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# EFFECTS OF CLIMATE CHANGE ON SUSTAINABLE TOURISM DEVELOPMENT IN THE REPUBLIC OF SERBIA - A CASE STUDY OF VRNJAČKA BANJA

## Abstract

*The most common definition in the professional literature is that climate is a product of the climate system. The climate system is a complex dynamic system whose basic parts are: the atmosphere, hydrosphere, biosphere, cryosphere, and their mutual relations and actions. Climate change is one of the most frequently mentioned negative phenomena in recent years. The consequences they have for the entire environment are almost immeasurable and will remain for future generations. The aim of this paper is to examine the effects of climate change which affect the sustainable development of tourism, with especial reference to Vrnjačka Banja. This tourist destination was chosen as an example of research since it is the largest and most famous spa resort in the Republic of Serbia and is in second place in terms of tourist attendance. Therefore, it is exposed to a larger number of visitors, which also has an impact on changes in the environment of Vrnjačka Banja.*

***Keywords:*** *Tourism, Sustainable Development, Climate Change, Effects, Vrnjačka Banja*

**JEL classification:** Z32, Q54, Q57

# ЕФЕКТИ КЛИМАТСКИХ ПРОМЕНА НА ОДРЖИВИ РАЗВОЈ ТУРИЗМА: СТУДИЈА СЛУЧАЈА ВРЊАЧКА БАЊА

## Апстракт

*У стручној литератури може се наћи најчешћа дефиниција да је клима продукт климатског система. Климатски систем представља комплексан динамички систем чији су основни делови: атмосфера, хидросфера, биосфера, криосфера и њихови међусобни односи и деловања. Климатске промене су један од најчешће спомињаних негативних феномена протеклих година. Последице које имају по целокупну животну средину су скоро немерљиве и*

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*остају и за будуће генерације. Циљ рада је да укаже на ефекте климатских промена које имају утицај на одрживи развој туризма, са посебним освртом на Врњачку Бању. Ова туристичка дестинација је изабрана као пример истраживања будући да је највеће и најпознатије бањско лечилиште у Републици Србији и налази се на другом месту према туристичкој посећености. Самим тим је изложена и већем броју посетилаца, који такође имају утицај на промене животне средине Врњачке Бање.*

***Кључне речи:*** *Туризам, Одрживи развој, Климатске промене, Ефекти, Врњачка Бања.*

## Introduction

In recent years, we have witnessed the growing climate change that has befallen the planet Earth. Some of them are small, but have long-term negative effects, while others are noticeable and visible today, such as the increase in temperature due to global warming. All climate change on a global level affects the living world, more precisely the processes and movements of all life on the planet. It can be stated that the anthropogenic factor, production, industry and negligence about natural resources have led to questioning the state of the Planet, which is left not only for the future, but also for the quality of the use of present generations. The rapid progress of information and communication technologies and scientific discoveries in all areas has conditioned the accelerated pace of life, the constant race for income and the acquisition of material goods. Since natural processes are long-lasting and very slow, the environment and the environment do not accept this pattern of behavior. Nature responds to the new situation with climate change, significant fluctuations in temperature, but also with the increased frequency of natural disasters. In order to establish a balance in nature to some extent, it is necessary to take appropriate measures urgently.

When it comes to tourism, it can be noticed that its impact on the environment is not negligible. Mass, which is one of its main characteristics, inevitably results in an impact on the natural resources of destinations that are often visited and popular. An example of this are the cities of Venice and Amsterdam, whose local authorities are strategically working to reduce tourist attendance in order to preserve the natural and cultural resources of the destination. Apart from the mass, one of the characteristics of tourism is the movement of people from place to place, and traffic is necessary for this process. The increase in traffic directly affects the increase in air pollution, which affects the ozone layer, etc. These chain processes have negative effects at the global level, and much more attention needs to be paid to the adequate application of the concept of sustainable development in the strategic documents of countries around the world (Voza & Fedejev, 2020).

