

THE CLIMATE CHANGE AND ITS IMPACT ON INTERNATIONAL DIMENSION OF TOURISM

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Abstract: Climate change is increasingly apparent. They manifest in all spheres of life, including tourism, a leisure activity sensitive to climate. Our research underscores the fact that when seen through the lens of tourism geography, climate, one of the components of tourism destinations, is a decisive factor. Having become a mass phenomenon, sensitive to the altering of optimal climatic parameters for tourism due to the global warming process, tourism clearly stands under the influence of climate change. The study also explores the possible measures of accommodation to such phenomena that human society can resort to, obviously at rather high costs: coastal improvements and the restructuring of hydrographic basins, the “elevation” of mountain resorts to higher altitudes, the integrated planning of activity in the tourism sector with activity in other fields, and so on.

Key words: tourism geography, global climate changes, World Tourism Organization (WTO), mass tourism, natural disasters, International Tourism Arrivals (ITA), tour operator (TO), accommodation measures, World Meteorological Organization (WMO).

1. RESEARCH BACKGROUND

As the effects of climate change on tourism are becoming increasingly visible, a growing number of studies are devoted to examining their impact on tourism. Authors such as Hamilton & Tol, 2006, have emphasized the complex, interdisciplinary effort of assessing the impact of climate change on tourism as a result of the interaction between various factors.

Among the first approximations of the effects that climate change may have in the tourism sector were those made by Nicholls & Hoozemans, 1996, while one of the first impact assessment studies was that conducted by Gable, 1997, which examined the impact of climate change on the Caribbean coastline and its coastal tourism, Olsen, 2003, argues for all integrated coastal management (ICM). Subsequent studies also focused on mountainous areas, where climate change effects may be perceived as threats to mountain tourism (Elsasser & Bürki, 2002), leading to a series of predictable developments insofar as winter sports and/or mountain resorts are concerned (Scott et al., (2007); Des Jarlais & Blondlot, 2010; Amelung & Moreno, 2012). Amelung & Moreno,

(2012) and Moreno & Amelung (2009) for instance, have estimated the costs incurred by the international tourism sector in European countries as a result of the global warming process, also Tsai & Chen, 2011, estimate the loss resulting of annual catastrophe events around the world from 1950 to 2008. The authors Asbjørn et al., (2012) attempt a macroeconomic analysis of impacts of climate change in European economies.

Impact assessment studies may focus exclusively on domestic tourism, as is the case of the study conducted by Bujosa & Rosselló, (2012), which highlights the reallocation of domestic Spanish tourist flows in the Spanish coastal areas; on international tourism alone (Hamilton et al., 2005 a, b); equally on domestic and international tourism (Bigano et al., 2006 a, and b); or on different regions and/or forms of tourism (Scott et al., 2007; Elsasser & Bürki, 2002; Gable, 1997).

Amongst the many studies and authors dedicated to this topic, some cited above, we should note the study undertaken by Bujosa & Rosselló, (2012), who have conducted simulations of tourism frequency in the Spanish coastal provinces, studying the impact of air temperature increase due to global

warming. They have demonstrated that the southern provinces of Spain (Huelva, Cádiz, Málaga, Almería) will most likely record a negative tourism growth rate, while the coastal areas of the northern provinces (A Coruña, Cantabria, Guipúzcoa, Girona) will register positive growth. The eastern provinces (Murcia, Alicante, Valencia, Castellón, Tarragona, Barcelona) will not record high variability rates as regards tourism frequency).

Following the same research logic, but focusing on South-Eastern Europe, more specifically, on Bulgaria, Mishev & Mochurova, (2010), have captured the reallocations of tourist flows and the volume of overnight stays.

Referring exclusively to international tourism and using mathematical simulations, Hamilton et al., (2005 a) have simulated the international tourism demand for 207 countries, marking the changes that have occurred in International Tourist Arrivals (ITA) (Hamilton et al., (2005, b), both for low climate change and for high climate change.

To better meet the challenges that tourism is facing as a result of climate change, associations of multiple partners have been set up: regions (as power holders with regional and local competencies), higher schools of tourism and research institutes. Their overall aim is to study the phenomenon in order to develop and implement common, unitary and well-articulated response strategies.

The adaptation modality, the partners proposed, entails the diversification of alpine recreational activities in alternative sports clubs, spas, golf courses and Nordic skiing, information having to be offered to tourists on a permanent basis.

Two directions of research addressing the climate change impact on tourism have gained contour: That followed by researchers who start from the phenomenon of tourism, whose climatic parameters are deteriorating and which, therefore, undergoes transformations and tourist flow reallocations, with consequences for tourist resorts and the local economy. On the other hand, that approached by researchers who were initially interested in climate change and have noticed its influence on tourism. Both of these research directions share the assumption. However, that the impact of climate change on tourism entails not only the transformation and alteration of the forms of tourism that are practised, especially those directly related to climate and water, namely coastal tourism and winter sports tourism, but also transformations (reorientation, volume decrease/increase, etc.) of tourist flows that are rather sensitive to the

“human comfort” factor.

