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ЛОГИСТИКАТА ВО 21 ВЕК
CHALLENGES OF TOURISM AND BUSINESS
LOGISTICS IN THE 21ST CENTURY**

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DARK SKY TOURISM: PROSPECTS AND CHALLENGES FOR NORTH MACEDONIA

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Abstract

Due to the various negative impacts of tourist expansion, destinations frequently seek out new frontiers for expanding tourism demand while also ensuring its long-term sustainability. As a result, the 'night sky' has been identified as a natural resource that provides a unique experience for promoting dark sky tourism (DST). The goal of the study is to provide a thorough understanding of the DST idea, as well as the possibilities and challenges for its development in North Macedonia. The analysis indicated many 'dark spots' in rural areas as prospective venues for launching DST development based on the light pollution map and a quick evaluation. According to the findings, certain rural locations may be able to offer unpolluted night sky for the viewing of naturally occurring celestial phenomena.

The paper suggests that DST may stimulate tourism diversity, enhance local economies, and prevent rural regions from being neglected. As a result, DST may be considered as a long-term option for promoting rural vitality through sustainable tourist development. Future study is needed to investigate the sustainability mode in greater depth to find options for gaining dark sky designation from the International Dark-Sky Association, such as dark sky communities, parks, reserves, and sanctuaries, urban night sky places, and dark sky friendly developments of distinction.

Key words: Nature-based tourism, Night sky, Astrotourism, Sustainability.

Introduction

Over the last decade, there has been a lot of discussion on air, water, and land pollution, with light pollution being overlooked. Light pollution is described as the presence of excessive, poorly directed, and unneeded artificial illumination at night that crosses the line between meeting basic lighting needs and becomes intrusive or detrimental in the natural environment. Negligence of light pollution is partly due to a lack of knowledge of the harmful effects of artificial light on the environment and human health, but also due to a lack of allusions to the potential of using the night sky as a primary source of attraction. So, the sky glow, trespass, mild confusion, decreased night visibility are effects of artificial light (IDA, online). This obstructs astronomical observation, causes ecological disruption, and prevents seeing the stars at night (Chalkias et al., 2006; Hölker et al., 2010; Kyba et al., 2011; Pedani, 2004; Ros, 2007).

Unshielded lights cause astronomical light pollution that reduces the number of visible stars, and the sky glow from the cities disrupts distant ecosystems (Longcore & Rich, 2004). Even more, light pollution has adverse effects on human health provoking circadian disruption by light exposure at night (Falchi et al., 2011; Pauley, 2004). On the other side, the sky is the universal common heritage and must be protected along with the cultural heritage in relation to astronomy so called "tangible astronomical heritage" (UNESCO, 2009).

The concept of astronomy tourism or astrotourism is mostly based on the astronomy or astronomy-related activities such as stargazing, astrophotography, observatories, or planetarium visits, and similar, while the concept of dark sky tourism (DST) is focused on activities that encourage people to enjoy the stars, the night sky or natural darkness.

Therefore, night sky and natural darkness, thus absence or minimal light pollution, are a precondition for DST, while astronomy tourism includes daytime activities mentioned above. Both astronomy tourism and DST broaden the tourism offer while also creating a distinct and unique destination image. Overcrowding, pollution, waste and infrastructure development can all contribute to environmental degradation in rural areas where the number of visitors outnumbers the number of locals. So, sustainable, and responsible development in rural regions can contribute to save the environment and raise public knowledge of resource values. In this line, introducing the DST in rural areas may assist in protecting the environment and biodiversity, implementing sustainable development measures, and creating a unique tourism package. By combining both, the earth and the sky, people may practice tourism based on experiencing diversity by 'touching the stars' and 'doing' some activities in rural places (Clarke, 2005).

The paper presents insights for understanding the idea of the DST and possibilities and challenges for its development in North Macedonia. The goal is to raise awareness for developing new innovative tourism product in rural areas by creating completely new attractive image which also allows environmental and economic sustainability. North Macedonia is used as a suitable ground for exploration since to our knowledge, no previous investigation has been made on this topic. The paper sets out the theoretical context concerning dark sky, astronomy tourism and DST. This is followed by the methodology. Findings are discussed, followed by conclusion and recommendations.

