www.ejthr.com

European Journal of Tourism, Hospitality and Recreation
Vol. 2, Issue 1, pp. 42-71, 2011

Printed in Portugal

EFFECTS OF CLIMATE CHANGE ON ROMANIAN MOUNTAIN TOURISM: are they positive or mostly negative?

Camelia Surugiu
Marius-Razvan Surugiu
Cristi Frent
National Institute for Research and Development in Tourism, Romania
Zélia Breda
University of Aveiro, Portugal

Abstract: Climate change represents a real threat for the winter sport resorts, especially those situated at low altitudes and without any diversification of the tourism product. Mountain tourism represents a real attraction for the holidays and for short weekends being mostly visited by tourists in summer and winter season, which make them more vulnerable to the lack of snow in the cold season, floods, storms or even heat waves. This paper has two main objectives, firstly to measure the impact of the climate change on tourism demand for Romanian mountain tourism, and secondly to identify sustainable solutions for adaptation of vulnerable mountain resorts, such as Sinaia, one of the most known winter sport resorts in Romania. First, the authors will identify the impacts of climate change on Romanian mountain tourism, starting with the effect of the temperature increase, snow depth variation and the extreme weather events occurring in mountain resorts on tourist flows. Positive and negative effects of climate change will be identified, and starting from the results, the authors will present necessary measures to transform the Romanian mountain tourism in an adaptive destination. **Acknowledgement**: This paper was supported by CNCSIS-UEFISCU, project number PN II-RU 94/2010, Contract no. 30/28.07.2010. **Keywords**: tourism, mountain, climate change, effects, Romania.

Resumen: El cambio climático representa una amenaza real para los deportes de invierno, especialmente aquellos ubicados a baja altura y sin la diversificación del producto turístico. El turismo de montaña representa una verdadera atracción para los días festivos y fines de semana cortos, siendo más visitados por los turistas durante la temporada de verano e invierno, lo que los hace más vulnerables a la falta de nieve en la temporada de frío, inundaciones, tormentas o incluso por las olas de calor. Este estudio tiene dos objetivos principales: en primer lugar, medir el impacto del cambio climático sobre la demanda turística para el turismo de montaña de Rumania, y en segundo lugar, identificar soluciones sostenibles para la adaptación de las estaciones de montaña vulnerables, como *Sinaia* ubicado en el *Valle de Prahova*, uno de los centros más conocidos de este deporte en Rumania. En primer lugar, van a identificar cuáles son los impactos del cambio climático en el turismo de montaña en Rumania, empezando por el efecto del aumento de la temperatura, la variación de la profundidad de la nieve y fenómenos meteorológicos extremos, en los resorts turismo de montaña. Los efectos positivos y negativos del cambio climático serán identificados y, a partir de los resultados, los autores presentan los pasos necesarios para transformar el turismo de montaña de Rumania en un destino adaptado al cambio climático a través de la innovación, del desarrollo de productos, de las asociaciones y de la iniciativa empresarial. **Palabras clave**: turismo, montaña, cambio climático, efectos, Rumania.

RESUMO: As alterações climáticas constituem uma ameaça real para os desportos de Inverno, principalmente quando são praticados em locais situados a baixa altitude e sem diversificação do produto turístico. O turismo de montanha é uma verdadeira atracção durante as férias e nos fins-de-semana prolongados, sendo mais praticado pelos turistas nas épocas de Verão e de Inverno, o que torna especialmente vulnerável: no Inverno, devido à falta de neve, a inundações e a tempestades; no Verão, devido às ondas de calor. Este artigo tem dois objectivos principais: em primeiro lugar, medir o impacto das alterações climáticas sobre a procura turística no turismo de montanha da Roménia, e, em segundo lugar, identificar soluções sustentáveis para a adaptação das estâncias de montanha vulneráveis, como *Sinaia*, situada no *Vale de Prahova*, um dos centros mais conhecidos deste desporto na Roménia. Em primeiro lugar, são identificados os tipos de impactos das alterações climáticas no turismo de montanha na Roménia, começando pelos efeitos do aumento da temperatura, da variação da profundidade da neve e dos fenómenos meteorológicos extremos, nos *resorts* de turismo de montanha. São identificados os efeitos positivos e negativos das alterações climáticas e, com base nesses resultados, os autores apresentam os passos necessários para transformar o turismo de montanha da Roménia num destino adaptado às alterações climáticas através da inovação, do desenvolvimento de produtos e de iniciativas empresariais e associativas. **Palavras-chave:** turismo, montanha, alterações climáticas, efeitos, Roménia.

INTRODUCTION

Mountain tourism is strongly dependent on natural and cultural resources. Environmental conditions, especially climate, affect tourism development in mountain areas. These areas are also amongst the most threatened ecosystems by climate changes.

The interdependence of economic activities implies that climate impacts would extend far beyond resources, activities, and regions where physical effects are initially observed (Rose et al., 2000). The negative effects generated by climate change on agriculture, forestry, fishery, and infrastructure will leave their mark on the tourism sector, decreasing the quality of the services provided to tourism operators, affecting them in terms of inputs, outputs, incomes, and prices.

More scientists are agreeing that the climate is likely to change in the decades to come. Regional weather patterns, including change of landscape and on nature due to changed weather conditions; the perception and evaluation of climate change in society and political, administrative and economic reactions; and weather conditions in competing destinations may influence tourism in a given mountain area, namely its attractiveness as a destination and the motivation of visitors to go there.

Winter tourism is particularly vulnerable to climate change, but its sensitivity varies considerably across regions. Climate change will come with "winners" and "losers", both in terms of regions, and in terms of ski areas themselves, with low-lying ski areas being considerably more vulnerable than areas with high altitudinal range (OECD, 2007). For most mountain resorts, good snow conditions are a necessity, but with a differentiated tourism product the resorts will not be endangered. Still, financial viability of mountain cable-way companies will be seriously affected and ski tourism will no longer be profitable.

In tourism, and not only, adaptation measures are necessary to face climate changes. There is a continuous need for tourism destinations and economic agents from tourism to adapt to climate change in a sustainable manner, in order to minimize the risks and to understand the new opportunities that may appear.

This paper aims not only to measure the impact of climate change on tourism demand for Sinaia resort as a winter sport destination, but also to identify sustainable adaptation solutions for vulnerable mountain resorts. In the second section the authors will focus on the literature review on the impact of climate change on mountain resorts and particularly winter sport destinations. The third section will present the tourism activity in Sinaia resort and its exposure to climate change. In the fourth section the vulnerability of Sinaia resort will be depicted, with the authors presenting the methodology of analysis and the regression analysis and final results. Positive and negative effects of climate change will be identified and starting from the results, in the fifth section the authors will present the necessary measures for adaptation and mitigation to climate change to transform the Romanian mountain resorts in adaptive destinations to climate change through innovation, product development, partnership and entrepreneurship.

LITERATURE REVIEW ON THE IMPACT OF CLIMATE CHANGE ON MOUNTAIN RESORTS

Climate in mountain areas varies considerably. In these areas, effects of climate change may refer to issues such as less snow, melting of the glaciers, etc. and as a result some impacts over mountain agriculture, mountain tourism, etc. may appear. Changes in climate, including the frequency of extreme events, will alter a wide range of characteristics of mountain systems: the cryosphere, ecosystems, and mountain economies (Björnsen Gurung, 2006).

As a result of the temperature increase in the winter season, the precipitation will vary considerably, the duration of snow and its thickness will be reduced. Warmer winters will come with more rain and less snow. Climate change will also bring uwanted events in nature that also affect the environment, such as fires in wild forests, storm, floods that also affect households located near rivers, etc. These events are already taking place, though with a bigger power than in the past, and in many places of the planet. The uncertainty and the crisis in European mountain tourism are both caused by climate and geo-cultural change (Bourdeau, 2009).

Various changes could have impacts on mountain settlements, on agriculture-based livelihoods, infrastructure from those areas, people's health, environment, etc. Today, the mountains are facing enormous pressure from global changes related to drivers such as climate change, industrialisation, increasing population, and changes in land use that place added demands on the ecosystem services the mountains offer (ICIMOD, 2009).

Climate change is a long-term challenge, which may alter the competitive relationship between tourism destinations (Scott, 2003), being both an indicator for structural contradictions and weaknesses of alpine tourism, and a "booster" for a cultural, geographic and economic revolution in the tourism industry (Bourdeau, 2009) and leading to a new pattern of favoured and disadvantaged ski tourism regions, with increasing pressure on ecologically sensitive high-mountain regions (Bürki et al., 2003).

