

Climate change and challenges for tourism in Central America

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Abstract

Tourism has been a very dynamic activity worldwide over the last fifteen years (until the 2008-2009 economic crisis). Some developing countries have been very active in promoting this activity and have been successful. Among these countries are several from the Central American region, where tourism accounted for more almost 8% of GDP in 2008. Tourism is a very broad activity, which includes leisure, business and family visits, but statistics for this region do not allow a distinction between these categories. Some countries are more specialized in leisure tourism (Belize and Costa Rica) while others have a more diversified visitor composition (El Salvador and Panama). Nevertheless, all countries have plans to considerably expand its leisure tourism, which depends to a great extent on their natural attractions, mostly on the coasts or near its coasts. The study mostly concentrates on this kind of tourism.

The Central American countries' rich biodiversity, forests, coral reefs, attractive beaches, among others, are under serious threat because of climate change effects, some of which are already being experienced. The vulnerability to these events is a result not only of the region's geographical location but also of the degree to which the countries' natural resources have been degraded, especially the accelerated deforestation in most of them.

Hurricanes are becoming more frequent and intense, and so are flooding, droughts, while rising sea levels and higher temperatures are to become more evident in the near future, according to scientific projections. Tourist sites are particularly sensitive to these changes, but little is being done to adapt these activities accordingly. Leisure tourism traveling to the region in mid year will be the one mostly affected by

climate change (temperatures could increase by 4°C in some tourist locations in July 2050 and greater extreme weather events could also occur around that time of the year, according to not particularly pessimistic scenarios).

This paper looks at the different Central American countries' tourism characteristics and vulnerability to climate change phenomena; compares the different situations of tourist sites among the countries of the region; looks into the legal and institutional framework that has been developed regarding environment protection and climate change in each country under study, analyzing its progress and limitations; explores the determinants of tourism demand in the past, including the role of hurricanes and other external shocks on the flow of tourists and, finally, suggest some adaptation policies mostly for leisure tourism.

I. Introduction

Tourism¹ has increased considerably worldwide over the recent period: it reached 880 million people in 2009 (up from 540 million in 1995). It grew by around 5% annually between 1995 and 2007, but fell by more than 4% between 2008 and 2009 (during the first half of 2010 growth had been 7%, regarding prior year) (UNWTO, 2010). Several new elements have given an impulse to this activity as never before². First, the increasing global population and the change in its composition (for example, there is a greater percentage of aging population which seeks warmer places to spend their winter); second, the development of new tourist attractions based on sports, adventure, biodiversity, among others, have opened new niches for visitors; third, new modes and greater frequency of transport, as well as lower transport tariffs; fourth, new destinations which were of difficult access before. Additionally, other kinds of visits that form part of the tourist figures, but do not respond necessarily to what traditionally is understood by tourism, i.e., vacations and leisure linked trips, also have rapidly increased. Among these are family visits that have multiplied as vast migration movements have taken place, as well as business, technical assistance and international conventions trips which respond partly to production of goods and services' internationalization. The effects of climate change on the vast tourist activities are of growing concern. This paper draws on this

¹ We will adopt the definition of the World Tourism Organization (WTO) for tourism, according to which tourists are people who are "travelling to and staying in places outside their usual environment for not more than one consecutive year for leisure, business and other purposes not related to the exercise of an activity remunerated from within the place visited". Nevertheless, the information regarding this activity is quite imperfect and it is difficult to know for sure what will the activities of visitors to another country be once they have entered such foreign nation. For the analysis developed in this paper, this represents a restriction.

² The analysis of this paper does not cover the economic crisis period that started in 2008.

subject with a special focus on the Central American region, where the tourist activity has become increasingly important³.

The interest on the impact of climate change on tourism has emerged only recently. One of the initial efforts to understand the link between Climate Change and tourism was made at the First International Conference on Climate Change and Tourism in Tunes where the Djerba Declaration on Tourism and Climate Change was signed (April 2003⁴). In this conference the fact that changes in climate will have a direct impact on many tourist destinations which will need adaptation, was recognized and the urgency for tourism activity to reduce its own negative impact on the environment was also emphasized. Climate Change was seen as a potential threat for beach and mountain tourism, with the resulting economic implications for this sector and those linked to it.

The Second International Conference on Climate Change and Tourism⁵ was held in Davos Switzerland in 2007 and the Davos Declaration “Climate Change and Tourism; responding to global challenges”⁶ was a result of it. The latter explicitly recognizes that climate is a central issue for the tourist sector because it is highly sensitive to its change. Among the specific actions proposed were: to mitigate the emissions produced by tourism; adapt tourist destinations and tourism business to the changing conditions of climate; and obtain financial resources to help poor regions and countries to adapt to climate change and mitigate its emissions.

According to the widely respected studies regarding Climate Change—the Intergovernmental Panel on Climate Change (IPCC, 2007a) and Stern Report (2006)—there are indisputable evidences that there is a systematic increase in world temperatures as a result of mounting greenhouse gas emissions (GHG) and concentration in the atmosphere. The increase in temperatures has been, on average, 0.13 °C [0.10 °C to 0.16°C] per decade over the last 50 years (IPCC, 2007a).

As for the future, the IPCC fourth report (2007a) states that “There is high agreement and much evidence that with current climate change mitigation policies and related sustainable development practices, global GHG emissions will continue to grow over the next few decades. For the next two decades a warming of about 0.2°C per decade is projected for a range of SRES⁷ emissions scenarios. Even if the concentrations of all GHGs and aerosols had been kept constant at year 2000 levels, a further warming of about 0.1°C per decade would be expected. Afterwards, temperature projections increasingly depend on specific emissions scenarios” (IPCC, 2007a, Synthesis Report, page 7). According to this fourth report, depending on the scenarios and models employed, global temperature will rise 1.8°C to 4°C by 2100, though it could exceed this estimation under certain circumstances.

Warmer weather will cause a series of other events, such as a greater number of warm spells/heat waves over most land areas, more frequent intense tropical cyclones, greater number of extreme high sea level such as tsunamis and severe drought. The report also considers that possibly 20% to 30% of species (medium confidence) will be at greater risk of extinction if global average warming exceed 1.5 to 2.5°C relative to 1980-1999 (IPCC, 2007a).

Human settlements rise in coastal areas as a result of migration and the natural increase in population already living there (worldwide it will increase from 1.2 billion in 1990 to a level of 1.8 in 2020 and to 5.2 billion in 2080 make these areas more vulnerable to climate change. The greater population will put additional pressure on drainage of coastal wetlands, deforestation, pollution of coastal waters, depletion of tropical and subtropical mangrove forests will undermine the environmental services that these resources provide (rich biodiversity, attenuation of waves and storms).

³ The region under study includes Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama.

⁴ WTO, Djerba Declaration on Tourism and Climate Change, on line [<http://www.world-tourism.org/sustainable/climate/decdjerba-eng.pdf>].

⁵ This conference was organized by the United Nations World Tourism Organization (UNWTO), the United Nations Environment Program (UNEP) and the World Meteorological Organization (WMO).

⁶ Second International Conference on Climate Change and Tourism, Davos Declaration, on line [http://www.gdrc.org/uem/ecotour/Davos-Declaration_2007.pdf].

⁷ Special Report on Emissions Scenarios.

The population itself will be affected by the former phenomena as well as by higher sea level, which could amount to 0.6 m by 2100⁸. Nevertheless, this prediction was based on the effect of ocean thermal expansion, but if Greenland and Antarctica glaciers start melting, a much greater rise in sea level may occur, i.e., between 1 to 3 meters in this century (Dasgupta et al., 2009) and more could be expected, depending on the degree in which glaciers may melt. The number of displaced population from coastal lands would reach hundreds of millions in the developing countries (USAID, NOAA and Coastal Resources Center, 2009).

The results of scientific research on climate change impacts leads us to presume that tourism may be a very vulnerable activity to climate change impacts, particularly in the future, if the climate patterns suffer a deep change. The effects of temperature changes on tourism activities have been an important research topic for a long time⁹, but the greatest effort had focused on the effects on tourism demand in countries with marked seasonal climate variations, but less so for countries that have a year round warm temperature, such as that for tropical countries.

Agnew and Palutikof (2001) analyze the relationship for countries with contrasting seasons: UK, Netherlands, Germany and Italy. Overall, they find that climate, particularly atmosphere temperature, has an influence on tourist activity (see also Perry, 2001). Special attention has been given to the impact of climate change on ski resorts, which have already been affected by warmer temperatures and a shortening of snow seasons (Tangborn, 2003; López-Moreno et al., 2009).

Many studies on climate change and tourism have also paid special attention to tourism in the Mediterranean region, since it is the greatest tourist geographic attraction area in the world. In 2006, 160 million tourists were recorded on its European coastline¹⁰. One of the greatest concerns is the occurrence of “heat waves” (abnormally hot and usually humid weather) that have been registered as a result of climate change in this area, and which may render this very popular vacation destination less attractive (Balafoutis and Makrogiannis, 2001). As this phenomenon takes place, together with others that result from higher heat, such as a more disease prone environment, greater water scarcity and more uncomfortable beach activities, a shift of tourism toward northern Europe may happen. Hence the present peak tourist cycle activity in the Mediterranean could flatten as summer becomes less attractive and autumn and spring are preferred by visitors (Perry, 2001, Maddison, 2001).

Small islands have had privileged characteristics which have favored the development of an important tourism sector, including their rich biodiversity, paradisiacal seashores and nature scenery, as well as its warm weather all year round. But at present they seem to be the most endangered areas by climate change, especially those in tropical zones, where countries in the Caribbean region stand out. Around 40 million people that presently live in the Caribbean islands will face some of the most extreme situations regarding climate change impacts. According to Bueno, et al. (2008), if no actions were taken regarding climate change¹¹, increased hurricane damage, loss of tourism revenue and infrastructure destruction would be of 22 billion dollars annually by 2050 and 46 billion dollars annually by 2100, which is the equivalent to 10% and 22% of 2004 GDP of those countries. This is particularly worrying because of their dependence on tourism (10% of their aggregate GDP in 2006; but some of the islands individually depend to a much greater extent on such activity, ECLAC, 2008a). Some relevant studies on the impact of climate change on tourism in these islands have already been developed (Uyarra, et al, 2005; WTO, 2003).

The Central American Isthmus, which includes Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama, share with The Caribbean some of the same leisure tourism attractions, already mentioned, to which archaeological monuments, especially in Guatemala and

⁸ Since 1961 seas have climbed at an average of 1.8 mm per year and since 1993 at 3.1 mm per year, as a result of higher sea temperature, melting glaciers and ice in different forms (IPCC, 2007a).

⁹ A very complete bibliographical compilation can be found in Scott, Jones and McBoyle (2006).

¹⁰ Research EU, on line [http://ec.europa.eu/research/research-eu/sea/article_mer30_en.html].

¹¹ Cost of inaction is defined as high impact minus low impact scenarios. The high impact scenario is a pessimistic one, which is “business as usual” and CO₂ emissions continue to increase at a very high speed, whereas the low impact scenario supposes actions to reduce emissions by mid century and further reduces them by the end of the century.

Honduras must be added. Economically, the tourist activity is also very relevant and is seen as having greater potential than that developed up to now. It has contributed with around 7% of the GDP and has been extremely dynamic, increasing almost 16% annually between 1995 and 2006, i.e., at a much faster pace than global tourism (5% annually during the same period, according to WTO). Still, none of the Central American countries individually has the capacity to receive as many visitors as the Dominican Republic, which has at least 50% more rooms than Costa Rica, which is the country best equipped for receiving tourists in Central America. (Compendium of tourist statistics, WTO).

Central America does not escape a high exposure to catastrophic weather events, droughts, rise in sea level, and increase in atmospheric temperatures, among other climate change effects.

It is important to consider that climate has always been an attraction for tourists going to the Caribbean and Central America, and its variations have not altered overall its warm and quite comfortable environment. Not even heavy rainy seasons have discouraged visitors from traveling there. Hurricanes and storms however, do make a difference and their intensification in the future could considerably reduce the flow of visitors to such region. Furthermore, though temperatures up to now have not had an impact, a considerable rise in them, to the point of causing human discomfort, could shift tourists' preferences toward cooler places. Hence, if climate change threatens tourists' vacations because of the uncertainty posed by increasing hurricanes and raising temperatures to uncomfortable levels (with other consequences such as greater health problems), the future of tourism in the region may be bleak, unless important adaptation policies are undertaken. However, it is important to consider that there are unique features of this region that cannot easily be replaced by countries which will count with better weather as a result of climate change, such as its rich biodiversity (though endangered itself).

As with other small developing economies, Central America contributes with only a small proportion of total greenhouse global emissions, i.e., 0.5% (ECLAC and DFID, 2009) but is very much at risk vis à vis the climate change phenomenon. Hence, while not neglecting mitigation efforts, adaptation of tourism to these adverse conditions is most important. But it is also relevant to consider that for Central American countries, mitigation and adaptation go hand in hand. Among their most important natural resources are forests, which (an important tourist attraction per se) are essential for absorbing CO₂ emissions. Preserving forests, also helps adapt to climate change, since it regulates temperature, work to a certain extent as a buffer to storms (particularly mangrove forests), preserves water and protects biodiversity (one of the most important tourist attractions).

This study intends to analyze Central America's tourism vulnerability to climate change and also to look into adaptation policies that may help this activity to endure the adverse conditions triggered by climate change. The analysis will concentrate mostly on leisure and more nature oriented tourism, rather than business and family visits tourism (though statistically they cannot really be separated). This topic has not been explored much up to now, although the impact of climate change has already been perceived in much of this region. Since 2003, losses related to hurricanes have meant a fall of 2% to 3% of GDP in Central America and Mexico (HMT, 2006). Some of the most vulnerable sites to climate change in Latin America precisely are in the region under study: Honduras, Nicaragua and El Salvador, according to the Stern Report (2006).

Research on tourism and climate change necessarily has to take into account the environmental performance of this sector. Tourism's environmental functioning may be helpful/damaging to control/worsen the impact of climate change on such activity (for example, helping or not to curb its emissions, taking care of forests or promoting their destruction, etc.). In the same way, tourism may be designed so as to adapt to a certain extent to climate change or it may ignore this phenomenon altogether, hampering its further development or even its survival. Hence, tourism prospect in this region goes hand in hand with complementary actions that may be taken jointly by tourism and environmental policies. In general, the effort to attain a harmonious link between vacationing and caring for the site in which leisure takes place, has been insufficient and thus there has been a negative effect on nature, including deforestation, biodiversity depletion, water contamination, among others.

In order to study the link between tourism and climate change in Central America, this document includes: i) An analysis of tourism performance over the 1995-2008 period; ii) a qualitative analysis of possible effects of Climate Change on the tourist activity in Central America; iii) the role of regulatory frameworks in the process of adaptation of tourism to climate change impacts; iv) an econometric study that highlights the determinants of several variables on tourism demand during the period 1995-2006 in the Central American countries; and v) conclusions and policy recommendations.

II. Analysis of the tourism sector performance of the Central American Isthmus

A. At a national level

Tourist arrivals to Central American countries have increased rapidly during the 1995-2008 period —10% rate per annum— hence rising from 2.4 million visitors in 1995 to 8.3 million in 2008 (see Table 1). The United States is the country that individually provides the greatest number of tourists to the region (30% in 2008), partly because it is the largest and most developed country closest to the Isthmus. Intra-regional tourism has grown even faster, accounting for 42.4% of total tourists' arrivals in Central America in 2008. The third most relevant source of tourists for Central America is Europe (9.3% of total tourists in 2008), though its weight as percentage of total tourist arrivals has been falling in recent years (it was 14.5% in 1995) (see Tables 1 and 2).

Within the Central American region, tourism has developed in an uneven way. In 2008 Costa Rica and Guatemala were the countries that received the largest number of visitors, 2.1 million and 1.5 million, respectively, followed by El Salvador, Panama, Honduras, Nicaragua and Belize (Table 3).

In economic terms, this activity has become very important for Belize, Panama, Costa Rica, and, to a lesser extent, El Salvador, reaching 20.3, 9.6, 8.5 and 5.3% of GDP, respectively in 2008 (Table 4). There has also been a positive trend considering that in all countries of the region the tourist industry made a greater contribution to GDP in 2008

than it had done in 1995. As to foreign exchange, tourism has become a central source of it for some countries, such as Belize, El Salvador and Costa Rica since through tourism these countries received the equivalent to 32.3%, 20.7% and 18.4% of total goods and services exports revenues each in 2008 (see Table 5).

The economic contribution of tourism to the different nations depends not only on the number of visitors, but also on the expenditures per tourist, the infrastructure developed to receive visitors by air, roads, and sea and their tourist attractions. Each tourist in Panama spends almost six times the amount a tourist does in Nicaragua, for example. The countries that fall in between these two extremes also show great differences: expenditure per tourist in Costa Rica and El Salvador are around 40% higher than those in Guatemala and Honduras (see Table 6).

Central American countries' capacity to receive tourists differs greatly. As can be seen in Graph 1, in 2008 Guatemala and Costa Rica had the greatest number of rooms for visitors, followed by Honduras and Panama. Although in 2008 Nicaragua had about one seventh of Guatemala's capacity to lodge tourists, the room expansion rate was the highest in the region in that year.

Because of insufficient information, the analysis on tourism development in the Central American countries has at least two important shortcomings. First, it does not take into account domestic tourism because data for such activity is mostly not available, even though local tourism seems to be important at least for some countries. For example, in 2007, in Costa Rica, the total number of visitors to the National Parks System (protected areas) was 1,205,123 of which 558,466 were domestic visitors and 646,657 were foreign visitors (El Estado de la Nación, 2008). Second, the flow of US retired citizens who have chosen some Central American countries as second homes falls into a category that is very close to tourism, but most of it is not registered as such. This is due to the fact that part of these "tourists" are considered to be residents of the country, because they do not leave the country more than once a year, albeit the resources they spend in the country mostly come from abroad. Hence, though investments in second homes were rising very quickly, especially in Costa Rica, El Salvador and Panama before the 2008 economic crisis, this activity has not been registered as tourism. Nicaragua also followed the trend of its neighboring countries and has made an effort to attract foreigners to have a second home in its country.

TABLE 1
TOTAL TOURISTS ARRIVALS TO CENTRAL AMERICAN COUNTRIES ACCORDING
TO PORT OF ORIGIN, 1995-2008
(In thousands)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
North America	973	936	1 072	1 248	1 407	1 485	1 492	1 509	1 732	2 060	2 330	2 482	2 875	3 068
Central America	798	863	1 001	1 315	1 654	1 831	1 811	1 946	1 895	2 416	2 782	3 118	3 352	3 531
The Caribbean	48	46	53	54	57	59	65	50	52	58	66	74	92	103
South America	221	219	247	261	246	301	329	307	332	356	395	456	574	633
Europe	356	350	355	394	411	443	465	492	550	576	611	635	685	773
Asia y Oceania	53	59	61	61	61	68	73	76	84	84	102	112	118	126
Africa	1	1	1	1	2	2	2	2	3	3	3	4	4	4
Non secified	6	5	18	53	72	68	72	59	16	17	31	64	77	90
TOTAL	2 456	2 479	2 808	3 388	3 910	4 257	4 309	4 443	4 664	5 570	6 320	6 945	7 778	8 328

Source: Elaborated with data of World Tourism Organization, *The Compendium of Tourism Statistics*, various years.

TABLE 2
TOTAL TOURISTS ARRIVALS TO CENTRAL AMERICAN COUNTRIES ACCORDING
TO PORT OF ORIGIN, 1995-2008
(In percentages)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
North America	39.6	37.8	38.2	36.9	36.0	34.9	34.6	34.0	37.1	37.0	36.9	35.7	37.0	36.8
Central America	32.5	34.8	35.6	38.8	42.3	43.0	42.0	43.8	40.6	43.4	44.0	44.9	43.1	42.4
The Caribbean	2.0	1.9	1.9	1.6	1.4	1.4	1.5	1.1	1.1	1.0	1.0	1.1	1.2	1.2
South America	9.0	8.8	8.8	7.7	6.3	7.1	7.6	6.9	7.1	6.4	6.2	6.6	7.4	7.6
Europe	14.5	14.1	12.6	11.6	10.5	10.4	10.8	11.1	11.8	10.3	9.7	9.1	8.8	9.3
Asia y Oceania	2.2	2.4	2.2	1.8	1.6	1.6	1.7	1.7	1.8	1.5	1.6	1.6	1.5	1.5
Africa	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Non specified	0.2	0.2	0.6	1.6	1.8	1.6	1.7	1.3	0.3	0.3	0.5	0.9	1.0	1.1
TOTAL	100.	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: Elaborated with data of World Tourism Organization, *The Compendium of Tourism Statistics*, various years.