2. METHODS AND DATA

While the impact of climate change on tourism is by now acknowledged as undeniable, its impact degree remains to be determined, as is its spatial location. From among the natural components of tourism destinations (Fig. 1), the climate has a major and primordial role because it determines all the others, including the anthropic component. Therefore, the landscape component, which is the sum of the physical, biotic and human components, is directly influenced by the climate. On the other hand, it is also certain that the most commonly used quantitative approach in assessing the impact of climate change on tourism demand is that of tourist numbers, together with its spatial component (ITA).

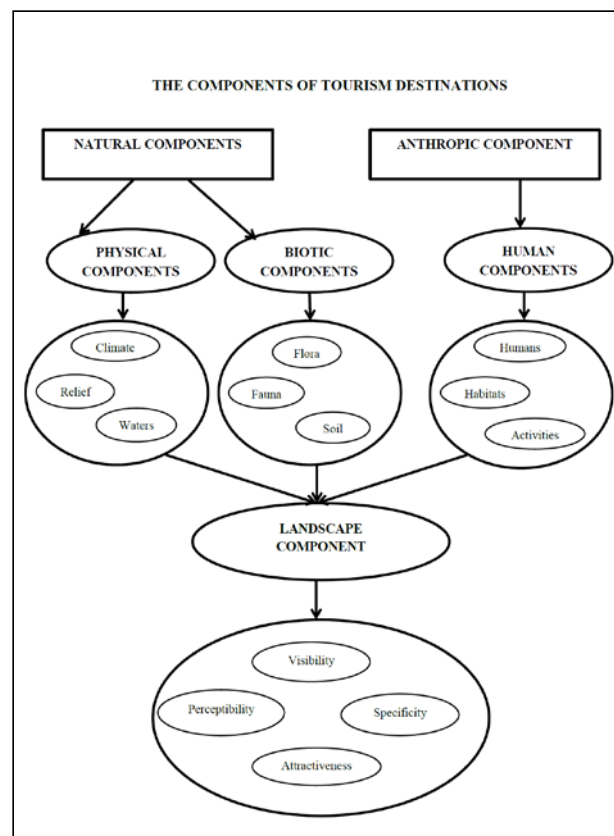


Figure 1. The components of tourism destinations.

Moreover, 131 countries register increases by over 2.6% of ITA, most of them being countries with large share in international tourism. The conclusion is clear - international tourism is expanding, so its sustainable development requires a clean natural and societal environment.

My study aims to highlight certain aspects pertaining to the weakening of various natural components of tourism destinations, primarily those

climatic elements with demonstrated effects on tourism due to climate change; to present several global warming scenarios, with their regional effects and their impact on tourism; and to outline adaptation opportunities. For a better understanding and spatial perception of the consequences that climate change has for tourism, I have cartographically represented the ITA evolution by country in 2012, correlating it with the areas of natural hazards, including those of a climatic nature, and proving that the ITA growth areas often feature a natural environment that global warming is rendering ever more fragile. I have attempted to answer the questions: what are the predictable effects of air temperature increase on the reorientation of tourist flows and the development of mountain and coastal tourist resorts?

The data in Table 1 clearly shows the expansion of international tourism, global growth rate of ITA was 4.6% in 2012 over the previous year.

Table 1. The level of the annual average increase of International Tourism Arrivals (ITA) in 2012 (% change 2011) (Grouping countries on ITA's evolution steps in 2012 to the previous year)

	ITA increase (%)	Number of countries
1.	Under -7.5	11
2.	-7.5 – -2.6	18
3.	-2.5 – 2.5	37
4.	2.6 – 5	36
5.	5.1 – 10	37
6.	10.1 – 15	30
7.	Over 15	28
<i>ITA increase world average: 4.6 %</i>		

The working tools I have resorted to are official public data provided by specialized bodies, such as WTO, WMO, the United World Organisation UWO, various consortia and prestigious research institutes, whose aim is to observe, record, analyse, synthesize and publish reports on the effects of climate change for tourism.

3. ENVIRONMENTAL FACTORS AFFECTING TOURISM

In order that the international tourism, registered on an upward developing trend, to have a sustainable development, it is necessary to take into account the climate change.

Tourism is under the incidence of some natural and social factors, like a climate conducive to tourism through its elements, such as temperature, precipitation, the duration and the force of the sun's brightness, the wind, thunderstorm phenomena, snow

deposits, the duration and the consistency of the maintenance of the snow layer and so on; the natural beauty of the landscape, the geographic configuration and the variety of the natural forms: mountains, hills, coasts, lakes, rivers, waterfalls; the value of the flora and fauna landscape, the therapeutic value of natural forest, the wealth in mineral and hot springs, curative mud, gas emanations.

From the above mentioned natural factors, the higher incidence of some negative natural events produced due to the global warming, conducted to the identification of the risk factors for tourism (Fig. 2), the climate change consequences: the ratio of victims (1) and of the ratio of the ensured damages (2) in disasters of different type related to natural disasters.