In the last few years researchers attempted to estimate the effect of climate changes on mountain tourism, analysing the patterns of climate-tourism relationship. Thus, Koenig and Abegg (1997) examined the impacts of three consecutive snow-deficient winters at the end of the 1980s on the winter tourism industry in Switzerland, showing that ski areas in lower altitudes suffered severe consequences, but ski areas at higher altitudes increased their transport figures. The snow--reliability of all Swiss ski fields under current climate conditions and under a 2ºC warming are investigated by authors, concluding that under current climate conditions 85% of all Swiss ski areas are snow--reliable, but this number would drop to 63% if the temperatures are going to rise by 2ºC. Rebetez et al. (1997) analyzed the debris flows in the region of Ritigraben (Valais, Swiss Alps), which generally occur in the months of August and September, in relation to meteorological and climatic factors. Debris flows linked to rain are likely to be triggered when total rainfall amount over a three-day period exceeds a significant extreme precipitation event. The analysis has highlighted the fact that the number of extreme rainfall events capable of triggering debris flows in August and September has increased. Breiling and Charamza (1999) deal with Austrian winter tourism and skiing and use a model that describes seasonal snow-cover depth related to altitude in six Alpine climate regions. According to the authors, the direction of economic impacts is clear, in terms of income losses and adaptation costs, but magnitude and time frames remain uncertain.

Richardson and Loomis (2001) apply a contingent behaviour analysis to estimate the effects of changes in climate and resource variables on nature-based tourism demand, and a visitor survey was used for a research study among visitors at Rocky Mountain National Park (USA) to analyse how their visitation behaviour would change under hypothetical climate scenarios. The results indicated that the effects of changes in certain climate variables would have a positive impact on visitation levels, temperature being found as a positive and significant determinant of visitation behaviour. Although the demand for mountain tourism in the national park was found to increase with higher temperatures, the results suggest a threshold effect where visitation may decline at levels of extreme heat.

Duchosal (2007) assessed the impact of climate change in winter tourism in the northern French Alps, the research method adopted being a questionnaire-based survey, the study revealing that a part of the resorts are more involved in the climate change management, like the lowest resorts compared with the high altitude resorts. The survey finds out that the diversification strategy is not directly linked to climate change but to the new customer needs. Moen and Fredman (2007) discuss the future development of the downhill skiing industry in Sweden and show that future climate change may have significant negative effects on both ski season lengths and associated economic impacts. The analysis of the authors show predicted losses for the skiing industry in Sweden that are larger than current ski-ticket sales. Vrtačnik Garbas (2007) deals with the potential influences of climate changes on tourist demand in selected winter sport centres in Slovenia. By using the method of inquiry, the author tried to ascertain how skiers perceive climate changes and what their potential responses are. The results of the survey, carried out in the winter 2004/05, showed that climate change would have a great influence on the structure of tourist demand and the frequency of visits. The loss of half of the present skiers would mean an enormous loss in terms of profits and the majority of ski centres (mostly smaller and middle size ones) would probably stop operating.

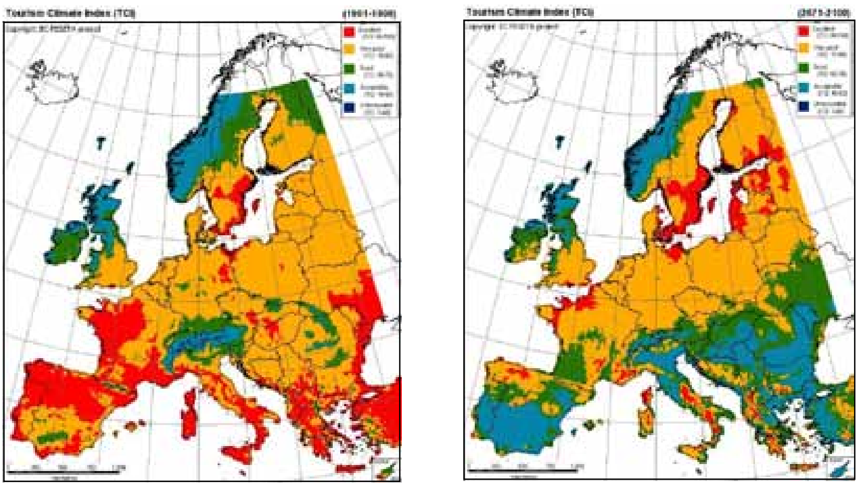
Scott and Dawson (2007) examined the supply-side vulnerability of the US Northeast ski industry under six climate change scenarios for the 21st century and under all scenarios, natural snow became an increasingly scarce resource causing decreased ski season lengths and increased snowmaking requirements. Based on the analysis, it would appear that it is not the entire US Northeast ski industry that is at risk to climate change but rather individual ski businesses and communities that rely on ski tourism.

Dawson et al (2007) use a climate change analogue approach to examine how a wider range of ski area performance indicators were affected by anomalously warm winters in the New England region of the USA. Tervo (2007) surveys the attitudes and preparedness for climate change of nature-based tourism entrepreneurs in Finland. The study also assesses which climatic conditions and weather events affect or limit the viability of snow-based tourism activities, including the differences between skiing and other snow-based activities. Based on thematic interviews and a questionnaire of nature-based tourism entrepreneurs, the results indicate that entrepreneurs providing tourism activities seem to be well prepared for normal climatic variability. Tepfenhart et al. (2007) analyzed possible impacts of climate change on the traffic dynamics on access roads to ski resorts. The authors applied a discrete choice model for day tourism to the hydrological catchment of the Upper Danube, covering parts of southern Germany, Austria and Switzerland and they applied a macroscopic traffic model in order to simulate the traffic dynamics on the road network. In different scenarios, the authors systematically study the traffic dynamics on the access roads to the ski areas, varying the shift of the lower limit of snow-reliability and hence the concentration of ski resorts. The results show that with increasing lower limit of snow reliability traffic jams will become significantly more frequent on the access roads to the ski resorts. Scott et al (2007) examine how climate change may influence park tourism in the Rocky Mountain region by focusing on both the direct and indirect impacts of climate change for visitation to Waterton Lakes National Park (WLNP) (Alberta, Canada). A statistical model of monthly visitation and climate was developed to examine the direct impact of climate change on visitation and the model projected that annual visitation would increase between 6% and 10% in the 2020s and between 10% and 36% in the 2050s. The environmental change scenarios for the 2020s and 2050s were found to have minimal influence on visitation, however the environmental change scenario for the 2080s was found to have a negative effect on visitation.

Surugiu et al. (2010) analysed the relation between climate variability and tourism activity in Predeal resort, one of the most representative ski destination in Romania, showing that tourism activity became vulnerable to meteorological parameters (temperature and snow-cover depth), with a negative relation between temperatures and tourism, which means that an increase in air temperature will generate a decrease in tourism parameters. Dingeldey and Soboll (2010) present an interacting multi-agent model as a new method of examining the impact of climate change on Alpine leisure tourism and ski areas in a complex interacting model network. The authors have developed a simulation model to rate the tourism development under different climate and societal scenarios in the German and Austrian Upper Danube catchment. According to authors, the effects of climate change are very different on a small spatial scale: some larger and higher located ski resorts will operate very successfully in the next decades and will profit from the shift of guests caused by the problems that smaller and no more snow--reliable ski areas are facing.

In order to measure the climatic suitability for general summer tourism purposes, the Tourism Climate Index (TCI) was computed (Figure 1). According to the study, some regions will see their climatic attractiveness improve in the summer, with other regions facing deterioration. Southern Europe will experience climatic conditions that are less favourable to tourism (extreme heat). At the same time, the traditional outbound northern countries will enjoy better conditions in summer, as well as a longer season with good weather. There will be significant shifts in the climatic suitability for tourism, with the excellent summer conditions moving from the Mediterranean towards northern Europe. Besides deteriorating thermal conditions, increasing water shortages are predicted, particularly in southern Europe. The TCI thus enables a comparison between destinations and therefore provides a notion of the relative severity of the impacts of climate changes.

Changes in climate occur every year, taking place more frequently than ever; this is a reality observable just by taking a look around us. According to Beniston (2003), climate change is likely to have direct and indirect impact on mountain tourism, direct impacts referring to changes in climatic conditions necessary for specific activities, and indirect impacts resulting from changes in mountain landscapes and wider-scale socio-economic changes.



Source: PESETA project.

