. Estudio Economía del Cambio Climático en Centroamérica.

Gráfico 3
Energy Consumption in Central America Consumption by sector - 2008



The region's average emissions in the energy sector in 2000 were 627 tons of CO_2-equivalent per GWH, but the range for the seven SICA countries – not including the Dominican Republic – spread from 298 to 857 tons of CO_2-equivalent (ECLAC, 2009).

As stated in the 2020 Energy Strategy, GHG emissions will increase by 48 metric tons of CO2 between 2005 and 2020, reaching 120 metric tons if environmentally-friendly measures are not taken. This represents a 67% increase. By comparing this projection with a more favorable scenario, the application of the measures set forth in the document will lead to a reduction of 28 metric tons of CO_2 by 2020.

Relevant impact on the region

Central America is a region located in the tropical zone of the Americas, between 7° and 21° N latitude and 76° and 93° W longitude. The region is located in the trade wind belt coming from the Northeast. The land stretches quite thin between the Pacific Ocean and Caribbean Sea, with mountain chains that determine the region's precipitation patterns, to a large extent. Climate variations enhance the natural vulnerability of the region and the islands. As of now, this becomes evident with the loss of human lives, ecosystems and the environmental services associated; reduction of availability and quality of water resources; more incidence of gastric, respiratory and vector diseases. Besides, these variations have a negative impact on the main economic activities in the region such as agriculture and tourism; food security, increase of vulnerability in human settlements, loss of forest ecosystems and coastal/marine resources which are the basis of the economic activity, representing a major proportion of income and employment in all the countries in the region. All the scientific and technical studies on the topic show the region is being and will be impacted at a greater frequency and intensity of extreme climate phenomena, because of excess of precipitation and droughts.

A brief synthesis of these impacts on SICA countries:

- Increased vulnerability and extreme events
- Uncertainty of food supply
- Deforestation and loss of ecosystems
- Water availability
- Harm to human health
- Loss of coastal and marine resources
- Reduced tourism
- Involvement of life and cultures of indigenous peoples, ethnic groups and communities from African descent
- Severe damage to infrastructure
- Polluting energy sources.

Increased vulnerability and extreme events

Central America is highly vulnerable to extreme climate change. Of the 248 climatic and hydrometeorological events recorded between 1930 and 2008, most happened in Honduras (54), and the least occurred in Belize (18). The most frequent events were hydrometeorological in nature (flooding, tropical storms and landslides), which represented ≈85% of all events; nine percent were droughts, 4% forest fires and 2% extreme temperatures, mostly lows. The disasters that had the most impact were also hydrometeorological and were associated with tropical hurricanes of different magnitudes. Most impacts were felt on the Atlantic Coast.

Other events that occurred during 2009 should also be noted as an example of the region's vulnerability to climate variability. In 2009 drought provoked losses in food production in Guatemala, El Salvador and Nicaragua; the situation was most extreme in Guatemala. Later, that same year, Tropical Storm Ida left thousands of victims in Nicaragua. At the beginning of November, weather patterns caused torrential rains that led to landslides resulting in hundreds of deaths and destroying infrastructure and means of living for thousands of rural families.

Two time periods of 19 years have been compared for the Central American region: 1970-1989 and 1990-2008. The region was most affected by flooding, but the frequency of hurricanes and tropical storms has increased in the past decades, with respect to early periods. The frequency of flooding has practically doubled in all countries. El Salvador and Guatemala had no registered hurricanes or tropical storms for 1970-1989, but have experienced eight and seven, respectively, for 1990-2008. Belize and Costa Rica have also experienced increases. Nicaragua is the country with the most recorded storm activity, with 14 events more in the second period. Even though a similar pattern has not been observed for droughts, beginning in 1970 recorded droughts have been more intense. In general, a drought happens in the region every five to six years; however, it is hard to predict with certainty when the next will occur. There is also great uncertainty about hurricanes and tropical storms. What is certain is that with increased global temperatures, extreme events – both droughts and hydrometeorological events – will be more intense.

An economic evaluation of the impact of extreme climatic events requires credible sources of information. Information collected by ECLAC, in cooperation with national and regional authorities, has been used to evaluate the economic impact of 11 extreme climatic events in the region, mainly occurring in five countries: Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua. These 11 events have caused over US $13.6 billion of damage in 2008 dollars. Of the 11, Hurricane Mitch in 1998 produced the most losses ($8 billion), equaling 58.2% of total losses. Next is Hurricane Joan in 1988 ($1.4 billion, 10.4%) and Tropical Storm Stan in 2005 ($1.3 billion, 10% of the total). The countries that have most been affected with economic losses are Honduras ($5.6 billion, 41% of the total), Nicaragua ($4.5 billion, 33%) and Guatemala ($2.2 billion, 16.2%). El Salvador and Costa Rica have experienced fewer losses, with 7% and 3% of the total for the 11 events, respectively.

Uncertainty of food supply

There are several factors that contribute to agricultural vulnerability to climate change and/or variability; they can be classified as socio-economic, bio-ecological and technological. Socio-economic factors of vulnerability include high poverty rates and low education levels in rural areas and small and medium producers' limited access to markets. In addition, public policies that have discouraged agricultural competition in the last 20 years have created greater vulnerability in the sector, particularly for small producers, rural producers and indigenous communities. They lack appropriate credit, technical assistance, training, social and productive investments, basic services (healthcare, education, energy, water and sanitation) and sales support. Economic liberalization that prolonged monopolies and high prices for agricultural inputs and low sale prices due to disloyal competition and dumping, also affected these groups. One indicator is a lack of agricultural insurance coverage with environmental components for practically all agricultural areas.

Bio-ecological vulnerability factors include the following: i) In Central America 80-98% of agricultural areas depend on rainfall, or in other words, they do not use irrigation. This increases exposure and sensitivity to climatic variability; ii) Twenty five to seventy percent of soil in arable agricultural and pasture lands have been degraded from erosion; iii) Forest cover has been reduced, particularly in areas where forest eco-systems are important for water resources and biodiversity.

Technological vulnerability factors include inappropriate paternalistic approaches on technology transfers that do not value or incorporate ancestral and local knowledge and a lack of coverage for agricultural technical assistance and expansion programs, especially for small and medium producers. Irrigation technologies are limited, both in terms of coverage and water efficiency. National and regional innovation and technology transfer systems were weakened or dismantled with privatization processes. Scenarios of climate change and variability have not been considered to structure technologies that improve the resistance of agricultural systems to these changes. Agricultural productivity is low in the region.

The agricultural sector should be considered for two reasons. On one hand, Central America is one of the main sources of greenhouse gases, and on the other, it offers great potential to reduce emissions and capture carbon. The sector greatly contributes to carbon dioxide (CO_2) emissions from burning vegetable byproducts in the productive cycle and changing forest eco-systems for agricultural purposes. Several National Communications have indicated that the sector is one of the main causes of methane (CH_4) emissions, mostly from enteric fermentation inherent to nutrition for bovine, ovine and caprine livestock production, and rice production using a flooded paddy system. The agricultural sector is also mostly to blame for nitrous oxide (N_2O) emissions from the use of nitrogen fertilizers in production.

Deforestation and loss of ecosystems

Central America's annual deforestation equals some 350,000 hectares. According to the Energy/Economic Information System at OLADE, in 2005 the region's residential sector consumed the most energy (43%), and 83%[16] came from firewood, directly influencing sustainable production since most deforestation is attributable to logging for firewood. These deforestation processes have important implications since reductions in habitats are one of the many causes of lost terrestrial biodiversity around the world. Therefore, if Central America continues its deforestation process and changing land use, a loss of biodiversity is inevitable. Forest cover in Central America can be calculated using country reports published by the World Bank (Table 9). Forests represent between 14 and 58% of terrestrial eco-systems in at least seven countries in the region.

Despite their importance as carbon sinks, forest eco-systems are also vulnerable to climate change and variability. Therefore, the adaptive capacity of certain socio-economic sectors that depend on forest eco-systems services could be compromised by adverse climatic phenomenon that have been projected in climate change scenarios.

Projected changes in temperature and precipitation (annual averages and distribution throughout the year) for Central America, and corresponding increases in the frequency and intensity of extreme events, can directly influence how forest eco-systems operate. For example, projected changes will affect tree growth and the capacity of trees to act as carbon sinks. The survival of species and organisms that live in forest eco-systems can be affected if fruit and flowers that are used as food for these species change in terms of seasonal and spatial distribution. Climate change and variability can also affect tropical forests indirectly. For example, a reduction in precipitation levels can increase the chance of forest fires, especially in dry tropical forests. The frequency and intensity of forest fires depend on the forest's hydrological conditions and forest eco-system management. Climate change can create conditions favorable to the development of pests or invasive species that damage forests. A good example of this is an increase in pine beetle (Dendroctonus frontalis) attacks in Honduras, Nicaragua and Guatemala after the 2001-2002 drought.

[16] 52 Mbep

Water availability

Water is one of the most important resources for SICA countries. The population, health, agricultural competitiveness, food security, energy generation, hydroelectric generation, agro-energy, aquatic transportation (i.e. the Panama Canal) and maintenance of biodiversity, among others, all depend on water.

Water resources are very vulnerable to climate change and variability. The lack or excess of water can create social instability; increase the vulnerability of the population, infrastructure and strategic economic activities for development; and spark conflicts internally and between countries. Central America and the Caribbean have experienced six episodes of drought, including El Niño Southern Oscillation (ENSO), and at least ten hurricanes that were strong enough to cause significant losses in human lives and economic production. Projections done by the IPCC (2007) on climate change and variability and those included in the countries' National Communications, indicate that the frequency and intensity of extreme climate will increase. Therefore, in the next 20 years, Central Americans can expect at least three to five droughts and the same number of tropical storms that have happened in the past 20 years. Climate change scenarios project more intense and more frequent droughts and storms. Today's climatic models cannot precisely predict how often these events will occur. The incapacity of national hydrometeorological information systems is one of the main reasons why these models cannot adequately predict information, resulting in uncertainty about climatic models. Finally, the availability of fresh water or potable water in marine/coastal areas will be affected by salinization of underground sources due to rising sea levels.

A study on the evolution of climatic parameters during the last 40 years (1961-2003; Aguilar, et al., 2005) concluded that precipitation distribution patterns have changed in Central America. The number of dry days during rainy season has increased and has been compensated by more days of heavy precipitation.
Water is less available on the Pacific Coast than the Caribbean Coast.

Harm to human health

The region's 2007 population was estimated at 42 million inhabitants (Table 3). This doubled from 1980-2007, and will continue to grow at rates above the average for Latin America (2.61%). Forty-five percent of Central Americans live in poverty. Poverty is detrimental to health because it limits the ability of a population to improve health conditions and quality of life. Poverty especially affects children, rural inhabitants, indigenous communities and women. These are the most vulnerable groups. One of the diseases that has been most researched is dengue fever. Central America reported 72,000, 55,943 and 83,167 cases in 2003, 2004 and 2008 (State of the Region, 2008). In 2008, 4,773 cases corresponded to hemorrhagic fever. Even though the number of cases of dengue has increased in the region, the State of the Region (2008) still does not attribute this trend to climate change.

Historically, rural populations have been more vulnerable to diseases transmitted by vectors: i) dengue fever on the warm, low coastal areas, such as Chorotega in Guanacaste; and ii) malaria on the Caribbean Coast and in the northern parts of the country, which are humid and warm. There is evidence of a relation between Pacific Ocean surface temperatures during ENSO and increased cases of dengue fever in areas of Costa Rica directly influenced, such as Guanacaste, Puntarenas, southeast Alajuela, San Jose and Heredia (IMN, 2008). One of the observed impacts is an increase in public expenditure by the Social Security Insurance Institute (Caja de Seguridad Social) for dengue fever treatments, which increased from US $620,000 in 1997 to $3.5 million in 2007. If temperatures increase, so will the metabolism of the dengue fever vector (Aedes aegypti; Diptera: Culicidae) and the range of occurrence or population distribution. Leishmaniasis and Chagas disease are also transmitted by insect vectors. With increased temperatures, vectors find optimal conditions for reproduction, increasing attacks in areas where cases have already been registered and increasing spatial and seasonal distributions (i.e. altitude). Increased incidences of arthropod pests, including mites, require additional sanitation efforts. Indirect effects of climate change, such as diseases from pathogens transmitted by water, affect water quality and increase risks in coastal areas. The effects of global warming on food security are also closely related to health. As observed in 2009-2010 in Central America's dry corridor, and mostly in Guatemala, the lack of food due to ENSO led to malnutrition, and women and children are the most vulnerable population segments.

Another health problem that the region should monitor, which is indirectly related to climate change and variability, is the number of accidents that happen on the job in the agricultural sector. One of the main causes of labor accidents is the use of pesticides in agriculture (State of the Region, 2008). With climatic changes the incidences of entomological and arthropod (i.e. mites) pests affecting crops, forests and farms will increase, leading to more frequent pesticide applications and increasing chances for intoxication. Systems to register intoxications from pesticides are only able to record a fraction of what actually occurs. At the beginning of this decade, approximately 400,000 cases of intoxication from pesticides were reported in the region (State of the Region), but studies do not establish a clear relation between intoxication and climatic parameters.

Loss of coastal and marine resources

It is important to highlight that the SICA countries have key urban centers on the coasts, in addition to large investments in strategic infrastructure (i.e. ports, hotels, industry, roads, etc.) located there. The vulnerability of these coastal areas to climate change must be evaluated, considering sea level as the main threat, followed by the effects of global warming on marine diversity.

Coastal/marine resources in SICA countries are strategic for the region's socio-economic development. These include the Pacific Ocean and Caribbean Sea coasts, underground areas and islands corresponding to each country. Therefore, marine hydrobiological resources and coastal eco-systems have been considered, as well as fishing and aquaculture practices that provide employment, income and high-quality protein as food for Central Americans and their diets and food security.

The area just off of the coast (less than 50 meters) provides homes to 60% of fish species (in number) that have been identified in the Pacific Ocean.[17] Aquaculture installations used for raising sea shrimp are located off the Central American coast of the Pacific Ocean and the Caribbean Sea in Belize.

Projections on climate change indicate a slow increase in surface, terrestrial and marine temperatures, elevated concentrations of carbon dioxide (CO_2) and increased sea levels, which will affect, among other things, activities related to fishing, aquaculture, fishing communities and coastal erosion, particularly:

- The region's populations, and in particular, fishing villages located in urban/coastal centers;
- Investments made to develop fishing and aquaculture and related investments close to high-tide;
- Coral reefs;
- Aquaculture at sea level;
- Underground and surface water resources that are important for potable water in aquaculture and for domestic use;
- Flooding in low areas, including the formation of lagoons in current wetlands that provide homes to hydrobiological species;
- Marshlands important to hydrobiological species, causing the front perimeter of marshlands to move inland;
- Salinization of soil and aquifers.

Other opportunities may also arise, for example, increased flooded areas provide chances for species to have more space to reproduce and develop, considering elevated temperatures of surface waters.