Spas as very visited tourist places are extremely susceptible to the negative effects of tourism. The more visited the spa, the better the chances that its natural resources are endangered. Climate change also plays a relevant role in disrupting the current state of the environment and sustainable tourism development. Namely, spa tourism is based on the concept of health tourism and generally spas have a specific microclimate that favors the development of spa tourism. If the climate in these areas is disturbed, the spa loses its

primary property and function. Therefore, even the sustainable development of tourism cannot be properly implemented.

The question arises how to reduce the negative effects of climate change on the sustainable development of spa tourism? We will try to give the answer to this question in further work by presenting examples of the most visited spa destination in the Republic of Serbia - Vrnjačka Banja.

The subject of this paper is the analysis of the effects of climate change on the sustainable development of tourism. The aim of this paper is to examine the effects of climate change which affect the sustainable development of tourism, with especial reference to Vrnjačka Banja. On that occasion, the following scientific research methods were used: methods of analysis and synthesis, methods of induction and deduction, as well as a comparative method. Certain relevant data are presented in a table to make them easier to interpret through the method of descriptive analysis. The authors of the paper used the data from the official website of the Republic Hydrometeorological Institute of the Republic of Serbia for 2019 and 2020 and adjusted them to the structure of the paper. It is expected that the results will indicate unfavorable tendencies in the change of climatic conditions of Vrnjačka Banja. Therefore, there is a change in the ecological picture of this tourist destination. The question is how it is possible to achieve sustainable tourism development of this destination.

## Climate change in general

In recent years, on a global level, tourist demand is changing more and more. On the one hand, tourists tend to visit destinations with preserved natural environment and clean air, while, on the other hand, many of them want to travel in order to get to know the cultural and historical assets of the destination where they decided to spend their vacation (Gligorijević & Novović, 2018). Climate change refers to a statistically significant modification in the average state of the climate, which lasts and continues in a longer time interval (usually one decade is used as a time determinant) (Popović, et.al, 2009).

Global climate change has been a frequent topic in recent years due to worrying facts presented by scientists regarding the melting of glaciers, increasing average air temperature in certain areas, as well as due to more frequent natural disasters with increased intensity in scope and duration. Regionally, climate change manifests itself in different ways. Changes can be reflected through the change in the average amount of precipitation, humidity or average temperature for the observed annual period, for a particular region. Low-intensity changes may have a relevant effect on the probability distribution of weather events, as well as on the extent of possible extreme conditions (Wei, et.al., 2013). On the other hand, a meteorological event that is defined as an extreme in a certain region (eg. a heat wave) can be considered a completely normal occurrence in another area. An example of this is the high, tropical temperatures characteristic of the African continent, which, if they occur in, for example, Canada, can seriously damage some ecosystems or human and animal health (Bishop-Williams, et al., 2015). Since the climate system is a very complex phenomenon with various manifestations, scientists warn that crossing a certain threshold in global warming can reach a critical point, more

precisely the state of irreversible warming. This further results in an exponential increase in the greenhouse effect without the potential to mitigate and reduce this negative phenomenon (Prutsch, et.al, 2014).

It is evident, therefore, that climate change brings with it various side effects, such as scope of extreme weather conditions, which, further, have direct material consequences, ie. economic losses. Viewed in this way, the value of economic losses is expected to increase markedly soon.

When it comes to the Republic of Serbia, it is expected that there will be a significant decrease in precipitation during the summer, while a smaller decrease in average precipitation is expected during the fall. The changes during the winter and spring period have a different tendency - an increase is expected. When the average expected precipitation is taken into account, it can be concluded that an annual decrease in precipitation is expected in the Republic of Serbia (Popović, et.al, 2009). On the other hand, warmer summers await us, as well as winters with less intensity of snowfall. Temperatures in the summer increase annually, while the same tendency is observed in the winter, which is a direct consequence of global warming.

## Sustainable development and spa tourism

Tourism is a complex socio-cultural and economic phenomenon, which originated primarily on natural resources and the indigenous environment of local communities. Today, the question of the survival of tourism as we know it remains, since the long-term degradation of the basic resources on which it is based, has led to serious environmental damage. In this sense, the concept of sustainable development for tourism has a special meaning (Šušić & Đorđević, 2019).

