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Astro-tourism: Discovering a whole new world under the stars

Burhan Öksüz[1], Şirvan Şen Demir[2] and Nevzat Özdemir[3]

[1]*Süleyman Demirel University, FEAS, Department of Tourism Management, Isparta, Türkiye. https://orcid.org/0009-0005-4936-7369*
[2]*Süleyman Demirel University, FEAS, Department of Tourism Management, Isparta, Türkiye. https://orcid.org/0000-0003-3253-1001*
[3]*Süleyman Demirel University, FEAS, Department of Tourism Management, Isparta, Türkiye. https://orcid.org/0009-0004-7129-8024*

Abstract

Astro-tourism is a form of tourism that involves traveling to remote or dark-sky areas to observe celestial phenomena, such as stars, planets, and meteor showers, away from light pollution. This study aims to evaluate the current status and potential of astro-tourism in Melikler Plateau, located in the Yenişarbademli district of Isparta. As one of the darkest locations in Turkey, identified by experts, this region is a prime destination for sky observation tourism due to its distance from city lights. The research collects data from three stakeholders: decision-makers (municipality, district governorate, provincial directorate of culture and tourism, and universities), residents, and tourism students experiencing astro-tourism for the first time. The collected data were analyzed thematically using content analysis. The findings indicate that all stakeholders agree on developing astro-tourism to contribute to the region's economic and tourism growth.

Keywords: *Astro-tourism, Sky observations, Light pollution, Astronomy festivals, Dark sky reserves, Melikler Plateau, Yenişarbademli, Isparta*

1. Introduction

Astro-tourism, which is a niche tourism based on tourists' special interest in sky-related activities such as stargazing and astrophotography (Cater, 2010; Soleimani et al., 2019), involves traveling where transient astronomical phenomena can be observed, including auroras, solar and lunar eclipses, comets, and meteor showers (Mitura et al., 2017). Offering a unique exploration experience intertwined with nature under the mesmerizing night sky, astro-tourism is an innovative tourism segment differentiating itself from traditional tourism types. The experience of observing the Sun, Moon, planets, star clusters, and galaxies allows individuals to closely explore the vastness of the universe and the magnificent spectacles nature offers (Abouelazm, 2022). While traditional tourism forms are generally shaped around history, culture, nature, or sea-sand-sun tourism (Demir et al., 2017), astro-tourism presents a unique alternative by combining science, education, and an immersive nature experience (Mkwizu & Kimeto, 2024).

Light pollution, which is excessive and misdirected artificial light produced in urban areas, makes it difficult for city dwellers to experience the full splendor of the night sky (Jiwaji, 2016). The lack of access to an unspoiled, starry sky fosters the desire to escape the city and immerse oneself in the awe-inspiring beauty of the universe (Bjelajac et al., 2021). Astro-tourism is conducted in regions with minimal light pollution, high altitudes, and suitable atmospheric conditions (Hearnshaw, 2022). Due to these characteristics, astro-tourism is not only a touristic activity but also a significant component of sustainable and ecological tourism (Escario-Sierra et al., 2022). Encouraging individuals to be in harmony with nature allows astro-tourism to intersect with ecotourism while supporting scientific curiosity and the learning process, linking it to educational tourism (Falchi et al., 2011; Fayos et al., 2014). Additionally, unlike traditional tourism activities, astro-tourism takes place at night, which can extend accommodation durations and consequently enhance regional economic contributions (Jacobs et al., 2020).