TABLE 3
TOURISTS ARRIVALS TO CENTRAL AMERICAN COUNTRIES, 1995-2008
(In thousands)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Belize	131	133	146	176	181	196	196	200	221	231	237	247	251	245
Costa Rica	785	781	811	943	1 032	1 088	1 131	1 113	1 239	1 453	1 679	1 725	1 980	2 089
El Salvador	235	283	387	542	658	795	735	798	720	951	1 127	1 279	1 339	1 385
Guatemala	563	520	576	636	823	826	835	884	880	1 182	1 316	1 502	1 448	1 527
Honduras	271	263	307	321	371	471	518	550	611	641	673	739	831	899
Nicaragua	281	303	358	406	468	486	483	472	526	615	712	749	800	858
Panama	345	362	421	431	457	484	519	534	566	621	702	843	1 103	1 293

Source: Elaborated with data of World Tourism Organization, *The Compendium of Tourism Statistics*, various years.

^a Arrivals of non resident visitors to Panama.

TABLE 4
CENTRAL AMERICA: REVENUES FROM TOURISM AND ITS CONTRIBUTION GDP, 1995-2008
(In percentages)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Belize	12.6	14.4	14.5	14.3	13.8	13.3	12.7	13	15.2	15.9	19.2	21.4	22.6	20.3
Costa Rica	6.5	6.7	6.7	7.4	8.0	9.3	8.2	7.7	8.1	8.5	9.1	8.4	8.5	8.5
El Salvador	1.6	1.5	1.3	1.7	3.3	3.3	3.3	3.6	4.4	4.7	4.9	6.3	5.7	5.3
Guatemala	1.5	1.4	1.5	1.7	2.0	2.6	3.1	3.1	2.9	3.4	3.2	3.3	3.1	2.7
Honduras	2.1	2.9	3.2	3.3	3.9	3.7	3.4	3.9	4.4	4.7	4.8	4.5	4.5	4.4
Nicaragua	1.6	1.7	2.4	2.9	3.4	3.3	3.3	3.3	3.9	4.3	4.2	4.4	4.5	4.2
Panama	4.3	4.6	4.7	4.5	4.4	5.4	5.6	5.8	6.2	6.4	7.2	8.5	9.3	9.6

Source: Elaborated with ECLAC's information on macro indicators related to international tourism project, World Tourism Organization and ECLAC (2010).

TABLE 5
CENTRAL AMERICA: TOURISM REVENUES AS PERCENTAGE OF GOODS AND SERVICES EXPORTS, 1995-2008

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Belize	26.1	30.7	29.3	31.0	24.6	25.5	25.5	25.0	28.4	31.0	34.1	34.3	35.0	32.3
Costa Rica	17.1	16.5	16.1	15.1	15.2	19.1	19.6	18.1	17.4	18.4	18.6	17.1	17.4	18.4
El Salvador	7.5	7.0	5.1	6.8	12.8	11.9	12.6	13.7	16.2	17.4	19.1	24.6	22.5	20.7
Guatemala	7.6	7.9	8.5	9.4	10.8	10.5	12.0	12.9	12.0	13.0	13.0	13.3	12.1	10.8
Honduras	4.2	5.2	5.5	5.3	6.6	6.8	6.6	7.1	8.4	8.1	8.1	8.1	8.8	9.1
Nicaragua	7.6	7.7	9.1	10.9	13.4	11.7	12.1	11.8	12.2	11.6	10.5	9.7	9.5	9.1
Panama	4.9	5.8	5.6	6.0	7.1	8.0	8.3	9.3	10.6	10.2	10.2	11.7	12.9	13.8

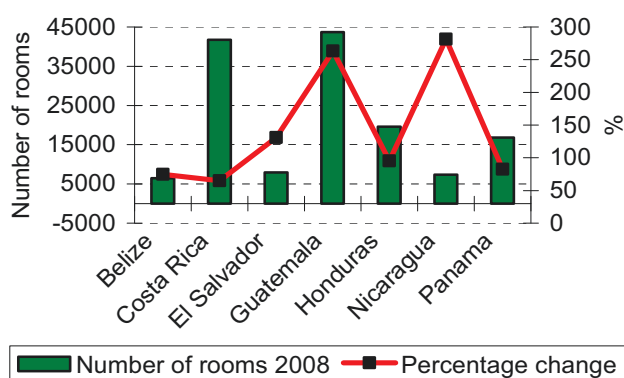
Source: Elaborated with ECLAC's information on macro indicators related to international tourism project, World Tourism Organization and ECLAC (2010).

TABLE 6
CENTRAL AMERICA: EXPENDITURE PER TOURIST, 1995-2008
(In dollars per tourist)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Belize	592.7	714.3	664.4	575.3	556.7	564.7	566.9	607.4	677.4	727.6	901.3	1097.2	1149.6	1125.8
Costa Rica	972.0	1021.1	1061.2	1100.4	1217.0	1357.9	1184.5	1160.9	1149.6	1090.9	1077.6	1095.2	1127.6	1207.3
El Salvador	647.4	547.7	386.0	380.4	619.9	549.1	614.8	652.6	922.9	921.1	864.8	1032.1	867.2	846.3
Guatemala	383.3	426.0	468.4	517.8	455.0	603.6	703.1	731.6	733.4	682.0	670.9	670.9	728.6	689.2
Honduras	313.7	453.6	492.2	543.3	576.8	558.0	501.7	554.2	594.7	654.8	692.2	663.7	672.4	700.9
Nicaragua	179.7	183.5	229.3	253.2	274.8	264.6	280.1	285.2	304.6	312.2	289.7	298.3	320.1	311.6
Panama	1080.6	1194.2	1117.1	1142.0	1105.9	1297.9	1281.9	1328.8	1418.9	1454.1	1577.6	1719.7	1668.9	1721.3

Source: Elaborated with ECLAC's information on macro indicators related to international tourism project World Tourism Organization and ECLAC 2010.

GRAPH 1
CENTRAL AMERICA: NUMBER OF ROOMS IN 2006 AND ITS RATE OF GROWTH, 1995-2008



Source: Elaborated with data of World Tourism Organization, *The Compendium of Tourism Statistics*, various years.

B. Tourism in a regional perspective

When focusing on tourism with a regional perspective, at least two aspects need to be considered: a) the way in which the Central American Isthmus attracts tourism from abroad as a whole, i.e., as a multideestination place, where tourists can enjoy visiting several places in different countries in one single trip. There has been a relatively recent effort at a regional level to promote this kind of tourism, but it is almost impossible to measure its success because tourism statistical information does not allow to keep

track of multideestination visitors¹². b) Trips within the region undertaken by Central American citizens. In this case it is difficult to know to what extent the very dynamic intraregional trips consist of leisure-vacation trips and how much of this phenomenon is the result of a deepening of regional integration, which traditionally has involved trips for business purposes, trade, migration and other activities. There are also many family ties among residents of different countries which is at least partly, a legacy of the 1980s wars.

Tourism within the region, whether originating abroad or undertaken by Central American nationals, has been made easier by travel facilitation within the Isthmus. The economic and trade integration process have helped improve road infrastructure connecting the different Central American countries and made crossing borders easier for Central Americans and other citizens (as Central American integration has improved customs operations and other border proceedings).

Some regional efforts are meant to help integrate specifically the tourism activity. The Strategic Plan for Sustainable Tourism Development 2009-2013, which is being carried out cooperatively by the Tourism Ministries of Central American countries and by the Central American Tourism Integration System (SITCA, by its Spanish abbreviation), is meant to facilitate regional tourism by making migration processes easier and enabling routes and communication systems to offer regional plans for tourists according to their specific interests.

With the purpose of helping promote tourism for the region as a whole as well as for each country, a Network of Communicators on Central American Tourism was set up in 2005. This should help the integration process of this particular sector. Its effort is being supported by the International Tourism Organization (ITO) as well as national public institutions, private sector and journalists.

The regionalization of tourism promotion efforts done by regional institutions and by governments, mentioned above, has also been pursued by the private sector. The Federation of Central American Tourism Chambers was set up in 2004 and its base has been established in Honduras. It is raising information on tourism businesses throughout the region and planning regional projects.

As countries are uniting efforts to promote Central America as a diverse area, each country has tried to highlight its special features. Costa Rica has been able to stand out as an eco-tourist site, while Panama has traditionally been a place of business related arrivals because of its important financial center and its intense commercial activity (free tax port, geographical location and the Panama Canal, favor these characteristics). In recent years, though, Panama has encouraged “sun-sea-sand” tourism and eco-tourism as well, and it has been very successful. Guatemala has counted with its cultural legacy for tourist attraction for very long, but has given a renewed impulse to it in recent years. El Salvador has been benefited by its increasing migrant population to the United States, which ensures a flow of visitors who pay family visits to that country. But lately, it has also developed important sea resorts which receive numerous Central American visitors, especially from Guatemala. Honduras has developed its tourism (mostly “sun-sea-sand”), but in a very limited part of its territory though its potential—considering its vast natural resources—is much larger. Nicaragua, with very attractive biodiversity, beaches, mountains, etc., has only recently started to promote investment in the tourist activity.

There are several concrete examples of regional efforts to integrate tourism activities. Among these is the Colonial and Volcanoes Route, which follows originally Spanish and native roads and takes visitors through colonial cities and villages in Panama, Cartago, Liberia, Granada, León, Comayagua, Gracias and Colosuca, as well as other sites¹³. The Plan has identified and helped commercialize this route, which links 53 points of interest for tourists in six Central American countries. There are 17 places in the region that have been declared Patrimony of Humanity by UNESCO, many of which can be visited following such Colonial and Volcanoes Route. This Plan has also provided capacity building

¹² This multideestination tourism has been promoted mostly by SITCA, with the support of the Spanish Cooperation Agency.

¹³ This regional tourism project has been backed by the Spanish Agency for International Cooperation (AECID).

in best practices in environmental conservation, quality, services management for public and private agents, as well as for small and medium size enterprises (SME).

There is also a network of rural hostels throughout Central America which by mid 2009 was still at a pilot plan stage with 50 of these small hotels participating in it (it should favor high quality small tourist enterprises in the region). These hostels will count with a communications link and will be able to jointly participate in quality tourist services capacity building and best practices training programs (backed by regional and international institutions and non-governmental organizations –NGOs). A regional Tourist Security Plan is also being carried out.

The Mayan World is another example of regional cooperation, linking Belize, El Salvador, Guatemala, Honduras and five Mexican southern states (Chiapas, Tabasco, Campeche, Yucatan and Quintana Roo). This program promotes the Central American region as well as part of Mexico as an attractive tourist area with multiple destinations and it also encourages, among other things, the participation of local population in an ecological sustainable development of tourism. Conservation of archaeological sites and of the green areas surrounding them is an example of local participation.¹⁴

TABLE 7
CENTRAL AMERICA: INTRAREGIONAL TOURISM IN CENTRAL AMERICA, 2008
(In thousands)

TO:		Belize	Costa Rica	El Salvador	Guatemala	Honduras	Nicaragua	Panama ^a
FROM:	Belize		0.9	2.3	31.8	2.3	0.5	1.5
	Costa Rica	NA		27.7	41.5	25.4	70.7	50.5
	El Salvador	NA	46.8		647.6	167.6	123.5	18.6
	Guatemala	11.7	40.8	537.6		128.6	68.8	28.0
	Honduras	3.1	31.7	213.1	155.1		182.5	13.1
	Nicaragua	NA	455.4	97.0	47.2	120.0		11.9
	Panama	NA	72.9	11.9	12.5	9.2	14.9	

Source: Elaborated with data of World Tourism Organization, *The Compendium of Tourism Statistics*, various years.

^a Arrivals of non-resident visitors to Panama.

NA: Not Available.

The intraregional flow of visitors, as mentioned before, has been growing at a higher rate than tourism coming from other parts of the world to Central America. By 2008, 42% of tourism going to Central American was intraregional. However, as shown in Table 7, these tourist flows are quite concentrated geographically. In fact, the most intense intraregional tourism takes place between El Salvador and Guatemala: in 2008, 538 thousand Guatemalans traveled to El Salvador and 648 thousand Salvadorians visited Guatemala (see Table 7). These two countries accounted for one third of total intraregional tourism. It is important to point out that Guatemala City and San Salvador, the capital cities of these two countries, are very close geographically (it takes no longer than three hours to travel from one city to the other by road), hence these trips involve many different activities besides leisure tourism. The third most important source of intraregional visitors is Nicaragua from where many citizens travel to Costa Rica, but mostly to work (with tourist visas).

¹⁴ There also is a “Sustainable Tourism in the Mayan World” agreement signed in 2002, which seeks to develop sustainably the region in economic and social terms through a cultural, ecological and adventure tourist circuit with the participation of the local community.

At the other end, Costa Rica (except for Nicaraguans) and Panama¹⁵ are the least visited by the rest of Central Americans since leisure tourism is expensive and not as many business and family ties exist.

Summarizing, the tourism industry has grown in terms of tourist arrivals and the income they generate. Furthermore, it is an important source of employment. However, as will be discussed along the document, the future of leisure tourism in Central America will depend, partly on the preservation of the environment and the impact of climate change on the region. Changes in current conditions could alter the fragile ecosystems and also the prospects of the industry in the future. It is possible that intraregional tourism, which is not as specialized in leisure tourism would be less affected by these elements than tourism coming from the United States or Europe.

¹⁵ For Belize little information exists, but apparently there is little tourism with the rest of the region, though migration, particularly from Guatemala and El Salvador to Belize seems to be important.

III. Tourism and climate change in Central America

As seen in prior sections, it is crucial to think about the future development of tourism in Central America considering climate change since this region is very vulnerable to such phenomenon. In this section we will firstly analyze the specific temperature changes to be expected in the main (leisure) tourist sites in Central America in 2020 and 2050. An insight of other impacts of climate change on tourist areas will follow, including extreme weather events. Thirdly, specific features of Central American countries will be looked into regarding their strengths and weaknesses to face climate change. Finally, a brief analysis of the legal and regulatory framework on environment and climate change in the Central American countries will be carried out, which are part of the adaptation (and in some cases mitigation) measures that are being taken.

A. Climate change impact on temperatures in specific tourist sites in Central America¹⁶

One of the most important effects of the climate change phenomenon is the increase in temperatures. According to the IPCC (2007a), the Latin American region has already experienced a 1°C increase in its temperature throughout the last decades and will probably experience an increase of 1°C to 4°C over the rest of the XXI Century, and could rise even by up to 6°C under certain circumstances. An analysis made on long

¹⁶ The source of the information on temperatures at a municipal level used in this section is the ECLAC-DFID Project “The Economics of Climate Change in Central America” (2009).

term daily data (1961-2003) for Central America and northern South America (Aguilar, et al, 2005) indicates that there has been a variety of changes in extreme values in temperature and precipitation during the last four decades in this region. This analysis arrives to the conclusion that the whole region has been warming over the last decades and temperature extremes are changing accordingly. This phenomenon is occurring comparatively more in the boreal summer and autumn (which in rough terms coincides with the rainy season).

Temperature has not been an important variable influencing tourism in the past in the Central American region as was mentioned before (and is also demonstrated in the last section with an econometric model), but it can become a crucial element in the future. To analyze this issue, 42 leisure tourist sites in Central America—among the most important in the region—were chosen and their location is shown in Map 1. Unfortunately, information is missing for important tourist areas in Guatemala.

We can see that a great number of these tourist destinations are located on the Pacific coast, some are on the Caribbean Ocean coast (mostly the Belize sites, as well as some Honduran and Panamanian tourist places), and a few are located inland. Most leisure tourism spots are particularly vulnerable to extreme weather events, although they would be more exposed if most of them were on the Caribbean coast, where there is more hurricane activity than on the Pacific side (however, hurricanes on this coast are also starting to occur).

According to the Model for Interdisciplinary Research on Climate (MIROC)¹⁷, all tourism sites selected for this analysis will suffer an increase in temperatures as a result of climate change (projections from this model were only available for the A1B scenario¹⁸ by the third quarter of 2009). For our analysis we have chosen the 2020 and 2050 average (of maximum-minimum) temperature forecasts, as well as two months—July and December—which are those when the greatest part of leisure tourism activity takes place in most Central American countries (some of the countries studied have tourist visit peaks in June and January, but the temperature rise in these months is similar to that in July and December, respectively).

One of the first phenomena that can be perceived is that the estimated rise in temperatures for tourist places in our sample experience a much greater increase in temperatures in July than in December, both in the projections for 2020 and for 2050 (see Table 8). Temperatures in December 2020 would rise between 1.00 to 1.40 °C, being several Panama sites those with the least temperature increases and Nicaraguan tourist centers those with the greatest rises. For 2050 the increase in December temperatures would be more pronounced in the tourist centers selected, rising between 1.50 and 2.90°C. The least affected locations would be in Belize (with a rise of 1.50°C to 1.70°C), while those with the greatest rises in temperature would be located in Costa Rica, especially Guanacaste (2.80°C to 2.90°C), which is the most important leisure tourism area in such country.

Notwithstanding the December increase in temperatures described above, these projected values would either not reach the baseline temperatures registered in July, or would exceed it by around 2°C at most. Considering the fact that December is a much dryer season than July, it should still be a relatively comfortable weather for tourists even in the places where temperature rises the most. This does not mean that there could be other factors derived from higher temperatures, such as droughts, that may render tourism activities particularly difficult even in the most pleasant season, because, of water shortages, for example. The country that will mostly suffer from droughts in the region would be El Salvador (Alvarado, et al, 2006). Among the tourist sites, Guanacaste in Costa Rica could be one of the most harmed. This region is already facing some water shortages, since rainfall has decreased by 20% during the last decade as compared to the 1961-1990 period (IPCC, 2007a). Most of the negative effect will hit the northern part of the Isthmus while the southern part will not suffer much variation in this sense (IPCC, 2007a; ECLAC and

¹⁷ Developed by several institutions in Japan, including the Center of Climate System Research at the University of Tokyo (IPCC, 2007b).

¹⁸ A1B is a scenario family, one of three groups of scenario families which describe alternative directions of technological change in energy system. The family A1B considers a balanced use of fossil and non-fossil energy source, with similar improvement rates for energy supply and end use technologies (IPCC, 2007b).

DFID, 2009). Though rainfall may not decrease as much on the coasts as inland, there may be a scarcity of water for tourism activities if its main source comes from inland areas.

The predictions for July are much more worrying. The highest increase in temperatures by July 2020 would occur inland in archaeological centers: Tikal (Guatemala) and Copan (Honduras), 2.20°C and 2.10°C, respectively. The most moderate rises in temperatures —1.10°C— would take place in several Panamanian sites. But the most dramatic escalation of temperatures would take place in July 2050, by over 4°C in six locations, of which three are in El Salvador, another is Tikal in Guatemala, Punta Gorda in Belize, and Cusuco in Honduras and between 3.0°C and 3.9°C in more than 20 other location, which would probably make tourism in those places quite uncomfortable for visitors. Somewhat more bearable warming would take place in Panama, in Islas de Bahía, Honduras, and some places in Belize, but still, these would experience temperatures increases by about 2.50°C in July. As mentioned before, with these increases most biodiversity would be threatened or become extinct (see Table 8). Also, the fact that these much higher temperatures will occur in the most humid season makes these conditions probably intolerable for tourist activities.

We may conclude from the atmospheric temperature increases that would result from climate change in Central America, that the region would still offer acceptable conditions for leisure tourism during December (and probably also for January), but summer tourism would become much less attractive because of the significant rise in temperatures, and also because of other conditions. It is also significant that some of the cultural sites which are inland will have to endure a drastic increase in temperatures, endangering much of the surrounding forests (generating forest fires) and putting these places themselves under stress.

B. Other climate change impacts on tourism in Central America

Besides the rise in temperatures, there will be many other climate change impacts on tourism, as has been mentioned before. The information available and/or the projections of these variables' behavior in the future are not available yet at a municipal level, therefore they will be dealt with at a more general level.

Impacts that climate change may have on sea and coasts are very relevant for the tourist activity, since Central America's coast line is very extended and much of its present and potential leisure tourism takes place precisely on such coasts. As can be seen in Table 9 total coastline in Central America is 7,179 kms, considering the Pacific and Atlantic coasts.

As a result of warmer climate there has been and will continue to be a rise in sea level. This is occurring particularly in the Atlantic or the Caribbean side of the ocean. Miller (2009) shows a complex situation, by which observable sea level over the last decades has been the result not only of climate change but also seismic activity. The study done by Miller (2009) also points out that the quality of the data is generally not good, both because much of it has been gathered only very recently and also because the way in which it is measured can bias the results. Notwithstanding these shortcomings, the paper is able to conclude that "The general trend is toward an increase in sea level, with an increased rate toward equatorial regions. Superimposed on the trend is a more significant geologically related component. Particular locations are sinking at a much higher rate than is indicated by the general trend..." The study states that, at any rate, rise in sea level analysis should be done for specific locations to be able to have a better view of what is happening and make some future estimates, though these would be quite uncertain. Some more detail will be given below.