Figure 1. Tourism Climate Index, 1961-1990 and 2071 and 2100

Year after year, it seems that milder winters and hot summers are more frequent. Without any complicated statistical estimations, the world's population may observe these changes in patterns of seasons. We can ask ourselves what policies and what measures governments could adopt in different countries or regions around the world to cope with the effects of the climate change phenomenon, but also what each individual can do to reduce the effect of climate change, starting from what each "citizen" of this planet does day by day through their behaviour to influence the ecological and environmental balance.

TOURISM ACTIVITY AND EXPOSURE TO CLIMATE CHANGE: THE CASE OF SINAIA RESORT

Prahova Valley is one of the most representative tourism regions from the country. The well known resorts from the Prahova Valley area (Breaza, Sinaia, Busteni, Predeal), both on the national and international tourist market, are concentrating an important tourist number all over the year which use the existing tourist facilities to experience different types of tourism. Tourism in this region is a tradition now and it supports the development of the Prahova Valley from an economic, social and cultural point of view.

The main types of tourism which are developed in the Prahova Valley – Brasov area are:

- *Winter tourism.* The most important component of the mountain tourism is represented by winter sports, skiing, sledding, bobsleighing, and snowboarding. The configuration of the Carpathians permits the practice of skiing from 800-2200 m altitude, without the danger of avalanches and snow storms. In the study area there are sloops and cable transportations (ski lifts, chair lifts, drag lifts, gondola lifts, baby ski lifts) which facilitate the development of these tourism forms. Some mountain areas, especially from Bucegi, offer conditions to extend the winter sports season until April – May, planning the sloops and cable transportation in a cascade system. Still the winter tourism has a lot of undeveloped tourism potential.
- *Active tourism.* The forms of relief make it possible for tourists to practice mountaineering, hiking, climbing, rappel, mountain biking.
- *Recreational tourism* supported by the presence of the Carpathian Mountains, natural potential, weather conditions and all natural conditions.
- *Business tourism* encouraged by the presence of various meeting centres for seminars, conferences, reunions in different resorts (e.g., Sinaia, Poiana Brasov, Predeal).
- *Itinerary and cultural tourism,* developed because in the region there are important cultural and historic monuments and an important heritage (archaeological sites, rich ethnographic and folkloric potential, Peles Palace, Pelisor Palace, Sinaia Monastery, George Enescu Memorial House, Cantacuzino Castle).
- *Health (wellness, balneal, treatment) tourism*, developed because of the presence of tonic and stimulating bioclimate, rich in ul-

traviolet radiations and increased ionization, pure air, rich in oxygen, without dust, relatively low atmospheric pressure, sulphate spring waters and multimineral waters.

• *Weekend tourism* which has been developed because of the closeness of important urban centres like Bucharest, Brasov, Sibiu and so on.

• *Other forms of tourism,* like hunting and fishing tourism, gastronomic tourism, ecotourism, agrotourism, speleological tourism, wine tourism.

Sinaia, also called "the Pearl of the Carpathians" is one of the most famous mountain resorts in Romania. Proximity to Bucharest, the capital, only 123 km on the road well known as "Prahova Valley" is the main asset of Sinaia (INCDT, 2007). The resort is situated at altitudes which are altering between 880 m in the south and 1000 m in the west. The first documentary mention dates from the year 1690, when the Sinaia Monastery was built by a Romanian nobleman Mihail Cantacuzino after undertaking a pilgrimage to Mount Sinai, Egypt. Initially, in this place there was a small village called Izvorul which on the desire of King Carol I, became the summer residence of the Hohenzollern Royal Family. The development of the locality started between 1870-1875, and became a town in 1880.

The most important tourist attraction in Sinaia is the Peles Castle built by King Carol I in the latter half of the 19th century. He attempted to imitate the Germanic styles from his former homeland, creating a Bavarian setting in the Romanian mountains. The Castle has 160 rooms and valuable collections of arts, weapons, furniture and it is one of the best preserved royal palaces in Europe. The castle is decorated, both the interior and the exterior, with intricate wood carvings and paintings of scenes from Wagner operas. Nearby Peles Castle is Pelisor Castle, built by Carol I for Ferdinand and Maria, the niece of Queen Victoria of Great Britain. The interiors are built in the German Renascence style. The town is well known as a balneal climatic resort, various natural therapeutic factors being present in this area like bioclimate, sulphate, bicarbonate, calcium, magnesium spring waters and mountain relief. The official accommodation capacity in Sinaia reaches 1,639 rooms and 3,385 bed-places according to the data provided by the register of accommodation units classified by the central tourism authority (MDRT, 2010). The same source indicates 90 accommodation establishments out of which 33 were boarding houses, 17 hotels and 16 villas (Table 1).

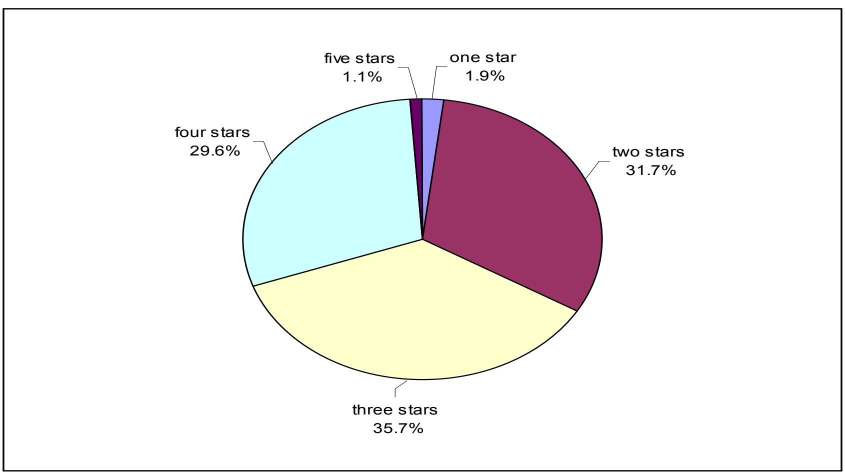
Table 1. Accommodation capacity by types of units in Sinaia resort in 2010

Type of units	No of units	No of rooms	No of bed places
Hotels	17	1,035	2,026
Boarding houses	33	291	600
Villas	16	133	264
Chalets	4	42	147
Other units	20	138	348
Total	90	1,639	3,385

Source: own calculations, MDRT, 2010.

It is important to note that hotels account for the majority of accommodation capacity with 1,035 rooms and 2,026 bed-places respectively, thus demonstrating the high share of hotels in tourism activity at Sinaia. This also shows the dominance of business tourism as a type of tourism. This is demonstrated too by the large number of conference halls (54) cumulating 3,766 seats (INCDT, 2009).

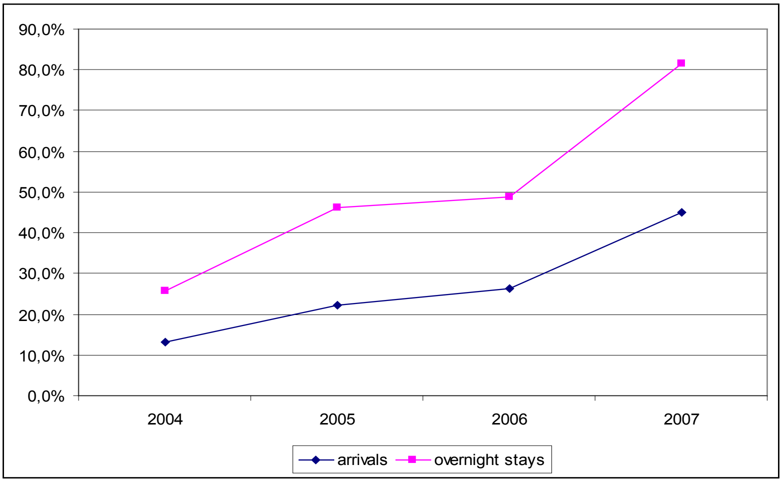
When analysing the classification categories of bed-places (Figure 2) these are equally distributed by two, three and four stars pointing out that the resort has diversified services categorization meeting the requirements of various types of tourists.



Source: own calculations, MDRT (2010).

Figure 2. Number of bed-places by classification categories existent in Sinaia resort

As regards tourist flows in 2007, Sinaia registered over 200,000 tourists and 500,000 overnight stays (DJS Prahova, 2008). It is important to see the evolution of these flows in the period 2002-2007 (Figure 3) observing that there is an obviously dynamic increasing trend both in arrivals and overnight stays. The fact that overnight stays have greater growth rates than arrivals confirms a consistent tourism development in the resort in the analysed period.



Source: own calculations, DJS Prahova, 2008.