[17] López, J. 2000. "Riqueza Ictica en el Pacífico Centroamericano." PROARCA/COSTAS, TNC.

Reduced tourism

Central America's tourism has grown constantly with positive impacts on the region's development; it has become one of the most dynamic sectors in the region (State of the Region, 2008). The global economic crisis slowed growth and affected tourism income in the region. In 2009, 19% less tourists arrived than in 2008. Tourism income in Central America was US $5,439.6 million in 2009, 20% less than 2008 (SITCA Statistical Bulletin, 2009). Approximately 8.8 million tourists visited the region last year.
Tourism is a very broad category that includes recreational, business and family visits. However, regional statistics should be honed to identify niche markets better. Some countries are more specialized in recreational tourism (Belize and Costa Rica), while others have a more varied mix of visitors (El Salvador and Panama). Nonetheless, all countries have plans to expand their recreational tourism supply considerably (beach tourism, eco-tourism, cultural tourism, among others), which depends on large part on their attractive natural resources, especially on and around the coasts.

The rich biodiversity, forests, coral reefs, attractive beaches and other aspects, of Central America and the Dominican Republic, are seriously threatened by climate change; some changes have already been observed. Their vulnerability is a result of the region's geographical location and the degree to which natural resources have degraded, especially because of deforestation or changing land use.

Future scenarios of climate change indicate that extreme events will be more intense and more frequent.
Due to its innate characteristics, the region's tourism sector is very vulnerable to climate change and variability, directly and indirectly. Direct effects refer to potential impacts of climate changes (i.e. increased sea levels) on tourism infrastructure. Indirect effects refer to potential impacts of international negotiations if a "climate tax" is applied for air fuel, which would increase the price of airplane tickets for tourists.

Involvement of life and cultures of indigenous peoples, ethnic groups and communities from African descent

SICA countries are historical and particularly rich in cultural diversity. Indigenous and ethnic people and people of African descent are present throughout Central America and the Dominican Republic. Different extreme climate events that have occurred in the region – from hurricanes and droughts to the degradation of natural resources – have provided evidence that these communities are highly vulnerable to climate change and variability.

Several factors contribute to this vulnerability. These communities live in areas with high poverty rates, they are generally marginalized and not present in socio-economic development plans and they have limited access to public services (i.e. health, education, electricity, communication, etc.) These communities live off of natural resources for food, transportation and traditional agro-forestry products, as well as to build their houses, fish, elaborate textiles and make other craft products to generate income. High dependence on natural resources for subsistence and the imminent threat of climate change and variability on these natural resources puts pressure on the very existence of these indigenous, ethnic and African-descent communities.

Severe damage to infrastructure

Central America, in particular, is already suffering from climate change, and the threats of climate change will only increase in the coming decades. Just in 2010, and since the start of rainy season in May, heavy rains have caused flooding, landslides and other damage that has left more than 300 dead and incalculable material damage.

Weather has shown no mercy in Guatemala, El Salvador, Nicaragua and Honduras – countries where the most number of victims and greatest damage has occurred. Governments have just started calculating the costs of these events.

Impacts from extreme hydrometeorological events in Central America have caused reported losses in productive sectors, in addition to human lives, and millions of dollars of damage in public and private infrastructure. According to ECLAC, the telecommunications and transportation sectors accounted for 86% of all losses in the region, mainly due to destroyed roads and communication lines. In the social sector, 79% of losses corresponded to housing (ECLAC, 2009).

Since the end of the 90s, reoccurring extreme phenomenon in the region have left a path of destroyed bridges, roads, highways, houses and public infrastructure, such as schools and health units. These last two are usually used as shelters for families that have been affected and displaced by the events. In many cases vulnerability increases because these spaces do not have appropriate conditions to meet the needs of the populations housed there.

The clearest form of these impacts has been: washed-out roads, houses, schools, health units, water and sanitation grids, electrical infrastructure, bridges and road systems. For most of these cases, damage is attributable to old problems with drainage, obsolete and inappropriate infrastructure designs, sub-standard materials and other issues related to land use in areas of risk.
Damage to public infrastructure has a direct impact on a territory's social and economic dynamics and puts pressure on local and national authorities. The response of governments is to use special budgetary funds, move programmatic resources for social investments or, in most cases, resort to million-dollar international loans from development banks (just in 2009-2010 Guatemala and El Salvador received loans for close to US $200 million). These measures are taken to try to recover damaged infrastructure and respond to demands for solutions from affected citizens in the short-term. [18]

This situation clearly shows the serious economic impact climate change has on public and private infrastructure and the urgent need for climate proofing because of the region's high vulnerability.

[18] Countries, such as El Salvador, have experienced different climatic events that have caused numerous losses in human life and material losses. It is estimated that during the low-pressure system related to Tropical Storm Ida in November 2009, damage to national infrastructure equaled approximately $100 million. Tropical Storm Agatha in May 2010 produced additional infrastructure damage and losses totally $36 million.

Polluting energy sources

It is important to highlight that of total imports (US $15,550.6) in Central America in 2007, petroleum represented 28.55% (SIECA, 2009). This leads to the conclusion that there are great opportunities to reduce the region's petroleum dependence if actions are taken in areas: i) increase capacity to generate electricity from renewable energy sources; ii) take better advantage of carbon market opportunities, for the energy sector and its connections to the agricultural sector; and iii) modify national regulatory frameworks to reduce barriers and increase the competitiveness of renewable energy sources in energy markets.

A study done by CATIE as part of the Tropical Forests and Climate Change Adaptation Initiative (TROFCCA)[19] in 2006 concluded that the region's installed power capacity in 2005 was 8,889.6 MW, of which 4,753.3 MW, or 53.4%, was from renewable energy sources. Of the region's total installed capacity, hydroelectric power plant capacity represented 3,804.3 MW, or 42%. Electrical generation in 2005 totaled 34,272.7 GWH, of which 40.13% was from public companies and the remaining 59.86% was private. Renewable energy contributed close to 20,921.6 GWH, or 61%, and hydroelectric generation was 49.85% of the total, or 17,086.6 GWH.

The study presents information on additional power needs, as well as projected energy demands for different countries in the region in the medium and long terms. These projections are based on planning reports for the sector that indicate that growth rates will remain around 5-6% annually in energy demand, for example, if the region's energy requirements increase from 22% in 2005 to 52% in 2014, with 2001 as the reference year.

Between 2009 and 2023 the region's installed capacity will increase between 8,548 and 11,338 MW, according to forecasts,[20] projecting that the percentage of renewable energy sources can vary widely, depending on the scenario.[21] Increasing renewable energy use is a huge challenge, as presented in a study done by ECLAC for the General Secretariat of SICA called, "Istmo Centroamericano: Las fuentes renovables de energía y el cumplimiento de la estrategia 2020,"[22] since many environmental and social barriers exists. These barriers were identified using an Exclusion Factor (EF), defined as the percentage of potential resources that, for environmental and social reasons (different from strictly economic and financial ones), cannot be developed. This can be applied to renewable and non-renewable energy resources. Technological changes must still be made to increase energy efficiency and take better advantage of existing energy potential.

[19] Coto, O. 2006. "Estudio del Sector Eléctrico de Centroamérica." TROFCCA Project, CATIE, San José, Costa Rica. May 2006.

[20] CEAC. "Plan Indicativo Regional de Expansión de la Generación 2009-2023." May 2009.

[21] See Figure 8.5. "Instalación Adicional por Tecnología en MW para el Período 2009 – 2023 del Plan Indicativo Regional 2009-2023." CEAC, May 2009. http://www.ceaconline.org/pdf/Doc_Relevantes/PLAN_INDICATIVO_REGIONAL.pdf

[22] Central American Isthmus: Renewable energy sources and compliance with the 2020 Strategy. December 2009. http://www.eclac.cl/publicaciones/xml/6/38216/L953.pdf

Economic Evaluation of the Impact of Climate Change and Variability in the Region

The Economic Commission for Latin America and the Caribbean (ECLAC) is currently doing a study on the "**Economics of Climate Change in Central America**," together with the Ministries of Environment and Treasury/Finance from the seven Central American countries, CCAD/SICA and SIECA. Its specific objective is to complete an economic evaluation of the impact of climate change on Central America, for different scenarios of emissions and projections. It considers the costs and benefits of inaction ("business as usual") and options to reduce vulnerability, implement adaptation measures and transition toward a sustainable economy with low carbon dependence. The study seeks to create technical evidence for policy-formation and to stimulate dialogue about policy options and national and regional actions that economic and social decision-makers can take.

The study's methodology starts with an inertial projection, based on economic activities without impacts of climate change (business as usual), and then projects sector and economic growth. Afterwards, it evaluates impacts in key areas, such as agricultural yields and water availability and demand, and presents those costs to establish projections for climate change. The differences between these two projections, in function of the selected discount rate, represent the economic consequences of climate change. Within this context, adaptation processes would modify the final results significantly. It should also be considered that some of the most relevant impacts of climate change do not have a direct economic value.

Climatic scenarios generated by the project estimated changes in temperature and precipitation, using climatic situations and models recommended by the IPCC. With an emissions scenario below current trends (Scenario B2 from the IPCC), in 2100 temperatures will increase 2.2 to 2.7 °C, depending on the country, with a regional average of 2.5 °C, with respect to 1980-2000. In Scenario A2, which could be understood as a scenario that maintains current trends of increased emissions, temperatures could increase between 3.6 and 4.7 °C, depending on the country, with a regional average of 4.2°C.

The expected projection for precipitation levels is more uncertain. For Scenario B2 with global emissions through 2100, precipitation will decrease 3% in Panama, 7% in Guatemala, between 10 and 13% in Costa Rica, Belize, El Salvador and Honduras, and 17% in Nicaragua. This results in an average decrease in the region of 11%. Scenario A2 through 2100 shows a possible decrease in precipitation of 18% in Panama, 35% in Nicaragua and between 27 and 32% in Costa Rica, Belize, El Salvador, Guatemala and Honduras. This results in an average decrease in the region of 28%.

In addition, studies were done on sectors and areas susceptible to climate change, considering these climatic results and trend scenarios for economic growth, population growth and changing land use.

Economic evaluation

Climate change represents a serious threat for Central American society, due to its many forecasted impacts on the population and productive sectors. In fiscal terms it is a contingent public liability that will affect public finance for several generations. It is estimated that by 2030 Central America will produce less than 0.5% of GHG emissions on the planet; it is also one of the regions that is most vulnerable to climate change. Economic impacts on Central American economies are certainly significant; however, there is much uncertainty due to the interaction of economic variables and climate conditions, as well as other social, political and cultural aspects.

The initial estimated costs grow, beginning in 2050 in most studies, and generally remain high until the end of the century. The initial estimate on the measurable accumulated cost through 2100 in Scenario A2, based on impacts identified in the agricultural sector, water resources, biodiversity and hurricanes, storms and flooding, is equal to US $73 billion current dollars or $52 billion in 2002 dollars, approximately 54% of the region's GDP in 2008 at NPV with a discount rate of 0.5%. The estimated accumulated cost in Scenario B2 through 2100 is $44 billion current dollars or $32 billion in 2002 dollars, approximately 32% of GDP in 2008 with a discount rate of 0.5%. This equals 60% of the estimated value in current dollars in Scenario A2. Likewise, it is important to highlight that estimates show that most increases in costs will happen during the second half of the century, when the effects of more emissions are felt.

At the sector level costs associated with agricultural production will increase rapidly beginning in 2070 in Scenario A2. Based on an initial analysis of the water sector, impacts reflected in costs will remain low until 2030, and will be high after 2070, with negative effects on the region. The quantifiable cost of the impact on biodiversity, measured by the Potential Biodiversity Index, will grow exponentially beginning in 2050 with more indirect costs in the agricultural and livestock sectors. Extreme events will also increase rapidly after 2050. An increase in temperature will imply more intense events, with greater costs for the region.

The impacts of climate change on Central America in a scenario of growing emissions and global inaction, the IPCC's Scenario A2, are significant and growing over time with certain similarities at the country level. It is important to note that developed countries, which have polluted the most, suffer less from the impacts and have the resources to adapt. On the other hand, countries that have contributed less to the problem will suffer more from its impacts and are less resilient. The costs of the impacts in a situation of global inaction, particularly for countries with high emissions, will be higher than if an agreement is reached internationally to reduce emissions significantly with common but differentiated responsibilities. Developing countries should be aided to adopt actions for adaptation and mitigation within a framework of sustainable development.

Regional Security and Climate Change

The region faces growing security problems. For many countries this issue endangers the region's incipient development and democratic governance. The traditional concept of "national security" is synonymous to problems with drug-trafficking and large-scale organized crime, associated with police control and capacity and the role of the judicial branch. However, the definition of security here has to do with "social and political stability." This is a broader approach that states that social and political stability are the pillars sustaining Central America's national security.

According to a study on the Climate-related Impacts on National Security in Mexico and Central America done by the Royal United Services Institute (RUSI) in Great Britain in 2009-2010, the problem of security in Central America is highly complex. There is growing evidence that impacts created by extreme climate in these countries are starting to threaten security, exacerbate growing poverty and social deficits, weaken fragile governments and promote greater social divisions and polarization.

Permanent deficits in food security, water availability and population displacements are threatened by growing climatic variability associated with climate change. Risk factors for social instability, such as a lack of water, forced migration, losses in harvests and famines, are quite present and demand response from national governments. The following identifies factors that should be considered in relation to regional security and climate change:

Satisfying basic needs

Adverse effects of climatic variability associated with climate change threaten the ability of the most vulnerable populations living in poverty and extreme poverty to meet their basic needs. Populations depending on agricultural production and livestock will be affected by vulnerable conditions and direct subsistence. This would create greater pressure on scarce natural resources, worsening the cycle of vulnerability and promoting a shift toward activities in the informal economy, including illicit ones, or immigrating internally or emigrating to try to solve problems. The governments' fiscal limitations due to special responses to climate disasters could mean less capacity to implement adaptation measures, which could also make the country more vulnerable to climatic impacts, creating a vicious cycle.

Social tensions

Access to and competition for scarce resources can create social tensions. The ability of sectors with economic and political power to control and regulate these resources would endanger the most vulnerable groups of people, leading to disputes and worsening latent conflicts. Social instability can create a cycle of underemployment and investment, which can increase poverty and the probability of additional social conflicts.

Governance

Reoccurring crises associated with extreme climate can imply changes in priorities to distribute public funds to deal with the situation and for recovery. This could create pressure on governance, affect local, state and national governments facing greater social demands and public expenditure. The governments' limited capacity to respond, time and time again, to disasters could lead to increased dissatisfaction, reducing trust in institutions and general public management.

The effects of this situation can lead to new political priorities and a new way to distribute public, private and social resources. As RUSI suggests in its study, the region's social structures, institutions, economies, cultures and policies will ultimately determine if environmental pressures exacerbated by climate change influence insecurity, weakened governance and increased conflicts. These changes can create a restructuring of social and political efforts with long-term implications on security. The result of this negative situation depends on the SICA countries' capacity to face climate change.