MAP 1
SELECTED TOURIST CENTERS LOCATION IN CENTRAL AMERICA



**TABLE 8
TEMPERATURES IN TOURIST SITES**

Code	Tourist Location	Country	First Order Administrative Division	Second Order Administrative Division	Ave. Historic Temperature (July)	Anomalies (MIROC) (July 2020)	Anomalies (MIROC) (July 2050)	Ave. Historic Temperature. (December)	Anomalies (MIROC) (December 2020)	Anomalies (MIROC) (December 2050)
					'C	'C	'C	'C	'C	'C
1	Corozal	BLZ	Corozal	-	26.60	1.50	3.00	23.10	+1.10	+1.50
2	Cayo Ambergris	BLZ	District of Belize	San Pedro	28.00	1.40	2.60	24.80	+1.10	+1.70
3	Cayo Caulker	BLZ	District of Belize	Cayo Corker	NaN	1.40	2.60	NaN	+1.10	+1.60
4	Blue Hole y Monumento Nacional Halfmoon Caye *	BLZ	District of Cayo	-	24.60	1.90	3.50	21.00	+1.10	+1.50
5	Cayo *	BLZ	District of Cayo	-	24.60	1.90	3.50	21.00	+1.10	+1.50
6	Reserva Marina South Water Caye	BLZ	District of Stan Creek	Dangriga	26.30	1.50	2.70	23.20	+1.10	+1.60
7	Placencia	BLZ	District of Stan Creek	Placencia	27.30	1.70	3.10	23.80	+1.10	+1.60
8	Punta Gorda	BLZ	District of Toledo	Punta Gorda	26.40	2.00	4.00	23.10	+1.20	+1.70
9	Tikal **	GTM	Depto de Petén	Municipios de Flores y San José	26.90	+2.20	+4.25	22.50	+1.10	+1.55
10	Livingston	GTM	Depto de Izabal	Municipio de Livingston	ND	ND	ND	ND	ND	ND
11	Puerto Barrios	GTM	Depto de Izabal	Municipio de Puerto Barrios	ND	ND	ND	ND	ND	ND
12	Quirigua	GTM	Depto de Izabal	Municipio de Los Amates	ND	ND	ND	ND	ND	ND
13	Retalhuleu	GTM	Depto de Retalhuleu	Municipio de Retalhuleu	ND	ND	ND	ND	ND	ND
14	Puerto San José	GTM	Depto de Escuintla	Municipio de San José	27.90	+1.70	+3.80	26.60	+1.20	+2.30
15	Isla de la Bahía	HND	Depto de Islas de la Bahía	Municipio de Roatán	NaN	1.40	2.70	NaN	+1.10	+1.80

(continued)

Table 8 (Continued)

Code	Tourist Location	Country	First Order Administrative Division	Second Order Administrative Division	Ave. Historic Temperature (July)	Anomalies (MIROC) (July 2020)	Anomalies (MIROC) (July 2050)	Ave. Historic Temperature (December)	Anomalies (MIROC) (December 2020)	Anomalies (MIROC) (December 2050)
					'C	'C	'C	'C	'C	'C
16	La Ceiba	HND	Depto de Atlántida	Municipio de La Ceiba	22.90	1.70	3.60	19.60	+1.10	+1.80
17	Cusuco	HND	Depto de Cortés	Municipio de San Pedro Sula	27.60	1.90	4.30	24.40	+1.10	+1.70
18	opan	HND	Depto de Copan	Municipio de Copan Ruinas	24.20	2.10	5.20	21.60	+1.20	+2.00
19	Puerto de Acajutla	SLV	Depto de Sonsonate	Municipio de Acajutla	26.40	+1.80	+4.00	25.40	+1.30	+2.30
20	La Zunganera ***	SLV	Depto La Paz	Municipio de San Luis Talpa	26.30	+1.80	+4.10	24.70	+1.30	+2.20
21	Playa Costa del Sol ***	SLV	Depto La Paz	Municipio de San Luis La Herradura	26.30	+1.80	+4.10	24.70	+1.30	+2.20
22	Puerto El Triunfo	SLV	Depto de Usulután	Municipio de Puerto El Triunfo	26.50	+1.80	+3.90	25.10	+1.30	+2.20
23	Puerto Corinto	NIC	Depto de Chinandega	Municipio de Corinto	27.80	1.90	3.60	25.90	+1.40	+2.40
24	Poneloya	NIC	Depto de León	Municipio de León	27.00	1.90	3.60	25.40	+1.40	+2.50
25	Puerto Sandino	NIC	Depto de León	Municipio de Nagarote	27.30	1.90	3.50	26.00	+1.40	+2.60
26	León	NIC	Depto de León	Municipio de León	27.00	1.90	3.60	25.40	+1.40	+2.50
27	Pochomil	NIC	Depto de Managua	Municipio de San Rafael del Sur	27.30	1.90	3.30	26.10	+1.30	+2.60
28	San Juan del Sur	NIC	Depto de Rivas	Municipio de San Juan del Sur	26.50	1.90	3.30	25.00	+1.30	+2.80
29	Golfo de Papagayo	CRI	Prov. de Guanacaste	Cantón Liberia	26.40	+2.00	+3.40	25.00	+1.30	+2.90
30	Playa Flamingo	CRI	Prov. de Guanacaste	Cantón Santa Cruz	25.90	+1.90	+3.30	25.00	+1.30	+2.80
31	Playa Tamarindo	CRI	Prov. de Guanacaste	Cantón La Cruz	25.30	+2.00	+3.40	24.00	+1.30	+2.90

(continued)

Table 8 (Concluded)

Code	Tourist Location	Country	First Order Administrative Division	Second Order Administrative Division	Ave. Historic Temperature (July)	Anomalies (MIROC) (July 2020)	Anomalies (MIROC) (July 2050)	Ave. Historic Temperature (December)	Anomalies (MIROC) (December 2020)	Anomalies (MIRC) (December 2050)
					'C	'C	'C	'C	'C	'C
32	Ciudad Puntarenas	CRI	Prov. de Puntarenas	Cantón Puntarenas	NaN	+1.90	+3.30	NaN	+1.30	+2.80
33	Puerto Quepos	CRI	Prov. de Puntarenas	Cantón Aguirre	26.80	+1.70	+3.10	25.40	+1.30	+2.70
34	Bahía Drake	CRI	Prov. de Puntarenas	Cantón Osa	26.20	+1.60	+3.00	25.00	+1.30	+2.60
35	Parque Nacional Corcovado	CRI	Prov. de Puntarenas	Cantón Osa	26.20	+1.60	+3.00	25.00	+1.30	+2.60
36	Golfito	CRI	Prov. de Puntarenas	Cantón Golfito	26.40	+1.50	+3.00	25.20	+1.30	+2.50
37	Bocas del Toro	PAN	Prov. de Bocas del Toro	Distrito Bocas del Toro	25.80	1.30	2.50	25.20	+1.20	+2.40
38	Boquete	PAN	Prov. de Chiriquí	Distrito de Boquete	20.70	1.40	2.70	19.70	+1.30	+2.50
39	Penonomé	PAN	Prov. de Coclé	Distrito de Penonomé	26.50	1.10	2.40	25.40	+1.00	+2.20
40	Valle de Antón	PAN	Prov. de Coclé	Distrito de Antón	27.20	1.10	2.40	26.40	+1.00	+2.20
41	Puerto de Colón	PAN	Prov. de Colón	Distrito de Colón	26.60	1.10	2.20	25.40	+1.00	+2.20
42	Las Perlas	PAN	Prov. de Panamá	Distrito de Balboa	27.00	1.20	2.40	26.30	+1.00	+2.20

* Data for Cayo District was used (First Order Administrative Division).

** A temperature average was calculated for the municipalities where Tikal is located.

*** No information of these municipalities exists, so we used information from the La Paz Department.

TABLE 9
CENTRAL AMERICA: COASTLINE OF CENTRAL AMERICAN COUNTRIES
(Kilometers)

Country	Pacific Ocean	Caribbean Ocean	Total
Panama	1 700	1 287	2 987
Costa Rica	1 100	200	1 300
Nicaragua	410	551	961
Honduras	133	671	804
Guatemala	255	148	403
Belize	-	386	386
El Salvador	338	-	338
Total	3 936	3 243	7 179

Source: Central American countries' First National Communications on Climate Change.

Higher temperature of seas are putting at risk not only various resources on land, but also sea biodiversity, which among other things is an important attraction for tourism. This is the case of the Mesoamerican Reef, which is the second largest barrier reef worldwide (covers over 700 kilometers from the north of the Yucatan Peninsula in Mexico through the Belize Barrier Reef, the coast of Guatemala and ending in the Bay Islands in northern Honduras), and in 1998 it already went through an extended coral bleaching episode¹⁹. Climate change is predicted to continue warming the sea surface of the Caribbean Sea, increasing the frequency of bleaching events, of which the latest was in 2005 (Vergara, 2009). While the living reef and associated ecosystems support recreation and commercial fishing for Mexico, Guatemala, Belize and Honduras, since it provides shelter for many species²⁰, its presence is also vital to the survival of many plants and animals as well as humans, because it is a natural barrier against severe storms and coastal erosion. Hurricanes themselves have caused great damage from coral breakage to these natural resources.

Warming of sea temperature is linked to climate variability and closely related to the intensification and more frequent presence of El Niño Southern Oscillation (ENSO). In fact, natural disasters linked to climate have grown 2.4 times between 1970-1999 and 2000-2005 in Latin America (ECLAC and DFID, 2009). In all Central American region, from 1930 to 2008 there were 248 extreme events associated to climate or hydro-meteorological phenomena countries, but 47% of them occurred over the last 9 years (Mansilla, 2009). Regarding tropical cyclones Mansilla (2009) mentions that according to the frequency of events occurred between 1977 to 2006, the most significant territories at risk are the following: almost the whole Caribbean Coast, all Belize's territory, and an important extension of the territories of Honduras and Nicaragua on their Caribbean side, as well as the North-East of Costa Rica, also on the Caribbean side.

Although Climate Change scenarios are not precise regarding the increase in number and intensity of cyclones that might occur geographically, it is probable that those areas that have been the most affected by them will continue being so in the future (Mansilla, 2009). It is important to consider that hurricanes that rise from the Caribbean Sea also have effects on the Pacific coast of the Central American Isthmus and that hurricanes have begun to rise from the Pacific Ocean itself, so more of the Central American region is being affected by these extreme weather events. Therefore, higher frequency and intensity of tropical storms, with ensuing risk of coastal zones flooding and greater erosion will take place (Schleupner, 2007).

¹⁹ Fortunately, the 1998 bleaching event was not severe, due to the cooling effects from Hurricane Mitch. However, during 2007 a category five hurricane hit Banco Chinchorro and caused significant damage to mangrove systems, and to a lesser extent, coral reefs. http://www.reefresilience.org/Toolkit_Coral/C8_MAR.html.

²⁰ <http://www.worldwildlife.org/what/wherewework/mesoamericanreef/projects.html>.

The destruction power of hurricanes and cyclones since the mid seventies has progressively increased, as they have gained greater intensity and have tended to last longer (ECLAC and DFID, 2009). Natural disasters can lead to changes on the physical, the biotic environment and the perceptual environment (see Table 10). These changes may be expressed in numerous ways and may have negative outcomes on the tourist sector, among others. Some of these are the losses in forested areas, which can cause a temporary loss of environmental services (hence of ecotourism attractions), accumulated debris in beaches, that can result in an interruption of tourist beach activities, and damages to the infrastructure in protected areas, which can cause a loss of recreation services (ECLAC, 2003).

ECLAC has used a methodology to assess the socio-economic and environmental effects of natural disasters that several countries in Latin America, the Caribbean and other parts of the world have made use of. Several sectors have been assessed including tourism industry and environment. This methodology distinguishes between direct and indirect impacts and in the case of tourism, direct damages refer to tourism-specific assets. This category includes costs linked to the natural resources that are part of the attraction of the place. Usually, tropical storms and hurricanes cause beach erosion and its replenishment can be costly and can cause other damages if sand is subtracted from other places for such purpose. On the other hand, indirect losses refer to earnings that are not received as a consequence of cancelled reservations, fewer tourists visiting the country because of the negative image produced by the disaster, costs of promotion campaigns needed to help the tourist destination image to recover after a disaster, etc. Similar to direct losses, the economic indirect damage can be quite large, e.g. Mitch caused indirect losses for tourism in Guatemala for 15.5 million dollars (ECLAC, 2004b) and in El Salvador 8.9 million dollars (ECLAC, 2004e).

Both direct and indirect damages frequently add up to large losses for countries and their tourism industries. Table 11 shows some recent climate related natural disasters in which the damage for the tourism industry was quantified. For comparative purposes, together with Central American countries, Mexico and some Caribbean countries were added. Total damages vary considerably and can be quite large, such as the impact of hurricane Stan and tropical storm Wilma during the same season (2005) which caused losses of more than 1.6 billion dollars in Quintana Roo, Mexico. Among the Central American countries, Guatemala stands out as the one which suffered more damages, with a total loss of 118.8 million dollars in 1998 as a result of Hurricane Mitch. This poses a great risk for countries' development and for the tourist industry that represents an important source of income to the Central America, Mexico and the Caribbean nations.

After a major storm or hurricane occurs, damages to natural systems can be large and it can take a long time to recover. For instance, after hurricane Mitch hit Central America it was estimated that some natural areas would take 15 to 20 years to recover (ECLAC, 2004g).

Another important problem produced by hurricanes and storms are floods, which also affect tourist centers. According to the ECLAC study carried out by Mansilla (2009), there are flood risk patterns clearly defined. The naturally flooded territories such as riversides and low zones, as well as coastal areas are the ones that show a higher recurrence and intensity. For Belize, the entire coast and the north of the country have registered the largest number of floods between 1975 and 2008. Guatemala also has experienced similar problems in coasts, riversides and lakesides, especially in the Departments of Alta Verapaz, Izabal, Zacapa, El Petén and those on the Pacific Coast.

TABLE 10
EFFECTS OF NATURAL DISASTERS ON THE ENVIRONMENT

Phenomenon	Effects on the physical environment	Effects on the biotic environment	Effects on the perceptual environment
Tidal wave	<ul style="list-style-type: none"> • Flooding of coastal zones • Intrusion of salt water in surface and subsurface bodies of water • Water contamination due to chemical spills 	<ul style="list-style-type: none"> • Ill effects on human health • From the impact of the wave • From environmental changes, water contamination and salinization • Damages to coastal plants and wildlife from the impact of the wave and salt water flooding 	<ul style="list-style-type: none"> • Significant affection of the coastal landscape • Possibly more significant and even permanent changes such as the appearance and disappearance of water bodies
Floods	<ul style="list-style-type: none"> • Erosion, soil destabilization and landslides • Sedimentation and washing of rubble and detritus into adjoining lands and bodies of water • Possible damming and subsequent avalanches • Contamination due to spills of water and sewage treatment tanks and the collapse of sewer and plumbing systems • Contamination from chemical spills 	<ul style="list-style-type: none"> • Ill effects on human health • From the energy released • From environment changes such as water contamination • Effects on plant and animal life from the energy released, physical changes and effects from chemical contamination • Loss of vegetation cover • Loss of habitat 	<ul style="list-style-type: none"> • Washing downstream of sediment and obstruction of natural drainage systems can cause changes, possibly permanent, to the course of water bodies and alter the coastline
Hurricanes	<ul style="list-style-type: none"> • Coastal erosion, changes to the granulometry of beaches and bathymetric changes brought on by tides and oceanic turbulence • Changes to geographic characteristics • Erosion, landslides and avalanches caused by rains • Intrusion of salt water into surface and subsurface bodies of water 	<ul style="list-style-type: none"> • Death and migration of animals • Splitting and falling trees due to winds • Loss of coastal vegetation (mangroves), marine plant life and physical damage to coral reefs 	<ul style="list-style-type: none"> • Drastic changes to the landscape due to loss of vegetation and alteration of the coastline • Floods
Drought	<ul style="list-style-type: none"> • Drying out and cracking of the soil; increase in the susceptibility of the soil to erosion and degradation • Decrease in the surface water reserves; increase in the temperature of water bodies, loss of capacity to dilute contaminants; well salination may occur in coastal zones due to over exploitation • Drying up of wetlands 	<ul style="list-style-type: none"> • Loss of vegetation cover due to drying up of vegetation cover and associated forest fires • Loss of biodiversity due to drying up of wetlands and forest fires 	<ul style="list-style-type: none"> • Drastic changes to the landscape due to loss of vegetation

(continued)

Table 10 (Continued)

Phenomenon	Effects on the physical environment	Effects on the biotic environment	Effects on the perceptual environment
ENOS phenomenon (El Niño)	<ul style="list-style-type: none"> • See floods and droughts 	<ul style="list-style-type: none"> • The appearance or increase in the incidence of some illnesses (malaria, dengue, etc.) is associated with the ENOS Phenomenon • Changes in the oceanographic structure, disappearance of phytoplankton, death of coral populations 	<ul style="list-style-type: none"> • Similar effects to those caused by floods and droughts

Source: Handbook for estimating the socio-economic and environmental effects of disasters, Volume 4 (ECLAC, 2003).

TABLE 11
ECONOMIC DAMAGE OF NATURAL DISASTERS ON THE TOURISM INDUSTRY
IN CENTRAL AMERICA, MEXICO AND THE CARIBBEAN
(In millions of dollars)

Country	Natural Disaster	Year	Total damage to the tourism industry
El Salvador	Hurricane Mitch	1998	18.9
Guatemala	Hurricane Mitch	1998	118.8
Nicaragua	Hurricane Mitch	1998	81.4
Cayman Islands	Tropical Storm Ivan	2004	108.3
Bahamas	Hurricanes Frances and Jeanne	2005	109.9
Dominican Republic	Hurricane Jeanne	2004	84.0
Mexico (Quintana Roo)	Hurricane Stan and Tropical Storm Wilma	2005	1 636.9
Guatemala	Hurricane Stan	2005	52.2
Mexico (Quintana Roo)	Hurricane Emily	2005	86.8
Mexico (Tabasco)	Cold Front No.4	2007	53.9

Source: Elaborated with data from several Disaster Evaluation Assessments performed by ECLAC (see 1999;2004a; 2004b; 2004c; 2004d; 2004e; 2004f; 2004e; 2005a; 2005b; 2008b).

For El Salvador and Honduras the flood risk pattern is concentrated basically in coasts (both coasts for Honduras), while this threat in Nicaragua concentrates in two areas: the Autonomous Region of the North Atlantic sea area and the coastal zone of Chinandega. Regarding Costa Rica, extreme floods affect mainly Guanacaste and the north of Alajuela, Heredia and Limón. Finally, Panama is the country that has the lowest incidence of extreme floods. The territories at I risk are located in the Province of Darién, Sixaola and Changuinola, riversides of Coclé River (Province of Colón) and coastal zone of the Province of Chiriqui (Mansilla, 2009).

In sum, intensification of storms, hurricanes, coast erosion, coastal flooding, loss of biodiversity, loss of beach sand, salinization of water, droughts in some places, among other consequence of climate change are elements that certainly will have adverse effects on tourism if no adaptation measures are undertaken.

C. Specific country conditions regarding climate change and the challenges for tourism

Though facing similar climate change phenomena, the Central American countries face a somewhat different situation in their tourist sectors, depending on the degree in which they have been able to preserve their nature (see Table 12); the type of tourism that they normally attract; their geographical location and, within each country, their leisure tourist centers site; among other factors. The policies that the countries are taking to protect the environment and adapt to climate change are very important as well, as a way to guide society in its adaptation measures.

1. Costa Rica²¹

An important feature to take into account when analyzing Costa Rica is that, besides Belize, its tourism is the most leisure related of the region. Within this activity, the country has greatly developed eco-tourism and it has become one of the greatest destinations in the world for this kind of tourism. Hence, its success in the tourist industry depends on the preservation of its scenery and its natural environment, which may be endangered by climate change.

In the 1940s, Costa Rica had 75% of its territory covered by forests, but this area had been reduced considerably to 46.5% in 2000 and only recently the deforestation tendency has reverted. In 2007 the forests covered 46.9% of the land (see Table 12). A successful set of incentives for the private sector to preserve or expand forests (particularly through Fondo Nacional de Financiamiento Forestal, FONAFIFO) and public policies, has led to a recovery tendency.