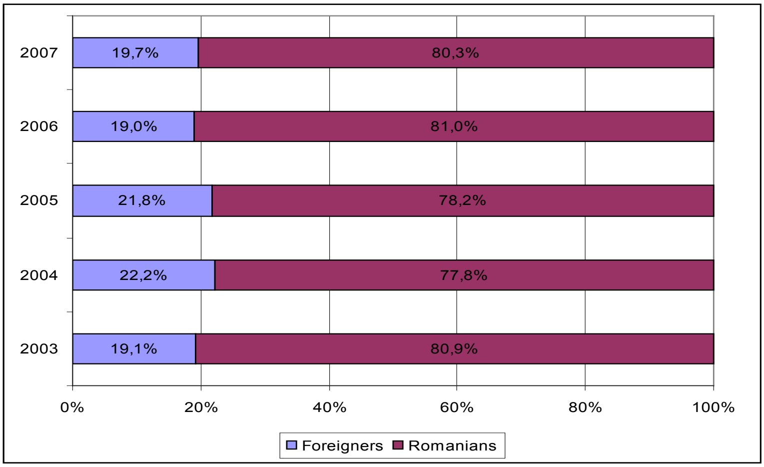
Figure 3. Growth rates of arrivals and overnight stays in Sinaia resort, 2004-2007
2003 – base year

However it must be mentioned that these figures refer only to officially registered accommodated tourists and not to same-day visitors or tourists staying at friends and relatives, or in small unclassified tourist establishments.

It is important to analyse also the profile of the tourism market based on the breakdown of overnight stays of Romanian and foreign tourists (Figure 4). This shows a concentration on the domestic market, the overnight stays of Romanian tourist representing around 80% of the total overnights recorded in the resort in the analysed period.

It has to be mentioned that this characteristic is in line with the figures for all Romanian tourism where the domestic market prevails, and Sinaia is no exception to this rule.

Besides accommodation facilities there are also other tourist facilities which contribute to the tourism activity in the resort. Therefore 65 classified Food and Beverage (F&B) facilities are located in Sinaia cumulating 8,242 table seats (MDRT, 2010). F&B facilities are also diversified as regards their categorization, half are superior categories (three and four stars), while the rest are low categories (one or two stars).



Source: own calculations, DJS Prahova (2008).

Figure 4. Breakdown of overnight stays recorded in Sinaia resort, 2003-2007

Table 2. Food and Beverage facilities in Sinaia resort, 2010

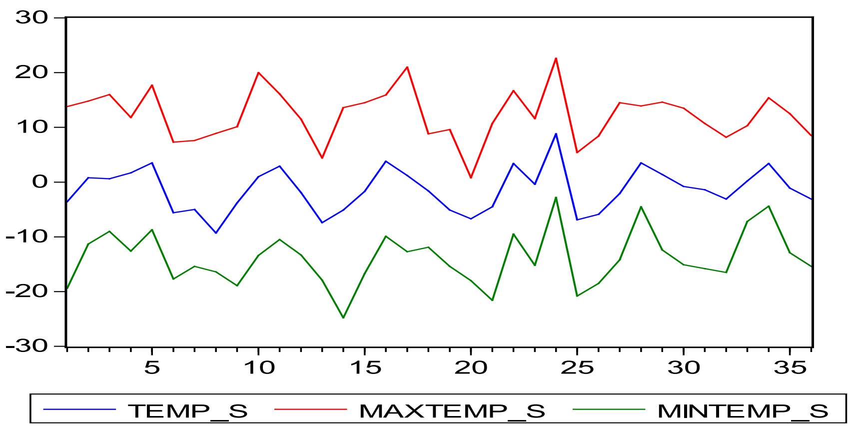
	No of units	No of table seats
Total, of which	65	8,242
one star	3	145
two stars	31	4,483
three stars	21	2,260
four stars	10	1,354

Source: own calculations, MDRT (2010).

However one must be aware of the fact that the major attraction of the resort and one of the major cultural attractions in Romania is the Peles Castle, the former summer residence of Romanian kings dating from the 19th century. The tourist product is completed with other important attractions such as Sinaia Orthodox monastery, the old Casino and historical buildings. Moreover natural resources given by the presence of Bucegi Mountains should also be mentioned. In this regard one should underline the ski area of the resort which by its extent and possibilities of tourist planning is one of the most representative tourist resource of the resort (INCDT, 2008). From all points of view Sinaia provides a complex tourist product combing both cultural and natural attractions.

Returning to the ski area Sinaia there are 9 homologated ski slopes in Sinaia, all of them being located at altitudes above 1,500 meters. Also 6 cable transport installations should be added as ski facilities such as one chair lift, one gondola, two cable cars and two ski lifts.

Although Sinaia has most of the ski area located at relatively high altitudes, the exposure to climate change should not be neglected. In this regard it is important to analyse the temperatures for 6 consecutive winter seasons more precisely to observe the evolution of the mean, maximum and minimum temperatures for the period November – April 2002-2007 (Figure 5). Some real fluctuations of the temperatures can be observed, which indicate the climatic change in each year.



Source: CLAVIER: Climate Change and Variability: Impact on Central and Eastern Europe, 6th Framework Programme.

Figure 5. Mean, Max and Min air temperature for Sinaia resort: November-April 2002-2007 (ºC)

So as a possible exposure to climate change one might speak also about the vulnerability of the resort.

VULNERABILITY OF SINAIA MOUNTAIN RESORT: METHODOLOGY AND DATA ANALYSIS

This section will investigate the relation between climatic parameters (air temperature, snow-cover depth) and tourism indicators (tourist arrivals, overnight stays, accommodation capacity in function, occupancy rate) in Sinaia mountain resort. The analysis will be carried out for the winter season, which runs from November to April, for the period

2002-2007. For this purpose, an econometric analysis will be carried out, aiming at the identification of the connections existing between climate and tourism. Some aspects regarding the cointegration, causality and correlation will be revealed. Regression analysis will also be finished and the results explained. The short chronological series of monthly data for tourist indicators (2002-2007) didn't allow the investigation for each of the winter season months of the relation climate/tourism.

Cointegration analysis

Frequently, the specialists use the cointegration test to study the statistical property of time series variables. Studies in empirical macroeconomics almost always involve nonstationary and trending variables (Greene, 2002). The issue of cointegration applies when two series are I(1), but a linear combination of them is I(0). In this case, the regression of one on the other is not spurious, but instead tells us something about the long-run relationship between them (Wooldridge, 2002).

Table 3. ADF tests results for Sinaia

Variable	t-Statistic		Level	Value
temp	t-Statistic = -6.503	Test critical values	1% level	-3.65
			5% level	-2.95
			10% level	-2.62
	R^2=0.612, R^2 adj.= 0.571, Durbin Watson = 2.20			
overnight	t-statistic = -6.02	Test critical values	1% level	-4.26
			5% level	-3.55
			10% level	-3.21
	R^2=0.597, R^2 adj.= 0.54, Durbin Watson = 1.96			
snow	t-Statistic = -0.714	Test critical values	1% level	-2.65
			5% level	-1.95
			10% level	-1.61
	R^2=0.558, R^2 adj.= 0.44, Durbin Watson = 1.88			
occupancy	t-Statistic = 0.34	T est critical values	1% level	-2.64
			5% level	-1.95
			10% level	-1.61
	R^2=0.459, R^2 adj.= 0.35, Durbin Watson = 2.09			
arrival	t-Statistic = 1.31	Test critical values	1% level	-3.68
			5% level	-2.97
			10% level	-2.62
	R^2= 0.64, R^2 adj.= 0.52 Durbin Watson = 1.99			

Source: authors own calculations.

To perform an Augmented Dickey-Fuller (ADF) test for nonstationarity, the Eviews software was used. According to the ADF test, for the analysed period, the data regarding the air temperature for Sinaia proved to be stationary, including an intercept but not a trend (the series are displayed in Figure 5). The data available for the snow-cover depth in Sinaia proved to be non-stationary and cointegrated with the non-stationary data on tourist arrivals. Engle and Granger (1987) pointed out that a linear combination of two or more non-stationary series may be stationary. If such a stationary linear combination exists, the non-stationary time series are said to be cointegrated.