III. Political Framework for action and regional response

Political and Institutional Regional Framework to Climate Change

All countries belonging to the Central American Integration System (SICA) are part of the United Nations Framework Convention on Climate Change (UNFCCC), adopted in 1992 during the Rio de Janeiro Summit. Since 1994 these countries have participated in and followed negotiation processes and Conferences of the Parties (COP) to establish common but differentiated agreements and commitments, such as those set forth in the Kyoto Protocol (1997), Marrakesh Agreement (2001), Nairobi Work Program (2006) and Bali Action Plan (2007).

Within this context SICA countries have independently made efforts to establish policies, strategies and programs in accordance with their national priorities in the area of climate change. At the same time, the countries have made progress in, strengthened and consolidated their efforts in economic, social and environmental integration. An example of this regional awareness on the topic is the 1993 Regional Agreement on Climate Change, signed by the Ministers of Foreign Affairs of Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama. Later, in 1999, the region adopted the Strategic Framework for the Reduction of Vulnerabilities and Disaster Impacts.

In the Special Meeting of Presidents and Chiefs of State held by SICA countries in May 2008 to discuss the topic of climate change, also known as the "**San Pedro Sula Declaration,"** the Presidents approved the "Guidelines for the Regional Strategy on Climate Change." The Declaration recognizes that due to climate change and variability effects or impacts in the region, it is urgent for governments to take specific and coordinated actions showing political willingness and interest to work together to strengthen the integration process. This is true for areas of common vulnerabilities and impacts from climate change, as well as for complementary efforts and synergies to design strategies for adaptation and working together in global negotiations on the topic.

The Declaration signed during the Presidential Summit in San Pedro Sula in May 2008 states, among other things:

1. "To incorporate climate change as a transversal and high-priority topic in national development plans and strategic and operational plans at institutions that form part of the governments of our countries."

2. "The member countries of SICA have decided to approve the document on the Guidelines for the Regional Strategy on Climate Change, adopted by the Council of Ministers of Environment and Natural Resources, which will allow us to elaborate a regional strategy on climate change in order to face the impacts and effects of this global phenomenon successfully and based on the national realities and contents of the Appendix of this Declaration."

This Declaration clearly and specifically directs regional institutions to implement a Regional Strategy on Climate Change (ERCC for its name in Spanish), so that the instrument is used across institutions and sectors in each SICA member country. The Regional Strategy should become part of each country's strategic plans, as established in the abovementioned Presidential mandate.

In July 2010, at the Special Meeting of Presidents and Chiefs of State from Central America and the Dominican Republic, the final Declaration agreed to relaunch the regional integration process
Authorities highlighted their concern about the fact that in the last few years the region has had to face reoccurring emergency situations with disasters and different risks caused by climate change and variability. Therefore, they restated their commitment to elaborate, approve and apply the Regional Strategy on Climate Change as soon as possible, as well as develop different policies and plans focused around mitigation and adaptation to climate change.

The Declaration orders the Council of Ministers of Environment to complete the process to elaborate and hold regional consultations on the Regional Strategy on Climate Change and immediately put it into effect. The goal is to have the Strategy in effect for the United Nations Framework Convention on Climate Change negotiations (COP 16), to create a sound regional position based on positive public policy actions.

The Action Plan that resulted from this meeting indicates that the Council of Ministers of Environment should develop public policies, joint strategies and action plans focused on mitigation and adaptation to face climate change threats. They should also promote growing use of alternative and renewable energy sources within the framework of existing regional strategies and plans. Finally, the Plan states they should work together with the Council of Ministers of Foreign Affairs, and authorities from the Ministries of Treasury and Finance, to find additional external financial resources and donations, principally from developed countries, to prepare Central America and adapt to the extreme climate that the region is facing more frequently.

Simultaneously, the region has started building a set of complementary policy instruments in its agenda on climate change. The Regional Strategy on Agriculture, the Environment and Health (ERAS for its name in Spanish) resulted from an agreement made at the Second Joint Meeting of the Councils of Ministers of Agriculture, the Environment and Health in June 2006. It was approved in 2008. This Agreement includes, within is strategic areas and objectives on climate change and variability, the Health Agenda for Central America and the Dominican Republic, coordinated by the Council of Ministers of Health in Central America (COMISCA); the Central American Agenda on Territorial Zoning, coordinated by the Council of Ministers of Housing and Settlements in Central America (CCVAH); and others. Likewise, the Presidential Summit held in Panama on June 29 and 30, 2010, approved the Central American Policy on Integrated Risk Management (PCGIR for its name in Spanish), which includes a focus on adaptation to climate change.

These existing regional instruments and the attention and consideration of mandates from the Conventions on Biodiversity, Desertification and Drought, among others, represent technically-feasible policy instruments that contribute approaches, perspectives and proposals, integrating visions, concepts and action areas that complement and support the Regional Strategy on Climate Change.

Based on this, and considering what has been established by the region's highest authorities, the Regional Strategy on Climate Change responds to an internal need to face the threat of climate change for the region's survival and development. The Regional Strategy seeks to reduce ecological, social and economic vulnerabilities, mainly through adaptation to climate change. It also focuses on preventing and reducing negative impacts of climate variability, through several mitigation measures that support adaptation, as the region's priority.

Regional Strategy on Climate Change: Strategic Priorities

The Regional Strategy on Climate Change Its objective is: to contribute to preventing and reducing the negative impacts of climate change by increasing resilience and the capacity for adaptation in order to reduce human, social, ecological and economic vulnerabilities, build capacity to influence and reduce climatic threats and voluntarily contribute to reducing GHG emissions, as permitted by national circumstances.

The design of the Regional Strategy is based on the Guidelines for Programmatic Areas that was elaborated by the Presidential Summit in May 2008 in San Pedro Sula.

The Principles of the Regional Strategy on Climate Change are based on:

- Common but differentiated responsibility nationally and internationally,
- Environmental justice and compensation for ecological debt,
- Contributions to achieving the Millennium Development Goals,
- Transversality, inter-cultural awareness and a cross-sector approach – one of the most important transversal topics is gender equity and equality,
- Coherence among governmental policies, solidarity, equity, gender equality and social justice, and
- Recognition of the region's most vulnerable populations, including indigenous communities, populations of African descent, rural and urban women, children, senior citizens and families living in poverty.

The Regional Strategy contemplates actions to be taken by governmental authorities, the private sector and civil society in the following strategic and programmatic areas:

1. Vulnerability, adaptation to climate change and variability and risk management
2. Mitigation
3. Capacity building
4. Education, awareness, communication and citizen participation
5. Technology transfers
6. Negotiations and international support

Strategic Area 1: Vulnerability, Adaptation to Climate Change and Variability and Risk Management

Strategic Objective 1: In this area is: Reduce vulnerability and promote adaptation to climate change and variability among the population and socio-economic sectors:: • Extreme climate and risk management • Agriculture and food security • Forest eco-systems and biodiversity • Water resources • Public health and climate change • Coastal/marine resources • Tourism and climate change • Indigenous communities, ethnicities and people of African descent • Public infrastructure	**Operational Objective 1:** Increase the region's capacity to design and implement policies, programs and measures for adaptation and the resilience of the population and socio-economic sectors to climate change and variability.

Strategic Area 1.1:
Extreme climate and risk management

Strategic Objective 1.1.: Promote regional institutionalism to reduce the population's vulnerability to extreme climate, focused on sustainable development in the region aligned with the Central American Policy on Integrated Risk Management (PCGIR) and the Regional Plan on Disaster Reduction (PRRD).	**Operational Objective 1.1.:** Conduct research and create communication systems and networks to implement integrated risk management that improves forecasting and preparation for extreme climate, following mandates set forth in PCGIR and the established guidelines in PRRD.
Action Areas	**Measures**
1.1.1. Strengthen applied research on reducing and managing disaster risk and promote information exchanges among national and regional institutions working in the topic, in coordination with CEPREDENAC.	1.1.1.1 Conduct studies on vulnerability and risk to climate disasters in urban and rural areas, by sector and considering gender, indigenous peoples, and communities of African descent. Implement measures to prevent risk at the appropriate level.
	1.1.1.2 Provide technical and financial support to strengthen and foster implementation of the Regional Climate Database, the Climate Forum and the Central American Center for Integrated Meteorological and Hydrologic Activities (CIMHAC).
	1.1.1.3 Sign short- and long-term agreements on technical/scientific cooperation with universities and other specialized centers to build capacity to study and understand the causes and patterns of extreme climate that affect the region. Publish regional annual reports.
	1.1.1.4 Design and implement an Early Warning System on climatic threats for society and productive systems, including, but not limited to, food security risks and individual information to warn society about different vulnerabilities.
	1.1.1.5 Create a regional scholarship fund for technical/scientific training of professional in universities in the region in subjects related to meteorology, climatology, hydrology, extreme climate forecasting, risk management and other specialized studies.
	1.1.1.6 Find resources to work with women organizations, since they have information, knowledge, experience, networks and resources that are vital to resilience in disasters.
	1.1.1.7 Design a damage evaluation system, differentiating impact by gender.
	1.1.1.8 Strengthen national hydro-meteorological services and meteorological and hydrological observation networks and databases.

1.1.2. Coordinate technical/scientific information exchanges and integration mechanisms regionally, developing standards and protocols that include efforts made by specialized institutions and offices.	1.1.2.1 Creation and implementation of the Regional Consultative Forum on Central American Policies for Integrated Disaster Risk Management, including public and private sector institutions and civil society, organized nationally and regionally.
	1.1.2.2 Creation of a Commission on Regional Instruments. Hold two meetings annually to review achievements (ECADERT, ERAS, ERCC, ECAGIRH – for their names in Spanish, and others).
	1.1.2.3 Strengthen the use of climate communication platforms in Central American, particularly CIMHAC and national climate systems that provide information to civil protection agencies and the population, in general, on short-, medium- and long-term forecasts for extreme climate.
	1.1.2.4 Provide technical and financial support for the Climate Forum, incorporating extreme climate.
1.1.3. Analyze, design and promote the implementation of risk transfer mechanisms for infrastructure, settlements, personal assets and public and private productive activities to reduce the socio-economic impacts of disasters, following the guidelines set forth in PRRD and the PCGIR mandates.	1.1.3.1 Review and adopt an economic evaluation methodology for direct and indirect losses caused by extreme climate, standardizing methodologies regionally and presenting impacts by gender or different vulnerable populations.
	1.1.3.2 Design and implement private insurance policies against climate risk in different vulnerable socio-economic sectors and monitor coverage periodically.
	1.1.3.3 Design and implement non-private insurance policies for low-income sectors and monitor coverage periodically.
	1.1.3.4 Design and negotiate a regional contingency fund as a financial mechanism for prevention and recovery in case of extreme climate, subject to distribution with criteria based on equity and/or proportional to damage.
	1.1.3.5 Review existing risk management initiatives in the region, incorporating a focus on gender so that institutions can take advantage of the technical and financial resources that are already available to improve living conditions for women in the region.

1.1.4. Review, elaborate and apply standards for safe infrastructure construction in each one of the countries in the region.	1.1.4.1 Design risk management standards for economic infrastructure, urban center and coastal/ marine settlement designs, and implement them in the short-term.
	1.1.4.2. Promote low-interest financing and other economic incentives for people and families that immigrate to risky areas.
	1.1.4.3 Integrate a gender perspective into disaster policies on risk management, plans and decision-making processes, including those related to risk evaluations, early warning systems, information management, education and training.
	1.1.4.4 Adopt financial protection investments through insurance mechanisms to foster innovation in products and instruments with subsidiary and solidarity protection that cover "non-insurable" social groups.
	1.1.4.5 Coordinate with the Council of Ministers of Housing and Settlements (CCVAH), with support from SISCA and CEPREDENAC, to focus integrated disaster risk management in their policies and strategies for human settlements, territorial development and zoning.
	1.1.4.6 Promote, together with CEPREDENAC, SISCA and CCVAH, coordination mechanisms on information management to provide inputs for safe housing construction and attention to houses affected by disasters and in conditions of risk, following the 2009-2012 Central American Strategy on Housing and Settlements.
1.1.5. Promote communication of climate information regionally and a capacity to respond to extreme climate.	1.1.5.1 Design/Promote mechanisms to facilitate access to information on climate risk by different channels and in different languages for populations and sectors in risk that do not have Internet connections.
	1.1.5.2 Improve websites with Central American climate information, particularly CIMHAC and the national climate systems that offer information on short-, medium- and long-term extreme climate forecasts.
	1.1.5.3 Develop national strategies that deal appropriately with processes, which are becoming more frequent, for evacuation, temporary and permanent relocation and immigration of populations most affected by increased and reoccurring extreme climate.

Strategic Area 1.2:
Agriculture and food security

Strategic Objective 1.2: Reduce agricultural vulnerability to climate change and variability, incorporating adaptation measures in relevant regional policies.	**Operational Objective 1.2:** Promote implementation of the Regional Strategy on Agriculture, the Environment and Health, with emphasis on programmatic areas directed toward climate change and climate variability in agriculture and sustainable soil management.
Action Areas	**Measures**
1.2.1. Build institutional capacity for adaptation to climate change, considering territorial vulnerabilities.	1.2.1.1. Promote research about the relation between climate and agriculture and its different effects on men and women, with emphasis on evaluating current and future vulnerabilities on food cultivation, livestock (including aviculture and other domestic animals), fish and aquaculture.
	1.2.1.2. Summarize methodologies to evaluate current and future vulnerabilities in agriculture and food security in the context of climate change for 2015, 2020, 2030 and 2050.
	1.2.1.3. Organize annual training courses for technical/scientific personnel in agricultural research centers on methodologies to evaluate current and future vulnerabilities to climate change and their application. Design adaptation measures.
	1.2.1.4. Promote the development of specialized centers to create and transfer agricultural technologies for dry areas or the regional corridor, incorporating pertinent ancestral and local knowledge.
	1.2.1.5. Promote the participation of regional actors working on creating and transferring agricultural technologies, including farmers and indigenous people, in international agricultural conferences on climate change (i.e. the Commission for Agricultural Meteorology at the WMO, the Global Climate Conference, SBSTA, CoPs and others).
	1.2.1.6 Develop and build capacity to incorporate gender perspectives and diversity in adaptation measures.