Also, the policy of creating diverse conservation areas, which covers around 25% of national territory, including National Parks, Biological Reserves, Protected Zones, Forest Reserves, Wildlife Refuges, Wetlands/Mangroves, among other categories has helped stop deforestation and protect its biodiversity (Costa Rica National Parks, National System of Conservation Areas²²).

Costa Rica's particularly ambitious climate change and environmental agenda is helping all sectors to make a special effort to adapt and mitigate Climate Change greenhouse gas emissions. In fact, the Costa Rican Climate Change Strategy is very wide in scope since it focuses on a wide range of areas: energy, transport, agriculture, industry, solid wastes, tourism, water, change in land use, health, infrastructure, fisheries and coastal zones, biodiversity, among others. The country has also set itself the target of becoming "Carbon Neutral" by 2021 so that policies concerning mitigation, environment care, among others, have become crucial²³. This national policy undoubtedly helps efforts to conciliate all productive activities within the country with these targets, including the tourist activity.

²¹ The order in which the countries appear in this section is according to the importance of their tourist sector, considering the number of tourists they receive.

²² National System of Conservation Areas on line [<http://www.sinac.go.cr/>].

²³ One of the big challenges for the "Carbon Neutral" plan is the measurement of emissions. Without an emissions inventory, success of the policy cannot be proved.

TABLE 12
FOREST COVER CENTRAL AMERICA, 2000-2007

Country	Forest area				Average rate of growth 2000-2007
	2000		2007		
	1 000 ha	% Land	1 000 Ha	% Land	
Belize	1 653.0	72.5	1 653.0	72.5	-
Costa Rica	2 376.0	46.5	2 397.0	46.9	0.1
El Salvador	324.0	15.6	287.6	13.9	-1.7
Guatemala	4 208.0	39.3	3 830.0	35.7	-1.3
Honduras	5 430.0	48.5	4 335.2	38.7	-3.2
Nicaragua	5 539.0	46.2	4 979.0	41.5	-1.5
Panama	4 307.0	57.9	4 288.8	57.7	-0.1

Source: FAOSTAT online [<http://faostat.fao.org/site/377/default.aspx#ancor>].

Synergies between environmentally friendly tourism and natural resources in Costa Rica provide one of the best policy platforms to help mitigate emissions caused by tourist activities as well as to adapt the latter to climate change in the region. Notwithstanding these positive relations, tourism, that since 1993 became the most important source of foreign exchange for Costa Rica economy, is still a matter of concern regarding its possible effects on the environment and its vulnerability to climate change.

The challenges that lay ahead for Costa Rica, derived from climate change, are quite worrying, as is expressed in its First National Communication on Climate Change issued in 2000 (First National Communication²⁴), which developed a specific analysis on vulnerability of agriculture, forests, water resources and coastal resources, several of which have an incidence on tourism.

First, Costa Rica's coasts, in general, are close to a mountain range which, together with weather and morphology characteristics, has produced alluvial plains where there are almost no cliffs on the sea shore. Though this makes the scenery in the coast very attractive, with wide seashores and vegetation (from mangrove swamps), it is very vulnerable to climate change. The rise in sea level will provoke regressions in the coastal line and widen the areas subject to tidal floods in almost all the coastal line (First National Communication).

Some of the most vulnerable geographical areas to climate change are Guanacaste and the southern Pacific coast. Higher temperatures and droughts will particularly hit the Northern part of the Pacific coast. Very attractive areas for tourism in Costa Rica are located precisely on the Northern Pacific and Nicoya Peninsula in Guanacaste which counts with excellent beaches (called The Gold Coast of Costa Rica). Guanacaste will face temperature increases of up to 3.8 C° and a reduction in rainfall of up to 63% by 2100. At present, rainfall has already been diminishing and drinking water for coast settlements is being procured progressively more from the inland (First National Communication).

Further south on the Pacific coast is the City of Puntarenas, which under the optimistic scenario of IPCC studies, sea level would rise by 0.3 m in 2100, flooding 60% of the current residential area of this suburb. If sea level rise reaches 1.0 m (IPCC pessimistic scenario), high waters would penetrate the city, flooding 90% of it. Also the cities of Quepos and Golfito on the Pacific coast would become uninhabitable (First National Communication).

²⁴ There is a First National Communication on Climate Change for each Central American country. They will be referred to as "First National Communication" in each case and the detailed reference is given in the bibliography.

Hotter waves and less rain will have a seriously negative impact on biodiversity, which is also a very important tourist attraction. Such biodiversity will be threatened especially in the humid tropical areas and the dry tropical areas even under an optimistic scenario. But also hurricanes and storms which have not been very damaging in Costa Rica (on the Caribbean Coast) will be occurring more frequently on the Pacific coast, and tourism in this area could be discouraged.

Ports would also suffer severe damage and there would be conflicts regarding land tenure near the coast, which would also harm tourist developments in such area (First National Communication).

There are important measures being taken, such as a first emission of environmental services certificates for Guanacaste, which aims at regenerating seven thousand hectares of forest, which may protect the surface and underground water resources and reduce emissions in Nicoya, Santa Cruz, Filadelfia, Carrillo and Liberia. "The macro-emissions for Guanacaste have a value of 1.995 million dollars"²⁵. The face value will be of 285 dollars per hectare, for at least five years.

2. Guatemala

Guatemala is the largest tourist destination after Costa Rica in Central America. It offers an invaluable cultural heritage that has attracted visitors for many years. It is this feature of Guatemala which has been most valued, and places such as Tikal in Petén, Quirigua in Izabal, Zaculeo in Huehuetenango, and Kaminal Juyu in Guatemala City are known worldwide. Nature as well as sun and sea tourism have been secondary to the former, but could be developed in the future²⁶. Rural or agricultural tourism has begun to develop, particularly visits to coffee estates, while ecotourism is also beginning to take off (there is a National Plan for Ecotourism since 2002).

This country's natural resources are under threat. Guatemala's forests cover 36.3% of its territory and had a deforestation rate of 1.3% a year between 2000 and 2007 (Table 12). According to several studies, the main cause of deforestation is the use of wood as fuel and is responsible for around 63% of the forest loss (Melgar, 2003).

The tourism sector has been considered of great priority for economic development of Guatemala, as expressed in the "National policy for sustainable tourism development, 2004-2014". This Plan has the purpose of strengthening environmental protection in traditional tourism sites and also the ones of more recent development. Like other sustainable tourism development programs in the region, there is no explicit concern with climate change effects on this sector and hence no clear measures to face this phenomenon are set.

A greater effort is aimed at achieving sustainable tourism and therefore dealing with solid waste and pollution in tourism centers has been considered a priority. For example, Atitlán Lake, which is one of the most beautiful and attractive places for tourism in the country, but very polluted, was provided with a sewage water recycling plant in 2005. There is a program to create a "Blue Flag" Certification, similar to the Costa Rican one, which by the end of 2009 it had not been launched yet.

While these measures are very important, they do not guarantee protection of present tourist activities regarding climate change by themselves. For example, one of the main cultural sites, Tikal, is in the area of Petén, which is part of the Mayan Biosphere and has fragile soil, is suffering increasingly from forest fires and illegal hatchet. Climate change will turn that region much hotter and drier, hence making this pre-Hispanic cultural heritage and very rich natural resources surrounding it, vulnerable to this phenomenon. Tikal, is not only a cultural site but also a refuge for a great part of Guatemalan

²⁵ FONAFIFO, on line [http://www.fonafifo.com/paginas_espanol/invierta_bosques/e_ib_que_es_csa.htm].

²⁶ According to CAMTUR and ASIES (2003), in the short run there will be a further development of tourism in the following areas: Central Guatemala: Guatemala City and Antigua; Altiplano: Panajachel, Chichicastenango and Quetzaltenango; Petén: Ciudad de Flores, Petén; Parque Nacional Tikal and Sayaxché; Caribbean: Puerto Barrios and Livingston; Verapaces: Cobán and Salamá; Pacific Coast: San José Port and Retalhuleu. In the medium term (3 to 5 years) the following sites will be developed for tourism: South-West: Esquipulas; Altiplano: Huehuetenango, Totonicapán. In the longer run, the following places will be developed further: South -East: Chiquimula and Monterrico and other transit and excursion centers near the ones already mentioned above.

mammals, as well as a privileged place for bird observation many of them living in mature forests with trees that are under threat.

The Guatemalan First National Communication on Climate Change (2001) shows that between 1961 and 1990, particularly during the final years of this period, the country experienced an increase in temperatures and a reduction in rainfall. The simulations carried out to estimate future impacts of climate change at a national level included studies on human health, on grain production, on hydro resources and the natural environment. Among the extreme events already occurred that were considered in such Communication are the following: Hurricane Mitch's (1998), droughts of 2001 which produced extreme food shortages, and Stan Tropical Storm (2005) that caused human and infrastructure losses as well as an agricultural crisis.

Two of the topics studied by the First National Communication may have a direct effect on tourism. The first is water, for which the intermediate scenario (neither optimistic nor pessimistic) would mean a 10% reduction of its availability by 2030 in all water basins. The second one is forest surface, which, according to the intermediate scenario, would fall by 1.6% as a result of climate change. The areas vulnerable to these negative effects are Huehuetenango, Quiché, Totonicapán, Sololá, Alta Verapaz, Zacapa and Chiquimula.

According to the Ministry of Agriculture and Natural Resources (MARN), 12% of Guatemalan territory is under desertification threat and 18 departments have already suffered droughts, six of them being the most vulnerable: Jalapa, Jutiapa, Chiquimula, Zacapa, El Progreso y Baja Verapaz. In mid 2009 hunger was striking the people living in the "dry corridor" El Progreso, Zacapa, Chiquimula, Jalapa, Jutiapa, Santa Rosa y Baja Verapaz²⁷.

As to the coastal areas of Guatemala, sea level rise may reach between 0.33 m to 1.21 m by 2100. But how specifically this will affect the potentially tourist areas was not considered in this First National Communication.

Compared to other Central American countries, Guatemala does not have a large coast and beach resorts have been less developed. Around 4% of total tourism reported the Caribbean coast as its final destination, while 2% was heading to the southern coast (on the Pacific). Guatemala's coral reefs, sport fishing, among others, are potentially of high tourist interest. Places like Puerto Barrios and Livingston Island in the Caribbean and Puerto San José and Retalhuleu on the Pacific Ocean are rapidly developing as tourism areas and many more coastal tourist sites could be offered. Unfortunately, coral reefs are in poor state of conservation because of sedimentation caused by land erosion, itself a result of deforestation. Coast resources are under great threat also because of the loss of 70% of its mangrove since 1950 as a result of agriculture and cattle raising activities, urban development in the coast, ports and tourism, and development of aquaculture, especially of shrimp (MARN, 2008). Although the Forest Law explicitly forbids the destruction of mangroves, every year around 500 hectares of this ecosystem are destroyed.

Ports require special attention, because of increasing cruise tourism, which can cause sea natural resources damage. In 2006 63,000 people visited the country through this means, 100% more than in the previous year (MARN, 2008).

²⁷ La Nación, 2009, on line [http://www.nacion.com/In_ee/2009/septiembre/10/mundo2085521.html] Costa Rica, Thursday, September 10th.

3. El Salvador

With the highest population density in Central America, a high reliance on wood for energy (50% of the total consumption) and an annual shift of the agricultural frontier to cultivate crops, El Salvador has experienced the most important deforestation in the Isthmus. In 2007 only about 14% of its territory was covered by forests (Table 12). An important reduction in the area of primary natural forests was also the result of the above problems, so that between 1950 and 1971 the natural forest area decreased by 18% and by 1994, it was estimated that these survived only in 2.5% of the national territory (SEMA, 1992; FUSADES, 1997).

The expansion of cotton crops, coconut and sugar cane near the coastline were greatly responsible for deforestation in lowlands along the coastline. This caused erosion and loss of soils due to the runoffs in the highlands and lowlands of the basins that flow into the coastlines. Mismanagement of slopes most probably worsened these trends. Production activities that take place on the coast, such as salt production, as well as seafood and fish hatchery, among others, have meant the destruction of mangrove and the marine life that usually survives within them. Coastal soil is also suffering from salinization due to the floods and the mismanagement of irrigation waters as well as the already mentioned disappearance of mangroves, which naturally filters sea salt. All these phenomena have caused one of the worse soil erosions in Latin America (World Bank, 2008) and hence reduced the natural assets that could protect to some extent the country against hurricane and storm damages. It is important to note that the former situation has not inhibited the expansion of sun-sea-sand tourist sites, which have had a significant expansion and are expected to grow dynamically in the future, hence the importance of adaptation policies (see following section).

Sea rise is another threat for tourism activity in this country. Estimates indicate that El Salvador could lose 10% of the total coastal area (149.1 km²) under the optimist scenario of a 0.13 m rise in sea level, but under a pessimist scenario of a 1.1 m. rise, it could lose up to 27.6% (400.7 km²) of such land over the next 100 years (First National Communication). The costs for tourism would be enormous, not only because of the loss of beaches as such, but also because of the loss of infrastructure, such as hotels, bridges, roads, ports and possibly airports, together with loss of employments in this activity.

As to rainfall the models simulating the effects of climate change are more uncertain than those regarding temperatures and sea level rise. Estimates consider precipitations varying from -11.3% to 3.5% in 2020 and from -36.6% to 11.1% in the year 2100, which is a very wide range of possibilities, and little can be concluded from them. On the other hand, there is greater certainty regarding the ENSO phenomenon which will continue producing droughts in the future with negative effects on vegetation on the coast and agricultural production in this area (First National Communication).

Additionally, the rise in sea level could cause an increase in coastline salinity. A strong impact on mangroves is foreseen, due to the inland displacement of the coastline. Mangroves would be exposed to greater levels of salinity and the structure of species would be modified with the displacement of these species due to their limits in salinity tolerance levels. The increased ground water salinity levels would also reduce drinking water for humans and would affect agriculture production, hence raise costs for tourist activities.

El Salvador has undertaken a very active promotion of tourism over the last few years. The National Tourist Plan (Plan Nacional de Turismo 2014)²⁸ contains several incentives to promote this activity. Its main target is for El Salvador to become the third most important tourist destination in the region by 2014, but no mention of adaptation to climate change is made in such Plan.

²⁸ Plan Nacional de Turismo 2014, El Salvador (2008), on line, [http://www.elsalvador.travel/userfiles/file/plan_nacional_de_turismo.pdf].

An increasing flow of tourists has arrived to El Salvador, especially from Guatemala, while interest by North American citizens to establish second homes in this country especially close to the coastal areas has also risen.

An example of the vulnerability of El Salvador to climate change is the fact that some areas that are most likely to be flooded in the coast coincide with the country's biological corridor. At least two ports are also located in areas where land flooding will most probably occur because of sea rise level: Puerto El Triunfo and Puerto Acajutla. Mangroves are located mainly in the areas where sea level rise will have the most damaging effects such as Usulután and La Paz districts.

4. Panama

Panama has been able to preserve a large part of its forest cover (57.7% in 2007, see Table 12) and 70% of it is primary forest, which is the most bio-diverse form of forest. Panama counts with many different ecosystems and large protected areas²⁹, which are themselves an attraction for the tourist activity. Other appeals are Panama's mixture of cultures (indigenous, urban and rural) as well as extended sea coasts on both Pacific and the Caribbean Oceans which are also important sites that interest visitors. Notwithstanding, the Panama Canal by itself is still the most important tourist destination, accounting for 63% of total tourism in 2007 (ATP, 2008).

In recent years, there has been an important effort to diversify and expand tourism and the results have been successful, and potentially Panama has much more to share with visitors than it has up to now. An important part of the Panamanian territory – 34.4% – consists of protected areas and may potentially help develop tourism further (Tourist Development Master Plan in 1993, IPAT/OEA, 1993). In fact, the biological and cultural richness that exists in these areas have been recognized internationally. There are two World Reserves of the Biosphere, two sites of the World Nature Heritages, two World Cultural Heritages and three RAMSAR (The Convention on Wetlands of International Importance) sites (ATP, 2008), all of them under the responsibility of the Sistema Nacional de Areas Protegidas (SINAP).

The private sector has become active in promoting eco-tourism. For example, a “Private sector natural reserve network” of environmental and business sector has been created and offers a variety of alternatives for tourism (including flora and fauna observation and specialized bird observation).

Since the end of 1990s tourism has been growing at an unprecedented pace, but tourist sector infrastructure is still incipient. Therefore, the capacity to receive a greater number of visitors needs to be expanded if this sector is intended to have the economic impact that is expected. At the same time, the fact that tourism activities are in their initial phase, allows authorities to guide such expansion, considering climate change possible impacts on the areas where tourism would develop.

Regarding sea-coast areas, there are estimates that predict a rise in sea levels that would cause flooding and the shifting of wetlands and low coastlines as well as the erosion of such coastline. The rise in sea levels will also make water in estuaries and further inland saline (Hernández, *et al*, 1999, cited in the First National Communication).

Panama has in its coasts many areas vulnerable to climate change and many of them coincide precisely with tourist sites, such as Bocas del Toro. Future tourist development should consider adequate measures to protect the tourism activities from these effects and for these not to worsen the impact of climate change phenomenon on the country. An example of extreme vulnerability to climate change is the Kuna Yala region, which has a population of approximately 36.000 people in an area of 3.206 square kilometers. It is located on a narrow land strip of 373 kilometers long on the Caribbean and next to Colombia. Kuna Yala has an archipelago with 365 islands of which 36 are inhabited.

²⁹ Tropical Rainforests: Deforestation rates tables and charts, on line [http://rainforests.mongabay.com/deforestation/2000/Panama.htm].

In short, though not free from climate change impacts, Panama will probably suffer less temperature increases and less extreme weather events than other countries of the Isthmus because of its geographical location and its still abundant forests and other natural resources, but is not free from climate change impacts.

5. Nicaragua

Nicaragua is a country with many natural resources, hence potentially a great attraction for tourism, especially ecotourism. It has very attractive beaches on its Atlantic as well as on its Pacific coasts (the latter being the most developed as a tourist destination). It also has large and beautiful lakes, as well as virgin mountains which have its own original flora and fauna (Bosawas, Arenal, Reserva Indio Maiz). Though tourism has not developed up to now in an important way the government has increasingly valued this sector as an area of national importance for the country's economy. It has prioritized three main topics for tourism: tourist facilitation, promotion and commercialization of this activity.

The country had 41.5% of its territory covered by forests in 2007 (see Table 12) and it has more than twenty ecosystems rich in biodiversity. Although accounting only for 0.13% of world's land surface, it shelters 7% of all biodiversity (TWSC, 1990). Nicaragua is also the place where 31% of the whole Mesoamerican Biological Corridor is located and has 76 protected areas (about 17% of its territory) all of which are under the System of Protected Areas (SINAP). The Institute for Tourism (INTUR) is working with SINAP to develop a compatible strategy of conservation and tourist development in protected natural areas. Mangroves, turtles and reefs are protected by the Environment and Natural Resources Ministry.

Climate in this country varies considerably depending on the region. On the Caribbean area, there is much more precipitation than in the rest of the country (9 to 11 months a year), while the Pacific area has two distinct seasons: the dry and the rainy seasons. The central zone climate characteristics fall in between the two coasts' climate. Unfortunately, Nicaragua is also located in a region frequently struck by extreme natural phenomena such as hurricanes, flooding and droughts. Its vulnerability has increased during recent years, given the inadequate use of land, deforestation, pollution, among others.

On the other hand, precipitation is expected to fall considerably as a result of climate change both on the Pacific and the Atlantic sides of the country. According to the intermediate scenario of the IS-92 of the IPCC (2007a) study, rain will fall by 16.9% and 16.5% by 2050 on the Pacific and the Caribbean areas, respectively, while the reduction will be 25.3% and 24.7%, respectively by 2100³⁰ (First National Communication). As in other countries of the region, climate change would most probably render dry areas even drier. Northern districts and Chinandega and Leon would be among the most affected. These last two areas are well known tourist destinations.

A reforestation program to prevent damage and protect riverbeds and other high vulnerability areas would be very useful to stop soil erosion and avoid sedimentation, hence helping water to maintain its natural flow.

One of the places with the greatest potential for tourism is the Fonseca Gulf (on the North Pacific coast). But for its development, a regional effort is needed since El Salvador, Honduras and Nicaragua, all have a share of territory in the Gulf. In fact, there are two initiatives that may help improve the deteriorated conditions of this area – the Trinational Project on the Integrated Management of the Gulf of Fonseca and the Mangrove Corridor of such Gulf – and may render this area as a very attractive tourist place.

For such purpose, according to both government authorities it would be convenient to build biological stations in each protected area to have more information on how the different ecosystems work. This would be useful both to promote tourism in these areas as well as to know how to take care of them considering future human presence.

³⁰ No estimation is given for 2020.