Terminological explanation - theoretical concept

Sustainability has been vastly explored in the line of tourism development, so meeting the tourists' needs while preventing and maintaining the resources has been a clear concept (Butler, 1991; Elkington, 2004; Hitchcock & Willard, 2009; Lélé, 1991; Saarinen, 2006; Sharpley, 2000; Ruhanen, 2008). Yet, the sustainability of the starlight is a relatively new concept gaining attention in the past decade. The 'tangible astronomical heritage' of UNESCO (2009) allowed people to explore places in the universe through the day and night sky, and to encourage a sense of wonder and discovery.

Today, with the technology evolution, tourism develops far beyond the Earth's limits, and reaches the stars in various forms, astrotourism, atmospheric space tourism, terrestrial space tourism, land-based space tourism, etc. (Crouch, 2001; Cater, 2009; Jafari, 2007).

There is a significant difference between astronomy tourism, DST, but also space tourism. Space tourism or orbital, lunar and interplanetary tourism is based on the opportunity of seeing Earth from the orbit or experiencing weightlessness and similar. So, space tourism takes place above the surface of the Earth in outer or atmospheric space, opposite to the DST and astronomy tourism which are based on the terrestrial surface (Bjelajac et al., 2021; Spennemann, 2008). Astronomy tourism is also known as astrotourism, terrestrial space tourism, astronomical tourism, or celestial ecotourism. It consists of activities that are related to astronomy (from professional or amateur point of view) which can be presented through travels to destinations with preserved dark skies, visitations to astronomy-related historical sites/observatories or participation in astronomical activities such as stargazing (Figure 1).

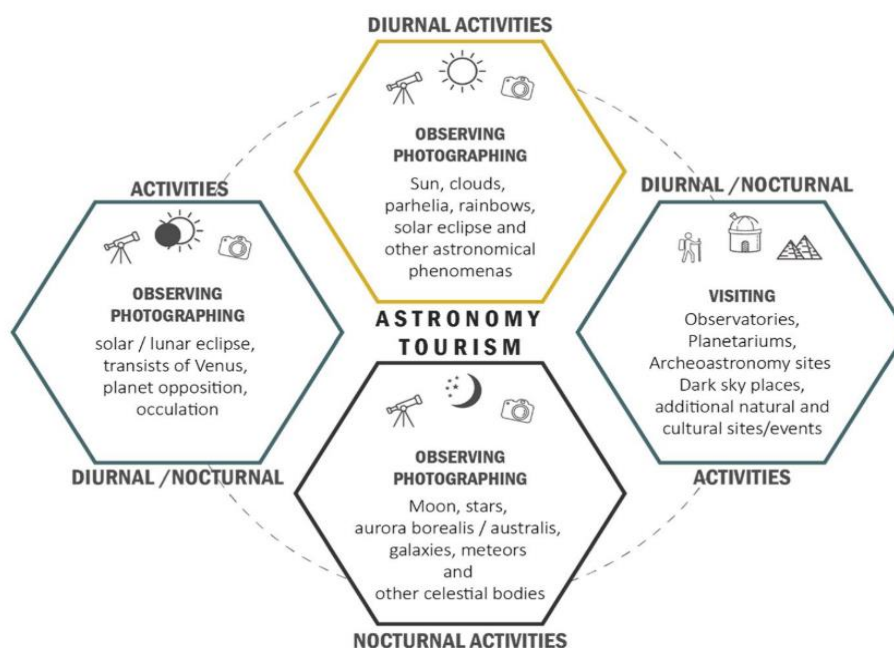


Figure 1. Forms of activities in astronomy tourism depending on the time of the day
 Source: Bjelajac et al., 2021; Wen, 2017.

On the other hand, DST consists of visitors travelling to remote, unlit areas on land or water, to observe celestial objects and can be accompanied by astrophotography or storytelling (Dalglish and Bjelajac, 2022). Therefore, the main difference between DST and astronomy tourism is that the latter is not limited by the level of light pollution and availability of dark skies.

The International Dark Association (IDA) was founded in 1988 to address the light pollution problem. Its main mission is to certify locations with exceptional nightscapes. As of August 2021, there are over 180 certified International Dark Sky Places in the world, out of which only two in Croatia established in 2019 (Vrani Kamen in Daruvar and Petrova Gora – Biljeg in Selakova Poljana) are located the closest to North Macedonia (IDA, online). Today, IDA is a well-established association that promotes programs and features on setting:

- International Dark Sky Communities (37 in the world) refers to legally structured cities and towns that implement good outdoor lighting laws and educate citizens about the value of dark sky.
- International Dark Sky Parks (100 in the world) are publicly, or privately owned places maintained for environmental protection and provide tourists with dark sky programs and adequate outdoor lighting.
- International Dark Sky Reserves (17 in the world) are made up of a dark "core" zone surrounded by a populated periphery with policy constraints in place to safeguard the core's darkness.
- International Dark Sky Sanctuaries (14 in the world) are the world's most isolated (and often darkest) areas, with the most delicate conservation status.
- Urban Night Sky Places are locations near or surrounded by major metropolitan areas where the planning and design actively encourage a genuine evening experience in the presence of substantial artificial light at night, and which do not otherwise qualify for classification as an International Dark Sky Place.