Table 4. Johansen cointegration tests results

Unrestricted Cointegration Rank Test (Trace)				
Thickness of snow cover and arrivals				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5% Critical Value	Prob.**
k=1 *	0.459	22.11	15.495	0.004
k ≤1	0.036	1.231	3.841	0.267
Trace test indicates 1 cointegrating eqn(s) at the 5% level				
Thickness of snow cover and occupancy rate				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5% Critical Value	Prob.**
k=1 *	0.481	31.833	15.495	0.0001
k ≤1 *	0.245	9.553	3.842	0.0020
Trace test indicates 2 cointegrating eqn(s) at the 5% level				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Thickness of snow cover and arrivals				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5% Critical Value	Prob.**
k=1 *	0.459	20.878	14.265	0.004
k ≤1	0.036	1.231	3.842	0.267
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 5% level				
Thickness of snow cover and occupancy rate				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5% Critical Value	Prob.**
k=1 *	0.481	22.280	14.265	0.002
k ≤1 *	0.245	9.553	3.841	0.002
Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 5% level				
* denotes rejection of the hypothesis at the 5% level				
**MacKinnon-Haug-Michelis (1999) p-values				

Source: authors own calculations.

ADF-Test reveals that the occupancy rates in Sinaia are non-stationary. Furthermore, the Johansen test indicated that these data are cointegrated with snow-cover depth. The results of the cointegration test are more reliable for occupancy rate and snow-cover depth, Max-eigenvalue test indicates 2 cointegrating equations at the 5% level (Table 4).

The overnight stays in Sinaia are trend-stationary at the 1% significance level. Taking into consideration that the air temperature and overnight stays are stationary data, the regressions will be constructed using these data series. The simple regressions using as dependent variable tourist arrivals or overnight stays or occupancy rates and as predictor the snow-cover depth didn't prove to be reliable, the p-value very high and the R-squared very low.

Test of Granger-causality presumes the use of covariance stationary data (Arize, 1993). This test is a technique for determining whether one time series is useful in forecasting another. Applying the Granger-causality test indicated that the hypothesis that snow-cover depth does not Granger-cause arrivals cannot be rejected (Table 5). Therefore, it appears that Granger causality runs one-way from climatic parameters to tourism indicators.

Table 5. Granger Causality Test Results

Null Hypothesis:	F-Statistic	Probability
overnight does not Granger Cause temp	0.450	0.642
temp does not Granger Cause overnight	9.681	0.0006

Source: authors own calculations.

The concept of Granger causality, by which we actually understand precedence, is based on the idea that a cause cannot come after its effect (Konya, 2004). More precisely, the variable snow-cover depth is said to Granger-cause the tourist arrivals, because the current value of arrivals is conditional on the past values of snow depth. For our case study, Granger causality test indicates that the air temperature causes the overnight stays, but not the other way around, using a lag of zero.

Regression analysis and results

The second step of our analysis implied the construction of the regression equation and the discussion of the results. First, using the Chow Test (Chow, 1960) in simple linear regression analyses, the results didn't show any structural breaks for the data series on overnight stays and arrivals as dependent variables and the climate parameters, namely air temperature and snow-cover depth as independent variables.

In the case of Sinaia resorts, multiple linear regressions will be performed. When there is more than one independent variable, the regression line cannot be visualized in the two dimensional space, but can be computed just as easily. In this case, multiple regression procedures will estimate a linear equation of the form:

$$Y = a + \beta_1 * X_1 + \beta_2 * X_2 + ... + \beta_n * X_n + \varepsilon \qquad (1)$$

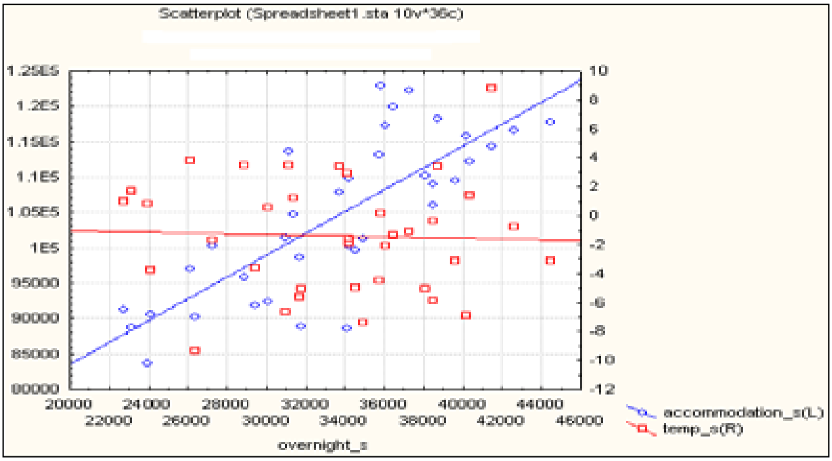
This multiple regression analysis was preferred because some other parameters like tourism offer expressed through the accommodation capacity exercised a higher influence on the arrivals and overnight stays than the climate. The general purpose of multiple regressions is to learn more about the relationship between several predictor variables and a criterion variable.

First it was tested for the simple linear regression, but afterwards the accommodation capacity in function (accommodation **s**) measured in bed-places-days[1] was introduced as manipulated variable, also due to the availability of the data series. The introduction of an additional explanatory variable improved the significance of the regression equation.

Various regression equations between tourism indicators (i.e., overnight stays, tourist arrivals and occupancy rates) as responding variables and climatic parameters (mean, max and min temperature, snow-cover depth, number of days with the snow-cover depth higher than 30 cm) and accommodation capacity in function as explanatory variables were tested for the period 2002-2007, the winter season which was extended from November to April (Figure 6). The regression equations were modelled using the EViews software. EViews' default approach is OLS/TSLS (Ordinary Least Squares, Two-Stage Least Squares), which technique minimizes the sum-of-squared residuals for each equation, accounting for any cross-equation restrictions on the parameters of the system.

The most viable results were obtained when the overnight stays were used as controlled variable and the accommodation capacity in function in combination with minimum temperature and snow-cover depth as predictors.

1 According to Romanian National Institute of Statistics, *tourist accommodation capacity in function (expressed in places-days)* represents the number of accommodation places made available for tourists by establishments of tourist reception with functions of tourist accommodation, multiplied with the number of days when the establishments are open during the respective period. Places in rooms or establishments temporarily closed because of lack of tourists, for repairs or other reasons, are excluded.



Source: authors own representation.

Figure 6. Scatter plot over overnight_s vs. temp_s and accommodation_s - Sinaia

The estimated model can be expressed as follows:

$$Overnight = \alpha + \beta_0 * Accommodation + \beta_1 Snow + \beta_2 * MinTemp + \varepsilon \qquad (2)$$

Where $Overnight$ represents the dependent variable, α the parameter representing the overall constant in the model, β_i the regressors coefficients, $Accommodation$ is the accommodation capacity in function, $Snow$ is the snow-cover depth, $MinTemp$ is the minimum air temperature, ε is the error terms.

The summary of the linear multiple regressions for Sinaia is compiled in Table 6. The multiple linear regressions were tested for significance.

The interpretation of the reported R-squared and F-statistics shows that they describe the explanatory power of the entire specification taking into consideration the number of parameters, and the number of estimated coefficients. The R-squared statistic measures the success of the regression in predicting the values of the dependent variable within the sample. In standard settings, may be interpreted as the fraction of the variance of the dependent variable explained by the independent variables. The R-squared value indicates that the variation of the regressors explains 67.4% of the variation of the overnight stays variable, whereas the remaining 32.6% can be explained by unknown, lurking variables (promotion expenditure, incomes, prices) or inherent variability, suggesting a very tight fit of the overall regression.

The p-value given for the F-statistic is the marginal significance level of the F-test. The p-value is essentially zero, so we reject the null hypothesis that all the regression coefficients are zero, showing that the model is relevant. The p-value for the coefficients of the regression equation are validated, accommodation and minimum temperature at 5%, while snow-cover depth is significant at 10% level.

EViews reports the Durbin-Watson (DW) statistic as a part of the standard regression output. The DW statistic is a test for first-order serial correlation. More formally, the DW statistic measures the linear association between adjacent residuals from a regression model. The value of the DW statistic reported above (5% significance points of dL and dU), namely, dU = 1.353 < dcalc = 2.135 < (4-1.353 = 2.647) shows that the residual variables are not serially correlated.

Table 6. Multiple regression results for Sinaia resort_VAR1

Dependent Variable: OVERNIGHT_S

Sample: November-April 2002-2007

Method: Least Squares

Included observations: 36

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ACCOMMODATION	0.437	0.054	8.125	0.0000
SNOW	-38.28	22.201	-1.725	0.0943
MINTEMP	-328.21	149.79	-2.191	0.036
C	-15276.61	6298.58	-2.425	0.021

R-squared = 0.674, Adjusted R-squared = 0.643, Durbin-Watson stat = 2.135
F-statistic = 22.03, Prob(F-statistic) = 0.000000

Source: authors own calculations.