1.2.2. Promote the creation, transfer and diffusion of information on technological and institutional processes for adaptation in agriculture.	1.2.2.1. Strengthen and expand areas that are not currently covered by weather and climate observation systems, processing and relevant climatic and sector data and information analyses, including atmospheric, terrestrial, eco-system, oceanographic and hydrologic parameters.
	1.2.2.2 Make dynamic climate projections for agriculture, by crop, for private and public sector decision-making, with emphasis on basic crops for the region's food security.
	1.2.2.3. Strengthen national and regional capacity for early climatic forecasting and alerting with specialized forecasts and impacts on agriculture.
	1.2.2.4. Creation, promotion and diffusion of information to private and public sectors and its use for adaptation to climate change processes, including cultural diversity and a focus on gender.
	1.2.2.5. Implement programs and projects on urban agriculture for food production and products for farmers markets, with a focus on gender.
	1.2.2.6. Adopt measures pertinent to the Sustainable Soil Management section of the Regional Strategy on Agriculture, the Environment and Health (ERAS), incorporating a focus on adaptation to climate change.
1.2.3. Strengthen technical and university training centers and meteorological and hydrological services in the topic of agriculture and climate change: mitigation technologies and adaptation to climate change and variability.	1.2.3.1. Training on the implementation of bio-climatic models, water balance and simulations of crop development and other relevant tools to analyze and evaluate adaptation options.
	1.2.3.2. Establish alliances with universities, public and private sectors, gender centers specialized in agriculture, specialized regional and international centers and SICTA to develop and implement innovation and technology transfer programs for mitigation and adaptation to climate change in agriculture.
	1.2.3.3. Identify, systematize and share best practices in mitigation and adaptation for agricultural/food chains, including ancestral practices in indigenous communities and from women, particularly in rural areas.
	1.2.3.4 Promote best practices in production (considering women's initiatives) that contribute to eliminating contamination or the deterioration of the quality and availability of water for different uses, particularly when facing extreme climate.

1.2.4. Develop and promote financial mechanisms to manage climate risk in agriculture.	1.2.4.1. Promote appropriate legislative and institutional frameworks to develop and strengthen agricultural security, assuring access to women, including community insurance policies linked to opportunities created by the UNFCCC multilateral process.
	1.2.4.2 Promote appropriate supplies of climate information based on the needs of the insurance market, including financing for insurance companies to improve those services.
	1.2.4.3 Promote research related to reducing environmental risks in agriculture and developing technologies or best practices.
	1.2.4.4 Develop a regional fund for women so they can access productive economic resources and capital (land, capital, forests, technology, training and education).
	1.2.4.5 Create a financial mechanism for projects that reduce GHG emissions through biogas systems, eco-stoves, eco-system restoration and sustainable food production (agricultural and forest systems) with gender participation.
1.2.5 Review sector policies to integrate climate change and variability.	1.2.5.1. Review commercial policies related to the regional food market to strengthen food and nutritional security regionally.
	1.2.5.2. Promote territorial storage of food based on the needs of local, national and regional populations.

Strategic Area 1.3:
Forest eco-systems and biodiversity

Strategic Objective 1.3: Society recognizes the importance of forest eco-systems and biodiversity for adaptation to climate change	**Operational Objective 1.3:** Reduce the vulnerability of forest eco-systems and biodiversity through policies, incentives and scientific knowledge creation.
Action Areas	**Measures**
1.3.1. Improve scientific knowledge on the vulnerability of forests to climate change. Reduce deforestation and degradation rates in forest eco-systems.	1.3.1.1. Conduct studies on the vulnerability and adaptation of forests in the region to climate change and variability, and their relation to vulnerable water resources, and implement necessary measures.
	1.3.1.2. Evaluate the vulnerability and adaptation of socio-economic sectors and systems that depend on environmental goods and services from forest eco-systems, and implement suggested measures.
	1.3.1.3. Cross-evaluate vulnerability to climate change between water resources and forest eco-systems.
	1.3.1.4. Evaluate vulnerability and adaptation measures in protected areas in SICA countries.
1.3.2. Design and implement policies with economic incentives to reduce the vulnerability of forests and biodiversity to climate change, incorporating gender criteria.	1.3.2.1. Systematize economic and financial incentives used currently in the region and their contribution to adaptation of biodiversity and forest eco-systems to climate change. This includes payments for environmental services.
	1.3.2.2. Promote existing financial mechanisms to recognize and compensate for environmental services that forest eco-systems offer, to conserve biodiversity, hydrological services and agricultural eco-systems for mitigation and adaptation to climate change, including a reduction in emissions due to deforestation.
	1.3.2.3. Find synergies between REDD mechanisms and adaptation of forests, biodiversity and water resources to climate change and variability.
	1.3.2.4 Design criteria to assure that all REDD processes incorporate gender issues to guarantee full participation of women and improved distributions of benefits.
	1.3.2.5 Include a gender perspective in national standards and guidelines in order to assure that women have access to and control over benefits provided by economic and financial incentives.
	1.3.2.6 Design and implement policies that promote economic and financial incentives based on the reality of each country and its contribution to adaptation of biodiversity and forest eco-systems to climate change, including payments for environmental services.

Strategic Area 1.4:
Water resources

Strategic Objective 1.4: Reduce the vulnerability of water resources and associated infrastructure to climate change and variability.	**Operational Objective 1.4:** Promote the implementation of the Regional Strategy on Integrated Water Resource Management (ECAGIRH) regionally and in the immediate future.
Action Areas	**Measures**
1.4.1. Strengthen regional capacity to implement integrated water resource management practices.	1.4.1.1 CRRH will coordinate with other regional or international scientific centers to elaborate scenarios on climate change and variability and their effects on water resources in the region every five years. It will produce a report to be communicated publicly through all available channels.
	1.4.1.2 CRRH, together with members of the Consultative Water Group, will develop indicators for water source vulnerability, in terms of quantity and quality, for populations living in areas vulnerable to drought and will recommend measures for adaptation.
	1.4.1.3 Systematize and document best practices and technologies to capture and conserve water in areas critical to the Central American region's dry tropical zone, with emphasis on dry areas and vulnerable groups.
	1.4.1.4 Evaluate the vulnerability of superficial and underground water resources to climate change and variability and establish measures for adaptation.
	1.4.1.5 A scholarship fund will be created to support thesis studies for Masters and Doctorate Programs related to integrated water resource management, nationally or regionally.
1.4.2 Coordinate implementation of ECAGIRH with other regional instruments.	1.4.2.1 Incorporate integrated water resource management in the Annual Operations Plans at CCAD, CRRH and CEPREDENAC, and provide joint annual reports of achievements.
	1.4.2.2 Establish mechanisms for coordination among regional entities that implement ERCC, ERAS, ECADERT and others, and report annually on activities done.
	1.4.2.3 Hold bi-annual regional conferences on integrated water resource management with participation of all regional actors and leadership from CCAD and CRRH.
1.4.3 Develop economic instruments for hydrographic watershed management and a reduction in contamination in water resources.	1.4.3.1 Systematize and document experiences with environmental compensation mechanisms for water goods and services, which are applicable to water-producing eco-systems in the region. Promote adaptation at the local, national and international levels.
	1.4.3.2 Systematize and document economic instruments for integrated water resource management and promote regional dialogue to apply them at the local, national and international levels.
	1.4.3.3 CCAD and CRRH, together with CEPAL and other organizations, will work to implement studies on economic evaluations of water resources in scenarios of climate change and variability and document results to strengthen international negotiations under the UNFCCC and with international organizations.

1.4.4 Promote best practices for efficient water use and the management of water-producing eco-systems.	1.4.4.1 Promote greater use of improved soil, water, forest and biodiversity conservation systems with gender equity.
	1.4.4.2 Promote technological innovation initiatives focused on the fair use and sustainable management of water, giving priority to the most vulnerable users, both men and women.
	1.4.4.3 Promote the development, validation, diffusion and transfer of technologies on efficient water use in domestic activities for vulnerable populations.
	1.4.4.4 Promote greater use of improved soil, water, forest and biodiversity conservation systems with gender equity, using REDD mechanisms (governance and responsible natural resource management).

Strategic Area 1.5:
Public health and climate change

Strategic Objective 1.5: Reduce vulnerability to climate change and variability in the public health sector.	**Operational Objective 1.5:** Improve technical/scientific knowledge about climate change and variability and their effects on public health in the region.
Action Areas	**Measures**
1.5.1 Build technical/scientific capacity in national, regional and professional training institutions.	1.5.1.1 Promote integration among working groups with the participation of experts from specialized meteorological research service centers and health experts, to model the impacts of climate variability on the development and expansion of diseases, directly or indirectly related to climate (i.e. transmitted by vectors, infectious disease, respiratory disease, cardiovascular disease, heat stress and others).
	1.5.1.2. Systematize studies on climate change and variability and their effects on public health, differentiating by gender.
	1.5.1.3. Support health and climate professional training institutions, with a focus on preventing disease, and organize annual training events nationally and regionally.
	1.5.1.4. Conduct research specific to each country on the implications that climate and human environmental conditions (urban and rural) have on health, and apply the results.
	1.5.1.5. Study more profoundly the effects of using firewood stoves on the incidence of respiratory and ocular diseases in families that use them as a source of energy, and apply corresponding technological changes.
	1.5.1.6. Conduct studies on the effects that disease and climate have on different genders, age groups, occupational groups, ethnic groups and beliefs.

1.5.2 Design policies to reduce risk to diseases transmitted by vectors, infectious diseases and others exacerbated by GHG emissions.	1.5.2.1 Find resources to identify the most vulnerable areas and redistribute budgets to prevent diseases transmitted by vectors and infectious diseases caused by a lack of clean water and sanitation.
	1.5.2.2 Review existing policies and adjust them to increase access of vulnerable populations to health services, with emphasis on indigenous communities, women, senior citizens and people living in poverty.
	1.5.2.3 Find external resources to increase education and communication, as well as per capita expenditure to combat diseases transmitted by vectors and infectious diseases in vulnerable populations.
1.5.3 Build institutional capacity at COMISCA and national institutions to increase access to health services among the most vulnerable populations.	1.5.3.1 Find appropriate resources to implement the 2009-2018 Health Agenda for Central America and the Dominican Republic, with emphasis on Strategic Objectives Numbers 5, 7, 8 and 10, which are most linked to the Regional Strategy on Climate Change (see note below).
	1.5.3.2 Support the participation of COMISCA to coordinate and implement other strategies that integrate health and sustainable development (i.e. the Regional Strategy on Agriculture, the Environment and Health).
	1.5.3.3 COMISCA will develop specific communication instruments to share results of studies and analyses on vulnerability in the region.
	1.5.3.4 Promote preventive health services and timely and appropriate attention during evacuation and relocation processes, during and after climate disasters.
1.5.4 Adjust regional population and development plans considering the current impacts of climate change.	1.5.4.1. Strengthen policies on food and nutritional security and access.
	1.5.4.2 Develop nutrition programs for women and children.

Strategic Area 1.6:
Coastal/marine resources

Strategic Objective 1.6. Institutional and human resource capacity building in the region to generate knowledge on the relation between climate change and sustainable management of coastal/marine eco-systems.	**Operational Objective 1.6.** Develop a research/action agenda on climate change and variability and their relation to coastal/marine eco-systems and resources and integrate results in coastal/marine policies in the region.
Action Areas	**Measures**
1.6.1. Improve knowledge about the effects of climate change and variability on eco-systems and coastal/marine resources.	1.6.1.1. Build public and private capacity to monitor and evaluate the impact of climate change on coastal/marine eco-systems and its effect on the distribution and abundance of fishing resources, differentiating by gender.
	1.6.1.2. Build sea level models for 2015, 2020, 2030 and 2050 and the potential impact on coastal populations, water resources, tourism and logistics (port) infrastructure and coastal territory. Design specific policies and adaptation measures.
	1.6.1.3. Elaborate studies on vulnerability and adaptation to climate change with a focus on gender and diversity among fishing populations and communities on small islands in the region. Define specific policies and measures for scenarios for 2015, 2020, 2030 and 2050, including a focus on gender.
	1.6.1.4. Develop specialized regional research centers on ocean studies, coastal/marine biodiversity, fishing resources, gender and their relation to climate.
	1.6.1.5. Create alliances with specialized international research centers to understand the ocean carbon cycle, the effect of ocean warming on climate in the region and the effects of climate change on marine eco-systems, marine biodiversity and coastal communities, including indigenous populations.
	1.6.1.6. Reduce continental or island soil/sand erosion around reefs, integrating sustainable land use management in watersheds that drain into the ocean.
	1.6.1.7 Create participatory research processes incorporating knowledge from men and women living in coastal/marine areas and strengthen efforts already being made to systematize the use of local resources.

1.6.2. Integrate scientific research results in policies on comprehensive coastal/marine area management.	1.6.2.1. Adopt the Manado Declaration signed May 2009 and come up with specific ways to implement it.
	1.6.2.2. Elaborate policies on coastal land use for tourism and logistics (ports, others) infrastructure and urban centers.
	1.6.2.3. Design and implement a regional policy on fishing resources use, with emphasis on promoting artisanal fishermen/women from SICA countries and their families.
	1.6.2.4. Strengthen early warning systems for fishing communities and populations living in coastal areas and offer specific training to women and young adults in the area.
	1.6.2.5. Develop a regional policy to prevent contamination of oceans, coasts and surrounding areas and a Code of Conduct for companies operating in coastal areas.
1.6.3. Institutional strengthening of OSPESCA to improve its response regionally.	1.6.3.1. Capacity building in OSPESCA with trained human resources and financial resources to lead the effort on adaptation to climate change in coastal/marine areas.
	1.6.3.2. Build a joint institutional coordination platform that is appropriate to find synergies with other sectors: tourism, port authorities, municipalities, fishing associations, federations of artisanal fishermen/women, organizations of women with products from the ocean and others.
	1.6.3.3. Design and implement an integrated coastal/marine management plan, including planned use of these areas to minimize and reduce risk and vulnerability of coastal communities and critical infrastructure.
	1.6.3.4. Promote research and training on climate change with a focus on eco-systems. Design inter-disciplinary and inter-institutional actions within OSPESCA and with other national institutions and coastal community groups.
	1.6.3.5. Align national policies on fishing regulations and integrated aquaculture with a regional focus to adapt to phenomenon caused by climate change.
	1.6.3.6 Capacity building in CONFEPESCA (the representative of the artisanal fishing federations in the region) with human and financial resources so they can lead an organized effort on training and preparation in the fishing sector to face climate change.
1.6.4 Strengthen capacity building in coastal communities to reduce climate change vulnerability.	1.6.4.1 Nationally, look for support from governments for community governance efforts in coastal/marine areas through initiatives in protected common areas, responsible fishing and others, in which men and women actively participate in developing fishing regulations in the region.
	1.6.4.2 Implement conservation and sustainable management programs and projects in mangroves and estuaries to assure that the livelihoods of the thousands of men and women who depend on those eco-systems can continue.