Some authors point out that the phrase ″sustainable development″ refers to development that meets the needs of present generations, but with special regard to the rational use of limited resources so as not to jeopardize their use to meet the needs of future generations (Pavlović, et al., 2009). This also means that sustainable development represents a harmonious relationship between the needs of the environment and the demands of the economy, to preserve natural resources for future generations. More than a decade ago, World Commission on Environment and Development, also known as ″Brundtland Commission published a detailed report entitled ″Our Common Future″. It presents data and facts that indicate the danger of uncontrolled use of natural resources for profit. The danger is not only reflected in the violation of biodiversity, but it was also stated that man himself is directly endangered in this negative process (Pavlović, et al., 2009).

At a time when climate change and environmental degradation are our present, sustainable development models are recognized as the potential to reduce the negative effects of tourism on specific, vulnerable destinations. Ecological factors of tourism are today a very common topic for the general, professional and general public. In our country, this topic is relevant from the point of view of the accession of the Republic of Serbia to the European Union and the open chapter 27 on environmental protection and climate change - the most expensive and most demanding chapter with several aspects.

Spas, as a special tourist segment, have all the features of ecological tourism, especially in terms of healthy and preserved environment and natural resources. However,

in order for spas to be preserved as areas of special importance, it is necessary to pay attention to the pollution of their ecosystems. Pollution of air and other elements of the environment inevitably affects the change of climate fractors, which further have an impact on tourists, ie consumers of spa products. Therefore, it is necessary to take appropriate strategic measures as soon as possible, in order for spa tourism to remain sustainable (Pavlović, et al., 2009).

Degradation of natural resources can be the most common problem in spa tourist destinations. Namely, the increase in the number of tourists in one destination leads to a change in biodiversity, biogeochemical cycles, and therefore to a general deterioration of the environment. In that sense, it is necessary to strategically lead the tourist development of the spa area with active cooperation with the local community. This can first be done by forming a visitor management strategy.

As mentioned, the area of the Republic of Serbia is extremely rich in thermo-mineral springs, which sets us apart from other countries in Europe, yet only about 30% of groundwater potential has been used properly. However, tourism in Serbia, and especially spa tourism, is one of the activities from which great achievements are expected in economic terms and it is certainly a great opportunity that should be used (Pavlović, et al., 2009). However, apart from the negative consequences that climate change has, the. As much as the situation is not favorable on a global level because of the pandemic of Covid-19, it can be concluded that spa tourism in this sense has potential for development. In accordance with the new situation, tourists visit closer destinations in their countries. This is supported by the fact that, according to Republic Statistical Office of the Republic of Serbia data, compared to August 2019, in August 2020 the number of domestic tourist arrivals increased by 25.3% while the number of foreign tourist arrivals decreased by 87.1%. This situation should, conditionally speaking, be used and work on the development and promotion of spa tourism within the country.

## Spa of Serbia and climate change

The spas of the Republic of Serbia represent a great potential for the development of Serbian tourism. The Republic of Serbia is rich in thermo-mineral springs of cold and hot water; on the territory of the state there are over 1000 springs of thermal waters and about 50 spas in which health tourism is most represented. It is easy to come to the conclusion that the area of Serbia has rich natural resources, as well as that spa tourism is a very important branch of Serbian tourism.

The climate of certain geographical regions, such as spa destinations, has a stimulating and sedative effect on the human body, which is understood as the basis of climatotherapy. The healing properties of climate are defined as a dynamic balance of biometeorological elements within optimal limits, starting from the fact that climate treatment is a reactive therapy that achieves the normalization of vital functions, preventive, curative and rehabilitation (Ranđelović, et al., 2016).