Finally, it is worthwhile noting that the First Communication makes a special analysis of the effects of climate change on malaria. This topic was included in the Communication because of the high incidence this illness has on the Nicaraguan population and the high costs it means for its health system. The Communication states that the cases of malaria increases exponentially regarding the rise in temperatures. Depending on the geographical area and the scenario of temperature increase, malaria Index would climb between 38 and 150% as a result of climate change. According to the three scenarios of climate change (optimistic, intermediate and pessimistic) the proportion of the population infected with malaria could reach 3 to 9% in 2030, 3 to 10% in 2050, and 5 to 15% in 2100. This phenomenon could have an indirect effect on tourism, because it could discourage visitors to travel to Nicaragua.

In short, Nicaragua has a great potential to expand its leisure tourism and because it is at an early stage in its development it can determine the conditions under which this activity is to develop, to avoid or at least lessen to the climate change expected impacts on the tourist sector. This effort will require much support from local and international institutions to succeed, given the limited resources the country counts on.

6. Honduras

It is the second largest nation in Central America, and 75% of its territory is mountainous. Forest cover has fallen very quickly and was only 38.7% of its territory in 2007. Its deforestation rate is the highest in the region, i.e., 3.2% a year between 2000 and 2007 (see Table 12). The uncertainty regarding land tenure and the lack of conservation and reforestation techniques are among the obstacles for this country to preserve its forested areas³¹.

Honduras has a great variety of natural resources and this continues being the basis of the livelihood of its inhabitants. There are 107 protected areas (some of them are still at a planning stage), which constitute the National System of Protected Areas (SINAPH), covering about 20% of the country's territory. It also has large sea side resources with white sand beaches along its Caribbean coastline. Mostly the Bay Islands (Islas de la Bahía) and La Ceiba have been developed as tourist areas while much of its coasts are promising tourist destinations, but have not developed as such yet.

Tourism is still at an early stage of development and is very concentrated geographically in areas that are particularly vulnerable to climate change, especially the Bay Islands not only for being islands, but also because they are located on the Caribbean Sea which faces the greatest intensification in extreme weather events. Notwithstanding these problems tourism is potentially important for this nation. With a rich morphology, very mountainous, with different heights, water bodies and long coast lines, Honduras has great assets for tourism driven by nature and not as exposed to climate change impacts as the Bay Islands. The coastal ecosystems include five types of natural resources: coral reefs, mangroves, beaches, coastal lagoons, and continental platforms³². These elements create a great number of ecosystems and weathers as well as an extraordinary biodiversity (First National Communication).

Its mountainous interior includes one of Central America's important natural tropical forests (especially in the Mosquitia region) and the archaeological site at Copan, a major cultural and commercial center of the ancient Mayan culture. The Cusuco National Cloud Forest Park is one of Honduras's best parks, located west of San Pedro Sula, in the Merendon Mountain Range. The Reserva de la Biosfera de Río Plátano is also worth mentioning: it is a jungle area that has been designated a world heritage site. This Reserve includes lowland tropical rainforest, coastal lagoons, beautiful beaches, mangroves, grasslands and patches of pine savannah.

³¹ There are programs, such as Pro-Bosque that will help a more sustainable use of forests benefiting small and medium size forest enterprises, municipalities, rural communities, among others. Medio Ambiente online [http://www.medioambienteonline.com/site/root/resources/industry_news/2223.html].

³² According to the UN Convention on Sea Rights, the continental platform of a country includes the bottom of the sea and subsoil of submarine areas that extend beyond its territorial sea up to the exterior border of the continental margin, or up to a distance of 200 miles from the coast.

The biological diversity of the Honduran continental platforms is the least known in the region, but according to specific studies done by a Japanese Mission to Honduras, a submarine prairie with vegetation under the sea that provides a refuge to more than 1800 fish species, 4 threatened turtle species, 100 seaweed species among others was found on the Caribbean sea (First National Communication).

Mangrove coverage is also quite unknown and an inventory exists only for the Bay Islands. There are estimations done by AFE/COHDEFOR³³ that indicate an approximate mangrove extension of 6,300 ha., which help to protect estuaries and coastal zones.

Honduras, as several other Central American countries, has already experienced vulnerability to extreme weather events, which will probably become more frequent and stronger in time as a result of climate change. The country was seriously hit by the El Niño Event in 1995-1996 and Hurricane Mitch in 1998. The impacts of these extreme events have been exacerbated by the poor response to them by the country, partly because of its precarious economy. In this way, droughts have caused hunger, mortality and health problems of many sorts. High temperatures have caused agricultural crisis and forest fires. Hurricane Mitch and storms of 1999 caused human deaths, loss of infrastructure, among other very serious problems. The interaction of extreme events and human action, such as deforestation, has accelerated soil erosion, increased river sedimentation, hence limiting the capacity of rivers to transport water and direct them to dams. Another side effect of this sedimentation is the frequent flooding of rivers, especially of Chamelecón, Ulúa and Aguán.

Climate change could cause important distress to leisure tourist activities especially in Roatán (the largest and most developed of the Bay Islands). The scenarios on climate change effects coincide in that climate conditions in the Northern coast will become increasingly extreme and desertification will expand in the central and southern area of the country. Biodiversity is expected to be harmed by these and other climate change trends. Increase in sea level will have severe effects such as flooding of low lands and will have adverse effects on its mangroves and coral reefs.

To develop tourism in a sustainable way and protected from climate change impacts, Honduras needs to diversify tourism destinations, develop an adequate infrastructure taking into account precisely its vulnerability. Adaptation measures need to be developed and new infrastructure be designed in an innovative way so as to face in the best possible way this situation.

7. Belize

As mentioned in the first section, tourism is one of the most important economic activities in Belize (20.3% of GDP in 2008) and this activity is greatly oriented towards its natural attractions, especially those located in the coast area. Belize is the country that has preserved the greatest proportion of its natural vegetation, over 72.5% of the country in 2007 (see Table 12) and 42% of its land is under some form of legal protected status³⁴. This country's tourism is probably the most sand and sea oriented one, since 84% of tourists are accommodated in coastal communities³⁵ (Coastal Zone Management Authority and Institute). Tourism is among the most important economic activities in the country, as seen in the first section (20.3% of GDP in 2008).

At the same time, Belize is one of the most threatened countries of the region by the climate change phenomenon, particularly because of the low lands, its coastal communities and its exposed economy to extreme weather events. In fact, Belize is considered to be a small island developing state (SIDS) because of these characteristics (Richardson, 2007). Low-lying lands are located, not only along its coasts and islands (the latter account for 5% of the territory) but also in the northern half as well as the southern third of the country.

³³ AFE/COHDEFOR is the institution in charge of regulating and managing the country's natural flora and fauna. It is the entity that executes the forest policy of the State of Honduras.

³⁴ Belize Embassy in Washington D.C., on line [<http://www.embassyofbelice.org/environment.htm>].

³⁵ No information on tourist domestic destination was found for the rest of the Central American countries.

Some inland areas are below sea level and the coastlines are as low as one meter above the coastland and maintain such heights several kilometers inland. The central part of the country is the most elevated because it is dominated by the Maya Mountain/Mountain Pine Ridge massif, which reaches 1,124mts (First National Communication). Another reason for the special vulnerability of Belize's tourism sector to climate change is that it concentrates on its coast and cayes, which face the Caribbean Ocean. As has been mentioned before, it is this ocean which endures the most aggressive effects of extreme weather events, and the Caribbean sea coasts lie within the hurricane belt (more than forty hurricanes and tropical storms hit Belize during the 20th century, according to Richardson, 2007). The former capital —Belize City— was destroyed twice by hurricanes in the last century and a new capital, Belmopan, was created. The fact that 45% of the population lives in the coastal area, makes them vulnerable to climate change impacts. A recent survey carried out in Ambergris Caye and Cayo District found that 25% of respondents in the first and 46% of respondents in the second tourist destinations (132 respondents in total³⁶) lacked insurance protection against natural disasters, though 70% of total respondents considered their own business to be highly or moderately vulnerable to climate change impacts. Nevertheless, the businesses included in the survey demonstrated having a limited knowledge of what climate change effects could be, having little awareness of sea rise effects, warming of sea, erosion and land loss, loss of biodiversity and salt water intrusion (Richardson, 2007).

One of the greatest tourist attractions is the Belize Barrier Reef, which is the second largest mass of living coral in the world and the largest in the Western Hemisphere. The Belize Barrier Reef Reserve System was included as a World Heritage Site in 1996³⁷. Since coral reefs are home to one quarter of the earth's marine plants and animals, its preservation is very important to protect biodiversity in the world. Belize's tourism is also attracted to cayes, national parks and wildlife sanctuaries.

There are seven protected areas within the Belize Barrier Reef Reserve System: Bacalar Chico National Park and Marine Reserve; Glovers Reef Marine Reserve; South Water Caye Marine Reserve; Sapodilla Cayes Marine Reserve; Half Moon Caye Natural Monument; Blue Hole Natural Monument and Laughing Bird Caye National Park. The efforts to preserve its natural resources were recognized through several awards (Environmental Conservation Award by the Belize Tourism Board in 2001 and the James Waight Award in 2002).

An effort to protect coral reefs in this part of the Caribbean has also been done by members of Belize's cruise tourism industry. A Declaration of Commitment was signed in 2008, by government, private sector, civil society (NGOs) and the cruise lines. Its purpose was to engage in sustainable cruise tourism practices, such as protecting coral reefs. This was done within the framework of Conservation International's (CI) Mesoamerican Reef Tourism Initiative (MARTI).³⁸

Notwithstanding the various efforts to protect barrier reefs, those close to Belize City and near Placencia, in southern Belize were in peril.

³⁶ Respondents included hotels, guesthouses, restaurants, bars and tour operators.

³⁷ On line [<http://www.belizetourism.org/content/view/247/294/>].

³⁸ Global travel Industry News, on line [<http://www.eturbonews.com/2476/new-agreement-works-balance-belizes-cruise-sh>], may 12th, 2008.

IV. Adaptation and regulatory framework that directly or indirectly favor the tourism sector³⁹

Important studies on climate change, such as the Stern Report (2006), suggest adaptation policies are very useful to take into account for tourist activity. Such Report points out that government will have to play an essential role in leading adaptation policies in several areas. Among these is the need for governments to design long term policies for public goods that are vulnerable to climate change, including natural resources and coastal zones protection. In this section we will look firstly at the existing legislation and regulations that are related to climate change directly or indirectly (through environment protection regulations), as well as some economic instruments that can also help promote adaptation to and mitigation of climate change; secondly, the cooperation among countries to face climate change effects in the region will be looked into, since this aspect may be considered essential for the successful climate change policy in each country and the region as a whole; finally, a specific analysis of adaptation to climate change impacts of tourism sector in coastal areas will be developed.

³⁹ In this study the numerous climate change projects that are being developed in the region linked with renewable energy and energy saving areas will not be looked into. Neither will Clean Development Mechanisms be taken into consideration, since they have not focused on curbing tourism emissions.

A. Institutional and regulatory framework linked with climate change

Legislation has only recently started to take into account climate change, its causes and effects. As seen in Table 13 much of the concern of governments has been geared toward the environment and not toward climate change impacts.

Consciousness of climate change effects on Central American economic and social spheres is growing and it appears as an important issue in some of the National Development Plans (NDP), as is the case with the Costa Rican NDP (2006-2010). Nevertheless, it is also noticeable that in most tourism plans (even sustainable tourism plans) no mention is made of climate change. In this section, we consider laws and rules on environment protection and climate change which directly or indirectly relate to tourism. In fact, the regulatory framework concerning tourism is a powerful tool for adaptation and mitigation since it may determine many of the rules the tourist sector needs to follow so as to survive climate change impacts (location, construction, etc.).

One of the weakest regulatory aspects faced by Central American countries —hindering the control of activities that can worsen climate change effects and obstruct adaptation to these effects— is the lack or adequate land use regulations (“ordenamiento territorial”). However, there have been efforts made to improve these regulations. The enormous damages caused by hurricane Mitch in Honduras, for example, made it clear that floods, land slides, and other phenomena that took many human lives could have been avoided if better urban planning, human settlement rules, natural resources handling had been in place. At present, all countries have a land use (“ordenamiento territorial”) national program or law, except Guatemala, which is in the process of developing it. They greatly differ and some have problems to integrate the local ordinances at a national level, but these new rules will undoubtedly help. Notwithstanding, climate change problems will probably require a new revision of these regulations so that adaptation to new circumstances is allowed for.

As has been seen throughout this paper, the deforestation process that has resulted from changing patterns of soil use in most Central American nations is an element that may accelerate the negative impact of climate change in the region (see Table 12). Most countries in Central America have a forest vocation, but large zones have been deforested making them more vulnerable to extreme weather events which often turn into natural disasters.

Climate change poses special challenges for tourist activities. If tourism infrastructure does not respect land use rules (supposing these are adequate) it can destroy natural defenses against storms and hurricanes, erode beach sites, accelerate biodiversity loss, among other problems.

Notwithstanding the relevance of sustainability, not only for tourism but also for many other economic activities, a wide range of interests may interfere with this aim. An example is the Nicaraguan coasts laws, one of the latest of this kind to be approved in the region. It took about five years to be approved in Congress (and finally passed in June 2009). The National Tourism Chamber (CANATUR) opposed it because the law proposal determined a construction prohibition on the first 50 m —with free access for the general public— along the coast starting from the limit set by the high tide, while the private sector wanted that land strip to be 30 m. The law proposal also established the following 250 m as an area of construction subject to restrictions. For lakes, though, only the first 5 m from the coast would be of public property and public access, hence buildings could be raised much closer to the water. At the end, the proposal of the government was approved with the difference of keeping 200 m as an area of construction subject to restrictions instead of the 250 m originally proposed. Whether this final version of the law will endanger buildings in this area as a result of climate change effects is still to be seen.

This kind of situations demonstrates the importance of making an effort to raise society’s consciousness on Climate Change effects and what is at stake as a result of it. There is a need for countries to arrive to a social consensus on the need to count with a useful set of rules to protect everyone from this phenomenon.

As can be seen in Table 13 all countries have an institution in charge of tourism, which has a high status in the government structure (even at a ministry level in several of them). All countries have tourism programs and a component of sustainability is usually important in them. Nevertheless, most of them do not consider the climate change phenomenon. There is, however, a climate change policy in all countries, which can be wide in scope (Costa Rica) or relatively modest. There are many more environment, forest and coastal laws, which intend to avoid deforestation, preserve biodiversity, protect coastal zones from erosion and destruction, create and protect national parks, develop the legal instruments to persecute environmental delinquency, etc. These are all very useful for countries to adapt to and mitigate climate change effects but probably require to be reviewed in the light of the strong impact expected from such phenomenon.

Another point in question is the capacity of governments to implement rules and laws. A frequent problem is, for example, that although the countries under study have taken an important responsibility regarding the creation of National Parks, they often lack the human and financial resources to protect them from illegal logging and other transgressions. Probably, Costa Rica and Belize are the most successful nations in protecting their national parks, but as deforestation information shows (Table 12), control over forests by authorities is quite weak in most of the Isthmus.

TABLE 13
LEGAL AND INSTITUTIONAL FRAMEWORK
TOURISM AND CLIMATE CHANGE

Country	Tourism Entity	Sustainable Tourist Program	Climate Change Policy	Environmental and coastal zone Laws	Private Sector participation in tourism and Climate Change
Belize	Belize Tourism Board	Belize Sustainable Tourism Program, (2008)		Environmental Protection Act, (2000) Wildlife Protection Act (2000) Coastal zone management act Chapter 329 (2000) Subsidiary Coastal zone management act Chapter 329 (2003) The National Integrated Coastal Zone Management Strategy for Belize National Biodiversity Strategy,(1997)	
Costa Rica	Costa Rican Institute of Tourism (Ministry status)	General Plan of Sustainable Tourist Development 2002-2012	National Strategy for Climate Change (voluntary) (included in the program Peace with Nature) Environmental Guide for Construction (2008) Program to become a Carbon-Neutral Nation by 2021	Environment Organic Law (1995) Maritime and Land Zone Law and its Regulations (1972) Wild Life Conservation Law (1992) Forest Law (1996) Biodiversity Law (1998)	Climate Change Plan for Tourism (Costa Rican Institute of Tourism)
El Salvador	Tourism Ministry of El Salvador	National Tourism Plan 2014 National Tourism Plan 2020 (presented on December, 2008)	Climate Change Municipal Policy for San Salvador (2009)	Environmental Law (1998) Protected Natural Areas Law (2005) Wild Life Conservation Law (1994) Forest Law (2002)	

(continued)

Table 13 (Concluded)

Country	Tourism Entity	Sustainable Tourist Program	Climate Change Policy	Environmental and coastal zone Laws	Private Sector participation in tourism and Climate Change
Guatemala	Tourism Institute of Guatemala	Policy for Tourist Activities in Protected Areas National Policy for Ecotourism in Guatemala	Climate Change National Program (Environment and Natural Resources Ministry) (2003) Climate Change National Policy (not approved yet at the beginning of 2010)	Law for the Protection and improvement of the Environment (1986) Protected Areas Law (1989) Forest Law (1996) Regulatory Law of Areas of Territorial Reserves (1997) Environment Management Framework (2003)	National Policy for Sustainable Tourism Development in Guatemala 2004-2014 (Guatemalan Tourism Chamber) Recommendations and Action Plan to Integrate Biodiversity Conservation to Tourism Policies of Guatemala (Critical Ecosystem Partnership Fund, Counterpart and Balam Association) Green Alliance
Honduras	Tourism Secretary of Honduras Honduran Institute for Tourism	National Strategy for Sustainable Tourism National Program for Sustainable Tourism	National Program for Climate Change	General Environmental Law (1993) Incentives for Forest Development, Reforestation, and Forest Protection Law (1993) Law for Rural Sustainable Development (2000) Declaration of National Parks (1987)	
Nicaragua	Nicaraguan Institute of Tourism	Strategy and Action Plan for traditional tourism and ecotourism in protected areas	National Commission for Climate Change (Norm 014-99)	General Environmental Law and Natural Resources (2006, reformed 2008) Conservation, promotion and Sustainable Development of the Forest Sector (2003) Special Law on transgressions against the environment (2005) National Environmental Policy and its Action Plan	
Panama	Tourism Authority of Panama (Ministry)	Master Plan for Sustainable Tourism Development 2007-2020	National Policy on Climate Change (2007) Creation of The National Committee of Climate Change (2009)	General Environmental Law and creation of the National Environmental Authority (1998) Forest Law (1994) Law on Wild Life Conservation (1995)	Panama Association for Sustainable Tourism

Source: Own elaboration with official information.

Getting the tourism activity prepared for climate change and reducing its own contribution to global warming requires a new strategy by policymakers. Construction regulations must be defined in a different way, land use must be determined much more carefully, reforestation has to be carried out with new criteria, and the same is true for the use of fertilizers, water shed protection, etc. Hence it is essential that coastal zones be managed in an integrated way (UNEP and Ecology and Energy Ministry of France, 2009). This is particularly important for the Central American region, since its economic activities in coasts are very important to them—tourism included—and at the same time very vulnerable to climate change impacts.

In addition to the policies and institutions shown in Table 13, there are several economic or other kind of instruments that have helped the tourist activity to become more environmentally friendly and could help to combat climate change effects. Among these are a number of incentive schemes, such as: (i) recognition of environmental good practices: includes certification of environmental protection practices (though it has a cost it may have the compensation of creating a new niche for tourist markets such as hotels, clean airline trips, etc.); (ii) technical regulations which forces tourist agents to comply with environmentally adequate regulations: environmental impact study of tourism project, public and private coastal and maritime property limits definition, environmental Construction Guidelines (in Costa Rica only); (iii) promotion of new ecological markets: organic, biotrade, natural cosmetics, etc; (iv) international instruments that may render environmental or climate change measures profitable, i.e. ,rewards for environmental service: such as Certificates of Emissions Reductions (CERs), tax breaks, transfers or other monetary benefits (particularly linked with forest protection and reforestation); and (v) United Nations Collaborative Program on Reducing Emissions from Deforestation and Forest Degradation (UN-REDD)⁴⁰ which will economically reward the protection of forests. This program may help curb deforestation, greenhouse emissions and maintain attractive environments for tourism in the region. This instrument would start operating after 2012 when the Kyoto Protocol is substituted by other agreements.