The regression coefficients indicate the direction of the relationship between variables, showing that the relation between minimum air temperature and overnight stays is negative. That means that minimum air temperature doesn't stimulate the tourists to stay in the resort during the winter season, and thus overnight stays will decrease. One degree Celsius increase in the minimum air temperature will generate an average decrease of overnight stays of 328 tourists-days. The expected sign for the snow-cover depth (SNOW) was positive as the higher snow-cover attracts the skiers and the winter sports. The sign of the regressor is negative, contrary to what we expected, this leaves us to the idea that the profile of the resort does not entirely depend on winter sports and ski slopes.

A second multiple linear regression was finished using as predictive variables the overnight stays and as predictors, the mean air temperature ($Temp$) and minimum air temperature ($MinTemp$), number of days with the snow-cover depth higher than 30 cm ($Days\_Snow$) and accommodation capacity in function ($Accommodation$).

$$Overnight = \alpha + \beta_0 * Accommodation + \beta_1 Days\_Snow + \beta_2 * MinTemp + \beta_3 * Temp + \varepsilon \quad (3)$$

The results of the second regression are displayed in Table 7. The p-value given for the coefficient of the regressors and p-value for the F-statistic suggest that they are significant different from zero. The R-squared value indicates that the variation of the regressors explains 73.6% of the variation of the overnight stays variable. The value of the DW statistic reported above (5% significance points of dL and dU), namely, dU = 1.295 < dcalc = 2.352 < (4-1.295 = 2.705) shows that the residual variables are not serially correlated.

Table 7. Multiple regression results for Sinaia resort_VAR2

Dependent Variable: OVERNIGHT_S

Sample: November-April 2002-2007

Method: Least Squares

Included observations: 36

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DAYS_SNOW	-71.28	23.63	-3.017	0.0051
MINTEMP	-405.49	139.70	-2.903	0.0068
TEMP	79.23	29.16	2.72	0.0107
ACCOMMODATION	0.460	0.0498	9.24	0.0000
C	-19077.93	5918.81	-3.22	0.0030

R-squared = 0.736, Adjusted R-squared = 0.702, Durbin-Watson stat = 2.352, F-statistic = 21.66, Prob(F-statistic) = 0.000000

Source: authors own calculations.

As it regards the influence of each regressor, results are quite similar to the previous regression equation. Thus, an increase in minimum temperature decreases the number of overnights which are not attracted by low temperature in the mountain resorts. The increase in mean air temperature increases the number of the overnights. The number of days with snow-cover depth higher than 30 cm does not necessarily attract tourists to stay longer as the profile of Sinaia resort is more for business tourism and weekend tourism, recreational tourism and not the first option for winter sports tourism.

The regression equations indicate to us that the resort is not as much vulnerable to climate change and reduction in snow-cover depth, as expected, and an increase in temperature on the contrary seems to attract the tourists.

The most influencing air temperature parameter seems to be the minimum temperature. Conceptually, if a critical temperature level is reached conditions would likely be too uncomfortable for most people (i.e., frosty weather), and rather than increasing, visitation would begin to stabilize and then decline.

Still, the vulnerability of the resorts to climate change remains, as we can not conclude that Sinaia is not totally vulnerable to climate change effects (i.e., extreme weather events). Even so, Sinaia seems to register more positive effects from the climate change as the number of tourist arrivals increases in the hot period of the summer season, when visitors from Bucharest and other important cities come to this mountain resort attracted by colder temperatures and fresh and clean air.

CLIMATE CHANGE ADAPTATION AND MITIGATION MEASURES

In order to reduce the adverse effects of climate change on national economies, mitigation and adaptation policies have been adopted. Mitigation involves reductions in the concentrations of greenhouse gases, while adaptation measures involve acting to tolerate the effects of global warming.

The United Nations Framework Convention on Climate Change (UNFCCC) is the global framework for fighting climate change. It was constituted in 1992 in order to stimulate industrialised countries in tackling climate change. The Kyoto Protocol, concluded in 1997, is probably the most recognized action taken by UNFCCC. It commits industrialised nations to cut their emissions of greenhouse gases.

The European Union (EU) is setting the example, having put in place legislation in order to cut its greenhouse gas emissions to 20% below 1990 levels by 2020 (ECCA, 2010a). The European Commission (EC) launched, in June 2000, the European Climate Change Programme (ECCP), aiming to identify and develop all the necessary elements of an EU strategy to implement the Kyoto Protocol.

Although the European Commission has taken many climate-related initiatives since 1991, when it issued the first Community strategy to limit carbon dioxide emissions and improve energy efficiency, research in support of planning of national and international adaptation measures started only recently. Therefore adaptation, unlike mitigation, as a policy response to climate change, is still in its early stages of development, being a new policy area for the European climate change policy (ECCA, 2010b).

The ECCP II was launched in October 2005, and the Impacts and Adaptation Workgroup has been set up as part of this second programme. In June 2007, the European Commission adopted the Green Paper "Adapting to Climate Change in Europe – Options for EU Action". It represents the Commission's first comprehensive policy initiative on adaptation to climate change and can therefore be considered as a milestone. The paper offers a concise assessment of the situation in Europe and of the challenges it is facing. It argues that, parallel to deep cuts in greenhouse gas emissions, it is necessary to adapt to the changing climate conditions. It describes possible avenues for action at the EU level.

A public debate followed, in the second half of 2007, on the need for adaptation in Europe, and specifically on the role of the EU. A 'White Paper on Adaptation to Climate Change' was developed in April 2009. The European Commission is therefore exploring its role and the scope for a policy strategy to adapt to the impacts of climate change and how to best assist local, regional and national efforts.

Only a few European countries have already developed adaptation measures to climate change. One of them is Spain, which carried out a National Adaptation Plan (Oficina Española de Cambio Climático, 2006). Some of the proposed measures, activities and work areas for the assessment of impacts, vulnerability and adaptation related to the tourism sector are:

- Evaluating the role of the current climate in the Spanish tourism system and the impacts which would result from climate change in vulnerable areas and products, integrating the different scales of manifestation of the phenomenon;
- Mapping critical and vulnerable areas for tourism, under different climatic change scenarios;
- Development of indicators on the relationship between tourism and climate change for measurement and detection purposes;
- Development of management models to optimize the adaptive main options and implications for tourism policy;
- Evaluation of the potential impacts of climate change on cultural heritage (tangible and intangible) and its impact on tourism.

Portugal, for instance, has recently approved the national strategic plan for adaptation, prepared based on the findings of the most comprehensive study on the impact of climate change in Portugal – Scenarios, Impacts and Adaptation Measures (SIAM) project (Santos, Forbes & Moita, 2002). In the framework of international commitments, notably the Kyoto Protocol, Portugal has pledged limiting the growth of the country's greenhouse gases (GHG) emissions by 27 % in the period 2008-2012. To accomplish this goal, it established fundamental tools:

- The National Climate Change Programme (firstly approved in 2004, with a second programme in 2006, and its amendment in 2008) defines a set of internal policies and measures aimed at reducing GHG emissions by various sectors of activity;
- The National Allocation Plan for Emission Allowances, which is applicable to a range of facilities strongly emitting GHG, and as such included in the European Union Emission Trading Scheme (EU ETS);
- The Portuguese Carbon Fund, established in 2006, aiming to develop activities for the crediting of GHG emissions, notably through investment in flexible mechanisms of the Kyoto Protocol.

As for Romania, its greenhouse gas emissions are still below the Kyoto target, however, they are expected to continue to grow. Mitigation policies need to put into practice in order to limit emissions. Nevertheless, adapting to climate change strategies and actions are a priority, in order to tackle the severe threats from increased temperature, particularly increased risk of droughts and flooding (COWI, 2010).