The climate risk factors for tourism are: abundant precipitation followed by floods, hurricanes and tropical cyclones, with a tendency to expand towards temperate areas, snow storms, droughts, which have an impact upon vegetation, favorable factors for fire (Dubois-Maury & Chaline, 2004). Neumayer et al., (2014) focus on the three types of disasters causing the vast majority of damage worldwide: earthquakes, floods and tropical cyclones.

The earthquakes and their effects, such as tsunami waves, are added to the factors of climatic risks, which gravely affect the tourism.

Active volcanism represents major disasters generated by over 1,000 active volcanoes, few settlements with touristic function are found in their proximity (Chaline & Dubois-Maury, 1994).

In terms of natural disasters, neither Europe is found in a better situation, its impact upon tourism is greater, given the fact that is the most "touristified" continent, during the year 2012 concentrating 46.7% of the total volume of ITA (WTO, Data 2008-2012, 2014).

Direct consequences of the global warming, floods have a major impact on tourism.

The hurricanes and tornados strick Europe frequently making damages in the tourism area also.

Their frequency is increasing in the whole Europe affecting a different range of countries.

In the tropical regions the major disaster is represented by the high frequency of cyclones.

In the USA, the most important touristic area – Florida Peninsula – is subject to 5-10 tropical cyclones/year, whose trajectory delimits in both towards east and towards west (Espenshade, 1993).

As an effect of the climate changes the cyclones have the tendency to move towards north.

Other effects of climate changes that may have a negative impact on tourism are: large quantities of liquid precipitation, to which torrential rains and/or solid precipitations can be added, too;

massive snowfalls, floods, thunderstorms; regular floods, snowfalls, forest fires.

High amounts of precipitation – heavy rains or torrential rains, which fall within a short time span, may affect tourism, especially in the Mediterranean space, where the phenomenon is frequently encountered. Torrential rains are more frequent in Italy, Switzerland and Spain.

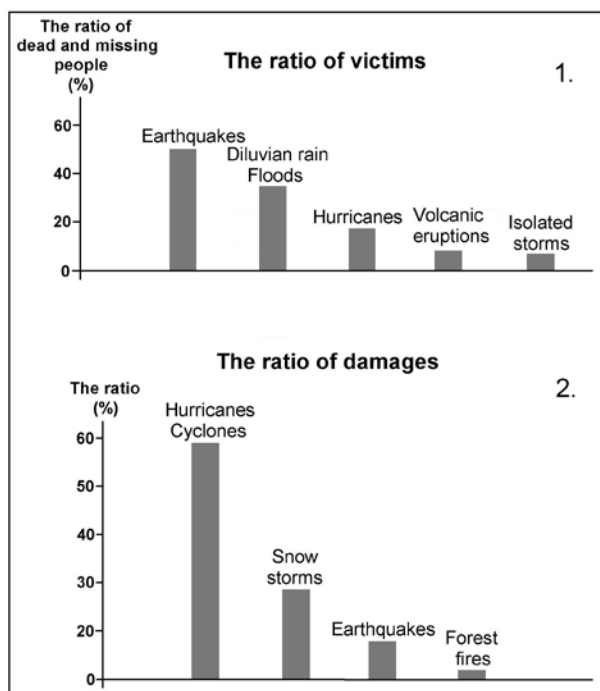


Figure 2. Consequences of climate change: ratio of victims (1) and ratio of damages (2) in different type of natural disasters.

Floods affect riverside settlements following torrential rains, with large amounts of precipitation. Floods are frequent in Monsoonal Asia, more specifically in countries like India, Thailand, Cambodia and Vietnam, where, during the rainy season, tourist activity is practically interrupted.

If massive snowfalls in the mountainous sector are more frequent, their accumulation entails the risk of avalanches. For instance, in Carpathian Mountains, a tourist area in high expansion, Bedmorz, (2013), is predicting the increasing risk of avalanches in Tatra Mountains and Dragotă & Kucsicsa, (2011), prove some visible manifestations of global warming in the Rodnei Mountains as regards the evolution of air temperature and of the quantity of precipitation, particularly in warm season of the year.

Forest fires are the result of long droughty seasons. They hinder tourism through smoke emission and the destructions caused to accommodation.

Devastating forest fires have affected Los Angeles, Sydney (2002), Portugal (2003, 2005),

Spain, Italy, or Greece, with numerous dramatic episodes. Tsai & Chen, 2011, account the occurrence of catastrophe risk around the world from 1950 to 2008 and loss resulting and plead for the establishment of a rapid natural disaster risk assessment model for the tourism industry.

The influence of climatic elements on tourism has been analysed by Mieczkowski, 1985, through the Tourism Climate Index (TCI), indicating a biometeorological approach.

A tourist site's attractiveness may be due to certain climate conditions. Of all the climatic elements (or other climatic variables), temperature is the element that most frequently influences the tourists' decisions (Agnew & Palutikof, 2001). The average annual temperature variation underlies the "Hamburg model" of tourist flow predictions in response to climate change, which has been proposed by Hamilton et al., (2005 a). This follows logically from the fact that on the one hand, tourism is influenced by the effects of climate change generated by increasing carbon dioxide emissions, and, on the other hand, it is also climate sensitive.