A useful experience to take into account is that of Costa Rica, through the National Fund for Forest Financing (FONAFIFO)⁴¹. This is an institution which has been quite successful in promoting forest protection and reforestation. This organization finances small and medium size producers through loans, or other financial resources, to help them manage their forests, to carry out reforestation, create forest greenhouses, develop agro forestry systems, recover depleted areas, and acquire new technology for the productive use of forest resource. It also provides payments for various services provided by the forest, helping producers to protect forests. FONAFIFO was able to expand 404,313 hectares of forest between 1997 y 2004, and more than 7.000 families were benefited from it. Public funds for this program were insufficient to finance entirely this ambitious program, so the Environmental Services Certificate (ESC) was created. These Certificates are meant to attract funds from enterprises and institutions that benefit from the environmental services. Tourist enterprises or firms linked to this activity have made investments in the forest activity and have received the mentioned above certificate⁴². Unfortunately, certificates do not benefit mangrove preservation because these are state owned territory so they are not subject to these stimuli. Some small tourist enterprises, which run eco-tourism sites may combine forest protection, funded by FONAFIFO, and tourism activity.

B. Climate change adaptation measures for coastal resources

We have seen up to now, that most of the leisure tourism sites in Central America (see Map 1 again) are located on the seaside, although there are a few very important sites inland too. Although many of the climate change impacts, such as extreme weather events, temperature rises and other phenomena linked

⁴⁰ The IPCC estimates that the cutting down of forests contributes with 20% of the overall greenhouse gases emissions. Forest degradation also makes a significant contribution to emissions from forest ecosystems.

⁴¹ FONAFIFO, on line [<http://www.fonafifo.com/>].

⁴² Among these are Reserva Conchal, Horizontes, Nature Tours, Costa Rica, Mapache Rent a Car, Pax Natura airlines, Los Sueños Marriot Hotel, Adobe Rent a Car.

to global warming will not be possible to avoid, countries may be more or less vulnerable to such events depending on the adaptation measures they undertake.

All countries under study have plans to expand considerably their tourism industry. There is an enormous potential for increasing sun-sea-sand tourism as well as nature oriented and other kinds of tourism in the Isthmus. But, there are many incompatibilities between these plans and the multiple uses that are being given to coastal resources. By developing tourism in areas that will come under stress, risk of failure of this activity is high because of competing resources demand. The Integrated Coastal Zone Management (ICZM) principles could be very useful for the Central American region. These consider management and planning essential for (i) water, which is a major integrating force in the coastal resources system; (ii) the edge of the sea, which is considered the focal point of coastal management with multiple sector involvement, is seen as crucial for the sustainable use of coastal resources (UNEP and Ecology and Energy Ministry of France, 2009).

Measures to reduce climate change impact on tourism are essential and need immediate action as well as planning ahead. A very good example of adaptation measures for tourism in coastal areas can be observed in Figure 1 (taken from USAID, National Oceanic and Atmospheric Administration—NOAA—and Coastal Resources Center, 2009), which shows adaptation to climate change by tourism in coastal areas.

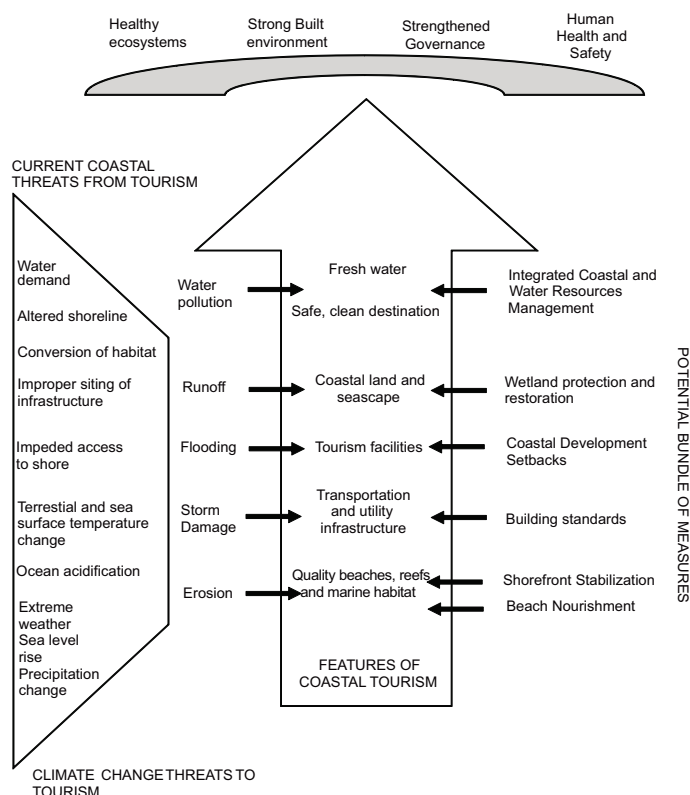
The center column of Figure 1 shows the desirable conditions in the coastal areas that are needed for successful tourism investment. The threats to these vital features of coastal tourism are shown on the left side of the figure. Some of these are generated by unsustainable tourism development itself (water demand; altered shoreline; conversion of habitat; improper siting of infrastructure, impeded access to shore) and others are caused by climate change impacts (terrestrial and surface temperature change, ocean acidification, extreme weather, sea level rise, precipitation change).

These tourism and climate change threats translate into water pollution, runoffs, floodings, storm and hurricane damage and erosion, all of which become an obstacle for tourism investment and activity.

The following question is: what sort of adaptive measures can be taken to avoid such damage to tourist activity? Several policies should be undertaken to at least minimize the former impacts: integrated coastal and water resources management; wetland protection and restoration; coastal development setbacks; establish adequate construction standards; shorefront stabilization; beach nourishment.

The World Tourism Organization (WTO, 2003) also considers adaptation measures for maritime and coast sites, some new and some already mentioned above: construction of contention barriers in the sea and bulwarks to protect the coasts; preserve and reconstruct natural defenses (such as wetlands in the coastal areas); construct tourist infrastructure further away from the coast, restore the beaches with sand brought from elsewhere (though this is a polemic issue, as discussed below); avoid use of sand as a construction material. Other measures that could help the tourist industry adapt to climate change, according to this organization, are: substitution of some of the traditional attractions for tourists for others (especially during bad weather or high heat seasons) and cooperation between private and public sector, which is essential in their view to take joint action when health problems, water shortages and infrastructure vulnerability arise.

FIGURE 1
ADAPTATION TO CLIMATE CHANGE IN COASTS
 DESIRED COASTAL OUTCOMES



Source: Adapting to Coastal Climate Change, a Guidebook for Development Planners USAID, NOAA and Coastal Resources Center (2009).

There is an important debate regarding the “refill” of beaches with sand brought from other places. This method, which has already been used for Cancun, is washed away once and again by weather events and sea currents, requiring the repetition of the sand replenishment. This is not only economically costly, but environmentally destructive. Artificial protective coral reef could be developed in front of those places in the Mexican Gulf where the great Mesoamerican Reef—which extends from Contoy Island in Mexico to Honduras—is interrupted (this is the case for Cancun and Playa del Carmen in Mexico as well as for the Guatemalan Caribbean coast). The deterioration of reefs in these areas have been the result of sediments and polluted elements disposed in the sea.

For the Mexican case, the National Commission of Natural Protected Areas (CONANP, by its Spanish initials), has introduced 162 artificial ball reefs near West Coast of the National Park of Isla Mujeres, Punta Cancún-Punta Nizuc⁴³. But a much larger scale effort and the introduction of more complex reef artificial structures would be needed to ensure effectiveness.

Many of the adaptive measures mentioned up to now stem from public policies and these directly and indirectly guide and limit the private sector activities so as to protect the tourist sites so that they can face climate change with the least possible damage. Nevertheless the private sector will have to take additional step to protect its patrimony and to rebuild it if destroyed. Hence, insurances against extreme weather events seem very important in this sense.

⁴³ Turista Quintana Roo, on line [<http://quintanaroo.turista.com.mx/article605.html>].

C. Central american regional cooperation and climate change

Cooperation among countries to strengthen their capacity to face climate change effects is essential, especially because there are many shared resources that need to be protected and the impacts of climate change will also hit many areas simultaneously, so that joining efforts may help considerably. This cooperation must be carried out both for creating and sharing information, as well as for concrete action.

Central America has a quite solid experience in environmental cooperation, mostly carried out through the Comisión Centroamericana de Ambiente y Desarrollo (CCAD), which belongs to the Sistema de Integración de Centroamérica (SICA). The CCAD is formed by the Ministers of the Environment of the region and an Executive Secretary that implements their decisions or agreements. A Strategy for Climate Change in Central America has been agreed in the region. Its basic Principles are: (i) to have a shared but differentiated responsibility at a national and an international level; (ii) Environmental justice and compensation for the ecological debt; (iii) respond to the natural rights of the people of the region; (iv) national and regional scope; (v) contribute to reach the Millennium Goals; (vi) transversality and intersectoral aim of policies; (vii) coherence between policies and governability; (viii) solidarity, equality and social justice. Actions are to be carried out in five different fields: (a) vulnerability and adaptation; (b) mitigation; (c) institutional development and capacity building; (d) education and other ways of helping develop public sensibility to the issue of climate change; and (e) search for international support for these efforts (ECLAC and DFID, 2009).

Counting on reliable information on climate events and having the necessary plans and instruments to face risky situations is very important for tourism in Central America, given its vulnerability to extreme weather events. In addition, undertaking some preventive measures jointly, given their small size and their proximity seems essential.

Central America already has regional entities that are of great help to share information and adopt joint measures *vis à vis* climate change effects. The Coordination Center to Prevent Natural Disasters in Central America (CEPREDENAC) which, as CCAD, is part of SICA, is very relevant in this sense. Plans, such as the Environmental Plan for Central America (PACA), are also very valuable instruments to achieve cooperation regarding climate change (ECLAC and DFID, 2009).

There is an interactive system that has been set up to facilitate consulting on prevention of natural disasters and provide support to the areas that may be facing emergencies in the region. Visualization and Monitoring Regional System (SERVIR, by its Spanish acronym) set up by the Humid Tropic Water Center for Latin America (CATHALAC), with the help of the United States Agency for International Development (USAID) and National Aeronautics and Space Administration (NASA) since June 2009, will be very helpful for tourism activity in the Isthmus and southern Mexico. It will prevent tourist exposure to these dangerous situations and protect infrastructure.

The Central American tourist sector will be able to take advantage of the Earth Observation System also, which will make decisions by tourists easier regarding their destinations within the region. This new information system, backed by Central American Tourism Integration Secretariat (SITCA) and CATHALAC will help reach the targets set by the “Strategic Plan for Sustainable Tourist Development 2009-2013”. This information and interactive maps mechanism will help evaluate the available tourist assets, their location and potential of development.

Cooperation among Central American and the Caribbean countries is also essential to monitor coral reef evolution and protection, as well as sea water temperature and level. An example of this cooperation, which is already taking place is the Network of the Caribbean: Planning for Adaptation to Global Climate Change (CPACC) for the measurements of sea level rise and sea surface temperature and the Central American Network for Climate Change (RONMAC). CPACC has a Web site which provides links to other relevant global information sources on climate change. This network operates with stations in Central America and the Caribbean and is being made part of the Global Ocean Observation System (GLOOS) (Vergara, 2005).

BOX 1 INTEGRATED MANAGEMENT OF MARITIME AND COASTAL RESOURCES IN PANAMA CITY

Panama is probably one of the countries of the region that has made one of the most important efforts to handle its maritime and coastal resources in an integrated way. The National Committee of Climate Change (CONACCP) is integrated by 17 institutions, among them the Canal Authority, and is in charge of developing tasks linked to adaptation and mitigation of climate change. The actions that will be taken by this committee include reforestation, watershed protection, maritime and land ecosystems protection, monitoring of forest cover and carbon capture as an environmental service.

Nevertheless, it is worthwhile looking at measures that have not even been labeled as adaptation policies for climate change but are very useful for that purpose. In this sense, an intra sectoral governmental effort in Panama, that would be a typical adaptation measure (and probably will need to be taken by many countries), is the sanitary effort undertaken for the improvement of the water and sewage system for Panama City to stop sea and inland water contamination.

The increasing transit of boats through the Panama Canal, population growth, the extraordinary construction expansion in the city have meant an increase in water demand and increased dumping of sewage water in the sea. It has been estimated that annually 40 million tons of residual water, equivalent to 1.300 liters per second has been discharged without prior treatment into the Panama Bay (BID, OMT, PNUD, Trade & Leisure, Instituto Panameño del Turismo; Análisis Diagnóstico General del Turismo en Panamá; Plan Maestro de Turismo Sostenible de Panamá 2007-2020, Mayo 2008, Madrid on line, http://www.atp.gob.pa/documentos/Analisis_Diagnostico_General_del_Turismo_en_Panama.pdf).

To face this situation new guidelines were established, therefore new construction developers have to construct their own sewage networks and purification systems of used water before being discharged. To solve the pre existent problem of water and sewage system, a Master Plan to Sanitize the Panama Bay^a, which covers about 350 square kilometers, five rivers and 65 dependent watersheds, has been designed. This project has additional environmental and mitigating advantages such as energy plant that will provide the necessary power to collect the city's residual waters. The feasibility study was done in 1998 and the project as such took off at the beginning of the present decade. By mid 2009 30% of the Plan had been accomplished and is estimated to be finished by the middle of the next decade (EFE, 03/06/2009; http://www.soitu.es/soitu/2009/06/03/info/1243993750_347844.html).

Several national and international institutions, as well as some other countries have participated in it. For example, in 2007, the Panama government signed with the Japanese government, through the Japanese International Cooperation Bank (JBIC), a loan contract to help finance the Sanitation Project of Panama City and Bay.

It is important to point out that in this enormous project many new rules and a close cooperation among different public sector dependencies has taken place. For example, the Authority for the Environment (ANAM) determined the maximum recycled water that can be discharged without polluting the flows of natural water. Another institution that has an important role in this Master Plan is the Institute of National Aqueduct and Sewage (IDAAN). There is also Master Plan to Sanitize the Colon Bay, which is a very tourist area. Its aim is very similar to that described for the Panama Bay.

^a Most of the information of this box was taken from the Proyecto para el Saneamiento de la Ciudad y Bahía de Panamá, on line [<http://www.minsa.gob.pa/minsa2004/saneamiento/proyecto.htm>].

Also, under the Mesoamerican Barrier Reef System (MBRS) Project and the Coral Reef Targeted Research and Capacity Building for Management Project (supported by Global Environment Facility-GEF), there are working groups whose activities relate to climate change (Vergara, 2005).

There is a regional mechanism for tourist security, as well. It relies on the support of embassies and can help foreigners return to their countries in case of extreme events. This is already working in El Salvador.

Some actions that are being taken at a national, bilateral or regional level, although not meant as measures to face Climate Change effects, but rather as ways to reach sustainable development and protection of natural resources, could be seen as measures to adapt to climate change too. Panama provides a good example at a national level with its Integrated Management of Maritime and Coastal Resources Project in Panama City (see Box 1).

The biological corridor in Central America, which is part of the Mesoamerican biological corridor, is an example of regional coordination and cooperation. According to this agreement, seven governments have agreed to coordinate their efforts to create a system to interconnect parks, reserves and wildlife corridors which link this whole region and allow its fauna to survive in better conditions.

The “Mangrove Corridor” in the Fonseca Gulf (“Corredor del Mangle”) is another good example of joint efforts to protect and restore mangrove in this important area. This initiative, which is backed by the Spanish international cooperation and is being coordinated by CCAD, will complement the

Trinational Project on the Integrated Management of the Fonseca Gulf Ecosystems (financed by Inter-American Development Bank and GEF). The latter intends to prevent degradation of such gulf and preserve the integrity of its ecosystem. This requires an integrated approach to preserve marine and land resources and its sustainable use. For this purpose this project intends to strengthen the required institutional framework and help capacity building in this area among other aims.

A project to safeguard the Lempa river basin, financed by USAID and other United States institutions as well as international organizations is worthwhile mentioning too as an example of good practices in adapting to the climate change phenomena. It specifically has the purpose of improving the regional capacity to mitigate the effects of natural disasters. This is a three country project for the sustainable management of the shared Lempa River watershed (Guatemala, Honduras and El Salvador). The expected outcomes of this project are:

(i) The establishment of an institutional framework for the sustainable tri-national water management and signature of tri-national agreements for the management of shared watersheds (between governmental entities and or private sector);

(ii) Institutional arrangements for an effective water management, for which a shared data network among the three countries on the institutional management of the basin will be designed. The purpose of the network is for the exchange of information among institutions on watershed management and systematic disaster mitigation. Inter-institutional agreements would be signed for the systematic exchange of information;

(iii) Development of a plan for the sustainable management of the Lempa watershed, and to mitigate disasters. To accomplish these tasks the following would be needed: Preparation of a basin sustainable management plan, as a bases for the signing of tri-national agreements and preparation of response plans in face of disasters, at the municipal level, based on the risk analysis of selected communities;

(iv) Establishment of a data system and procedures for decision making; development of a data base; generation of critical information and computerized models for watershed management and disaster mitigation; design of a monitoring system and procedures for basin management and disaster mitigation; development of a Geographic Information System (GIS) to manage the basin; Installation of automated meteorological stations, with telemetric connections and the establishment of a forecast center, management of a hydrological model and the purchase of equipment to process data (First National Communication).

As we have seen, there is considerable evidence that reveals some of the major threats that Central America is exposed to as a result of climate change. There is a deep concern among scientist about the impact that climate changes may have on the environment, particularly to some fragile ecosystems. Policy makers in the region have started to realize the potential damage that climate change may have on their countries. Further regulation will be needed to promptly address the challenges that the region will have in the short and long term, being adaptation a priority for Central America. There is also a need to cooperate between countries since many of the threats posed by climate change do not respect national borders.

V. Tourism determinants in central american countries

A. Introduction

This section has the purpose of investigating the main determinants of tourism demand in the Central American countries. Literature on tourism demand modeling has focused disproportionately on developed countries and little has been done on developing countries. This trend, according to Song, Witt and Li (2009), is not unusual since developed countries account for the largest global tourism flows. This part of the study is intended to contribute to reduce this analytical gap by developing an insight on the determinants of tourism demand in Central America. It includes possible effects of extreme events and other external shocks on arrivals of international tourists to a specific country, so that some of the impact that climate change may already have had on this activity is taken into account. For this purpose, we estimate a tourism demand model for six Central American countries, namely Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama⁴⁴.

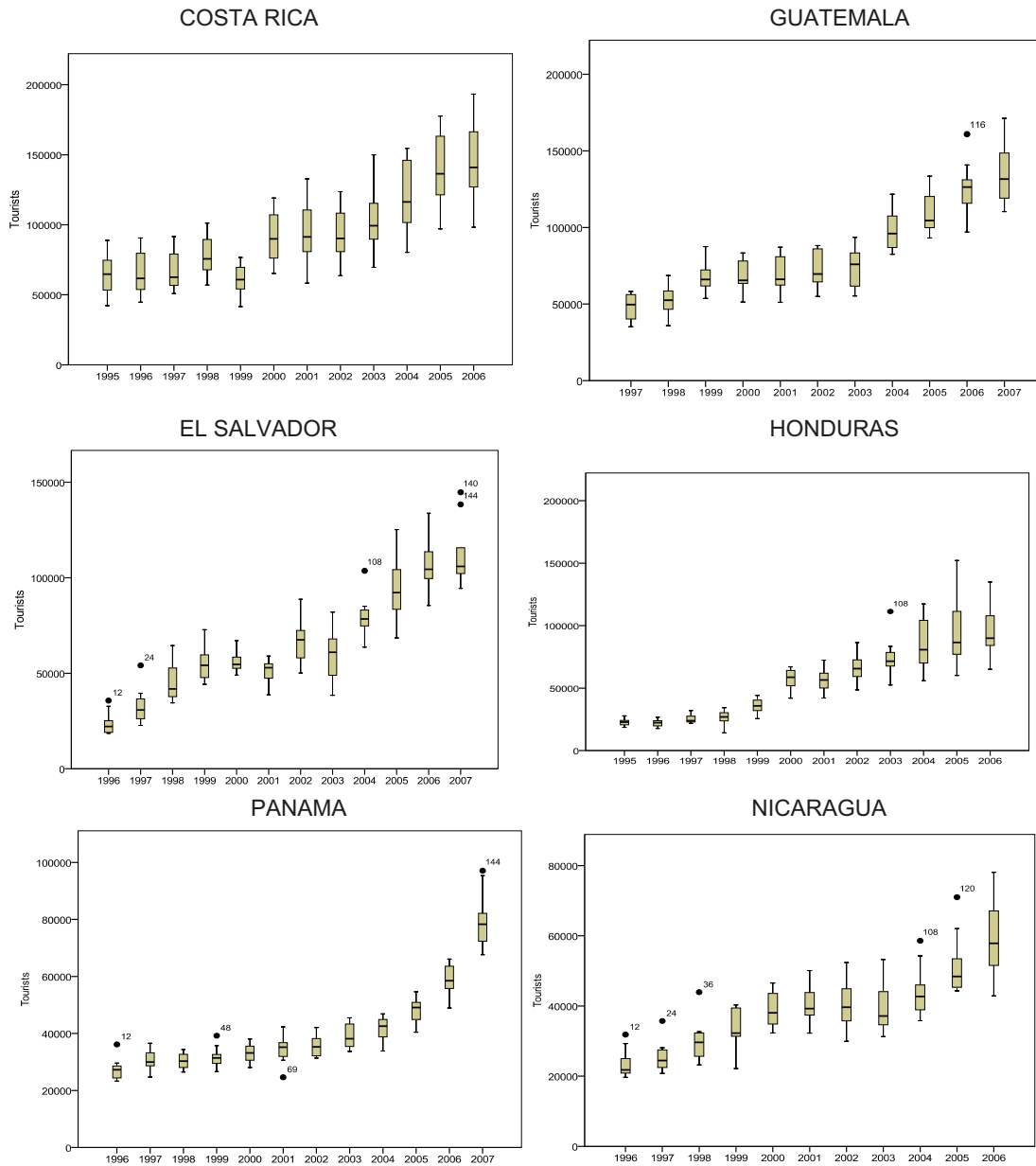
B. Statistical and descriptive analysis

⁴⁴ Belize was not included in this part of the study because lack of specific information.