Unfortunately, global climate changes have disrupted the ecosystem in our country, and the climate in spas has changed. Climatic factors that seemed relaxing (walking in nice weather in the fresh air in nature, for example) have significantly decreased. The increase in temperature in the summer period results in the non-use of the full benefits of the spa

by tourists. The winter months in regions like ours, which are characterized by a mild climate in the previous five years, have many more rainy days than days with snowfall. This results in very frequent floods in certain parts of Serbia, which prevents the arrival of tourists, more precisely consumers of the spa period, to these destinations. Many of the main and local roads, especially in Eastern Serbia, have been blocked due to floods in previous periods, and this may be the cause of less attendance at Serbian spas.

It should be noted the high concentration of carbon gases, which are released from industrial plants, which results in an increased manifestation of the "greenhouse effect". This is especially noticeable in the regions of Serbia where heavy industry is actively represented (Ranđelović et al., 2016). In addition to the healing properties of thermo-mineral springs, visitors to spa areas also need healthy, fresh air. It certainly cannot be said that the advantage of Serbian spas has been in the past five years. Due to the high concentration of harmful gases in the atmosphere, dense clouds of smoke and soot, which are especially visible in the winter months, are increasingly noticeable above the cities near which the spas are located. An example of this is Gamzigradska Banja, which is located near Bor and Zaječar, cities with a high frequency of air pollution.

The authors of the professional literature state that the attendance in the spas of Serbia dropped significantly in 2014, as well as that the cause is a change in climatic factors (Ranđelović et al., 2016). Since the days during 2014 were marked by intense rainfall, this resulted in a reduced number of sunny days. Temperatures in some tourist destinations decreased by almost 2˚C during the winter, especially during the night. This is reflected in the additional heating of the rooms in which tourists stay in spas; additional heating leads to increased energy consumption, which further results in increased operation of thermal power plants, which are considered one of the major polluters of the environment. This cyclical process seems unstoppable, because the winter months are not the only problem. As temperatures increase during the summer months, there is a noticeable and increased use of air conditioners in spa destinations, which results in the above-mentioned problem of increased energy consumption.

## Analysis of the effects of climate change on sustainable tourism development in Vrnjačka Banja

Vrnjačka Banja has the already built and recognizable image at the tourism market, is the largest and most famous spa resort in the Republic of Serbia. It can pride itself on the 150-year-long tradition of organized tourism activity. According to the number of visitors, Vrnjačka Banja has always been ranked the first among other Serbian spas (Lakićević, et al., 2020). In order to analyze the effects of climate change on the sustainable development of tourism in Vrnjačka Banja, we must first get acquainted with its basic, climatic specifics.

The unique topology of the terrain and lush vegetation in the area of Vrnjačka Banja has the influence that the spa has the characteristics of a temperate-continental climate: temperature oscillations are not large, the dry period is short, while the rainy period is on average long. On the other hand, Vrnjačka Banja has a lowland climate, forest type with elements of subalpine climate (Brčeski, Čikara & Maksimović, 2009). Due to this climate, there is not much precipitation in the winter, while the maximum

amount of precipitation was recorded in early summer.

The destination of Vrnjačka Banja is the reason why its climate significantly deviates from the climate of the classic urban settlements that surround it (cities: Kraljevo and Kruševac). Vrnjačka Banja is also characterized by its microclimate, which is conditioned by numerous forests, lush vegetation, significant altitude, as well as cold and hot springs and openness to the north.

The average annual temperature is 10.3°C. In winter, the average temperature is -0.8°C, and in spring it is in the interval of 10.5°C, in summer 20.0°C. In autumn, the average air temperature is 11.4°C. The highest air temperature was recorded on July 22, 1939 and it was 40.5°C. The lowest temperature was recorded on February 11, 1929. year and amounted to -28.5°C. The warmest month is August with an average temperature of 20.2°C (Brčeski, et al., 2009).

The average cloud cover in Vrnjačka Banja is 55%. The difference between the brightest month of August and the most cloudy month of January is large and amounts to as much as 35%. In all months, except the month of June, it was noticed that the clouds are higher in the morning than in the evening. On average, there are about 80 clear days a year, with average cloudiness below 20%. Thus, most of the year in this destination is moderately cloudy (Dimitrovski, et.al., 2019).