The design of this index for the periods 2011-2040 and 2071-2100 at the level of the European territorial units (NUTS 2) and its correlation with the ITA volume and the number of overnight stays (bed nights) has enabled Amelung & Moreno, 2012, to identify several scenarios, according to which the climatic conditions for tourism will deteriorate in Spain, Italy, Greece and Turkey, while in Northern Europe, in the British Isles and to the east of the Adriatic Sea, they will improve.

In tourism, the disruptive aspect of the climate is included under the general notion of "bad weather", which is a relative notion. In the more temperate areas, it means rainy summers and snowless winters, while in the warmer, tropical areas, it means a more intensive cyclonal activity, which disturbs or, when its intensity becomes catastrophic, annihilates the process of tourism.

Summertime tourists who use camping as a form of accommodation may have to modify their sojourn according to the weather conditions. Nowadays, when we are witnessing a decrease in the sojourn duration, as well as careful holiday planning, destinations are well defined and scheduled according to the weather. For example, when choosing a seaside resort, European tourists tend to focus on the Mediterranean Sea, the Caribbean Sea occupying the second place in this regard, followed by the more remote tropical islands.

Tourists who want to go skiing will choose a resort according to the interplay between two elements: altitude, which would entail that the resort

must have a lot of snow, and the existence of ski tracks on sunnier slopes.

For tourists with limited possibilities, who may be dreaming of a warm climate, the weather forecast is determinant in choosing a tourism destination. The climate data are featured on the tourism sites. If they vary within certain limits, they can provide the holiday with more charm, making the resorts more attractive or rendering them unappealing.

As more and more studies have been conducted, scientific literature has also come to refer to other climatic variables, such as rainfall, humidity, sunshine and wind speed. In this sense, Besancenot's model (1990) of "types of weather" for the temperate areas as an outstanding model of its kind. The climatic elements – temperature, precipitation, air movements (the wind), the intensity and duration of sunshine and so on – are approached with a maximum clarity in tourism studies through the lenses of climate indexes and weather types.

The method of "weather types", which was introduced by Besancenot, 1990, and Hoerner, 1993, takes into consideration all the climate elements that are more or less favourable for tourism and that appear to be interrelated, in one place or another. For our temperate climate latitude, Besancenot, 1990, identifies eight types of weather that are likely to meet the needs of tourists. In short, at temperate latitudes, sunshine duration is satisfactory (except for situations where the cloud layer is thick), temperatures are high, at least over 16°-18°C, there is almost no precipitation and the wind speed rarely exceeds 8 m/h. Over a decade after Besancenot, 1990, Gössling & Hall, 2006, considered that an impact assessment study on the effects of climate change needed to take into account, in addition to temperature (perceived as the most important element of the climate), rainfall levels and frequency, the duration and intensity of solar radiation, and wind frequency and intensity. In addition, in order for predictions regarding the impact of climate change effects to be well founded, it is necessary that climate data should include long series of meteorological observations, while insofar as the reorientation of tourist flows is concerned, it is vital that indicators such as the available income, the time budget and the cost of the journey should be taken into account. For short-term predictions, unexpected events should be taken into account, including natural disasters, acts of terrorism and mega cultural (sports) events.

The term "climate change" is understood as "a sustainable change of the general climate of the Earth in terms of climatic parameters, medium

values and variability" due to both natural causes and causes pertaining to human activities. Gas emissions are mainly attributable to human activities (CO₂, NO₂, CH₄, fluoride gases, etc.) and lead to changes in the anthropic climate, generically known as the "greenhouse effect". According to the Intergovernmental Expert Group on Climate Change (GIEC), the term "climate change" refers to all the changes produced in time either as a result of natural causes, or as a result of human activities. The anthropic pressure at different levels (macro-, mezo- and micro-scale) suffered modifications, but the processes of consumption and degradation of primary eco-energies were continuous and event accelerated, due to the fragility of natural components (Ianoş et al., 2011).

According to the United Nations Specialised Body, within the framework of the United Nations Convention on Climate Change, the term designates only the changes that occur as a result of human activities (XXX, United Nations, *Framework Convention on Climate Change* [FCCC/KP/AWG/2008/5], Geneva, 2008).

The sea level has got higher, at an average of 1.8 mm/year (within a spread of 1.3-2.3 mm/year) after 1961, and of 3.1 mm/year (within a spread of 2.1-3.8 mm/year) after 1993, as a result of glacier melting and global warming.

The surface covered in glaciers in the arctic areas has decreased since 1978, by 2.7% per decade (within a spread of 2.1-3.3%).

During the period 1900-2005, rainfall increased significantly in the eastern parts of North America and South America, in Northern Europe, Northern and Central Asia and decreased in Sahel, the Mediterranean Basin, Australian Africa and in some regions of South Asia.

Observations have shown an increase in cyclone activity in the North Atlantic after 1970.

In conclusion, the observations conducted at the level of the entire planet show that a great many natural systems are affected by global and regional climate changes, mainly given the temperature increase due to the greenhouse effect. Insofar as tourism is concerned, three aspects of climate change are relevant: thermal, physical and aesthetic (Freitas, 2003).