*Corresponding author
E-mail: *sirvansendemir@gmail.com*

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The most significant appeal of astro-tourism lies in the rediscovery of stars lost in city lights through a clear night sky (Weaver, 2011). Areas where the Milky Way can be seen with the naked eye, meteor showers can be observed, or rare celestial events such as the Northern Lights serve as major attractions for astro-tourists (Abouelazm, 2022). Moreover, this form of tourism is supported by activities such as observatory visits, astronomy festivals, telescope observation tours, and night walks, offering visitors not only scenic views but also scientific awareness (Pásková et al., 2021). The future potential of astro-tourism is quite significant. Increasing light pollution and technological advancements encourage people to reconnect with nature and the stars, while the development of space tourism is expected to boost interest in astro-tourism further (Jacobs et al., 2020). Initiatives such as "Dark Sky Parks," supported by UNESCO, are increasing the number of astro-tourism destinations worldwide and fostering interest in this field. Turkey, with its geographical advantages and regions with low light pollution, holds great potential to become a significant destination in this sector (Yağcı, 2023).

Astro-tourism is gaining increasing attention as a new-generation tourism concept that integrates natural and cultural heritage with sky observations (Kunjaya et al., 2019). Notably, regions with high altitudes, clear skies, and minimal light pollution hold great potential for astro-tourism (Bjelajac et al., 2021). However, academic studies on this subject in Turkey remain limited, and in-depth research on the development of astro-tourism beyond specific regions is insufficient. Existing studies generally focus on particular centers, such as Balıkesir, Antalya Saklıkent, and Batman (Karaca, 2018; Taşaner & Arıca, 2023; Yalçın & Karabacak, 2022), while the potential of rural and untouched areas is overlooked. In this context, Melikler Plateau, located in the Yenişarbademli district of Isparta, presents a significant opportunity for astro-tourism with its low light pollution, high altitude, and natural beauty. This study aims to assess Melikler Plateau as an astro-tourism destination, address the knowledge gap in this field, and contribute to the academic literature.

The Yenişarbademli district of Isparta, located in Turkey's Mediterranean region, is a rural area with these characteristics. Situated 110 km from Isparta and 1,150 meters above sea level, Yenişarbademli lies on the western shore of Lake Beyşehir. The district includes part of the Kızıldağ National Park, renowned for its blue cedar forests and houses various natural attractions such as Pınargözü Cave, Turkey's longest cave, and Dedegöl Mountain, the highest peak in the Central Taurus Mountains at 2,998 meters (www.yenisarbademli.gov.tr/tanitim). Where construction is prohibited, national parks provide the most suitable areas for astro-tourism. Melikler Plateau, located within the national park's boundaries, has long been a popular destination for campers, mountaineers, and motorcycle enthusiasts. Following measurements conducted as part of a project by Astronomy and Space Sciences Department faculty members to identify dark sky areas in Turkey, interest in Melikler Plateau among sky observers has increased due to its low light pollution levels.

From an implementation perspective, the suitability of Melikler Plateau for astro-tourism has the potential to enhance tourism diversity in the region and revitalize the local economy (Gök, 2022). The development of astro-tourism within the framework of sustainable tourism in Turkey will promote tourism activities that are in harmony with nature. Furthermore, this study will shed light on topics such as the infrastructural requirements of astro-tourism, target audience analysis, and the interaction of local communities with this new tourism model. Given the insufficiency of existing research, this study is an essential resource for future academic studies. Consequently, it will help identify the necessary steps to establish Melikler Plateau as an astro-tourism hub and contribute to regional development.

2. Literature

Astro-tourism, a niche segment of the tourism industry, has gained increasing attention due to its potential for sustainable economic development, environmental conservation, and socio-cultural benefits. This section explores the impact of astro-tourism on regional economic development, its environmental consequences, and its socio-cultural implications.

2.1. The impact and consequences of astro-tourism on regional economic development

Astro-tourism, a type of tourism that thrives in regions with minimal light pollution and high natural and ecological value (Escario-Sierra et al., 2022), presents significant opportunities for regional economic development (Jacobs et al., 2019). Compared to traditional forms of tourism, astro-tourism is considered more sustainable (Jacobs et al., 2020) due to its relatively low infrastructure investment costs (Jiwaji, 2016) and its promotion of natural resource conservation (Escario-Sierra et al., 2022). Particularly in rural and developing areas, astro-tourism activities enhance economic diversity by providing new sources of income for local communities. The economic impact of astro-tourism on regional development can be examined under two main categories: direct and indirect effects (Vellas, 2011).