Strategic Area 1.7:
Tourism and climate change

Strategic Objective 1.7: Promote necessary adaptation to minimize risk derived from climate change and mitigate its effects on tourism sectors and actors, to stimulate greater tourism competitiveness for Central America as a multi-destination.	**Operational Objective 1.7:** Reduce vulnerability in the tourism sector and promote adaptation to climate change.
Action Areas	**Measures**
1.7.1. Determine the sector's level of vulnerability.	1.7.1.1. Define methodologies and build information systems that measure vulnerability levels.
1.7.2. Increase resilience to climate change.	1.7.2.1. Promote diversification of tourism products. 1.7.2.2. Promote the development of tourism in areas not vulnerable to climate change. 1.7.2.3. Increase capacity to respond to emergency situations. 1.7.2.4. Improve natural resource use, including water resources.
1.7.3. Implement best practices in adaptation to climate change.	1.7.3.1. Collect and share information on best practices (benchmarking). 1.7.3.2. Adapt experiences to the region's needs.
1.7.4. Institutional capacity building at SITCA and Ministries of Tourism as those responsible for strategic implementation.	1.7.4.1. Develop instruments and information systems. 1.7.4.2. Train technical personnel. 1.7.4.3. Capacity building in tourism project elaboration and management.

Specific Objective 2: Develop an information system to quantify, verify and report on mitigation efforts.	
Action Areas	**Measures**
1.7.5. Develop a baseline and inventory on greenhouse gas emissions (GHG).	1.7.5.1. Train businesspeople and other actors on how to measure their emissions. 1.7.5.2. Apply a homogeneous methodology that is ideal for the region.
1.7.6. Establish a monitoring system for the indicators that are created.	1.7.6.1. Systematize information collected in each country and create a periodic regional report.
Specific Objective 3. Reduce and compensate for greenhouse gas emissions.	
Action Areas	**Measures**
1.7.7. Develop projects that reduce or eliminate greenhouse gas emissions.	1.7.7.1. Share information on compensation options. 1.7.7.2. Build alliances in order to compensate for emissions. 1.7.7.3. Promote the efficient use of natural resources. 1.7.7.4. Promote the use of alternative energy and cleaner production practices. 1.7.7.5. Promote the adoption of solid waste management policies and practices.
Specific Objective 4. Educate and make the public aware, especially the tourism sector, of the effects of climate change and measures for mitigation.	
Action Areas	**Measures**
1.7.8. Create awareness and social responsibility on climate change.	1.7.8.1. Develop awareness campaigns. 1.7.8.2. Develop educational programs for school-age children. 1.7.8.3. Implement training programs for the sector and related actors.

Strategic Area 1.8:
Indigenous communities, ethnicities and people of african descent

Strategic Objective 1.8: Strengthen traditional systems in local and indigenous communities focused on practices for adaptation and mitigation to climate change and fostering their active participation.	**Operational Objective 1.8. Promote the implementation of traditional and ancestral knowledge and practices in adaptation and mitigation for climate change plans, programs and projects.**
Action Areas	**Measures**
1.8.1 Promote methods of adaptation and mitigation for climate change.	1.8.1.1 Build indigenous protocols on the specific vulnerabilities of these communities to climate change and structure adaptation measures with a participatory focus, based on customs and values.
	1.8.1.2 Create indicators for vulnerability to climate change, as well as how indigenous practices contribute to its mitigation.
	1.8.1.3 Promote processes of adaptation in indigenous communities locally or territorially.
	1.8.1.4 Review and formulate REDD policies that recognize ancestral rights and conservation practices, uses and sustainable management from indigenous people and local communities that have promoted integrated eco-systems and protected areas currently in existence.
	1.8.1.5 Review existing policies and adjust them to increase access of indigenous people and people of African descent in health services, with a focus on gender.
1.8.2 Promote the participation of indigenous people at different levels and in climate change mechanisms.	1.8.2.1 Create conditions that favor, promote and strengthen the participation of indigenous people in the implementation of policies and strategies on climate change.
	1.8.2.2 Establish mechanisms to foster participation of indigenous people.
1.8.3 Promote and strengthen traditional knowledge from indigenous people.	1.8.3.1 A program to foster full and effective participation of indigenous people.
	1.8.3.2 Systematize, document and share traditional practices related to adaptation and mitigation for climate change in order to present proposals.
	1.8.3.3 Foster eco-tourism practices in indigenous territories and communities of African descent with infrastructure and local products that strengthen cultural identity and contribute to reducing GHG.
	1.8.3.4 Rescue cultural values in agricultural practices from indigenous communities so they do not disappear and crops are not lost due to climate change.
	1.8.3.5 Promote natural or indigenous medicine and implement preventive campaigns to guarantee access to integral health services for indigenous women.

Strategic Area 1.9: Public infrastructure

Strategic Objective 1.9. Promote climate proofing and strategic public infrastructure for the social and economic development of SICA countries facing climate change.	**Operational Objective 1.9.** Promote and incorporate criteria on risk management and adaptation to climate change in the planning, design, supervision and implementation of public works.
Action Areas	**Measures**
1.9.1. Increase public and private knowledge regionally on climate proofing public infrastructure in the context of climate change.	1.9.1.1. Hold meetings and regional events with experts on the topic for authorities in charge of public works, the environment and finance.
	1.9.1.2. Promote private sector knowledge and participation in construction in the region.
	1.9.1.3. Elaborate and share technical documentation by infrastructure sector.
	1.9.1.4. Exchange regional and international experiences to understand how to apply technical methodologies and measures.
	1.9.1.5. Facilitate and promote specialized technical knowledge in the region's academic sector.
	1.9.1.6. Incorporate criteria for risk and adaptation to climate change in territorial zoning processes for human settlements and urban development.
1.9.2. Provide technical assistance to public institutions responsible for effectively incorporating risk and adaptation to climate change when rehabilitating or building new public infrastructure projects.	1.9.2.1. Establish a regional strategy and mechanism for technical assistance with governments to implement climatic proofing for infrastructure.
	1.9.2.2. Identify and facilitate specialized technical support to carry out analyses on threats, vulnerability and risk in priority areas and sectors for each country's social and economic infrastructure.
	1.9.2.3. National and regional evaluations on current construction regulations and standards and compliance.
	1.9.2.4. Territorial analysis and application of probability models for risk in the design of new public infrastructure projects.
	1.9.2.5. Modify technical standards and public infrastructure designs considering a territorial approach to risk.
	1.9.2.6. Evaluate climate proofing, considering economic, engineering and environmental analyses.
	1.9.2.7. Develop climate proofing plans based on territories
	1.9.2.8. Establish early warning and monitoring and evaluation systems for projects.

Strategic Area 2: Mitigation

Operational Objective 2. Use funds for mitigation in the context of the UNFCCC and opportunities in different carbon markets to promote programs in renewable energy, energy efficiency and energy savings; sustainable transportation; forest conservation and extension of forest lands; sustainable agriculture; and solid, liquid, industrial and agricultural waste treatment to capture methane.	**Operational Objective 2.** Use funds for mitigation in the context of the UNFCCC and opportunities in different carbon markets to promote programs in renewable energy, energy efficiency and energy savings; sustainable transportation; forest conservation and extension of forest lands; sustainable agriculture; and solid, liquid, industrial and agricultural waste treatment to capture methane.
Action Areas	**Measures**
2.1. Promote greater use of renewable energy sources in regional energy generation grids.	2.1.1. Review and adjust regulatory frameworks in countries to permit greater investments in renewable energy projects, including bioenergy, energy efficiency and energy savings.
	2.1.2. Build capacity at professional training centers teaching renewable energy sources and engineering, including methodologies to prepare projects applicable to the Clean Development Mechanism or other carbon markets.
	2.1.3. Produce and share technical guides on energy efficiency and savings with all groups: industrial, urban, domestic, groups of women, transportation and others.
	2.1.4. Organize professional courses, at least two a year, to create energy projects that will be financed within the framework of national mitigation actions in the UNFCCC or that may be eligible in the Clean Development Mechanism, or any other mechanism presented in the Convention.
	2.1.5. Support the Energy Coordination Office at the General Secretariat of SICA (UCE-SICA) and national energy authorities in implementing the 2020 Central American Sustainable Energy Strategy, by carrying out actions set forth in the Matrix for Energy Integration and Development Actions in Central America.
	2.1.7. Promote participation of the transportation sector in renewable energy and emissions reductions projects and in financing projects on adaptation in included areas (i.e. soil and watershed conservation, protecting roadside areas, etc.).

2.2. Promote carbon sinks by expanding forest coverage, reductions in deforestation and degradation or sustainable forest management and conservation, together with adaptation to climate change.	2.2.1. Take advantage of the implementation of the GTZ/CCAD REDD Project to promote specialized courses, once a year, to design and implement national strategies on the Reduction of Emissions through Deforestation and Degradation (REDD) and project initiatives within the UNFCCC framework and other voluntary carbon market options.
	2.2.2. Document and systematize experiences in forestry projects with emphasis on methodologies that can be applied to REDD projects under the UNFCCC and forestry projects that are eligible under the CDM of the Kyoto Protocol, among other mechanisms.
	2.2.3. Improve PERFOR, adding specific methodological guidelines for different types of REDD projects under the UNFCCC and forestry projects that are eligible under the CDM of the Kyoto Protocol.
	2.2.4. Design projects with a focus on gender to reduce emissions through savings in firewood in homes and SMEs where firewood is the main source of energy, and reduce risk for respiratory and ocular diseases in women and children.
	2.2.5. Promote synergies with forestry projects, within the frameworks of adaptation or mitigation (REDD), in watershed areas that are important to hydroelectric energy generation or priority, domestic water use.
	2.2.6. Update maps every five years of land that is eligible for different types of forest mitigation projects under the UNFCCC and the Kyoto Protocol.
	2.2.7. Promote specialized courses on incorporating gender criteria in REDD projects.
2.3. Reduce emissions through the use of bioenergy as part of the 2020 Energy Strategy.	2.3.1. Evaluate the potential use of firewood in the region as a bioenergy source and evaluate its sustainability nationally and regionally, including an analysis of externalities related to its use.
	2.3.2. Design a program to hand out improved stoves through a health program due to the effect of firewood on respiratory channels and eyes in households where firewood is the only or main source of energy.

2.4. Promote reductions in GHG in small and large scale agriculture and livestock production.	2.4.1. Promote and align the region's regulatory framework on biofuel production and renewable energy in the agricultural sector, evaluating adverse effects on food security, natural ecosystems and the access and use of land for poor, rural communities, indigenous communities and communities of African descent.
	2.4.2. Promote dialogue, research and regional and international cooperation to develop new technologies, sustainable best practices and opportunities for regional investments in Cleaner Production of biofuels.
	2.4.3. Promote energy generation based on solid waste and byproducts generated by the agricultural sector and other sources.
	2.4.4. Organize annual professional courses on how to elaborate GHG emissions reduction programs and projects in the agricultural sector.
	2.4.5. Promote regional research on agricultural technologies or practices that trap carbon and nitrogen in the soil and also contribute to adaptation to climate change in the sector.
	2.4.6. Promote research and technology transfers to reduce GHG emissions in livestock production, including productive efficiencies to optimize land use for animals and dairy production per hectare.
	2.4.7 Promote and align regional regulatory frameworks for biofuel and renewable energy production in the agricultural, industrial and livestock sectors.
	2.4.8 Promote reductions in GHG emissions in agriculture and livestock production that are synergized with adaptation measures.
2.5. Promote business practices on Cleaner Production (lower emissions).	2.5.1. Introduce emissions measurements and other considerations related to mitigation for GHG in environmental impact evaluation systems and other tools pertinent to environmental management.
	2.5.2. Design and implement certification systems from carbon neutral companies, with the corresponding economic incentives.
	2.5.3. Promote responsible consumer practices and patterns that help reduce GHG emissions and improve quality of life, reducing carbon footprints.

2.6. Design and implement mitigation measures for solid waste in climate change projects.	2.6.1. Systematize CDM projects on solid waste.
	2.6.2. Do an inventory of potential projects that can be developed for solid waste management with an estimation of related emissions reductions in order to look for financing from the UNFCCC multilateral fund or the CDM under the Kyoto Protocol (include agricultural, industrial and municipal waste).
	2.6.3. Find financial resources to implement solid waste management projects applicable to the UNFCCC multilateral fund and the carbon market under the Kyoto Protocol.
2.7. Design and implement specific measures to reduce emissions in the transportation sector.	2.7.1. Design and implement specific measures to reduce emissions in the transportation sector (regionally, urban) to then reduce GHG emissions.
	2.7.2. Adjust the applicable regulatory framework to optimize mass public transportation nationally and regionally and develop biofuels, without affecting food security negatively.
	2.7.3. Promote incentives and policies for technologies to convert transportation to biofuels, hybrids, gas, etc.
	2.7.4. Promote participation in projects to reduce emissions in the transportation sector and finance adaptation projects (i.e. soil and watershed conservation, protecting roadside areas, etc.).

Strategic Area 3:
Institutional capacity building

Strategic Objective 3. Increase and improve capacity to face climate change and variability.	**Operational Objective 3.** Increase institutional and human capacity in the region to better understand climate and climatic threats.
Action Areas	**Measures**
3.1. Capacity building in regional institutions.	3.1.1. With leadership from SICA's environmental offices, and using the technical group coordinated by CRRH, put together and coordinate a Panel of Experts on climate change in Central America (PECCAC), including experts from specialized centers in the region, academia and climate change meteorological services and commissions (including men and women with expertise from civil society institutions in the region), to implement the Regional Strategy on Climate Change.
	3.1.2. Form alliances with specialized international institutions that study climate to participate jointly in activities (i.e. NOAA, NASA, CPTEC, IRI, CRU and others).
	3.1.3. Implement joint research programs on climate change adaptation and mitigation efforts, using South/South, North/South and Triangular coordination.
	3.1.4. Create and support the Joint Council on Climate Change at SICA, comprised of officials whose sectors are involved in implementing the Regional Strategy on Climate Change.
	3.1.5. Promote scholarships and internship programs for officials, NGOs and the private sector for more training on topics related to climate change and its implications.
3.2. Promote joint programs for adaptation to climate change.	3.2.1. Joint programs on innovation and technological development for adaptation, including best practices in ancestral knowledge applied with a focus on gender and diversity.
	3.2.2. Strengthen networks on climate observation (atmospheric components, oceans, terrestrial eco-systems and geology [23]), including their relation to the Global Climate Observing System.
	3.2.3. Provide more resources to the Water Forum to improve the effectiveness of forecasting and early warning climate systems.
	3.2.4. Improve, expand and sustain early warning networks for events caused by climate change and variability (flooding, drought, landslides and impacts on sea level).
	3.2.5. Develop specialized programs to manage water and soil when facing risks from climate change in dry tropical areas of Central America, both in terms of research and professional training.