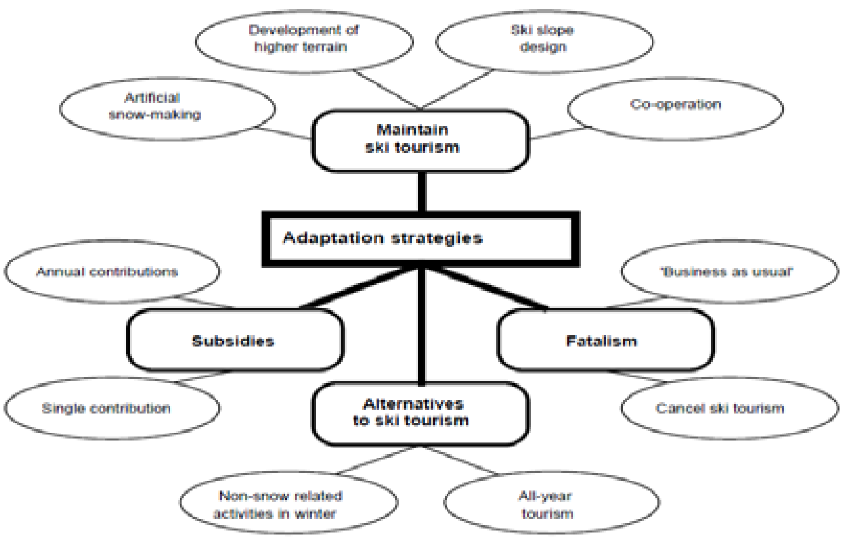
All over the world, tourism representatives at political, entrepreneurial and organizational levels are already taking some actions to fight the consequences of climate change, which represents a new challenge for tourism, particularly for winter tourism in mountain areas. These areas are adopting a growing body of action in order to minimize the negative impacts of climate change, namely the snow cover loss. These measures include technological measures, such as artificial snow making, or the diversification of services of mountain resorts to compensate for the loss of winter tourism caused by the lack of snow.

For example, in France and in Austria, large investments were made in order to introduce snow making machines. Despite their large costs, they contributed to prolong the ski season. Their introduction was also driven by other socio-economic factors, namely the enhancement of the reliability of resorts to increase revenues and expand their ski areas beyond previous natural limits (EEA, n.d.).

In Scotland, given the importance of winter tourism to the economy, some actions are already taking place, namely exploring other mountain experiences, so as to cater for a wider range of visitors, other than skiers, climbers and walkers. It is also being considered taking diversification actions to ensure the survival of winter tourism. The most extreme being the concentration on summer activities, with the eventual closure of ski resorts, or new winter activity schemes, such as indoor sports using artificial snow (Harrison et al., 2005).

Bürki et al. (2005) believe that climate change can also affect positively tourism in mountain areas. It can be viewed as a catalyst that reinforces and accelerates the pace of structural changes in the tourism industry, highlighting opportunities, namely the emergence of a two-tier structure: the co-existence of top resorts and smaller locations with less extensive developments and offers. This is a good way to alleviate the pressure from some areas, where the carrying capacity might have been already reached, or is on the way to be attained.

Nonetheless, climate change calls for the adoption of strategies and measures by tourism managers and tourists, in order to adjust to new realities. These strategies can result from four different paths (Figure 7). One of the most familiar strategies, although struggling against snow-deficient winters, is maintaining ski tourism. This may be attained by introducing artificial and high cost snow-making facilities, developing infrastructures in higher terrains, working on ski slope design and on safeguards against slope instability, or adopting cooperation actions between stakeholders. Another strategy is to develop alternatives to ski tourism, through non-snow related activities during the winter, or through all-year round tourism, based on other sports activities or nature related, for instance. Tourism promotion campaigns might be needed in order to infuse the destination image as a non-ski based destination.



Source: Bürki, Elsasser, Abegg & Koenig, 2005.
Figure 7. Adaptation strategies in mountain areas

Adopting a fatalistic approach means that both consumers and suppliers are not willing to change their behaviour, adopting a 'business as usual' attitude. Alternatively, they can simply cancel ski tourism, by closing down tourist facilities that were used for winter sports, not attempting to promote or develop other types of tourism. The last strategy is related with the subsidies, usually attributed by public entities, so as to ensure the survival of these winter ski resorts.

Other measures relate to urban planning and how it can be applied to measures in order to reduce the heat load in the cities. Additionally, the improvement of the public transportation network was recommended, which could help to reduce road accidents and the air pollution.

CONCLUSIONS

The changes in climate represent a challenge for the tourism sector, especially for the industry from mountain areas, because, for mountain tourism, less snow, more and more extreme events, etc., represent some issues that require immediate solutions and represent a threat for settlements, agriculture, business, etc., from this area.

According to the literature, climate change will bring both positive and negative effects for mountain tourism and winter sport tourism. It appears that not all the resorts will be at risk to climate change, but rather individual destinations, ski resorts or even business.

Sinaia as a mountain resort stands out thanks to its rich tourism potential, attracting important numbers of tourists, mostly domestic but also foreigners. This resort is the biggest on Prahova Valley and the visitors have the possibility to enjoy several types of tourism, winter tourism, active tourism, recreational tourism, business tourism, itinerary and cultural tourism, health (wellness, balneal, treatment) tourism, weekend tourism. Sinaia provides a complex tourist product, combining both cultural and natural attractions to offer a diverse tourism infrastructure (accommodation, food and beverage, recreational facilities, conference rooms, ski slopes).

In order to test the influence of climatic parameters (mean and minimum temperature, snow-cover depth, number of days with the snow--cover depth higher than 30 cm) on tourism demand in Sinaia resorts, econometric analyses were finished, starting with cointegration analysis and ADF- Tests, Granger causality and finishing with the construction of two regression equations. First, it resulted that Granger causality runs one-way from climatic parameters to tourism indicators. Secondly, the regression results indicated that the minimum temperature has the highest influence on the number of overnight stays, tourists not being attracted by very low temperatures. The tourist profile of the resort is not entirely made up by skiers, as the snow-cover depth and the number of days with snow-cover depth higher than 30 cm does not necessarily attract tourists to stay longer. The regression equations indicate that the resort is not as much vulnerable to climate change and reduction in snow-cover depth as expected, and an increase in temperature on the contrary seems to attract the tourists. Climate change expressed through increase in temperature does not necessarily bring only negative effects, but depending on the adaptive capacity of the resorts, it can also bring positive effects.

Thus, the second type of the results of the present paper focused on identifying the adaptation measures referring especially to the tourism product diversification and attracting tourists for various activities. Sinaia resort has a high chance to adapt to climate changes effects as it has various other tourist resources, both natural and cultural and with proper financial resources they could be sustained and developed in a sustainable manner.

The tourism sector has to be prepared to face extreme climatic events at national and local levels through improved coordination between disaster management offices, tourism administrations, businesses and host communities, and national meteorological services.

Future research should examine the way in which not only tourists, but also people living in mountain settlements, think that they would adapt to changes in climate from mountain areas, and also take into consideration other variables in the model we developed in this study, which may have an important impact over the dependent variable.

In the end, there are some questions to think about. Is it possible to circulate in large and crowded cities, and not only, with anything else than big cars that consume high quantities of fuel? Is it possible to take other measures to cool the air in the apartments, except through the use of air conditioning systems, which we know are big consumers of energy? Is it possible that deforestation, which happens for several reasons, and in many parts of the world, can be reduced? Such questions, and many others, should concern us all and may represent some future research topics, the results of such studies helping to develop strategies for a country to cope with the effects of climate changes in mountain areas.

REFERENCES

Arize, A.C. (1993). Determinants of income velocity in the United Kingdom: multivariate Granger causality. *The American Economist*, *37*(2), 40-5.

Balteanu, D., Dogaru, D., Surugiu, C., Dinca, A. I., Micu, D., & Dragota, C. (2009). Summer tourism case study: Romanian black sea coast - an assessment of sectoral vulnerability to climate change on case study level. *CLAVIER: Climate Change and Variability: Impact on Central and Eastern Europe*, 6th Framework Programme.

Beniston, M. (2003). Climatic change in mountain regions: a review of possible impacts. *Climatic Change, 59,* 5–31.

Björnsen Gurung, A. (Ed.) (2006). Global change and mountain regions (GLOCHAMORE), *Research Strategy. A joint project of the mountain research initiative (MRI), UNESCOMAB and IHP, and the EU framework programme 6*. Available at: http://unesdoc.unesco.org/images/0014/001471/147170e.pdf.

Bourdeau, P. (2009). Mountain tourism in a climate of change. *Alpine Space - Man & Environment*, *7*. Available at: http://www.climalptour.eu/content/sites/default/files/bourdeau_0.pdf.

Breiling, M., & Charamza, P. (1999). The impact of global warming on winter tourism and skiing: a regionalised model for Austrian snow conditions. *Regional Environmental Change*, *1* (1).

Bürki, R., Elsasser, H., & Abegg, B. (2003). Climate change - impacts on the tourism industry in mountain areas, *1st International Conference on Climate Change and Tourism*, Djerba, 9-11 April 2003. Available at: http://www.breiling.org/snow/djerba.pdf.

Bürki, R., Elsasser, H., Abegg, B., & Koenig, U. (2005). Climate Change and tourism in the Swiss Alps. In C. M Hall & J. Higham (Eds), *Tourism, recreation and climate change* (pp. 155-163). Clevedon: Channel View.