Direct effects include increased demand for tourism-related services such as accommodation, food and beverage, transportation, and guided tours. The growing popularity of astro-tourism has led to a rise in demand for boutique hotels, camping sites, and eco-lodges, thereby motivating local entrepreneurs to invest in these sectors (Van Wyk-Jacobs, 2018). Additionally, regional restaurants and local producers experience economic revitalization, creating new employment opportunities in food, agriculture, and handicraft industries.

Indirect effects of astro-tourism are observed in regional employment growth, infrastructure improvements, and the

enhancement of a region's brand value (Ennew, 2003). Astronomy festivals, observation events, and science camps organized within the scope of astro-tourism not only increase tourist activity but also attract national and international attention to the region. This influx of interest encourages investment from businesses and scientific communities, contributing to long-term regional development. However, specific considerations must be considered for astro-tourism to maintain economic sustainability. Tourism activities must be planned to avoid disrupting the natural balance, and light pollution should be controlled. Encouraging eco-friendly accommodations and ensuring the active involvement of local communities are crucial for the long-term success of astro-tourism (Kanianska et al., 2020). Additionally, improving regional infrastructure, enhancing transportation facilities, and implementing astronomy education programs can support the lasting economic contribution of this tourism segment. Astro-tourism offers an innovative development model for rural and economically disadvantaged regions (Rodrigues & Reis, 2022). By fostering tourism activities while preserving natural and cultural resources, promoting regional economic growth, and raising scientific awareness, astro-tourism is expected to become an increasingly important sector (Cater, 2010). Therefore, collaboration among relevant stakeholders is essential to support the sustainable development of astro-tourism, providing significant long-term economic and environmental benefits.

2.2. Environmental impact and consequences of astro-tourism

As a tourism segment conducted in close interaction with nature, astro-tourism offers significant advantages in line with sustainable development goals while posing specific environmental challenges. Unlike traditional tourism, astro-tourism is carried out in areas with minimal light pollution and well-preserved ecological balance, resulting in a relatively lower direct environmental impact. However, unplanned and uncontrolled growth of these activities may harm natural ecosystems in the long run. Therefore, assessing the environmental effects of astro-tourism and developing sustainable management strategies is crucial. One of the most notable environmental contributions of astro-tourism is its role in reducing light pollution. With urbanization and industrialization increasing, light pollution negatively affects natural ecosystems and human health (Falchi et al., 2011). Astro-tourism promotes policies for light pollution management and establishing dark sky reserves, directly contributing to environmental conservation. UNESCO-supported projects such as Dark Sky Reserves aim to establish sustainable environmental principles for astro-tourism activities.

However, the rising popularity of astro-tourism may exert pressure on natural habitats (Priyatikanto et al., 2019). Astrotourism sites are often located in remote, high-altitude, and pristine areas (Akeshova & Seıdıgalı, 2023). Due to inadequate infrastructure, an uncontrolled influx of visitors may lead to habitat destruction and increased pressure on flora and fauna. Nighttime observation events, in particular, may threaten sensitive ecosystems due to noise pollution, vehicle traffic, and human activity. Visitor numbers should be limited, designated observation areas should be protected, and ecotourism principles should be followed to mitigate these risks. Another environmental concern related to astro-tourism is its carbon footprint (Scott, 2022). Transportation, energy consumption, and the construction of lodging facilities contribute to regional carbon emissions (Escario-Sierra et al., 2022). The development of astro-tourism in remote areas with limited accessibility may increase fossil fuel consumption. Therefore, promoting sustainable transportation alternatives and eco-friendly accommodations is necessary (Demir et al., 2017). For example, ecological hotels and campsites utilizing renewable energy sources play a crucial role in reducing the environmental impact of astro-tourism. Astro-tourism encourages natural resource conservation and offers opportunities for environmental sustainability (Gerasimova, 2021). However, if its growth is uncontrolled, critical environmental issues such as light pollution management, habitat protection, and carbon emission reduction may be overlooked. Therefore, collaboration among local governments, tourism stakeholders, and scientists is necessary to implement sustainable policies that minimize the environmental impact of astro-tourism.