[23] This component is related to soil movements within the framework of reducing risk and integrated risk manage-

3.3. Strengthen professional training centers and universities to research and transfer knowledge on climate change and variability.	3.3.1. Design academic university curriculums that integrate adaptation and mitigation for climate change in professional training, with an unbiased point of view in terms of gender.
	3.3.2. Support Masters and Doctorate Program thesis at universities on topics of adaptation and mitigation for climate change, as well as reducing risk from climate threats.
	3.3.3. Develop specialized texts for academic and professional training.
	3.3.4. Build capacity to develop GHG emissions inventories for different sectors and businesses and nationally.
	3.3.5 Identify and analyze the impacts, barriers, opportunities and cost/benefit analyses for GHG emissions mitigation measures, within the framework of national mitigation actions under the UNFCCC.
	3.3.6 Do training on gender and climate change at public and private universities and elaborate indicators on the differentiated impacts on men and women to develop appropriate strategies.
3.4 Promote dialogue among SICA, governments and civil society (indigenous organizations, women organizations, cooperatives, academics, environmentalists, rural development specialists, etc.) on climate change, nationally and regionally.	3.3.6. Establish mechanisms for SICA's participation with civil society (indigenous, women, cooperatives, environmentalists, etc.) institutionally to dialogue on different topics related to climate change.
	3.3.7. Ensure SICA's full participation with different parts of civil society to formulate strategies, plans, programs and policies related to climate change, nationally and regionally.
	3.3.8. Find financial resources to systematize and share success stories that different civil society organizations (women, indigenous, etc.) have had with adaptation to climate change, and look for a sustainable development model that is in harmony with nature.

Strategic Area 4:
Education, awareness, communication and citizen participation

Strategic Objective 4. Involve civil society through education and awareness on climate change so that they participate in decision-making.	**Operational Objective 4.** Establish joint agreements with institutions working on public development programs, education and awareness on climate change and facilitate their participation in adaptation, mitigation and policy-formation.
Action Areas	**Measures**
4.1. Promote formal training at institutions of higher education and secondary education on climate change.	4.1.1. Incorporate the topic of climate change in educational curriculum at the primary, secondary and higher education levels.
	4.1.2. Design, adapt, develop and print texts on the topic of climate change in different languages and formats, including indigenous languages and dialects in the region.
	4.1.3. Hold training workshops on climate change with journalist, radio and press associations and design coordinated work plans.
	4.1.4. Promote teacher training at different levels on the topic of climate change, as well as training for technicians, scientists and managers.
	4.1.5. Prepare and exchange educational materials designed for public awareness on the topic of climate change and its impacts by gender.

4.2. Share information on mitigation and adaptation for climate change through the mass media.	4.2.1. Hold training workshops on the topic of climate change with journalist associations and design coordinated work plans.
	4.2.2. Document and systematize results from programs and projects on adaptation and mitigation for climate change (both coming from institutions and civil society) and share them in different formats and languages.
	4.2.3. Promote the Climate Forum and share information on it widely through different media.
	4.2.4. Maintain and improve the Regional Portal on Climate Change at SICA and demonstrate links to national institutions working on the subject.
	4.2.5 Do surveys and conduct awareness campaigns with the public and media, on vulnerabilities and capacity by gender and the need to focus on gender in adaptation and mitigation strategies.
4.3. Host activities to exchange experiences and elaborate regional proposals that contribute to adaptation and mitigation for climate change.	4.3.1. Organize a Regional Forum on climate change every two years to systematize what the region is doing on the topic with the participation of civil society.
	4.3.2. Organize National Forums on climate change every two years, in the years when there is not a Regional Forum.
	4.3.3. Promote the participation of the public in studying climate change and its effects and coming up with responses that help reduce vulnerability to climate change.

Strategic Area 5: Technology transfers

Strategic Objective 5. Develop a system to create and transfer technologies on adaptation and mitigation for climate change.	**Operational Objective 5. Develop Regional Centers on Technology Innovation in adaptation and mitigation for climate change.**
Action Areas	**Measures**
5.1. Create regional institutions on technology transfers and climate change.	5.1.1 Strengthen the Central American Council on Science and Technology, integrating national chapters to promote all phases of technology development related to adaptation and mitigation for climate change.
	5.1.2. Build alliances and cooperation with specialized institutions on technology transfers and climate change, like those that have been started with UNEP.
	5.1.3. Create regional technical commissions in different sectors specialized in estimating GHG emissions and studying corresponding technology options to reduce emissions with criteria of social and economic sustainability.
5.2 Develop and transfer technologies for climate change mitigation.	5.2.1. Identify and strengthen specialized centers in the region focusing on creating technologies for renewable energy, energy efficiency and others.
	5.2.2. Identify and strengthen specialized centers in the region focusing on creating technologies to reduce emissions in the transportation sector, including territorial and road zoning and biofuels.
	5.2.3. Create a specialized program to reduce GHG emissions from burning firewood in rural and urban homes in the region, with an emphasis on supporting women and indigenous communities.
	5.2.4. Create building codes to save energy and reduce emissions in construction and buildings (commercial centers, hotels, others).
	5.2.5. Identify and strengthen organizations of groups of women, indigenous people and people of African descent working on developing initiatives with technological options to mitigate climate change.

5.3 Technology transfers for adaptation to climate change.	5.3.1. Strengthen public and private systems for technology innovation and development, including native and ancestral knowledge, for adaptation to climate change in agriculture and natural eco-systems.
	5.3.2. Identify and support specialized centers that create and transfer technologies for adaptation in agriculture, with emphasis on the efficient use of water in dry areas, drought-resistant crops and new productive alternatives.
	5.3.3 Promote training programs on clean technology innovation and renewable resources for adaptation to climate change, with priority for groups that are most vulnerable (women, indigenous, children, African descent).
5.4. Design of financial mechanisms for technology transfers.	5.4.1. Financial mechanisms for technology transfers in mitigation for climate change, particularly in energy efficiency.
	5.4.2. Financial mechanisms for technology transfers in adaptation to climate change and variability.
	5.4.3. Hold events to estimate the costs of technology transfers for adaptation and mitigation for climate change and the costs to make national, regional and international negotiations more efficient.

Strategic Area 6:
Negotiations and international support

Strategic Objective 6. Improve effective participation of SICA countries in international negotiations on climate change.	**Operational Objective 5.** Increase fundraising and political decisions supporting SICA countries.
Action Areas	**Measures**
6.1. Strengthen regional negotiation capacity.	6.1.1. Support the Technical Committee on Climate Change for full and effective compliance with its duties.
	6.1.2. Accompany negotiators with personnel specialized in the topic being discussed at UNFCCC meetings, including experts from civil society and governmental decision-makers (Planning, Governance, others) and assure the representation of women's groups in negotiations.
	6.1.3. Hold at least two regional workshops a year to analyze and discuss topics/decisions to be negotiated as part of international UNFCCC processes.
	6.1.4. Capacity building at key governmental institutions for negotiations on the relation between climate change and gender, ethnic groups, poverty, production, food security, health and others.
	6.1.5. National capacity building to get key inputs for negotiations: 1) national communication strategies for the UNFCCC every five years; 2) elaboration of National Strategies on Climate Change, including local and territorial areas; 3) carry out studies on vulnerability to climate change and variability in indigenous communities and for women; and 4) conduct economic evaluations on investments for mitigation and adaptation.
	6.1.6. Build negotiating capacity among negotiators on the topics of gender and climate change.
	6.1.7. Find additional resources so that female delegates can participate in the GGCA Fund.
6.2. Find/take advantage of synergies between different international conventions.	6.2.1. Build synergies between the UNFCCC's Adaptation to Climate Change, the Hyogo Framework on Disaster Reduction and the International Strategy on Disaster Reduction (ISDR), the Convention on Biological Diversity, the Ramsar Convention and the Montreal Protocol.
	6.2.2. Integrate the Millennium Development Goals, Eco-system Evaluations and REDD when implementing the Regional Strategy on Climate Change.

6.3. Capacity building for international financial resources.	6.3.1. Hold regional workshops annually on existing financial mechanisms in the UNFCCC for mitigation, adaptation and other components to use them to meet the region's needs.
	6.3.2. Take fundraising to the international level with support from local financial mechanisms for mitigation, adaptation and other conventions that create synergies.
	6.3.3. Do periodic inventories on existing financial mechanisms to finance adaptation and mitigation projects for climate change and payments for environmental services, and share procedures to access those mechanisms in regional workshops.
	6.3.4. Prepare project or program profiles for both men and women, based on local, national or sector needs and direct them to potential sources of financing.
6.4. Strengthen local, national and regional financial mechanisms.	6.4.1. Strengthen existing local, national and regional financial mechanisms for effective and appropriate resource mobilization to support implementation of different components in the Regional Strategy on Climate Change.
	6.4.2. Raise international funds to support country efforts, civil society initiatives, initiatives from vulnerable groups (including women) and SICA offices to agree on, define and implement priorities in the Regional Strategy on Climate Change.
	6.4.3. Design local, national and regional policies and mechanisms to develop access to insurance with climate criteria as a way for individuals, companies and communities to manage risk.
	6.4.4. Design management mechanisms to guarantee that local, national and regional financial mechanisms are accessible to women.
6.5. Report on advances made in implementing the Regional Strategy on Climate Change.	6.5.1. SICA's General Secretariat will consolidate annual plans from the different offices and present an annual Action Plan and corresponding progress reports to the Council of Ministers from CCAD, TC-CC and the Panel of Experts on Climate Change, and other community organizations (CC-SICA, PARLACEN and CCJ), once designed and set up.
	6.5.2. Develop monitoring and evaluation systems for the Regional Strategy on Climate Change no later than three months after its approval, and develop a system database.
	6.5.3. Design indicators for the Regional Strategy on Climate Change, defining sensitive indicators and specifically including mechanisms to get data from the regional countries or institutions that are involved in order to not duplicate information.

Organization for implementation

Application and compliance with the Regional Strategy on Climate Change.

Implementation of the Regional Strategy on Climate Change assumes an extensive implementation framework that includes several measures that should be done immediately. The next concrete step in the process is to elaborate the Action Plan for the Regional Strategy. This Plan will define short-, medium- and long-term actions to be taken; indicators and monitoring mechanisms; verifications and direct responsibilities.

In operational terms, in order to apply and comply with the Regional Strategy, the General Secretariat of SICA, other sector offices, national environmental authorities and relevant national and regional institutions will all be involved. Institutionally, the region already has mechanisms and spaces to implement and apply the Regional Strategy on Climate Change, including:

- The environmental sub-system of offices at SICA, which includes CCRH, CEPREDENAC and CCAD
- Technical Committee on Climate Change
- Technical Committees from the Regional Strategy on Agriculture, the Environment and Health (ERAS for its name in Spanish)
- Technical Committees at CCAD
- Joint agreements between offices
- CC-SICA

In addition, considering the transversality of climate change, the Regional Strategy proposes the creation of: a) a Regional Panel of Experts on climate sciences, and b) a Consultative Committee for the Regional Strategy on Climate Change, including representatives from the Technical Committees at CCAD, civil society in the region represented by the Consultative Council at SICA (CC-SICA) and representatives from regional technical institutions. This institutionalized effort will help develop a planning and annual evaluation process, considering the different programmatic areas of the Regional Strategy on Climate Change.

In order to guarantee alignment and correlation during implementation of the Regional Strategy, the following measures are proposed for SICA:

- Optimize use of existing regional initiatives in different offices at SICA, integrating elements of the Regional Strategy's programmatic areas;

- National and regional initiatives that governments indicate are being processed by different financing agencies will be reviewed to incorporate elements promoting risk management and adaptation to climate change, in accordance with implementation of the Regional Strategy's programmatic areas;

- The General Secretariat will instruct sector offices to include the topic of climate change in their annually planning, and they should include corresponding annual progress reports;

- SICA will design the Regional Panel of Experts on Climate Change, defining its nature, scope and roles and work agenda for the first two years and determining and agreeing on a transparent process to select regional entities that will be part of the Panel, including definitions on eligibility terms and criteria;

- The General Secretariat of SICA will instruct the Central American Bank for Economic Integration to help implement the Regional Strategy by providing financing to implement adaptation and mitigation projects that help reduce vulnerability to climate change and variability, based on the Regional Strategy's programmatic areas. CABEI will include corresponding investments in its annual financing plans and share information in annual progress reports;

- SICA will produce annual reports sharing progress made on implementation of the Regional Strategy and will communicate the information extensively through electronic and print media in at least two languages: English and Spanish;

- Together with national environmental authorities from SICA member countries, SICA will do an inventory of initiatives that contribute to the Regional Strategy, but that are not directly managed by SICA, locally, nationally and regionally.

Financing mechanism

Existing financial mechanism in SICA countries.

Even though international financial mechanisms have not yet been implemented for adaptation to climate change, countries already have different investment programs and instruments that contribute to adaptation.
A comparative analysis of different funds available in SICA countries concluded that financial mechanisms have been implemented for GHG mitigation or adaptation to climate change with a focus on eco-systems. Some examples include: FONAFIFO in Costa Rica, the Forest Incentive Certificate Program in Panama, the Forest Incentive Program in Guatemala and the Protected Areas Conservation Trust (PACT) in Belize. Even though these funds contribute to forest management, conservation and reforestation, they have not yet been recognized and connected to global financial mechanisms for climate change.

Other financial mechanisms that have been implemented contribute to adaptation in the agricultural sector. Several countries have put into place risk management systems for extreme climate to prevent agricultural losses with limited success. However, these agricultural insurance systems do not have sufficient coverage and deserve critical analysis to determine restrictions to greater participation and expanded coverage. IICA, the World Bank and the IADB are making efforts to reduce barriers that prevent growth of the region's agricultural insurance market to include coverage for climatic risk.

Up until now, the existing financial mechanisms in the UNFCCC have not allowed countries in the region to access enough resources to strengthen and expand their adaptation activities and actions, especially those related to forest eco-systems and marine/coastal areas. In addition, they have done even less to respond to impacts from disasters associated with climate change. This is one of the main negotiation issues for SICA countries, who are defining their negotiation strategies for the UNFCCC. The July 2010 Presidential Summit highlighted the need for SICA countries to promote and create a regional fund for the prevention and mitigation of natural disasters and the reconstruction of countries that have been affected within the UNFCCC framework. In addition, the Summit mandated that the region should have an internal process so that the Council of Ministers of Foreign Affairs, Environment and Treasury/Finance jointly look for additional external and donated funding, mainly from developed countries, to prepare the region and help it adapt to extreme climate events, which are affecting the region more every day.

Financing for adaptation.

Given the high level of vulnerability of human populations, means of living and natural systems in Central America and the Dominican Republic, particularly among the poorest and most vulnerable populations, regional policy agenda priorities on climate change should focus on adaptation to climate change locally, nationally and regionally and promote proactive behaviors in international negotiations to develop financial mechanisms for adaptation that are consistent with the following principles and guidelines:

- Funds should be under the umbrella of the Convention.
- New resources in addition to those from Official Development Assistance and enough to support adaptation.
- Operational procedures to access the Adaptation Fund that are fast, direct and timely.
- Criteria to prioritize access to financial resources should be based on available scientific knowledge and evidence of observed and projected impacts related to social, economic and ecological vulnerability in developing countries, considering the precautionary principle.
- Establish an International Program for Adaptation (IPA) that includes aid to compensate for damages and losses.
- Create a multilateral fund for several areas: adaptation, mitiga tion and technology transfers.
- Design a strategy for fast technology transfer implementation on adaptation: North/South, South/South.
- Recognize complementary actions between mitigation and adaptation.
- Based on incremental costs of climate change for different sectors, recognize additional costs associated with adaptation measures to climate change.
- Create an international insurance system to recover losses in agricultural/livestock production due to drought and investments in infrastructure (i.e. housing, highways, etc.).
- Countries from Annex I that emit GHG should spend a percentage for emissions permits, as part of their responsibilities to create an adaptation fund or other mechanisms to cover the costs of adaptation in the region.
- Recognize mitigation mechanisms in the UNFCCC for ERC in the CDM created by developing countries so that they are aligned with adaptation measures. Nationally, define an instrument in accordance with national policies on adaptation, including a regional mechanism to strengthen national processes.