Methodology

The research makes an in-depth rapid analysis of how to use the night sky as the main resource for tourism development of rural areas in North Macedonia. It applies a holistic approach (Yin, 2004) supported by the light pollution map (Light pollution, online) and a quick evaluation.

Figures 2 and 3 present the light pollution maps of North Macedonia in World Atlas 2015 (based on the measurements from the ground) and VIIRS 2020 satellite data (measurements from above the Earth) which are not comparable due to the different type of data, but together provide a clearer picture on light pollution. Figure 4 presents the artificial night sky brightness map of Europe with North Macedonia in the red frame.

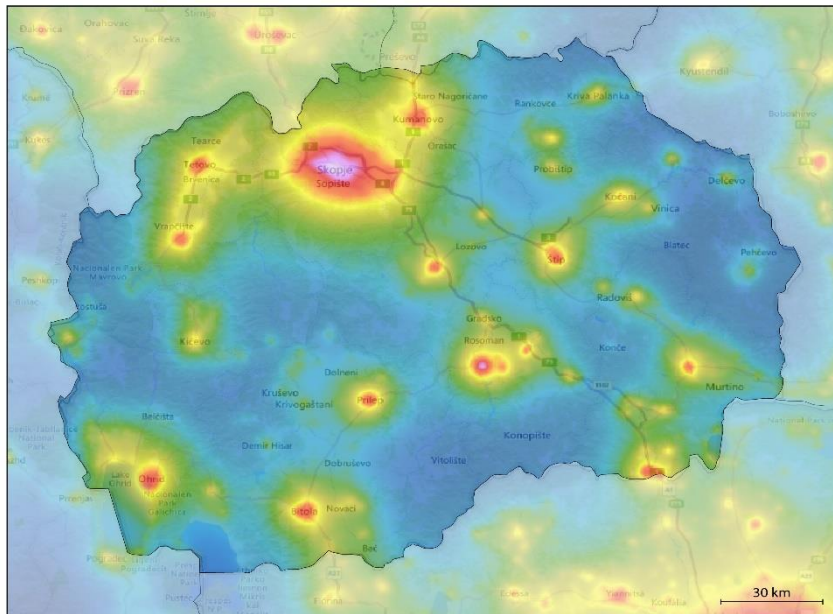


Figure 2. Light pollution map of North Macedonia, World Atlas 2015
Source: <https://www.lightpollutionmap.info>

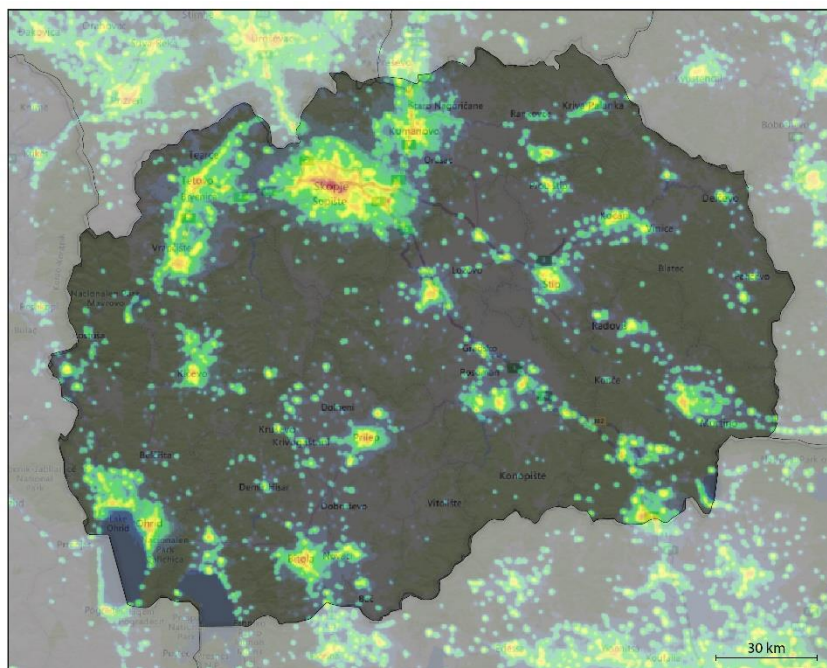


Figure 3. Light pollution map of North Macedonia, VIIRS 2020
Source: <https://www.lightpollutionmap.info>