2.3. Socio-cultural impact and consequences of astro-tourism

Astro-tourism has significant socio-cultural effects beyond its economic and environmental implications (Jacobs et al., 2020). While showcasing natural and cultural heritage, it also presents both opportunities and challenges for regional communities and local populations. The socio-cultural impact of astro-tourism arises from the interactions between tourists and local communities, resulting in various transformations. Understanding the positive and negative aspects of these interactions provides better insight into the socio-cultural outcomes of astro-tourism. Astro-tourism offers an opportunity for the promotion and preservation of local cultures. Since astro-tourists primarily visit destinations for night sky observations and astronomical activities, local traditions, handicrafts, and regional cuisines often gain prominence (Zuzic, 2016). Astro-tourism allows local communities to introduce their cultural values to visitors. For example, regional festivals, traditional music performances, and folk dances attract tourists while strengthening local cultural identity (Escario-Sierra et al., 2022). Such activities preserve cultural heritage and enable communities to pass their traditions on to future generations.

However, the negative effects of astro-tourism on socio-cultural structures can also be observed. In regions where traditional lifestyles prevail, local communities may struggle to maintain their cultural identity when faced with an influx of tourists (Daly et al., 2021). The rapid growth of the tourism sector can lead to the commercialization of local culture,

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changes in traditional habits, or even their disappearance (Zhao, 2024). Additionally, transforming local lifestyles to meet tourists' expectations may result in cultural degradation (Honggang, 2003). Another socio-cultural impact of astro-tourism is increased social awareness and scientific knowledge. Astro-tourism promotes scientific curiosity at a societal level by enhancing interest in astronomy (Pásková et al., 2021). Observatories, scientific workshops, and astronomy seminars provide greater access to scientific knowledge for both local communities and tourists. This contributes to developing scientific thinking skills, particularly among younger generations, and fosters the growth of an educated society. Moreover, astro-tourism can enhance social responsibility by increasing environmental awareness. While astro-tourism encourages cultural exchange between local people and tourists, it may lead to negative effects such as cultural change and commercialization if not correctly managed. However, due to its potential to preserve cultural heritage and promote social awareness, astro-tourism can be a significant tool for strengthening and developing socio-cultural structures. The sustainable management of these processes will help maximize the socio-cultural benefits of astro-tourism.

2.4. Scientific impacts and outcomes of astro-tourism

Astro-tourism extends beyond a touristic activity and contributes to scientific discoveries and educational opportunities. It has significant potential to increase interest in scientific knowledge, particularly in astronomy, physics, and environmental sciences. Astro-tourism activities reinforce public interest in astronomy, facilitate scientific awareness, improve access to scientific information, and create opportunities for interaction with scientists. In this context, the scientific effects of astro-tourism can yield both educational and research-based outcomes (Santos-Souza & Nascimento-Dias, 2023). Firstly, astro-tourism significantly contributes to disseminating astronomical knowledge and its accessibility to the public (Govender, 2009). Scientific infrastructures such as observatories and astronomy parks allow tourists to observe astronomical phenomena while offering educational content about astronomy. These activities enable the public to learn more about the universe, increasing interest in space and astronomy. By organizing educational seminars, astronomy lessons, and observation events for adults and children, astro-tourism develops scientific thinking skills within society.