It is common practice among econometricians to carry out a simple descriptive analysis of the data in order to allow the data to “speak”, hence

helping to understand its characteristics and behavior over time. Accordingly, this section is devoted to analyze the statistical properties of the dependent variable in our model, arrivals of international tourists, for each of the six countries.

GRAPH 2
CENTRAL AMERICA: BOX PLOTS OF THE SAMPLE OF COUNTRIES INCLUDED IN THE STUDY, 1995-2006



Source: Authors' own elaboration based on data from the Tourism Ministry of each country.

The evolution of the international tourists' arrivals is depicted in graph 2 in the form of box plot⁴⁵. The latter show that the tourist activity has expanded significantly in all countries in the period 1995-2006⁴⁶. In several nations, but especially in Costa Rica and Honduras, the dispersion of the data tends to increase after 2003, that is, the boxes become larger, indicating that there is higher data variability. This coincides, as will be seen in Graph 3, with the fact that tourist visits become more seasonal, primarily according to vacation periods.

Analyzing impact of shocks, such as hurricanes and September 11th attack on New York Twin Towers, these graphs show that their effects on tourism were limited. Only Costa Rica (1999) and Honduras (1998) seem to have experienced a fall in the tourist flow as a result of Hurricane Mitch which occurred in October-November, 1998. El Salvador⁴⁷ and Honduras, (the latter to a lesser extent), experienced a contraction of tourism as a result of the September 11th, 2001 events. Other countries, such as Panama had a decrease in the flow of tourists coming from the United States in 2001 but in the aggregate this was compensated by visitors coming from other countries.

In Guatemala the number of visitors did not fall in the years following Hurricane Mitch, in fact arrivals to this country increased 29.3% in 1999. However, during the period 2000-2003 tourist arrivals barely increased. Part of this low growth can be explained for the period following September 9/11 and the economic slowdown that ensued. Nicaragua had a relatively sluggish tourist activity between 2000 and 2003 too. All these facts mentioned on the previous paragraph and on this one can also be clearly seen on Graph 3.

Tourism is subject to pronounced seasonality and this can be appreciated in Graph 3, where we employ monthly series (each dot on the monthly curve corresponds to the number of tourists arriving that month in that year to the country, see footnote 45). Although all countries under study show such seasonality, for Costa Rica, Honduras and Nicaragua, this behavior is more pronounced than for the rest of the nations. The latter probably indicates that these countries' tourism concentrates in certain activities that attract tourists mainly in certain months of the year. Costa Rica's tourism appeals mostly to leisure tourists (sea-sun-sand, ecotourism, adventure, etc.), while other countries have a wider range of activities that generates a somewhat more homogeneous flow of visitors throughout the year. This is the case of Panama that has regional activities related to commerce and business events. It also has the Copa airline hub, which connects the country easily with other international destinations. El Salvador has at least two characteristics that make its tourism more evenly distributed throughout the year: its important migrant population in the United States that pay visits to their relatives and its Taca airline hub in San Salvador, which makes it easy to organize international or regional conferences there. In fact, when seasonality plot (not shown) for El Salvador's intra-Central American tourism—quite important for this country—is looked into, the monthly differences become milder than that including all tourism.

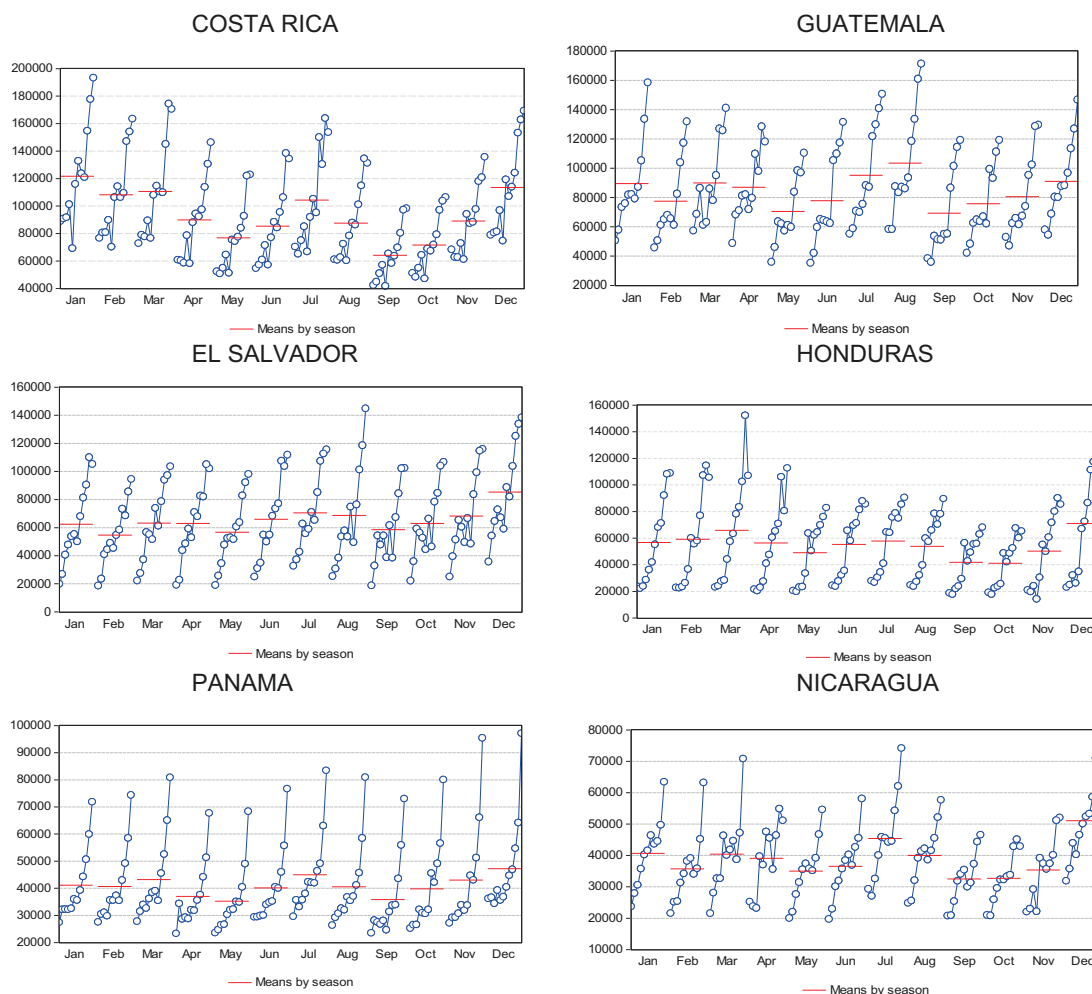
However, the peak of tourist visits in each country is apparently determined by the flow of leisure visitors. Most of the tourists going to Costa Rica, for example, come from North America and Europe, and their visits more or less coincide with the cold months in North Hemisphere (December to February), and vacations, i.e., mostly March and July. This pattern repeats in most countries (see Graph 3).

⁴⁵ A box plot is a convenient way of graphically depicting groups of numerical data through their five-number summaries (the smallest observation, lower quartile (Q1), median (Q2), upper quartile (Q3), and largest observation). A box plot may also indicate which observations, if any, might be considered outliers. Box plots can be useful for displaying differences between populations without making any assumptions about the underlying statistical distribution. The spacing between the different parts of the box indicates the degree of dispersion (spread) and skewness in the data, and identifies outliers. For this particular case, each observation comprehends data for the 12 months of every year depicted in the box plot.

⁴⁶ Because of information problems, the period covered for each country is not identical. It covers at least eleven years between 1995 and 2007.

⁴⁷ Another fall in tourism in El Salvador occurred in 2003, but this is probably associated with methodological changes in data collection undertaken by the Ministry of Tourism, since no other external shock was suffered by El Salvador at that time.

GRAPH 3
CENTRAL AMERICA: SEASONALITY PLOTS OF OUR SAMPLE OF COUNTRIES⁴⁸



Source: Authors' own elaboration based on data from the Tourism Ministry of each country.

C. Econometric model

In this section we estimate simple models based on time series econometric techniques for six Central American countries. The main objective of the modeling is to find the main determinants of international tourist arrivals together with the estimation of the effects of natural disasters (presumably due to climate change) and other external shocks on tourism demand. For most of the countries the sample covers monthly data of at least eleven years.

It is well known that tourism data at higher frequencies is subject to seasonality, already described. It is very common, for example, that vacations take place in December and January, March or April, and July and/or August, as mentioned before. Most of the studies analyzing tourism demand and the impact of natural disasters⁴⁹ do not use data at higher frequencies (monthly or quarterly data) due to

⁴⁸ Each dot on each month's curve represents the number of tourist that arrived during that month in a specific year. Nevertheless, not all countries cover the same period because of information restrictions. The years included by each country are: Costa Rica: 1995-2006; Guatemala: 1997-2007; El Salvador: 1996-2007; Honduras: 1995-2006; Panama: 1996-2007; and Nicaragua: 1996-2006.

⁴⁹ See Scott, Jones and McBoyle (2006); Song, Witt and Li (2009).

the difficulty in finding information for explanatory variables. However, in our estimation we use monthly data so that we could have more observations and therefore more degrees of freedom. Moreover, following suggestions by Enders (2003), McKinnon and Davidson (1993), as well as Johnston and DiNardo (1996), among others, we did not remove the seasonal pattern from our data. In fact, the seasonal pattern was modeled in our econometric estimation through the use of seasonal dummy variables^{50 51}.

The general model to be estimated is the following:

$$tur_{it} = \alpha + \beta_1 tur_{it}(-1) + \beta_2 iaeeu_{it} + \beta_3 iaeca_{it} + \beta_4 rerw_{it} + \gamma_1 Dmitch + \gamma_2 Dsep11 + \delta \sum_{j=1}^{11} Dseas_{jit} + \varepsilon_{it}$$

Where:

tur_{it} = international tourists' arrivals to the country i in time period t

$tur_{it}(-1)$ = international tourists' arrivals lagged one period (one month in this particular case)

$iaeeu$ = United States index of economic activity (the index of industrial production was used)

$iaeca$ = Central America index of economic activity (the monthly index of economic activity was used)

$rerw$ = weighted real exchange rate index (weights used according to the region's participation in tourism arrivals)

$Dmitch$ = Dummy variable for impact of hurricane Mitch of 1998

$Dsep11$ = Dummy variable for impact of the terrorist attack of September 11, 2001

$Dseas$ = Seasonal dummy variables⁵²

For reasons described below, we had to adapt this equation for some of the countries and therefore additional variables were devised:

$iaew$ = weighted index of economic activity in the United States and Central America

d_{out} = Dummy variable which takes into account two outliers that were affecting the normal distribution of the data in the case of Nicaragua.

All the variables included are in logarithmic form, so that the estimated coefficients represent elasticities.

Initially we also included other variables which were thought to be relevant in explaining tourist flows to the region. It is important to mention, first, that not only hurricane Mitch was included, but also Hurricane Cesar and Tropical Storm Stan were considered, but the last two had no apparent effects on tourism. Second, temperatures in each Central American country were included, but these did not contribute in the explanation of tourism visits to the region. Third, rainfall was included as an explanatory variable for all countries but it did not help explain tourism flow in any of the countries.

⁵⁰ This was the preferred method after reviewing other alternatives discussed in Enders (2003), McKinnon and Davidson (1993), as well as Johnston and Dinardo (1996).

⁵¹ We performed seasonal unit root tests on all the variables involved in our estimation for the six countries to check if there was a non-stationary pattern on the part of the seasonal component; we did not find evidence of non-stationarity in this component; however there is evidence of non-stationarity in the non-seasonal pattern, that is, there appears to exist a unit root in most of the variables involved in the estimation, but as the estimated residuals appear to be stationary, we do not think that the estimation results are spurious. Unit root tests results are shown in Table 14.

⁵² Each estimation includes seasonal dummy variables in order to take into account the seasonal pattern of the dependent variable. Thus, in theory twelve dummy variables should have been included, but to avoid the so called dummy variable trap, since a constant was included, we only included eleven dummy variables. To construct, for example, the first dummy we assigned the value of 1 to January and zero for the rest of the months. For the second dummy we assigned the value of 1 to February and zero for the rest of the months, and so on. The final estimations of the six countries include those dummy variables that were statistically significant; in some cases seven or eight seasonal dummy variables were statistically significant, so due to space limitations they were not shown in the table of results (Table 14).

Fourth, energy costs for airlines⁵³ was considered as an independent variable because of its possible influence on a rise of airline tickets, an element which could discourage tourism, but it was left out because it had no apparent impact on tourism behavior.

International tourist arrivals information was obtained from the Tourism Institutes of each country. Variables *rerw* and *iaeca* were constructed from information provided by the Central American Monetary Council (Consejo Monetario Centroamericano); the United States index of economic activity was taken from Economagic.com: Economic Time Series Page⁵⁴.

Note that the variables $tur_{it}(-1)$, $tur_{it}(-2)$, $tur_{it}(-4)$ and $tur_{it}(-11)$, were included to reflect the role of “word of the mouth” recommendation (that is, habit persistence) and/or constraints on supply^{55 56}.

⁵³ The only available variable of this type on a monthly basis was the West Texas Intermediate, which reflects the price of an oil barrel in international markets.

⁵⁴ Economagic.com: Economic Time Series Page, on line [www.economagic.com].

⁵⁵ See Song, Witt and Li (2009) for a deeper explanation of this point.

⁵⁶ Lags used were also the ones that gave the best econometric results.

TABLE 14
ECONOMETRIC MODELING

Dependent variable: tur											
Country/Sample	Variable	Coefficient value	t-statistic								
Costa Rica (1996-2006)											
	constant	-2.101574	-2.464020								
	tur(-1)	0.557287	8.483051								
	tur(-2)	0.139967	2.277858								
	iaeeu	0.673346	2.631245								
	iaeca	0.225023	1.777651								
	rerw	0.349445	2.214204								
	dmitch	-0.083741	-4.124205								
	dout	-0.426298	-7.456571								
<table border="1" style="width: 100%;"> <tr><td>Adjusted R² = 0.978</td></tr> <tr><td>JB = 4.338 (0.114)</td></tr> <tr><td>LM(1) = 0.126</td></tr> <tr><td>LM(12) = 0.06</td></tr> <tr><td>ARCH(12) = 0.780</td></tr> <tr><td>WHITE (nc) = 0.923</td></tr> <tr><td>RESET(1) = 0.546</td></tr> <tr><td>RESET (2) = 0.817</td></tr> </table>				Adjusted R ² = 0.978	JB = 4.338 (0.114)	LM(1) = 0.126	LM(12) = 0.06	ARCH(12) = 0.780	WHITE (nc) = 0.923	RESET(1) = 0.546	RESET (2) = 0.817
Adjusted R ² = 0.978											
JB = 4.338 (0.114)											
LM(1) = 0.126											
LM(12) = 0.06											
ARCH(12) = 0.780											
WHITE (nc) = 0.923											
RESET(1) = 0.546											
RESET (2) = 0.817											
El Salvador (1996-2007)											
	constant	-3.963627	-3.776114								
	tur(-1)	0.574356	8.221836								
	iaeeu	1.140596	2.964549								
	iaeca	0.726466	4.764599								
	dsep11	-0.103762	-2.938138								
<table border="1" style="width: 100%;"> <tr><td>Adjusted R² = 0.949</td></tr> <tr><td>JB = 11.858 (0.002)</td></tr> <tr><td>LM(1) = 0.790</td></tr> <tr><td>LM(12) = 0.969</td></tr> <tr><td>ARCH(12) = 0.920</td></tr> <tr><td>WHITE (nc) = 0.064</td></tr> <tr><td>RESET(1) = 0.423</td></tr> <tr><td>RESET (2) = 0.687</td></tr> </table>				Adjusted R ² = 0.949	JB = 11.858 (0.002)	LM(1) = 0.790	LM(12) = 0.969	ARCH(12) = 0.920	WHITE (nc) = 0.064	RESET(1) = 0.423	RESET (2) = 0.687
Adjusted R ² = 0.949											
JB = 11.858 (0.002)											
LM(1) = 0.790											
LM(12) = 0.969											
ARCH(12) = 0.920											
WHITE (nc) = 0.064											
RESET(1) = 0.423											
RESET (2) = 0.687											
Guatemala (1997-2007)											
	constant	-2.251005	-2.137829								
	tur(-1)	0.372237	6.532017								
	iaeeu	0.72574	1.950424								
	iaeca	1.210782	8.536501								
<table border="1" style="width: 100%;"> <tr><td>Adjusted R² = 0.926</td></tr> <tr><td>JB = 0.343 (0.842)</td></tr> <tr><td>LM(1) = 0.354</td></tr> <tr><td>LM(12) = 0.095</td></tr> <tr><td>ARCH(12) = 0.019</td></tr> <tr><td>WHITE (nc) = 0.001</td></tr> <tr><td>RESET(1) = 0.464</td></tr> <tr><td>RESET (2) = 0.598</td></tr> </table>				Adjusted R ² = 0.926	JB = 0.343 (0.842)	LM(1) = 0.354	LM(12) = 0.095	ARCH(12) = 0.019	WHITE (nc) = 0.001	RESET(1) = 0.464	RESET (2) = 0.598
Adjusted R ² = 0.926											
JB = 0.343 (0.842)											
LM(1) = 0.354											
LM(12) = 0.095											
ARCH(12) = 0.019											
WHITE (nc) = 0.001											
RESET(1) = 0.464											
RESET (2) = 0.598											

(continued)

TABLE 14 (Concluded)

Dependent variable: tur											
Country/Sample	Variable	Coefficient value	t-statistic								
Honduras (1996-2006)											
	constant	-1.676643	-5.741574								
	tur(-1)	0.326815	4.256818								
	tur(-11)	0.2021473	4.348994								
	iaew	1.521116	6.664335								
	dmitch	-0.415863	-2.046998								
	dsep11	-0.042878	-2.142996								
<table border="1"> <tr><td>Adjusted R² = 0.957</td></tr> <tr><td>JB = 20.171 (0.000)</td></tr> <tr><td>LM(1) = 0.204</td></tr> <tr><td>LM(12) = 0.068</td></tr> <tr><td>ARCH(12) = 0.812</td></tr> <tr><td>WHITE (nc) = 0.012</td></tr> <tr><td>RESET(1) = 0.181</td></tr> <tr><td>RESET (2) = 0.399</td></tr> </table>				Adjusted R ² = 0.957	JB = 20.171 (0.000)	LM(1) = 0.204	LM(12) = 0.068	ARCH(12) = 0.812	WHITE (nc) = 0.012	RESET(1) = 0.181	RESET (2) = 0.399
Adjusted R ² = 0.957											
JB = 20.171 (0.000)											
LM(1) = 0.204											
LM(12) = 0.068											
ARCH(12) = 0.812											
WHITE (nc) = 0.012											
RESET(1) = 0.181											
RESET (2) = 0.399											
Nicaragua (1996-2006)											
	constant	-1.193527	-2.614492								
	tur(-1)	0.382053	6.18202								
	iaeeu	0.885123	4.539253								
	iaeca	0.793181	7.144893								
	dout	-0.372485	-9.139624								
<table border="1"> <tr><td>Adjusted R² = 0.935</td></tr> <tr><td>JB = 0.133 (0.936)</td></tr> <tr><td>LM(1) = 0.086</td></tr> <tr><td>LM(12) = 0.163</td></tr> <tr><td>ARCH(12) = 0.778</td></tr> <tr><td>WHITE (nc) = 0.000</td></tr> <tr><td>RESET(1) = 0.445</td></tr> <tr><td>RESET (2) = 0.719</td></tr> </table>				Adjusted R ² = 0.935	JB = 0.133 (0.936)	LM(1) = 0.086	LM(12) = 0.163	ARCH(12) = 0.778	WHITE (nc) = 0.000	RESET(1) = 0.445	RESET (2) = 0.719
Adjusted R ² = 0.935											
JB = 0.133 (0.936)											
LM(1) = 0.086											
LM(12) = 0.163											
ARCH(12) = 0.778											
WHITE (nc) = 0.000											
RESET(1) = 0.445											
RESET (2) = 0.719											
Panama (1996-2007)											
	constant	-1.464490	-3.246365								
	tur(-1)	0.464776	7.494171								
	tur(-4)	0.354759	5.710289								
	iaew	0.751428	3.047114								
	dsep11	-0.266015	-3.868078								
<table border="1"> <tr><td>Adjusted R² = 0.957</td></tr> <tr><td>JB = 5.044 (0.080)</td></tr> <tr><td>LM(1) = 0.025</td></tr> <tr><td>LM(12) = 0.278</td></tr> <tr><td>ARCH(12) = 0.038</td></tr> <tr><td>WHITE (nc) = 0.572</td></tr> <tr><td>RESET(1) = 0.052</td></tr> <tr><td>RESET (2) = 0.055</td></tr> </table>				Adjusted R ² = 0.957	JB = 5.044 (0.080)	LM(1) = 0.025	LM(12) = 0.278	ARCH(12) = 0.038	WHITE (nc) = 0.572	RESET(1) = 0.052	RESET (2) = 0.055
Adjusted R ² = 0.957											
JB = 5.044 (0.080)											
LM(1) = 0.025											
LM(12) = 0.278											
ARCH(12) = 0.038											
WHITE (nc) = 0.572											
RESET(1) = 0.052											
RESET (2) = 0.055											

Source: Authors' own elaboration.