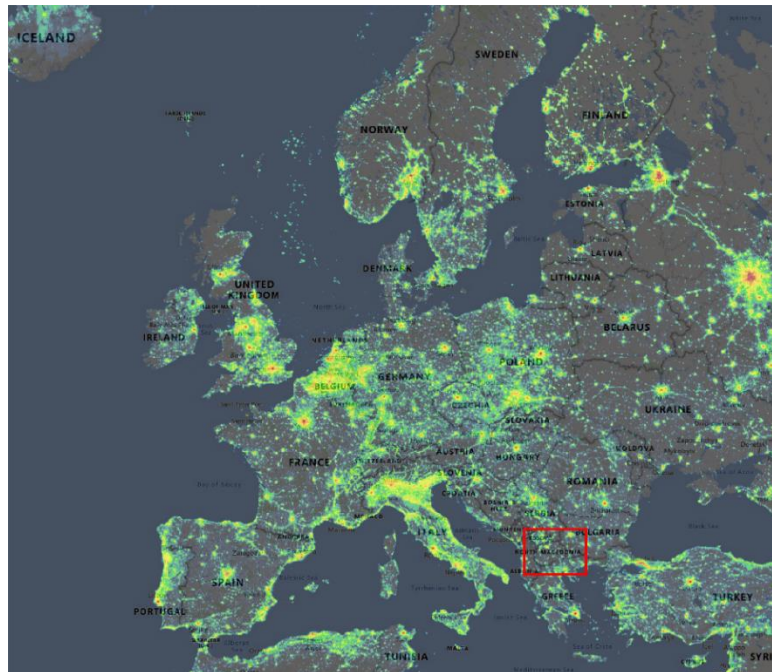


Figure 4. Artificial night sky brightness map at sea level for Europe
(North Macedonia is framed in red color)
Source: <https://www.lightpollutionmap.info>

Findings and Discussion

Based on the rapid evaluation of Figures 2 and 3, it is noticeable that generally the light pollution occurs around the urban areas of North Macedonia. So, public service lightening of streets and buildings appear to be the most powerful light polluter. It is interesting to note that except for Skopje, the capital of North Macedonia, only several large cities contribute to most of the artificial light at night in the country, as Kumanovo, Tetovo, Gostivar, Štip, Veles, Strumica, Gevgelija, Prilep, Bitola, Ohrid. The red level (Figure 2 and 3) is usually covering city centers and the immediate vicinity indicating possibility to see only few brightest stars or planets and Moon. The orange and yellow level indicates areas around urban cores where the Milky Way is still invisible, but observers can witness more stars comparing to the city centers. Green and light blue level indicate presence of artificial light at night, but Milky Way can be seen in the zenith. The darkest blue level indicate clear night skies where Milky way can be seen from horizon, with presence of minimum or no light pollution.

When analyzing Figure 4, it can be concluded that that within Europe, North Macedonia has been less light polluted compared to other European countries and even neighboring countries. This implies that North Macedonia may offer a competitive advantage when it comes to DST.