Vrnjačka Banja is not a windy area, thanks to the configuration of the terrain, mountain elevations and lush vegetation that protect it. The most common winds that occur are the northwest and north winds along the West Morava. The south wind is of medium strength. During the summer, in the evening, a slight breeze is felt. The average wind strength is between 1.8 and 2.6 Beaufort (Brčeski, et al., 2009). Windy days were recorded in February, March and April, while in other months they were much less. A large number of days in the year are without recorded winds - about 170.

The average annual humidity is quite high (78%). The driest month is August (71%), and the wettest is December (86%). The average air pressure in the summer months is almost the same and is around the value of the average annual pressure (990 mbar). In the spring months, it decreases (985.6 mbar), while in autumn and winter it goes above the average (993.2 mbar). The longest duration of sunshine is in July and August, and the lowest in December and January.

The average amount of precipitation in Vrnjačka Banja on an annual level is 928 mm, which has a favorable effect on vegetation. The month in which the highest rainfall was recorded is June, while the lowest precipitation is in September. In dry periods, drying of periodic springs occurs, while permanent springs reduce the volume of water (Brčeski, et al., 2009).

From the aspect of tourism, Vrnjačka Banja is the most famous and most visited spa in the Republic of Serbia. The development of its tourism is based on the mentioned natural factors: extremely favorable geographical position, climatic features, healing thermo-mineral springs, natural and ecologically preserved environment, flora and fauna, rich cultural and historical heritage, various events organized during the summer months and similar contents. which increases the quality of the time spent by guests (Dimitrovski, et al., 2019).

**Table 1.** Vrnjačka Banja, tourist arrivals and overnight stays in February 2018, 2019, 2020 year

| Vrnjačka Banja | Overnight stay of tourists | | | Arrival of turists | | |
|---|---|---|---|---|---|---|
| | In total | domestic | foreign | In total | domestic | foreign |
| 2020. | 31975 | 28346 | 3629 | 11403 | 9923 | 1480 |
| 2019. | 22094 | 20064 | 2030 | 6766 | 6061 | 705 |
| 2018. | 18657 | 16662 | 1995 | 6296 | 5672 | 624 |

*Source*: Authors, according to Statistical Office of the Republic of Serbia 2018-2020.

So, although the tourism of Vrnjačka Banja is not based only on health tourism, its foundations lie in the elements that make up the preserved environment. In order to gain insight into the attendance of Vrnjačka Banja, Table 1 shows the arrivals and overnight stays of tourists for the month of February in 2018, 2019 and 2020.

From the attached data, it can be concluded that the number of tourists, both foreign and domestic, is constantly increasing. When it comes to overnight stays, in February 2019, there was a total increase of 3,437 tourists compared to the previous year, 2018. In February this year, that number was increased by 13,318 tourists. Tourist arrivals in February 2019 compared to February 2018 were slightly higher (470 more), while that number increased significantly in 2020 and amounted to 5,107 guests more (compared to 2018). It is noticeable that the number of domestic tourists is constantly increasing.

These data support the claim of a constant increase in the number of visitors in Vrnjačka Banja. However, this picture, no matter how favorable it is for the economy and the economy of the locality, it is necessary to pay more attention to the increased use of resources that are directly related to the sustainable development of tourism.

**Table 2.** Vrnjačka Banja, tourist nights by months in 2019 and 2020.

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total number of overnight stays 2019 | 25133 | 22094 | 36990 | 54286 | 83939 | 85430 | 142449 | 210298 | 94687 | 62465 | 40502 | 49619 |
| Percentage of overnight stays, 2019 | 2,77 | 2,43 | 4,07 | 5,98 | 9,25 | 9,41 | 15,69 | 23,16 | 10,43 | 6,88 | 4,46 | 5,47 |
| Total number of overnight stays 2020 | 34156 | 31975 | 25318 | 8 | 31764 | 72266 | 138593 | 186200 | 92492 | 46155 | 0 | 0 |
| Percentage of overnight stays, 2020 | 5,18 | 4,85 | 3,84 | 0,00 | 4,82 | 10,97 | 21,03 | 28,26 | 14,04 | 7,00 | 0,00 | 0,00 |

*Source*: Authors, according to Statistical Office of the Republic of Serbia 2019-2020.