4. THE CAUSES OF CLIMATE CHANGE. FORECASTS AND SCENARIOS

The United Nation's experts have identified the main causes of climate warming: the regional variation of greenhouse gas concentrations (CO₂, CH₄, NO₂, fluorite gases); the aerosols in the

atmosphere that may diminish the changes affecting surface plants; and solar radiation, which can change the energy balance of the climate system.

Thus, greenhouse gas (GHG) global emissions increased by 70% during 1970-2004; only the annual emission of carbon dioxide (CO₂), the most important anthropogenic greenhouse gas increased by 80% (Pachauri & Reisinger, 2007).

As forecast in the conclusions of the Inter-Governmental Expert Group on Climate Change (GIEC) studies that formulate emission scenarios, climate changes will be influenced by the global GHG emissions in CO₂ equivalent, which will increase by 25-90% between 2000 and 2030, mainly due to the use of fossil fuels.

The GIEC perspective for 2090-2099, according to global warming scenarios and the evolution of the sea level, may be rendered in simplified manner as follows (Table 2).

Among the changes anticipated to occur at a regional scale and have an impact on tourism, we may notice:

- a more pronounced warming in the northern regions, and a "temperate" one in the Australian areas and the North Atlantic;
- the thinning of the snow layer, the permafrost layer in the tundra areas, the reduction of the surface and volume of glaciers;
- the increasing frequency of extreme temperatures, hot weather episodes and abundant rainfall;
- the numerical growth of tropical cyclone events and a movement towards the poles of thunderstorm phenomena;
- an increase in the amount of rainfall at high latitudes and a decrease in the subtropical areas;
- changes in the river flow rates, which will increase in the hydrographic basins at higher latitude areas and will drop in the more humid tropical regions. Some semi-arid areas, such as the basin of the Mediterranean Sea, the Western USA, Southern Africa, or the north-eastern parts of Brazil will register a decrease in water resources.

Climate change influences will affect mainly the terrestrial and marine ecosystems (A) of the

coastal areas (B) and the health state of the population (C):

A) As regards ecosystems, the terrestrial ones will be especially affected because of the sensitivity of these ecosystems to climate warming: the tundra, the boreal forests, and the mountainous regions. Also, the Mediterranean ecosystem will suffer due to increased aridization, tropical forest ecosystems will suffer due to declining rainfall, while coastal ecosystems will be affected mainly by damages incurred by the mangrove forests.

The response of boreal forest habitats to global warming has been studied by Soja et al., (2007), who have advanced the idea of possible environmental changes taking place in Alaska, Canada and Russia. They have observed changes in the structure of the boreal forest biotope, namely the decline of some species of conifers and the advancement of others, an increased incidence of parasitic infestation both in arboreal plants and in animals, an increased frequency of forest fires, especially in Siberia over the past 7-9 years, but also in Alaska and Canada.

In the marine ecosystem, the most affected will be the coral reefs from Eastern Australia (Great Barrier Reef) and from the Caribbean Sea (the eastern part of Belize).

B) Coastal areas will be affected due to increasing sea levels and to the risk of extreme meteorological phenomena proliferating;

C) The health status of the population will decrease as a result of weak adaptability and in response to the new pathogenic factors.

5. THE REGIONAL EFFECTS OF CLIMATE CHANGE

With varying degrees of intensity, all the regions of the planet will undergo climatic transformations as a result of global warming. Regarding our planet, the map (Fig. 3) clearly shows a partial overlapping of the areas weakened by climatic change effects, in all their manifestations: flooding, storms, damage of low coastline areas, the extension of arid and semi-arid surfaces, and so on, in

Table 2. Global warming scenarios and the evolution of sea level on the horizon of 2090-2099 (Pachauri & Reisinger, 2007)

Current situation/the scenario	Temperature (in °C) variation (D) during 2090-2099, in relation to 1980-1999		the increase of the level of oceans (in m), during 2090-2099, in relation to 1980-1999
	the most probable value	likely range	intervals of predicted levels
constant level concentrations 2000	0.6	0.3-0.9	not available
B1 Scenario (minimun)	1.8	1.1-2.9	0.18-0.38
B2 Scenario (moderate)	2.4	1.4-3.8	0.20-0.43
A1 Scenario (high)	4.0	2.4-6.4	0.26-0.59

those of countries with medium and high levels of average annual ITA increase. In other words, countries with an increasing trend of this indicator are exposed to the effects of climatic change that are already disrupting the tourism sector. This is the case of many countries, such as:

- in countries with frequent “vagues de chaleur” as Spain, Portugal, France, Greece, Bulgaria, Romania, the ITA increase in 2012 compared to 2011 was between 9.1% (Romania) and 1.8% (France);

- in countries with frequent thunderstorm events, including snowstorms, as USA, Cuba, Dominican Republic, Canada, this indicator has increased with values between 6.3% (USA) and 2% (Canada);

- in countries with sometimes catastrophic floods such as Germany, Switzerland, Italy, Czech Republic, Hungary, Serbia, ITA has increased by 7.3% (Germany) and 0.5% (Italy);

- in countries with frequent forest fires as Russia, Australia, Portugal, Greece, Spain, ITA has increased with values between 2.3% (Spain) and 13.5% (Russia);

- in countries with massive reductions of glaciers surface due to climate warming, as Island, Canada, Russia, Norway, ITA registered increases between 19% (Island) and 11.9% (Norway)

At the global level, the most affected regions will be: the Arctic, due to the speed of the warming process, with effects on the ice bank and with dramatic incidents affecting the fauna; the insular areas, due to their exposure to the risk factors themselves, as the ocean level rises and as thunderstorm phenomena multiply; the deltaic areas from Asia and Africa, with great population density, will suffer due to the rising sea level and to river floods.