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Regional Adaptation Fund.

In addition to working on the creation of financial mechanisms for adaptation under the UNFCCC and in compliance with a mandate from the region's Presidents and Chiefs of State, Central America must also work on building a Regional Adaptation Fund. This will be a financial mechanism complementary to other resources that countries can access directly. The Fund will provide and channel resources to projects in areas of common interest and value added for adaptation management in SICA countries, strengthening the integration and alignment of adaptation policies in different economic and social sectors in the region. The Fund will be complementary to national resources. It will be retroactive, permanent and in addition to market mechanisms established in the Kyoto Protocol (carbon emissions market, CDM and joint implementation).

These resources should be used to recognize Payments for Environmental Services provided by the region's natural carbon sinks and to compensate for human and material damage from natural disasters related to climate change.

The Fund should be implemented based on the following criteria:

- Greater flexibility to access existing funds.
- More equal and fair distribution of funds.
- Based on realities, traditions and customs of indigenous people and communities.
- Predictable, stable and timely mechanisms.
- Use resources and technology to promote applied research in the region.
- Funds should be administered by regional banks and decentralized institutions at the national and municipal levels and used by local governments.

To design and develop the Fund, the region can receive assistance from the Central American Bank for Economic Integration (CABEI), the Inter-American Development Bank (IADB) and the World Bank (WB), among others. The region should prepare measures to be applied immediately in order to make progress on the development of this financial mechanism:

- Evaluate economic costs of climate variability associated with climate change in the region currently and in future scenarios related to Scenarios A2 and B2. The ECLAC study on the economics of climate change provides this type of specific and reference data and information.
- Evaluation and estimate of the financial costs of adaptation measures proposed by the Regional Strategy on Climate Change in each country and regionally. This is a very technical and specialized study that should be done as soon as possible.
- Do inventories and estimate the funds that each country has already invested annually in actions that contribute to mitigation and/or adaptation to climate change.
- Identify local and regional sources and mechanisms that can facilitate implementation and access to these complementary resources.

Annex

15 actions for implementation of the Regional Strategy on Climate Change have been identified

These actions include coordination from regional institutions, national public institutions, social organizations and the private sector:

1 Regional climate monitoring

The Regional Committee on Water Resources (CRRH for its name in Spanish) successfully holds the Regional Climate Forum, which keeps socio-economic sectors in the region informed of expected climatic variability in the quarter immediately following the report. CRRH will continue to inform the region and improve its capacity to reach more people using better technology and more precise climatic forecasting. Likewise, it is expected that the Climate Change Center for the Caribbean Community in Belize will become more active in the coming months and provide another scientific and technical source of climate change information for the region once the strategic alliance with CARICOM and the small island states has been formalized.

2 Implementation of the Central American Policy on Integrated Risk Management (PCGIR for its name in Spanish)

The Regional Center for Disaster Prevention and Attention (CEPREDENAC) is the environmental office at SICA that is implementing the Central American Policy on Integrated Risk Management (PCGIR), currently the 2010-2013 Plan. This Plan is implemented in five programmatic areas:

i) institutional capacity building;
ii) territorial management;
iii) education and training;
iv) preparation and response; and
v) scientific/technical development.

The Regional Strategy on Climate Change seeks to promote and consolidate existing policies on the topic and promote more effective institutional connections using concrete actions to reduce the region's vulnerability.

3 Economic evaluation of climate change in Central America

This action is based on completing and analyzing the results of the Economic Evaluation of Climate Change in Central America study. The final results were presented in August 2010 in Guatemala for several key sectors, including agriculture, water resources and others.

An agreement has been signed between ECLAC and CCAD to extend the project through 2010 and 2011, with support from DANIDA, the Nordic Development Fund and others. This will help share the results of the sector studies with authorities, internalize the economic evaluation analysis and identify action areas to promote policy measures that incorporate economic criteria to face climate change in the region.

4 Design of the Regional Strategy on Security and Climate Change

This is an ongoing study and multi-institutional collaboration between CCAD and the British Royal United Services Institute (RUSI) to implement the Climate-related Impacts on National Security in Mexico and Central America study.

Several progress reports on this project have already been presented, and the final report with results should be ready for the fourth quarter of 2010. Due to the importance of the topic of national and regional security, this project will be extended beyond 2010, working together with the Democratic Security Committee at SICA. The General Secretariat of SICA, together with CCAD, plan to develop a joint initiative to promote policy dialogue on water security, food security, physical infrastructure security and immigration, as they relate to climate change, with key actors in the region and the international community.

5 Implementation of the Regional Strategy on Agriculture, the Environment and Health (ERAS for its name in Spanish)

This Regional Strategy has been implemented in SICA member countries, since it was approved by the Chiefs of State and governments in 2008. Actions have been coordinated among three SICA entities: i) the Central American Agricultural Council (CAC); ii) the Central American Commission for Environment and Development (CCAD); and iii) the Council of Ministers of Health in Central America (COMISCA).

Its implementation requires more national, regional and international financial resources. The first period of implementation will continue through 2024. Most actions already being implemented concentrate on initiatives and projects on sustainable land management, agro-environmental business and biodiversity. The project already has a Joint Technical Committee and Joint Consultative Committee to support implementation.

6 Attention to food security and developing the Health Agenda for Central America

The Council of Ministers of Health of Central America (COMISCA) is implementing the Health Agenda for Central America with direct intervention in regional healthcare policy formation, risk reductions and the presence of communicable and non-communicable diseases related to the environment. Implementation of the second phase of the Central American Food and Nutrition Security Program (PRESANCA) is about to start. This Program will promote local strategies and actions in priority areas to combat food insecurity and promote nutrition with vulnerable populations

7 Promote adaptation actions in indigenous communities in the region

In order to support natural resource conservation and protection in indigenous communities in the region, the Investment Program for the Cultural Use and Integrated Management of Natural Resources in Indigenous Communities in Central America was started. This type of initiative recognizes that knowledge exists, which has provided sustainable environmental use for thousands of years with cultural and territorial management. Indigenous populations can contribute important ancestral knowledge on adaptation and resilience in situations of high vulnerability.

8 Regional capacity building for adaptation to climate change

The region is negotiating support for technical skills and capacity building on natural resource management for adaptation. The InWent, DANIDA and Nordic Fund programs will provide technical, scientific and methodological support to key actors and officials in the region to increase knowledge and the development of instruments in key institutions in the region and at the country level.

9 Promoting sustainable management of the Mesoamerican Biological Corridor

The development of biological connections and shared territories in the region through Corazón del Corredor Biológico Mesoamericano, shared between Nicaragua and Honduras, and El Trifinio, between Guatemala, Honduras and El Salvador, among others, shows important progress that has been made. CCAD, with support from institutions, such as RUTA, IUCN and TNC, promote strategic public/private partnerships to conserve biodiversity in protected areas and biological corridors, reduce the impacts of climate and improve regional production quality, while conserving Mesoamerica's biological wealth.

10 Reducing threats and vulnerabilities in regional marine/coastal areas

The region will start the MAREA Program this year with international aid to promote management in priority marine/coastal areas and strategies to consolidate sustainable livelihoods and reduce vulnerabilities in areas, such as the Fonseca Gulf, Mosquito Coast, and others. CCAD and OSPESCA will participate in the initiative.

An effort is also being made to strengthen management in the "Mangrove Corridor" of the Fonseca Gulf, consolidating local capacity with governments and communities to manage coastal/marine resources sustainably.

11 Sustainable management of the Mesoamerican reef system

The region has new aid to promote the Mesoamerican Reef System Fund (Fondo SAM), which is a financial mechanism with local and micro-regional initiatives to conserve and use resources sustainably in the eco-region of the Mesoamerican reef system, including Mexico, Belize, Guatemala and Honduras.

12 Elaboration of the Central American Agenda on Territorial Zoning with a focus on risk and adaptation to climate change

The Council of Ministers of Housing and Settlements in Central America (CCVAH for its name in Spanish) is leading a process to design and elaborate the Central American Agenda on Territorial Zoning. It has worked with the Office for Central American Inclusion (SISCA) and CEPREDENAC to incorporate risk and adaptation to climate change into the Agenda and guarantee the presence of key criteria for territorial management of human settlements in the region.

13 Promoting regional energy sustainability

The SICA countries already have an important instrument to promote energy sustainability: the Central American Energy and Environment Alliance (AEA for its name in Spanish. The Austrian Development Agency (ADA), cooperation from the Finnish government and the European Union are helping to implement several projects on renewable energy and energy efficiency, particularly in order to connect communities with limited electrical coverage, support private initiatives and develop favorable policy and incentive frameworks to promote renewable energy. The German cooperation agency is also supporting interventions and larger-scale projects. CCAD and the Energy Coordination Office at SICA have started a dialogue on energy/environment to promote a common policy agenda for these two sectors.

14 Regional Reduction of Emissions from Deforestation and Degradation

CCAD and GTZ have begun implementing a regional program on Reducing Emissions from Deforestation and Degradation in Central America and the Dominican Republic. This program seeks to improve regulatory and institutional conditions in the forest sector and build capacity in the countries involved to facilitate sustainable implementation and innovative REDD mechanisms to take advantage of regional synergies. Implementation has been extended through 2016.

15 Regional Inventory on Emissions and Contamination Transfers

The region has begun registering emissions and contamination transfers to increase country capacity to control risks to health and the environment when increasing production and the use of chemical substances

GLOSSARY

Adaptation
Adjustments to human or natural systems when facing new or changing environments. Adaptation to climate change refers to adjustments in human or natural systems in response to projected or real climatic events and their impacts, in order to moderate their damage or take advantage of positive aspects. There are different types of adaptation, including preventive and reactive, public and private and autonomous and planned.

Aerosols
Groups of solid or liquid particles transported by air, ranging in size from 0.01 mm to 10 mm. These particles can remain in the atmosphere for at least a couple of hours. Aerosols can be natural or anthropogenic. They can influence the climate in two different ways: directly through radiation dispersion and absorption, and indirectly by acting as condensation nuclei in the form of clouds or modifying optical properties or the duration of clouds. See Indirect effects of aerosols.

Anthropogenic
Resulting from or produced by human actions.

Anthropogenic emissions
Greenhouse gas emissions or precursors and aerosols associated with human activities. These activities include burning fossil fuels to produce energy, deforestation and changes in land use, and result in a net increase in emissions.

Atmosphere
Gas surrounding the Earth. The dry atmosphere is almost all nitrogen (78.1% by volume) and oxygen (20.9%), together with small amounts of other gases, such as argon (0.93%), helium and radiative greenhouse gases, such as carbon dioxide (0.035%) and ozone. In addition, the atmosphere contains water vapor in varying amounts, but usually less than 1%, by volume. The atmosphere also contains clouds and aerosols.

Biofuel
Fuel produced using dry organic material or combustible oils produced by plants. Some examples of biofuels are alcohol (from fermented sugarcane), black liquor from paper production, wood and soy oil.

Biological diversity
The amount and relative abundance of different families (genetic diversity), species and eco-systems (communities) in a determined area.

Capacity building
In the context of climate change, capacity building is the process to develop institutional techniques and ability in developing countries or countries with transitional economies so that they can participate in all aspects of adaptation, mitigation and research on climate change, as well as apply the Kyoto Mechanisms, etc.

Capacity for adaptation
The ability of a system to adjust to climate change (including climate variability and extreme climate) in order to moderate potential damage, take advantage of positive consequences or deal with negative ones.

Carbon cycle
A term used to describe the flow of carbon (in several forms, for example, as carbon dioxide) through the atmosphere, oceans, terrestrial biosphere and lithosphere.

Carbon dioxide (CO2)
A gas that is produced naturally and also as a byproduct of burning fossil fuels and biomass, changes in land use and other industrial processes. Carbon dioxide is the main anthropogenic greenhouse gas that affects the planet's radiative equilibrium. It is the reference gas against which all other greenhouse gases are measured; therefore, it has a global warming potential of 1.

Changing land use
A change in land use or management by humans, which can lead to changes in land coverage. Land coverage and changing land use can impact albedo, evapotranspiration and greenhouse gas sources and sinks or other properties of the climate system. They can also change climate, locally or globally. Also see the IPCC's Special Report on land use,

changing land use and silvoculture (IPCC, 2000b).

Clean Development Mechanism (CDM)

Defined in Article 12 of the Kyoto Protocol, the Clean Development Mechanism meets two objectives: 1) help Parties not included in Annex 1 develop sustainably and contribute to the last objective of the Convention; and 2) help Parties in Annex 1 comply with quantifiable emissions limits and reductions. Within the framework of CDM projects created by countries excluded from Annex 1 to limit or reduce greenhouse gas emissions, investors (government or industry) in the Parties of Annex B can receive Emissions Reductions Certificates, if those reductions are certified by institutions designated by the Conference of the Parties/ Meeting of the Parties. One part of the certified project activity products is used to cover administrative costs and to help Parties that are developing countries and especially vulnerable to adverse effects of climate change defray the costs of adaptation.

Climate change

Important statistical variations in the state of climate or its variability that continue over a prolonged period of time (normally decades or longer). Climate change can be due to natural internal processes or forced external changes, or constant anthropogenic changes to the atmosphere and land use. Article 1 of the United Nations Framework Convention on Climate Change defines climate change as: a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods. The UNFCCC distinguishes between climate change attributable to human activities that alter atmospheric compositions and climatic variability, which is attributed to natural causes. Also see Climatic variability.

Climate

Strictly speaking, climate tends to be defined as the state of weather. A more accurate definition is a statistical description of weather in terms of average values and variability of pertinent quantities over periods of time, which can be from months to thousands or millions of years. The normal period is 30 years, according to the World Meteorological Organization (WMO). The quantities are almost always surface variables (for example, temperature, precipitation or wind), even though a broader definition of climate is a description (including a statistical description) of the state of the climatic system. Concentrations of carbon dioxide can cause the same degree of radiative forcing as a certain mix of carbon dioxide with other greenhouse gases.

Climatic projection

Projection on the response of a climatic system to emissions scenarios, or concentrations of greenhouse gases and aerosols, or scenarios of radiative forcing, often based on climatic simulations. Climatic projections differ from climatic forecasts; the first depend on scenarios of radiative forcing/emissions/concentrations/radiations that are used, which are based on hypotheses on different socio-economic and technological development guidelines that can be used and are subject to great uncertainty.