CEC (2009). *Adapting to climate change: towards a European framework for action*. Brussels: Commission of the European Communities.

Chow, G. C. (1960). Tests of equality between sets of coefficients in two linear regressions. *Econometrica 28*(3),591–605.

COWI (2010). *Climate Change Strategy for Romania*. Accessed on 23 October 2010 at http://www.cowi.com/menu/project/EconomicsManagementandPlanning/

Dawson, J., Scott, D., & McBoyle, G. (2007). Using an analogue approach to examine climate change vulnerabilty of the new england (USA) ski tourism industry. In A. Matzarakis, C. R. de Freitas, & D. Scott (Eds.), *Developments in tourism climatology*. Commission Climate, Tourism and Recreation, International Society of Biometeorology. Available at: http://www.urbanclimate.net/cctr/ws3/report/dTcl_2007_dawsonetal.pdf.

Dingeldey, A., & Soboll, A. (2010). *The impact of climate change on alpine leisure. Tourism in Germany and Austria*. Available at: http://ertr.tamu.edu/attachments/3112_Dingeldey%20Soboll.pdf.

DJS Prahova (2008). *Directia Judeteana de Statistica Prahova*. [data provided upon request to INCDT], February 2008.

Duchosal, E. (2007). *Climate change impacts and adaptation to winter tourism. How adapting winter tourism to climate change?* Based on a survey realised in the Northern French Alps, Master of Arts in European Tourism Management, Bournemouth University (UK), September 2007. Available at: http://www.du.se/PageFiles/5054/Duchosal.pdf.

ECCA (2010a). *EU action on climate change: Working with international partners*. Accessed 20 October 2010 at http://ec.europa.eu/clima/policies/international/index_en.htm

ECCA (2010b). *Impacts and Adaptation*. Accessed 20 November 2010 at http://ec.europa.eu/clima/policies/international/index_en.htm

EEA (n.d.), *Economic consequences of climate change*. European Environment Agency.

Engle, R. F., & Granger, C. W. J. (1987). Co-integration and error--correction: representation, estimation and testing. *Econometrica*, *55,* 251-276.

Greene, W. H. (2002). *Econometric analysis.* New Jersey: Prentice Hall.

Harrison, S. J., Winterbottom, S. J., & Johnson, R. C. (2005). Changing snow cover and winter tourism and recreation in the Scottish Highlands. In C. M Hall & J. Higham (Eds), *Tourism, recreation and climate change* (pp. 143-154). Clevedon: Channel View.

ICIMOD (2009). *Mountain biodiversity and climate change*. Available at: http://www.bdresearch.org.bd/home/climate_knowledge/cd1/pdf/IMPACT/South%20Asia_Impact/icimod-mountain_biodiversity_and_climate_change.pdf.

INCDT (2007). *Studiu de fundamentare privind reatestarea oraşului Sinaia ca staţiune turistică de interes naţional (in Support study on the certification of Sinaia as a resort of national interest). National Institute of Research Development in Tourism,* Bucharest, October 2007.

INCDT (2009). *Masterplan în turism pe Valea Prahovei și zona Brașov Râșnov (in Tourism masterplan for Prahova valley and Brasov Rasnov area).* National Institute of Research Development in Tourism, Bucharest, August 2009.

Koenig, U., & Abegg, B. (1997). Impacts of climate change on winter tourism in the Swiss Alps. *Journal of Sustainable Tourism*, *5*(1). Available at: http://www.linkbc.ca/torc/downs1/jost0050046.pdf.

Kónya, L. (2004). *Exports and growth: Granger causality analysis on OECD countries with a Panel Data Approach*. Presented at the Economic Society of Australia's 33rd Conference of Economists, Sydney, 27-30 September 2004, Published in the Conference Proceedings.

MDRT (2010). *Register of classified units in tourism – updated at 25 October*. Ministry of Regional Development and Tourism. Available at: http://mdrt.ro/turism/unitati-clasificate [Accessed 26 October 2010].

Moen, J., & Fredman, P. (2007). Effects of climate change on Alpine Skiing in Sweden. *Journal of Sustainable Tourism*, *15*(4). Available at: http://www.clima-net.org/docs/elibrary/articles/effectsofclimatechange.pdf.

Agrawala, S. (Ed.) (2007). *Climate change in the European Alps*, *adapting winter tourism and natural hazards management.* OECD.

Oficina Española de Cambio Climático (2006), *Plan Nacional de Adaptación al Cambio Climático: Marco para la coordinación entre Administraciones Públicas para las actividades de evaluación de impactos, vulnerabilidad y adaptación al cambio climatic*. Madrid: Ministerio de Medio Ambiente.

Rebetez, M., Lugon, R., Baeriswyl, P. A. (1997). Climatic change and debris flows in high mountain regions: the case study of the Ritigraben torrent (Swiss Alps). *Climatic Change, 36*,371–389. Available at: http://www.wsl.ch/info/mitarbeitende//rebetez/veroeffentlichungen_EN/Rebetez-Lugon--Baeris-B6A39.pdf.

Richardson, R. B., Loomis, J. B. (2001). *The effects of climate change on mountain tourism: a contingent behavior methodology*. Available at: http://fama2.us.es:8080/turismo/turismonet1/economia%20del%20turismo/turismo%20de%20monta%F1a%20y%20nieve/EFFECTS%20OF%20CLIMATE%20CHANGE%20ON%20MOUNTAIN%20TOURISM.PDF.

Rose, A., Cao, Y., Oladosu, G. (2000). Simulating the economic impacts of climate change in the Mid-Atlantic Region. *Climate Research*, *14*, 175-183.

Santos, F. D., Forbes, K., & Moita, R. (Eds.) (2002). *Climate change in Portugal: scenarios, impacts and adaptation measures - SIAM Project*. Lisbon: Gradiva.

Scott, D. (2003). *Climate change and tourism in the mountain regions of North America*, 1st International Conference on Climate Change and Tourism, Djerba, Tunisia, 9-11 April 2003. Available at: http://www.linkbc.ca/torc/downs1/danielscott.pdf.

Scott, D., Dawson, J. (2007). Climate Change Vulnerabilty of the US Northeast (USA) Ski Industry. In A. Matzarakis, C. R. de Freitas, & D. Scott (Eds.) (2007), *Developments in tourism climatology*. Commission Climate, Tourism and Recreation, International Society of Biometeorology. Available at: http://www.urbanclimate.net/cctr/ws3/report/dTcl_2007_scottdawson.pdf.

Scott, D., Jones, B., Konopek, J. (2007). Implications of climate and environmental change for nature-based tourism in the Canadian Rocky Mountains: a case study of Waterton Lakes National Park. *Tourism Management 28*, 570-579

Surugiu, C., Dincă, A. I., Micu, D. (2010). Tourism destinations vulnerable to climate changes: an econometric approach on predeal resort. *Buletinul Universităţii Petrol – Gaze din Ploieşti*, Seria Ştiinţe Economice, 62(1), 111-120.

Tepfenhart, M., Mauser, W., & Siebel, F. (2007). The impacts of climate change on ski resorts and tourist traffic. In A. Matzarakis, A., C. R. de Freitas, & D. Scott (Eds.) (2007), *Developments in tourism climatology*, Commission Climate, Tourism and Recreation, International Society of Biometeorology. Available at: http://www.urbanclimate.net/cctr/ws3/report/dTcl_2007_tepfenhartetal.pdf.

Tervo, K. (2007). Weather and climate as limiting factors in winter tourism in polar areas: changing climate and nature-based tourism in Northern Finland. In A. Matzarakis, A., C. R. de Freitas, & D. Scott (Eds.) (2007), *Developments in tourism climatology*, Commission Climate, Tourism and Recreation, International Society of Biometeorology. Available at: http://www.urbanclimate.net/cctr/ws3/report/dTcl_2007_tervo.pdf.

Vrtačnik G. K. (2007). The potential influences of climate changes on tourist demand in winter sport centres in Slovenia. In A. Matzarakis, A., C. R. de Freitas, & D. Scott (Eds.) (2007), *Developments in tourism climatology*, Commission Climate, Tourism and Recreation, International Society of Biometeorology. Available at: http://www.urbanclimate.net/cctr/ws3/report/dTcl_2007_vrtacnikgarbas.pdf.

Wooldridge, J. M. (2002). *Introductory econometrics: a modern approach*. South-Western College.

Submitted: 04th October 2010 Final version: 08th January 2011 Accepted: 28th January 2011 Refereed anonymously