According to the results obtained from the econometric model (Table 14)⁵⁷, for most countries, the most important explanatory variable was the economic activity of the tourists' country of origin. For a better understanding of the effect of this variable, we separated the effects of the evolution of economic activity of United States and that of Central America—the two main regions of tourists' origin—in order to know which had had a greater influence on tourism. However, for Honduras and Panama it was necessary to build a single weighted index of economic activity, otherwise problems of collinearity (or near-collinearity) emerged. Weights were assigned according to the importance of the tourist country of origin.

Finally, in the case of Nicaragua, another explanatory variable was added (d_{out}) to take into account two outliers⁵⁸ that helped validate the model. For the models run for Costa Rica and Panama no heteroskedasticity was perceived, but to estimate the econometric models for the rest of the countries, it was necessary to use the White Heteroskedasticity-Consistent Standard Errors & Covariance mechanism. Residuals of the models estimated are shown in Graph 4, and all of them are stationary.

Finally, as can be seen from Table 14, and Graph 4 the estimated models had satisfactory results since the estimates closely follow the historic evolution of tourists' arrivals in all countries of our sample. Residuals have the expected behavior, and they passed all the relevant econometric tests used for validating an econometric estimation.

D. Discussion of main results

In section B (statistical and descriptive analysis) we showed the high growth in tourist arrivals experienced by countries in Central America. On average, tourist arrivals to the region grew at a 15.7% rate during the period 1995-2006 and followed a seasonal pattern, though this varied among countries. The seasonality of tourism in each country varies according to the different types of tourism that each of them attracts.

The results of the model show that the United States economic activity index $iaeeu$ was the most important explanatory variable of tourist arrivals for Costa Rica, El Salvador and Nicaragua, with values (elasticities) of 0.67, 1.14 and 0.88, respectively. The Central America economic activity index $iaeca$ was second in importance as explanatory variable for El Salvador and Nicaragua (elasticities of 0.72 and 0.79). For Guatemala, the latter was the main explanatory variable, with an elasticity of 1.2, though $iaeeu$ (United States economic activity index) was also relevant with an elasticity of 0.72. Finally, the weighted index of economic activity in the United States and in Central America, $iaew$, was the most important explanatory variable for Honduras and Panama.

In the analysis we tested the hypothesis that extreme weather events have a negative impact on tourist flows to Central America. To do so, we tested the impact of several hurricanes and tropical storms during the period 1996-2005, but only Hurricane Mitch had a negative impact on tourist arrivals in Costa Rica (very small coefficient) and Honduras. The other major hurricanes and tropical storms did not appear to affect the number of tourist arrivals. It is interesting to point out that although Costa Rica and Panama were the countries that were the least affected by Hurricane Mitch, Costa Rica's tourism was somewhat harmed by such extreme event.

Several considerations should be made regarding this result. In the first place, Costa Rica was the country within the Central American region that received the greatest number of tourists (as seen before in section II. A.) most of them coming from United States and Europe. The visitors going to Costa Rica can be largely considered coastal leisure tourists, which probably are the most sensitive to extreme events. This could explain why Costa Rica's tourism was marginally affected by Hurricane Mitch, though this made practically no physical harm to such country. Honduras, instead, the most hit by such

⁵⁷ It is important to note that only the significant variables that resulted from the econometric analysis were reported in Table 14.

⁵⁸ This dummy variable takes the value of 1 in November and December 1999, and 0 otherwise.

hurricane and the least prepared to face it suffered the greatest negative impact on its tourism flow. Guatemala, though quite damaged by Mitch, did not suffer much impact in its tourism activity because it concentrated mostly in the cultural sphere.

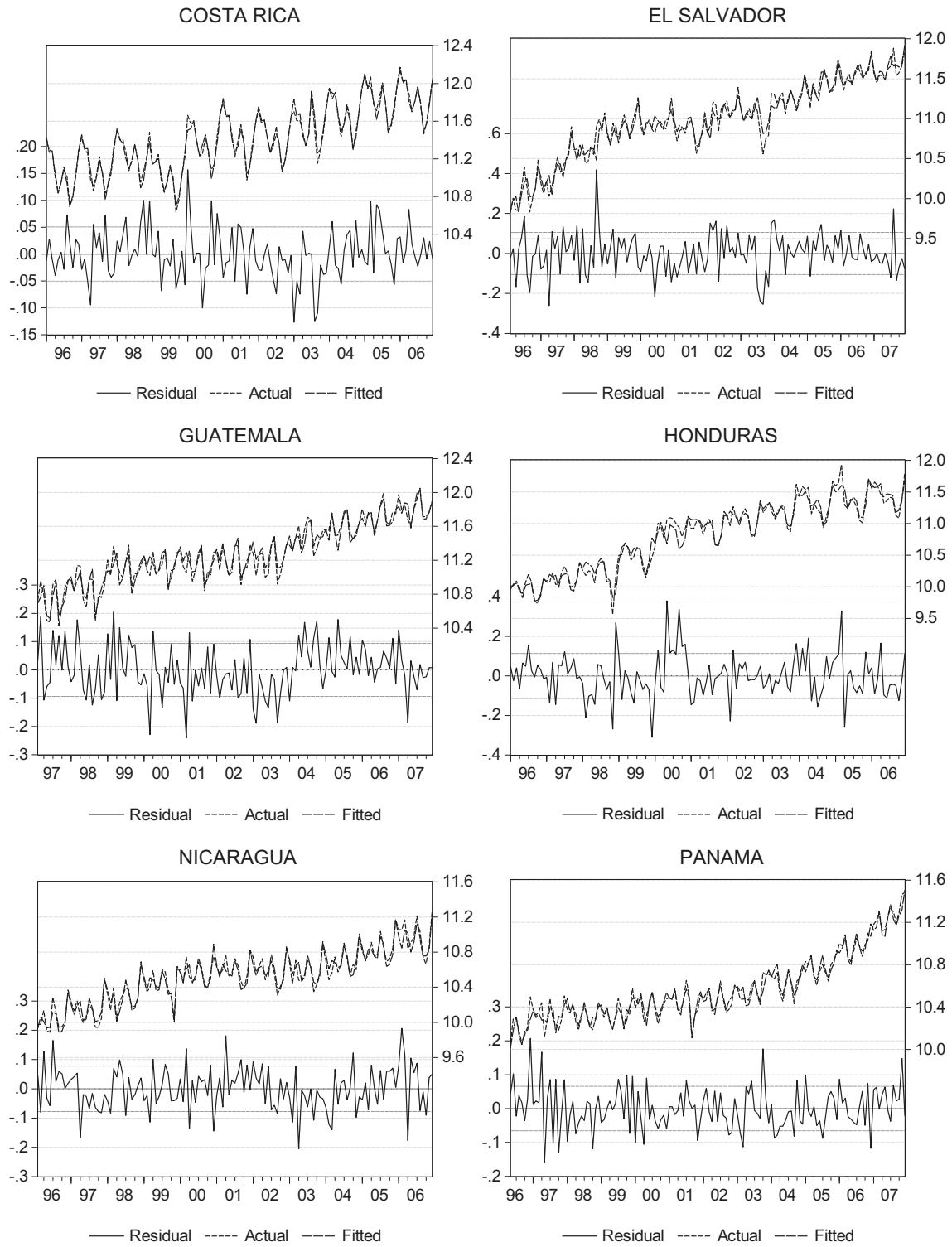
It is also important to consider the impact of the terrorist attack of 9/11 on Central American tourist activity. This variable shows the reaction of tourism to unforeseen events and also its response to new security circumstances. It is interesting to note that visits to El Salvador, Honduras, and Panama slowed down because of this event, though this drop was negligible for Honduras. The most affected countries were those with the least proportion of leisure tourism, i.e., those with an important flow of business and commercial visits (see Table 14).

The real exchange rate index coefficient, *rerw*, was expected to reflect the importance of price comparative advantage of countries regarding other tourist destinations, but this variable was statistically significant only for Costa Rica, with an elasticity of 0.34 (for El Salvador and Panama, which have the US dollar as its national currency, this variable was discarded from the beginning).

Regarding the temperature variables tested in the model, their irrelevance as explanatory variables is understandable for countries that have warm weather all year round. Though tourists traveling to the region appreciate such climate, the variations that have occurred in temperatures have never been dramatic, and therefore do not make any difference in their traveling decisions (in the future this could be different as a result of climate change).

As to climate change effects, this model shows that only major extreme weather events had a negative effect and this happened only in two countries within the region, while temperatures had no impact at all on tourist visits to the region. However, it is probable that in the future there will be more frequent and more extreme storms and hurricanes and that temperatures may rise to levels that will make leisure tourism uncomfortable in some seasons therefore these variable's influence on visitor flows to the region may change in the future (IPCC, 2007a, Stern Report 2006, Goldenberg et al., 2001).

GRAPH 4
CENTRAL AMERICA: RESIDUALS FROM THE ECONOMETRIC MODELING BY COUNTRIES, 1996-2006



Source: Authors' own elaboration based on data from the Tourism Ministry of each country.

VI. Conclusions

Tourism has become an important part of Central American's economy and climate change may become an obstacle for this activity. The countries of this region share many scenery, weather and biodiversity characteristics that attract leisure tourism, which is the most vulnerable to climate change impacts. But they also receive a great variety of other visitors whose trip purpose is business, trade or family visits and that for statistics and economic purposes are also part of the tourist activity.

The degree of exposure of tourism to climate change in each country depends not only on its geographical location and the state of its natural resources conservation, but also the purpose of tourists' visits. In this sense, leisure tourism —on which this study concentrates— would be the most exposed to climate change impacts and, since great part of this activity has developed on coasts (responding to “sea-sun-sand” and ecological interest, including sea and land biodiversity), and their vulnerability is very high. In this sense, Belize and Costa Rica, the countries with the most leisure oriented tourism, could be the most affected.

Eco-tourism, which is part of leisure tourism, and has grown worldwide at very high rates as compared to traditional tourism, is likely to suffer from climate change. Costa Rica is the most important destination for this kind of tourism in Central America, and an outstanding one at an international level, but the rest of the Isthmus is also developing this activity, therefore all of them need to take precautions to safeguard such sector. Cultural tourism is part of leisure tourism as well, especially important for Guatemala, and even though not on the coast, it has already experienced significant damages from the Mitch and Stan Hurricanes and

this will probably worsen in the near future (because of hurricanes, heat, forest fires and loss of biodiversity in these areas).

Most of leisure tourism sites are located on the Pacific coast, except for the Belize's, some Honduran destinations (such as the Bay Islands) and a few Panamanian tourist places. Since the Pacific coast is relatively less exposed to extreme weather events than the Caribbean Coast these tourist spots are relatively more protected from some climate change effects than if they were concentrated on the Caribbean coast. But, as hurricanes and other extreme weather events have become stronger with climate change (and this will worsen in time), they are hitting the Pacific coast even if they are born on the Caribbean and they are also rising from the Pacific Ocean itself, which did not happen before. Another climate change problem facing the Pacific coast is drought, especially serious for the already developed Costa Rica's North Western coast.

Temperature increases, as a result of climate change, will take place throughout the region, but with geographical and seasonal differences. For the two months —December and July— that usually bring the greatest flow of visitors to the region, predictions for temperature increases in 2020 and 2050 (if compared to the baseline: 1961-1990) could make Central America very hot, to the point of producing discomfort for the tourists. The most important increases in temperature —between 2.70 and 4.10°C— may take place in July of 2050. Considering that July is also a very humid period, these conditions may discourage tourists in some (or most) coastal areas as well as in some cultural sites. As a result, unhealthy conditions, such as malaria expansion, may take place, additionally curbing tourist visits. The countries suffering the greatest temperature increases in July of 2050 would be Costa Rica and El Salvador.

Much lower temperature increases are predicted for December 2020 and 2050 as compared to July of those same years. In some cases they will not reach present temperatures in July, or they may exceed the latter by about 1-2 °C. Considering that December is a dryer season, the conditions may still be favorable for tourism in all tourist sites even in December 2050, *ceteris paribus*, which is an encouraging prediction for such activity.

Adaptation measures will be needed to find alternative places for tourism during the summer season, which could probably be found inland for most countries, and at higher altitudes. Forested mountains, with much cooler temperatures, with rich biodiversity could be an alternative, especially for ecotourism (though the composition of such biodiversity will probably change as well).

At sea level, biodiversity may be significantly harmed by the climate change phenomenon. We know that the increase in temperature already occurred during the last decades meant the disappearance of many species (this has also been accelerated by rapid deforestation in most of the region) and estimates indicate that an additional increase in temperature of 2.5°C (that could be reached in some locations even by 2020), could put at risk of extinction 20% to 30% species and would drive others to emigrate to higher latitudes (if they have the possibility of doing so). In the same way, the warming of the sea which has already happened to a certain extent and caused bleaching of coral reef, would be more frequent in the future, and would mean the disappearance of important sea biodiversity.

All countries of the region have important plans to expand their (leisure) tourist activities, since this has been a driver for their economic development and is a promising area for the future. Nevertheless, most tourist expansion plans make little or no mention of climate change, the restrictions

it may pose for this sector, nor the competition it may pose for other activities that also rely on coastal resources. Adaptation measures are not considered when planning tourism expansion regarding the increasing temperatures, hurricanes or the rise in sea levels. The environmental orientation of some of the tourist development plans, although very important, may be insufficient to face the expected climate change effects on the areas where tourism has developed in Central America.

This lack of awareness of the challenges that climate change may signify for many tourist sites, is understandable since up to now few effects of these impacts have been felt in this sector. The rise in temperatures experienced by Central America have not yet made tourist sites uncomfortable, droughts have not affected them seriously (although in some cases drinking water has to be fetched from distant locations), and hurricanes, though suffered by some of these tourist areas, have not changed the tourist preferences in a significant or permanent way.

The econometric model developed in this study to find out what the determinants of tourist arrivals in each Central American country (except Belize) were in the last decade and a half yielded interesting results. It revealed that the United States and the Central American countries' economic activity indexes (depending on the origin of most part of their visitors) were important variables to explain tourist arrivals. One of the hypotheses of this study was that hurricanes and higher temperatures could negatively influence tourist arrivals. Several hurricanes in the past fifteen years were included as explanatory variables. However, only the major hurricane in that period, Hurricane Mitch, had a strong effect on Honduras flow of visitors. Costa Rica was somewhat affected, probably because of the information received by potential foreign tourists of the impact of Mitch in the region as a whole (though Mitch left Costa Rica unharmed). For the rest of the countries, not as hardy affected by this event and having a more diversified tourism, the effect of such extreme event was not important. Temperatures, on the other hand, had no explanatory role of tourism behavior in the model. Even though these findings reveal that just one hurricane was relevant to explain tourism arrivals, we acknowledge that the econometric model had some limitations and the results should be treated with care. In the future, these results could be different as hurricanes become more frequent and intense and that temperatures rise considerably.

A greater consciousness of climate change effects needs to be acquired by all sectors so that adaptation and mitigation policies can successfully be undertaken. One of the most important adaptation measures is to change the legal framework and strengthen institutions that are in charge of implementing the necessary rules to face climate change in the best possible way. Many of these rules, which may benefit tourist activities, need to protect natural resources, especially forests and mangroves and review soil use regulations so that activities that erode soil, cause sedimentation of rivers, promote flooding and landslides are stopped. New construction and infrastructure regulations should be combined with soil use regulations so that new developments do not flourish in vulnerable sites to extreme weather events, flooding, droughts and rising sea levels. Other adaptation policies include the creation of special funds by governments to help reconstruct destroyed tourism centers if hit by an extreme weather event and the requirement of an insurance for tourist centers that are specially exposed, so that reconstruction can take place if damaged.

Economic instruments to promote reforestation, sustainable agriculture, mangrove recovery, among others, should be developed. There are good examples within the region that have shown how some public policies already proved successful for environmental protection, could be also very helpful for adaptation and mitigation to climate change, e.g. FONAFIFO's forest conservation scheme in Costa Rica.

Cooperation between countries to face the climate change effects has already developed to exchange information on weather extreme events, for example. The cooperation to restore damaged environment, which may strengthen the countries to face climate change, has already started, but much more has to be done.

In addition, collaboration among government entities within countries is also vital to carry out the necessary measures that will be needed. The National Committee of Climate Change (CONACCP) in Panama integrated by 17 institutions (among them the Panama Canal Authority), in charge of tasks

linked to adaptation and mitigation of climate change, is a good example of this. This committee is planning to undertake actions such as reforestation, watershed protection, maritime and land ecosystems protection and monitoring of forest cover and carbon capture as an environmental service. It is also important to note that in Central American countries it is almost impossible to develop adaptation policies for tourism independently from what is done in other areas of the economic and social spheres. Inadequate agricultural practices, over exploitation of watersheds, inadequate land use, poverty, etc. even if not occurring precisely in tourist places may have a negative effect on this activity. An integrated coastal zone management is essential for successful adaptation policies.

The diverse countries of the region face somewhat different situations regarding exposure of leisure tourism to climate change. El Salvador is probably the country that is the most unprepared for such situation, since most of its land has eroded, it has almost no forests left, mangroves have also been destroyed to a great extent and it has low lands that may become permanently flooded with sea level rise. Therefore, in this case, leisure tourism expansion should be very carefully planned and regulated; while diversification of tourism should be developed (it is fortunate that this is one of the countries whose tourism is already very diversified).

Costa Rica, though being one of the most vulnerable countries to climate change in its tourist sector because of its specialization in leisure tourism and its geographical location, it has a very solid environmental regulatory framework that can be revised to face the climate change effects.

Guatemala has a long cultural tourism tradition and though not as exposed to coastal vulnerability to climate change impacts, its tourist attractions may be harmed by this phenomenon as high temperatures, droughts and deforestation become more acute.

Honduras and Nicaragua have great potential to develop ecotourism and beach tourism. Since this activity is in a starting phase, both countries have the opportunity to introduce regulations that could help to avoid climate change destructive impacts. Their inland attractions (lakes, forests, biodiversity) can be an appealing alternative to dangerous seaside tourist sites.

Panama has a very diversified tourism activity and ecotourism and beach tourism are also developing. However, Panama has already set up some tourist sites in vulnerable areas without much planning and without considering environmental or climate change effects (Bocas del Toro, for example). Much better regulations are needed.

Belize, although more careful than other countries with its very rich natural resources, needs to take joint action with neighbor countries, which are endangering its sea biodiversity.

Given the scope of the challenges that the tourism industry faces with climate change, there is a need to take national as well as regional action. Even though Central American countries cooperate in their tourist marketing strategies, they also compete to attract new tourism related investments including the second home market. In the race to attract the much needed capital flows, as well as to make the most out of their natural resources to attract tourists, they could be tempted to bypass environmental laws and fall short of creating the legal tools to face climate change in the best possible way. This could be more harmful than beneficial in the long run. If countries expect to continue benefiting from tourism as an activity that attracts investment, creates jobs and contributes to their economic development, they need to take action today to better adapt to what may come in the future as a result of climate change.

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