It is estimated that for a temperature increase of 3.5°C, 30% of the planet's coastline areas will disappear under water!

As anticipated by GIEC, the consequences of global warming at a regional level, with an impact on tourism, are outlined as follows:

Africa: the damage of the low coastline areas, especially those from Southern Africa, Zambia, Namibia; the extension of arid and semi-arid surfaces from 5% nowadays to 8% by 2080, with a direct impact on safari tourism.

Asia: the damage of coastline areas, especially of those from the south of the continent: Vietnam, Indonesia, India, Cambodia and Thailand; as a result of uncontrolled urbanisation, accelerated by climate change, and of the fact that the pauperized rural population is looking for opportunities in the urban environment, it is estimated that the pressure on the natural environment will intensify.

Australia-New Zealand: the damage incurred by the Great Barrier Reef from Eastern Australia and biodiversity in the humid tropical areas of Queensland; the deterioration of seaside tourism, ecotourism and cultural (scientific) tourism; the increase in the number of devastating fires caused by the absence of rain, affecting urban tourism (Sydney); the damage to some seaside areas, due to the rising sea level and thunderstorm phenomena, involving high costs for coastline design. Pacific Islands are highly vulnerable to climate change-related hazards such as cyclones, storm surge and flooding, sea level rise, erosion, transport and communication interruption and temporarily reduced water availability (Beken, 2005).

Europe: the negative climatic incidence phenomenon will increase the rates of flooding in Central Europe and the Iberian Peninsula; thunderstorm phenomena will also affect urban, rural and seaside tourism; the movement of glaciers and the thickness and consistency of the snow layer will influence winter tourism. For the region of the Mediterranean Sea, which is the first international tourist region in terms of the ITA and of the Income International Tourism volume, Giorgi & Lionello, 2008, provide an overview of the effects that climate change will generate: they have noticed a marked decrease in rainfall rates, especially in summer, the warm season, as well as the phenomenon of climate desertification (except in the alpine habitat, where winter precipitations have increased as a result of intense anticyclones activities).

Extended to 7-8 months, the warm overlaps with the dry climatic season, which records sequences of extremely high temperature events, call “vague de chaleur” by the French. In Romania too, the general tendency is towards increasing the annual global solar radiation (Tahas et al., 2011). The natural consequence is the abandonment of cities and the influx of tourists in the mountain and coastal areas.

The consequences for tourism, especially in the urban areas, are dramatic, in the sense that demand for this form of tourism is on the decrease; to become attractive, it needs major investments for the mitigation of the effects of aridization: the creation of new green areas, the introduction of air humidifying appliances, multiplying the number of swimming pools, parasolar systems, etc. At the same time, large areas in Central Europe are under the effects of severe summertime flooding (Christensen & Christensen, 2003).

Latin America: the disappearance of rainforests and their replacement with savannahs will occur by the end of the century, which will mean the disappearance of various species.