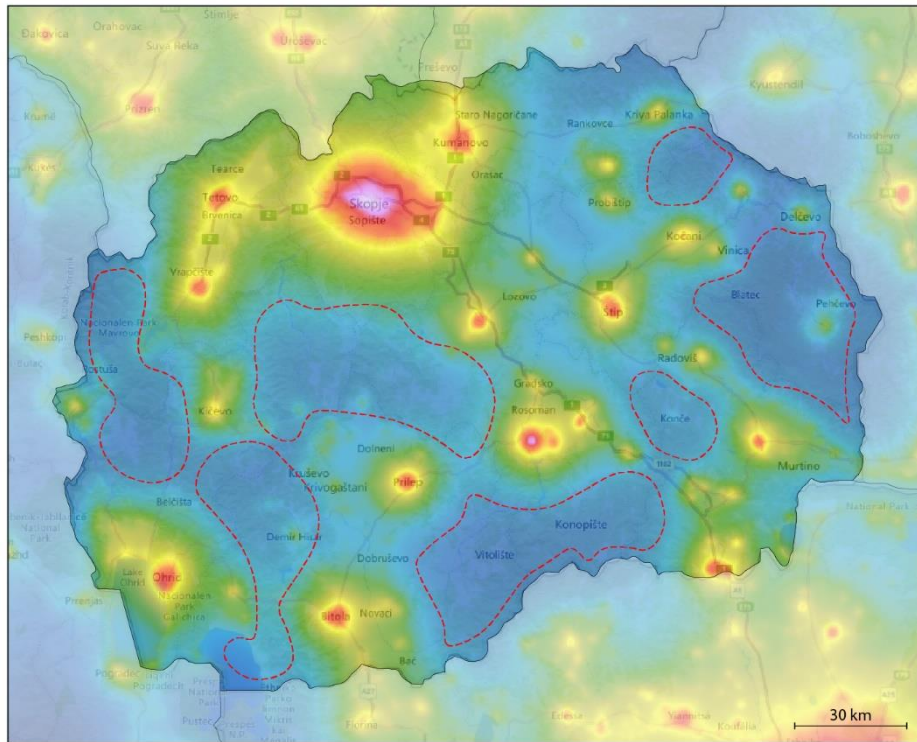


Figure 5. Dark spots in North Macedonia

Source: Authors, based upon rapid assessment of <https://www.lightpollutionmap.info>

Furthermore, the analysis indicated many potential 'dark spots' in rural areas as prospective venues for launching dark sky (Figure 5). These remote places may be able to provide a quality night sky suitable for witnessing natural celestial occurrences. Some of these dark locations have already been identified with potential for rural tourism in North Macedonia (Dimitrov et al., 2020, Petrevska & Dimitrov, 2020). This is in line with discussed possibilities for boosting development of small, neglected villages by additionally addressing the sustainability dimension. Some are even located in protected area as the National Park Mavrovo making it easier to implement the concept of DST (Rodrigues et al., 2014; Papalambrou & Doulos, 2019).

The identified dark locations may be used for creation of a distinctive tourism image from other rural destinations in North Macedonia. This raises the issue of awareness of tourism entrepreneurs for maximization of economic and environmental sustainability. Focus must be put on introducing new tourism activities based on the night sky, horse back riding at night, observation of the sky with astronomers and so forth. Along with utilizing night sky resources, these rural areas can offer rich and sustainable tourism activities during daytime – such as nature hikes, camping, eco-festivals, national gastronomy and similar. It is a way out for revitalization of small villages that suffer heavily from depopulation and economic breakdown. Tourism potential may be exploited by developing new DST product and developing area-based marketing with communities, local and regional stakeholders, and the scientific community involved. It is important selected rural dark spots to gain IDA designation and media support. Such a DST will enable creation of locations with the provision of activities that are not typical evening activities like bars and nightclubs, but rather enjoying the starlight, scenery, and life in the dark. Tourists usually have little or no experience with stargazing or are amateur astronomers who want to perform their own stargazing.

Conclusion and Recommendation

The excessive use of lightening at night seriously affects the ability to observe the dark sky, to enjoy the stars and other astronomical observations, and disrupts the ecosystem. The paper discusses the possibility

to use the dark sky as a main source of attraction for several locations in North Macedonia. It suggests that DST may boost tourism diversity and local economies and prevent rural areas from being ignored. New tourism product might be introduced enabling destination's image and diverse supply. As a result, DST may be considered as a long-term strategy for fostering rural vitality through sustainable and responsible tourism development.

Additionally, the paper argues that the night sky should be preserved serving as a base for DST development and enjoyment of nocturnal skyscape, observation of the firmament and high phenomena. Yet, to make serious further development on this matter, some insights must be taken into consideration. Namely, the most important success criteria are creativity, imagination, and innovation when refers to tourism development. At the same time, anticipating future trends is critical, but it necessitates thorough study. Funding is not always the most crucial aspect for implementing the idea, but it is the keeping the innovation process continuing, coming up with new ideas, and maintaining interest among all partners. Interaction and partnership between society, environment and various local actors is a precondition when creating innovative tourism product.

Future research is needed to investigate deeper into the sustainability mode to identify potential locations in North Macedonia for dark sky designation from the International Dark-Sky Association, such as dark sky communities, parks, reserves, and sanctuaries, urban night sky places, and dark sky friendly developments of distinction.

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