The frequency of foreign tourists' overnight stays on an annual basis is low. In 2019, overnight stays of foreign tourists amount to 14.72% of the total number of overnight stays, and in 2020 that percentage is even less, and amounts to 4.06%. In relation to the total number of overnight stays during 2019, the following months have equal frequency: May, June, and September with 10% of the total number of overnight stays each. The

most frequent month is August with 23.16% of the total annual number of overnight stays. All other months have a lower frequency of overnight stays in relation to the total annual number of overnight stays. The least frequent month is February (2.43%).

In relation to the total number of overnight stays in 2020 the most frequent month is August (23.26%), and then July (21.03%). The lowest frequency of overnight stays was recorded in April (0.0%). The following tables will give a monthly and annual overview of the average air temperature for 2019 and 2020. Note: it should be borne in mind that the average for 2020 is shown until September.

**Table 3.** Vrnjačka Banja, monthly display of average air temperature in 2019 and 2020, expressed in °C

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2019. | - 4 | 7 | 10 | 14 | 18 | 23 | 24 | 26 | 24 | 14 | 7 | 3 |
| 2020. | - 1 | 8 | 9 | 15 | 20 | 24 | 25 | 28 | 22 | / | / | / |

*Source*: Authors calculation according to Statistical Office of the Republic of Serbia 2019-2020.

If we have in mind the previously mentioned data that on average the coldest month is January with an average temperature of 0.7°C, and the warmest August with an average temperature of 20.2°C, in Table 2 we can see clear deviations. Namely, in 2020, in all analyzed months, an increase in the average air temperature was recorded. The biggest difference is in the month of January, when the average temperature increased by as much as 3°C, while in the warmest month, August, the difference is 2°C. Only in March, a decrease in the average temperature of 1°C was recorded. Vrnjačka Banja as the most famous spa tourist destination in the Republic of Serbia, therefore, records an increase in temperature in the past period compared to average values.

The relation between average temperature per month during the years 2019 and 2020 and the number of overnight stays is significant, positive, and strong. $r(20)=0.77$; $p=0.00$

When the relation of average temperature per months, years, and the number of monthly overnight stays of tourists is taken into consideration, it is perceived to be strong, positive, and significant in 2019, i.e. $r(12)=0.80$; $p=0.00$, as well as in 2020, i.e. $r(8)=0.75$; $p=0.03$.

Such data are very worrying given that they are a consequence of climate change in the region. It should certainly be borne in mind that other climatic factors need to be further examined in order to obtain even more precise data.

## Conclusion

We are witnessing global climate change, the consequences of which are already visible and far-reaching. The changes are attributed to anthropogenic influences that lead to an increase in $CO_2$ emissions and the creation of a "greenhouse" effect. This affects the reduction of the capacity of the environment, during the absorption of the created $CO_2$. It is also evident that tourist activities greatly contribute to world $CO_2$ production, through

traffic, heating, cooling, and other forms of energy consumption. The tourism industry has been significantly affected by climate change, both globally and locally.

From all the above, it can be concluded that climate change indirectly has effects on the sustainable development of tourism in the spa areas of the Republic of Serbia, of which, as the most visited, Vrnjačka Banja is significantly endangered. Namely, the tourism of this spa is based on its hitherto pleasant climate, which changes from year to year under the negative influence of climate change. These negative effects can be reduced as follows: strict respect and implementation of the principles of sustainable development; strategic planning of the use of natural resources of the Spa; formation of a working group that would take care that the number of visitors per year does not exceed the capacity of the Spa; switching to alternative forms of energy consumption and adequately implemented care for air pollution at the destination.

The global and regional adverse effects of climate change cannot be controlled by the actions of individuals, but effective cooperation between the public and private sectors is needed. However, some of these solutions can help Vrnjačka Banja, as a very attractive spa destination, reduce the harmful effects of climate change and excessive concentration of visitors.

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