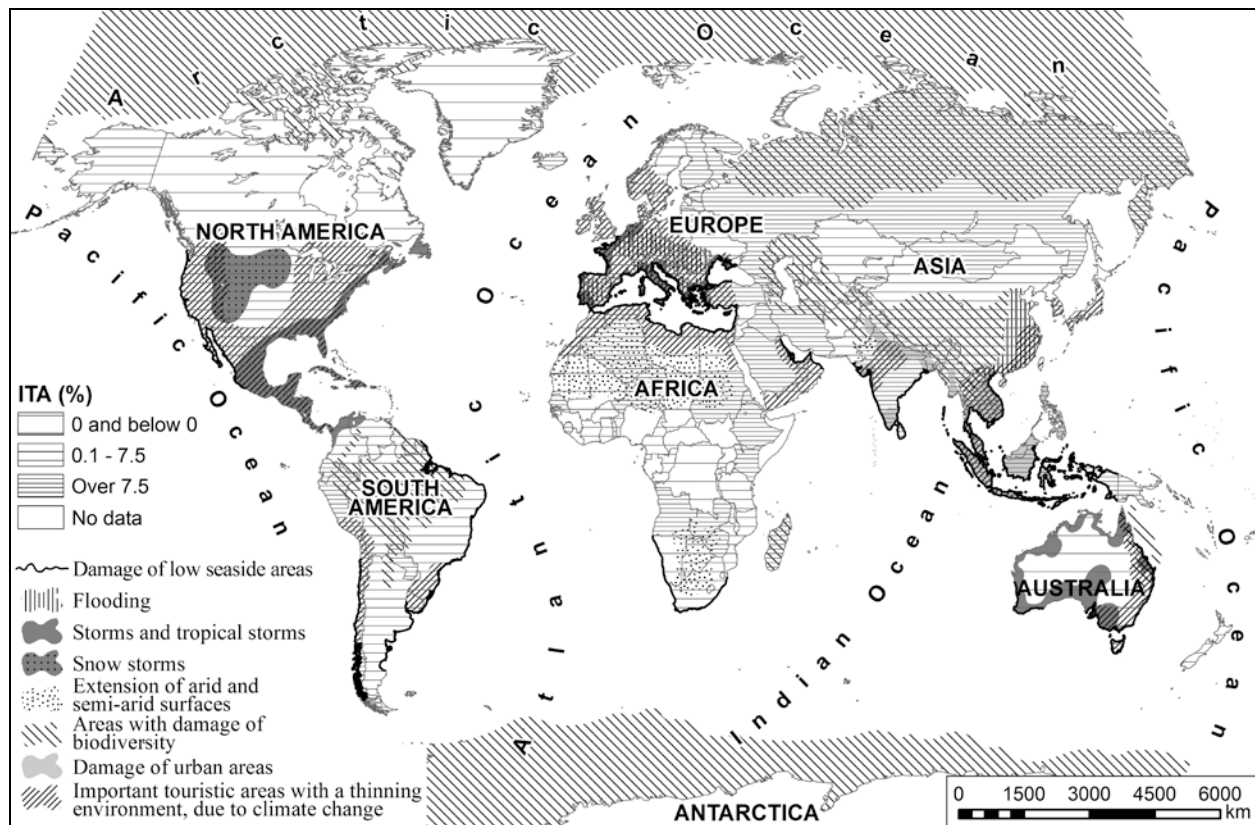


Figure 3. The Evolution of International Tourism Arrivals (ITA) in 2012 (% change 2011), by countries and the fragilized areas by the climatic change.

Scientific tourism will suffer, too. For South America, Skansi, et al., (2013) have found that during the period 1950-2010, rainfall rates increased in the south-east by 26.4 mm/year, in Amazonia by 16.09 mm/year, while in North-Eastern Brazil and in the western parts of the continent they dropped slightly. Significant signals of a warming climate are evident throughout the whole continent, mainly across the eastern parts of South America.

North America: the increase of snowfall amounts of the west will take place simultaneously with an increase in the number of snow thunderstorm episodes, affecting winter tourism and transport; the increase of thunderstorm phenomena along the southern and eastern coastlines, which will slightly move towards the temperate zone; the seaside areas will be affected by floods and hurricanes.

The polar regions: there will be recorded a reduction in the ice layer's surface and thickness, which will also affect the natural ecosystems, birds, mammals and predators alike, with consequences on adventure tourism, fauna and ecotourism. As a general consequence, the ecosystems and habitats in Antarctica and the Arctic regions will become more fragile; the traditional life of the inhabitants - the Eskimos, an old people, or the Siberians (Komi) - will suffer a lot of changes.

Islands and archipelagos will suffer due to the

amplification of coastline erosion phenomena, with consequences for people and for tourist attendance due to: the sea level increase; intensified thunderstorm phenomena; the rising incidence of tsunami waves and storms; frequent floods; the faster damage to the beaches and reefs, affecting tourism (Belize, Australia, Vanuatu, and so on).

6. CONCLUSIONS ON THE IMPACT OF CLIMATE CHANGES ON TOURISM

Environmental embrittlement due to climate warming, with its manifestation phenomena: annual average temperature increases, damage of low seaside areas, flooding, storms, extension of arid and semi-arid surfaces, damage of biodiversity, damage of urban areas affect tourism but not the tourism movements which have steadily increased.

Predictable consequences for tourism, whose feedbacks are already seen, are:

- a regional redistribution of tourist flows;
- the emergence of preferences for rural destinations and natural areas, ecotourism development;
- the modification and diversification of tourism service structures, preference increasing for thermal resorts, thalassotherapy, seaside and river cruises and also for the colder regions, in response

to the global warming effects;

- “elevating” the mountain resorts to higher altitudes and arranging skiable slopes on the shadowy mountainsides;

- the reconversion of various mountain resorts located at medium altitudes for trekking, walking, climbing, playing golf, swimming and other activities;

- high costs involved in coastal landscape arrangements, as a result of the rising levels of the planetary ocean;

- increasing health risks due to the reduced body adaptability to new pathogenic germs;

- higher costs for lake tourism. States that have large lacustrine areas, such as Canada, China, Poland, Baltic States, Finland or states that are concerned with these matters, such as Hungary, have undertaken impact assessment studies and stimulated scenarios regarding the evolution of lake tourism;

- the multiplication of “last minute” booking, as a result of tourist demand under the incidence of “nice weather” conditions;

- the appearance of a new generation of mountain and coastal resorts better integrated into the environment.

Closely related to and influencing one other, climate changes and tourism are gradually ascending phenomena. Climate changes generated by global warming have been affecting tourism both at the global and at the regional level, without disturbing, however, its ascending trend.

The actors from the tourism sector – tour operators, transporters, hoteliers and developers – have had to adapt their offers taking into account the evolution of the tourist market.