Climatic scenario

A plausible and often simplified representation of future climate based on a coherent series of climatological relations, which is built to be used explicitly for research on the possible consequences of climate change caused by anthropogenic activities. It often serves as the basis for simulations on climate change impacts. Climatic projections often serve as inputs to build climatic scenarios, but these scenarios require additional information, for example, on climate observed at a specific point in time. A climate change scenario is the difference between a climatic scenario and the current climate.

Climatic system

A very complex system that consist of five main components: the atmosphere, hydrosphere, cryosphere, surface of the Earth and the biosphere, and the interactions among them. The climatic system evolves over time under the influence of internal dynamics due to external forces (for example, volcanic eruptions, solar variations and forces caused by man, such as the changing atmosphere and changes in land use).

Climate variability

Climate variability refers to variations in the average state and other statistical data (such as typical deviations, the occurrence of extreme phenomenon, etc.) on climate over time and in all spatial areas that go beyond individual meteorological phenomenon. Variability can be due to natural internal processes within a climatic system (internal variability) or variations in anthropogenic external forcing (external variability). Also see Climate change.

CO2 (carbon dioxide) equivalent

The concentration of carbon dioxide that could cause the same degree of radiative forcing

as a certain mix of carbon dioxide and other greenhouse gases.

CO2 (carbon dioxide) fossil emissions
Emissions of carbon dioxide that result from burning fuels with deposits of carbon fossils, such as petroleum, natural gas and coal.

Deforestation
Conversion of forests into non-forest areas. For more information on the term forests and others, such as forestation, reforestation and deforestation, see the IPCC Special Report on land use, changing land use and silvoculture (IPCC, 2000b).

Desertification
Degradation of land in arid, semi-arid and dry sub-humid areas as a result of different factors, including climatological variations and human activities. In addition, the United Nations Convention to Combat Desertification defines soil degradation as a reduction or loss of biological or economic productivity in arid, semi-arid and dry sub-humid areas, and the combination of crop land watered by rain or sprinklers, pastures, grasslands, forests and forested areas as a result of land use or a process or series of certain processes, including those produced by human activities and settlements, for example: i) soil erosion from wind and/or water; ii) the deterioration of physical, chemical, biological or economic properties of the soil; and iii) loss of natural vegetation cover over time.

Eco-system
A system of live organisms that interact with their physical environment. The boundaries of a set eco-system are somewhat arbitrary, depending on the focus, interest or study. Therefore, an eco-system can range from very small spaces to the entire planet.

Emissions
Within the context of climate change, emissions are liberations of greenhouse gases and/or their precursors and aerosols into the atmosphere in a specific area and at a specific point of time.

Emissions scenario
A plausible representation of the future evolution of emissions of substances that are, potentially, actively radiated (for example, greenhouse gases or aerosols) based on a series of coherent and consistent hypotheses on the driving forces of this phenomenon (such as demographic and socio-economic development, technological change) and their key relations. Scenarios of concentrations, derived from emissions scenarios, use climatic simulations as inputs to calculate climatic projections. IPCC (1992) used a series of emissions scenarios as the basis for their climatic projections (IPCC, 1996). These emissions scenarios refer to IS92 scenarios. The IPCC's Special Report: Emissions Scenarios (Nakicenovic, et al., 2000) published new emissions scenarios called IEEE Scenarios. To understand more about terms related to these scenarios, see IEEE Scenarios.

Emissions trading schemes
A market approach to achieve environmental objectives that allow countries to reduce greenhouse gas emissions below required levels and use or sell the remainder to compensate for emissions from another source within or outside of the country. Generally, trading occurs between companies or nationally or internationally. The IPCC's Second Evaluation Report incorporates permits for national trading systems and international quotas. Emissions trading, as set forth in Article 17 of the Kyoto Protocol, is a system of sellable quotas based on attributable amounts calculated from reduction commitments and emissions limitations included in Annex B of the Protocol. Also see a Unit of Emissions Reductions Certificate and Clean Development Mechanism.

ENSO
ENSO is an ocean/atmosphere phenomenon that is the interaction of surface water in the tropical Pacific Ocean with the surrounding and global atmosphere. ENSO is related to climatic disturbances in many parts of the world, as well as significant alterations in different types of eco-systems, both terrestrial and marine.

Evaporation
Process by which a liquid becomes a gas.

Extreme meteorological phenomenon
A rare phenomenon within a statistical reference at a determined spot. Definitions about what is considered rare vary but an extreme meteorological phenomenon may be as rare as or rarer than the 10th or 90th percentiles. By definition, the characteristics of an extreme meteorological event vary by location. An extreme climatic phenomenon is the average of a series of meteorological phenomenon over a certain time period, which by itself is extreme (for example, precipitation during a season).

Food insecurity
A situation that arises when people lack secure access to enough nutritional food needed for normal growth and development and for a healthy and active life. It can be caused by a lack of available food or an inappropriate use

of food nationally. Food insecurity can be chronic, seasonal or temporary.

Forestation
Planting new forests on land that did not have forests in the past. For more information on the term forests and others, such as forestation, reforestation and deforestation, see the IPCC Special Report on land use, changing land use and silvoculture (IPCC, 2000b).

Fossil fuels
Carbon fuels based on deposits of carbon fossils, including petroleum, natural gas and coal.

Greenhouse effect
Greenhouse gases absorb infrared radiation from the surface of the Earth through the atmosphere because of the presence of those gases and clouds. Atmospheric radiation happens in all directions, including from the air down to Earth. Greenhouse gases can trap heat within the troposphere system. This is called the natural greenhouse effect. Atmospheric radiation is closely linked to the temperature of the atmospheric layer. Temperature decreases with altitude in the troposphere. Infrared radiation emitted into space originates at an altitude with an average temperature of 19°C, balanced with the net solar radiation that is entering. The surface of the Earth has an average temperature that is much higher, some +14°C. An increase in the concentration of greenhouse gases increases the infrared opacity of the atmosphere, or radiation into space from a higher altitude at a lower temperature. This causes radiative forcing, an imbalance that can only be compensated for with an increase in temperature at the surface level – in the troposphere. This is called an enhanced greenhouse effect.

Greenhouse gas
Gases in the atmosphere, naturally or due to anthropogenic activities, which absorb and emit radiation at certain wavelengths of the infrared radiation spectrum, emitted by the surface of the Earth, the atmosphere and clouds. This property causes the greenhouse gas effect. Water vapor (H_2O), carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4) and ozone (O_3) are the main greenhouse gases in the surface atmosphere. In addition, another part of greenhouse gases are produced completely by man, such as halocarbons and other substances containing chlorine and bromine, as set forth in the Montreal Protocol. The Kyoto Protocol deals with CO_2, N_2O and CH_4, in addition to other greenhouse gases, such as sulfur hexafluoride (SF_6), hydrofluorocarbons (HFC) and perfluorocarbons (PFC).

Halocarbons
Compounds that contain carbon and chlorine, bromine or fluorine. These compounds can act as potent greenhouse gases in the atmosphere. Halocarbons that have chlorine and bromine also contribute to ozone layer depletion.

Hydrofluorocarbons (HFC)
One of the six greenhouse gases that the Kyoto Protocol tries to eliminate. It is produced commercially as a substitute for chlorofluorocarbons. HFC are mostly used in refrigeration and manufacture of semiconductors. Their global warming potential is in the range of 1,300 to 11,700.

Infrastructure
Basic equipment, public service companies, productive companies, installations, institutions and services needed for the development, operations and growth of an organization, city or nation. For example, highways, schools, electricity, gas and water services, transportation, communication and legal systems can all be considered infrastructure.

Kyoto Protocol
The Kyoto Protocol of the United Nations Framework Convention on Climate Change (UNFCCC) was adopted in the third period of sessions at the UNFCCC Conference of the Parties in 1997 in Kyoto, Japan. It includes legally-binding commitments, in addition to those established in the UNFCCC. Countries in Annex B of the Protocol (most of the countries in the Organization for Economic Cooperation and Development, OECD) and countries with transitional economies, agreed to reduce anthropogenic emissions of greenhouse gases (carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulfur hexafluoride) by at least 5% under 1990 levels between 2008 and 2012. The Kyoto Protocol has still not entered into effect (September 2001).

Land use
Agreements, activities and inputs applied for a determined type of land cover (a series of human actions). Social and economic objectives for people who manage land (for example, pastures, logging and conservation).

Meeting of the Parties (to the Kyoto Protocol) (MOP)
The Conference of the Parties under the United Nations Framework Convention on Climate Change serves as the Meeting of the Parties (MOP), the supreme authority of the Kyoto Protocol. Only the Parties of this Protocol can participate in deliberations and make decisions.

The MOP will not be able to meet until the Protocol is in effect.

Methane (CH4)
A greenhouse gas hydrocarbon produced by the anaerobic decomposition (without oxygen) of trash, animal digestion, animal waste, production and distribution of natural gas and petroleum, coal production and incomplete burning of fossil fuels. Methane is one of the six greenhouse gases that the Kyoto Protocol tries to reduce.

Mitigation
Anthropogenic intervention to reduce sources or improve greenhouse gas sinks.

Montreal Protocol
The Montreal Protocol on substances that deplete the ozone layer was adopted in 1987 and later adjusted and amended in London (199), Copenhagen (1992), Vienna (1995), Montreal (1997) and Beijing (1999). It controls the consumption and production of chemical substances that contain chlorine and bromine that destroy stratospheric ozone, such as chlorofluorocarbons (CFCs), methyl chloroform, carbon tetrachloride and many other compounds.

Nitrogen oxide (NOx)
Any nitrogen oxide.

Nitrous oxide (N2O)
Potent greenhouse gas emitted in crop production, especially through the use of commercial and organic fertilizers, burning fossil fuels, producing nitric acid and burning biomass. Nitrous oxide is one of the six greenhouse gases that the Kyoto Protocol tries to reduce.

Ozone (O3)
Three oxygen atoms (O3). It is a gas compound found in the atmosphere. Ozone is formed naturally in the troposphere and from photochemical reactions in gas from human activities (photochemical smog). In large concentrations troposphere ozone can be harmful to a wide range of living organisms. Troposphere ozone acts as a greenhouse gas. In the stratosphere ozone is created by the interaction between ultraviolet solar radiation and molecular oxygen (O2). Stratospheric ozone plays a decisive role in stratospheric radiation equilibrium. Higher concentrations are found in the ozone layer. The depletion of the stratospheric ozone layer, due to chemical reactions, can be enhanced by climate change and produce an increased flow of ultraviolet radiation at the surface. Also see the Montreal Protocol and Ozone layer.

Ozone layer
The layer of the stratosphere where ozone concentrations are the highest. This layer extends from 12 to 40 km. The concentration of ozone reaches a maximum of 20 to 25 km. This layer is becoming depleted due to emissions of compounds with chlorine and bromine from human activities. Each year, during Spring in the South Hemisphere, the ozone layer becomes depleted in the Antarctic area from compounds with chlorine and bromine from human activities and meteorological conditions there. This phenomenon is called the ozone hole.

Photosynthesis
Process by which plants absorb carbon dioxide (CO2) from the air (or bicarbonate ions in water) to produce carbohydrates, emitting oxygen (O2) in the process. There are several ways for photosynthesis to occur, resulting in different effects on atmospheric concentrations of CO2. See Fertilization from carbon dioxide.

Policies and measures
In the United Nations Framework Convention on Climate Change policies are actions that a government can implement or order, often together with companies and industries within the country or other countries, in order to accelerate the application and use of measures to stop greenhouse gas emissions. Measures are technologies, processes and practices used to apply policies that, if implemented, can reduce greenhouse gas emissions under future anticipated levels. Examples can include carbon taxes or taxes on other forms of energy, regulations to improve fuel efficiency in automobiles, etc. Common, coordinated or aligned policies are those that are adopted jointly among the Parties.

Radiative forcing
Change in the net vertical irradiance (expressed in W/m^2) in the troposphere due to an internal change or a change in the external forcing of the climate system (for example, a change in the concentration of carbon dioxide or the output of the Sun). Usually radiative forcing is computed after allowing for stratospheric temperatures to readjust to radiative equilibrium, but with all troposphere properties held fixed at their unperturbed values.

Reforestation
Planting forests on land that had forests previously but was converted for another use. For more information on the term forests and others, such as forestation, reforestation and deforestation, see the IPCC Special Report on land use, changing land use and silvoculture (IPCC, 2000b).

Regeneration
Renewal of groups of trees, naturally (in the same spot or in adjacent spots, or from seeds

deposited by the wind, birds or animals) or artificially (planted directly).

Sink
Any process, activity or mechanism that removes a greenhouse gas, aerosol or precursor greenhouse gas from the atmosphere.

Solar radiation
Radiation emitted by the Sun. It is also called shortwave radiation. Solar radiation corresponds to a specific range of spectrum wavelengths determined by the Sun's temperature. Also see Infrared radiation.

Stabilization
Stabilization of atmospheric concentrations of one or more greenhouse gases (for example, carbon dioxide or several greenhouse gases of CO2-equivalent).

Sulfur hexafluoride (SF6)
One of the six greenhouse gases that the Kyoto Protocol is trying to reduce. It is used in industry to insulate high-voltage equipment and to manufacture cooling system cables. Its global warming potential is 23,900.

Sustainable development
Development that serves current needs without compromising the capacity of future generations to satisfy their own needs.

Technology transfer
A wide range of processes that include exchanges of knowledge, funds and goods between different interested parties to spread technology for adaptation and mitigation for climate change. Generally speaking, the term is used to describe the spread of technologies and technological cooperation between and within countries.

Thermal expansion
In connection to sea level, refers to an increase in volume (and a decrease in density) that results from warming water. Ocean warming creates an expansion in volume, thereby raising sea levels.

Uncertainty
An expression of the level of ignorance about a value (as in the future state of the climatic system) that is known or can be known. It can be based on many things, from quantifiable errors in data to concepts or terms that have been defined ambiguously, or uncertain projections on human behavior. Uncertainty can be represented with quantitative values (like a range of values calculated in several simulations) or qualitatively (such as the opinion of a team of experts). See Moss and Schneider, 2000.

Vulnerability
The level of susceptibility of a system or the level at which the system is unable to withstand the adverse effects of climate change, included in climatic variability and extreme phenomenon. Vulnerability is related to the type, magnitude and speed of climatic variation at which a system is exposed, sensitive to or is able to adapt to.

Central American Integration System (SICA)
Central American Commission on Environment and Development (CCAD)
Bulevar Orden de Malta No. 470, Urbanización Santa Elena,
Antiguo Cuscatlán, El Salvador, Centroamérica
Telephone: (503) 2248-8800
Fax: (503) 2248-8899
Web sites: www.sica.int/ccad y www.ccad.ws
Email: infoccad@sica.int
Facebook: www.facebook.com/ccad.sica