As a result of changing attitudes towards the environment, a new form of tourism has emerged and developed – ecotourism, which puts a greater emphasis on the environment, on preserving its elements. Disseminated at a global scale, local ecotourism will promote a generalized respect for the environment (Ianoş et al., 2009) and will define a new international form of tourism.

What has been noticed is a tendency of the major tour-operators to promote ecotourism and educate tourists in a “pro-climate” sense. For example, TUI - the giant German Tour Operator - is always involved in good practices towards people and nature. As part of the “pro-climate” education offered to tourists, attempting to raise their awareness that, in turn, they may become defenders of the environment, tourists are introduced to the manner of calculating the CO₂ footprint (Ecological Footprint), the equivalent of a return flight departing

from Frankfurt/Main to their destination, this process making them aware of the effects of global warming. The human society responds to the effects of climate changes in different ways, depending on the economic level and on the environmental education people receive.

Among the consequences of climate change for tourism, the following are self-evident: the “elevation” of mountain resorts to higher altitudes, so that they may maintain their profile as centres for the practising of winter sports; changing the hierarchy of tourist centres and areas with a weakened natural environment; shortening the holidays of summer tourist in one and the same location, simultaneously with their diversification and combination; “shifting” the tourist frequency peak for spring and/or autumn; increasing the frequency in summertime tourism in the mountainous areas with the climatic parameters of the cold season (temperature, snow layer, etc.) that have been depreciated as a consequence of climate change; the development of various forms of tourism, such as congress tourism (Meetings, initiation, congresse, exposition or MICE), exhibition tourism, cultural tourism; emphasizing the phenomenon of heliotropism, and highlighting the areas with holiday houses as second homes, such as the French Côte d’Azur, and the retirement areas, such as Florida, punctual locations in the Dominican Republic, along the Spanish coastline, in Thailand or Cambodia.

In the case of mountain tourism, due to the phenomenon of global warming, the resorts from the temperate climate area specializing in winter sports and located at 1800-2000 m altitude, will have to relocate, to be “elevated” to 2500-3000 m altitude in order to preserve their profile. Thus, the older generation of mountain tourism resorts will change their profile, each resort adapting itself to the new local conditions and demand. It is required a corporate adaptation of strategies.

Coastal tourism resorts (centres), very attractive now, are also located in a natural environment that has been weakened by the effects of global warming. Predictions for the next century indicate an increase of the planetary ocean’s level by 6-8 m, and by 14 m in 200-300 years’ time! Under these conditions, the physiographic configuration of the current coastline will suffer major changes, as will the largest part of the major tourism arrangements, including the “Riviera”. It would be hazardous to enumerate the thousands of miles of beaches and hundreds of coastal resorts that will be invaded by the sea, especially since a lot of factors are involved in shoreline dynamics.

Urban tourism is very popular today; the predictions of the WMO show that between the years 2050 and 2060, as a result of climatic change, there will begin a climatic aridization process of the large urban areas in the temperate zone. The effect can be attenuated if measures are taken now to expand the green areas, to reduce greenhouse gas emissions, to limit individual road transport in favour of common transportation, to integrate the built space into "islands" of green, etc.; that is the only way they will remain attractive for tourists. In all the cases presented above, depending on the dynamics of the phenomena, tourist flows will experience a quantitative reorientation and reshaping. The tourist frequency border will move, for mountain tourism, to higher mountain areas and to boreal areas; to virgin coastal areas (from Mozambique, Australia, Brazil and so on), with hundreds of miles of beaches still unspoiled by tourism, or to coastal areas which, depending on the evolution of the coastline, will respond to the sea level increase through safer relocations; as regards urban tourism, tourist flows will refocus on cities with an attractive climatic comfort index. These cities usually have large, inclusive green spaces, are surrounded by large forests with a recreational function and large areas of water, and have a balanced ecosystem; such is the case of the northern capitals, like Oslo, Stockholm and Helsinki.

The human society is greatly concerned with global warming and its effects, especially since this process has no precedent in the past, the cyclicity of interglacial warming having been caused by solar activity and not by human activity. Therefore, the most appropriate methods in response to its effects have been sought. For actors in tourism - developers, carriers, tour operators, government institutions, the tourists themselves, the effects of global warming on their sphere of activity have become a matter of great concern. Laboratories have already been founded for studying the impact of climatic change on tourism, as exemplified in the article. It is necessary to create a network of 15-20 laboratories located in representative points for the environment and the area they study, spread throughout the world, under the dual authority of WMO and WTO.

My study intends to warn about the acuity of the problem and also to urge scientific analysis moving in the direction of the inter-conditioning between climatic changes and tourism, including by reference to case studies. The specialized laboratories that I mentioned above can achieve this and provide a fair and coherent response that society can adopt in the face of this global challenge.

Responding to these changes, international tourism will engage in a permanent adaptation process, selecting more specific destinations, re-directing tourist flows and calibrating their intensities.

Thanks to the specialized regional organisms of the World Tourism Organization (WTO), the developers in the sector of tourism are well informed and prepared to meet the challenges caused by climate change.

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