Another scientific impact of astro-tourism is its support for astronomical research (Santos-Souza & Nascimento-Dias, 2023). Visits to observatories and astronomical observations as part of astro-tourism activities can provide valuable observational data for scientists. These data can be crucial, especially for night sky observations and space-related research. The observations recorded during astro-tourism activities can help scientists learn about exoplanets, star formation processes, and cosmic events (Cater, 2019). Additionally, astro-tourism regions can facilitate the implementation of scientific projects based on astronomy research. These projects create essential research opportunities for both scientists and universities. Besides promoting scientific research and education advancements, astro-tourism can potentially encourage scientific collaboration (Egbuim, 2024). Scientists and researchers from different disciplines can establish regional collaborations through astro-tourism activities, share databases, and contribute to international scientific projects. Furthermore, these activities allow scientific communities to engage more closely with the public, increasing scientific awareness. Astro-tourism offers significant opportunities for supporting scientific research, facilitating public access to scientific knowledge, and strengthening scientific collaborations. This field is not merely a type of tourism focused on entertainment or exploration but also a strategic tool for promoting scientific developments and public education. To fully harness the potential of astro-tourism, collaboration among scientific institutions, local governments, and the tourism sector should be ensured to establish a sustainable model.

3. Method

This research is supported by TÜBİTAK 2209-A University Students Research Projects Support Program 2023/2 and application number: 1919B12317898.

The study received approval from the Süleyman Demirel University's Social and Human Sciences Ethics Committee under protocol number 157/21 and dated 29.11.2024 and adhered to the guidelines outlined in the Declaration of Helsinki for research involving human subjects.

This research is a qualitative study in which the interview method was used (Figure 1). The participants to be interviewed were determined using the purposive sampling method. Purposive sampling is widely used in qualitative research to identify and select information-rich cases to effectively use limited resources (Bryman & Bell, 2011). This sampling method involves identifying and selecting individuals or groups who are knowledgeable and experienced in the subject of interest (Palinkas et al., 2015).

3.1. Participants

Data were collected from three different sample groups in the study. The first group consists of decision-makers, including representatives from the Municipality, the District Governor's Office, the Provincial Directorate of Culture and Tourism, and universities. The second group consists of the local community, which is most affected by this type of tourism. The third group consists of students experiencing this type of tourism for the first time. Based on the literature, a semi-structured interview form was prepared to assess participants' perspectives on the development of astro-tourism in the region regarding the three pillars of sustainability: environmental, economic, and socio-cultural. The fourth pillar, the scientific aspect of astro-tourism, was excluded from the evaluation due to the inability to obtain satisfactory

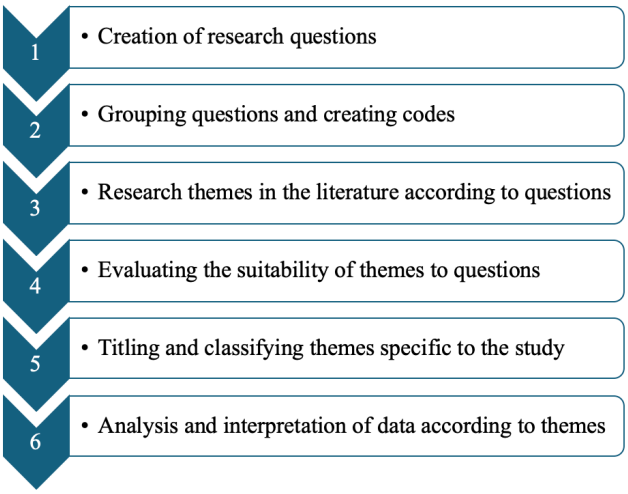
responses as it did not align with the participants' scientific backgrounds.

In the study, interviews were conducted with a total of 17 participants, including the District Governor, the Mayor, an official from the Provincial Directorate of Culture and Tourism, faculty members from the tourism departments of Süleyman Demirel University (SDÜ) and Isparta University of Applied Sciences (ISUBÜ), local community members, and tourism students. The aim was to determine their perspectives on the development of astro-tourism in their region. The interviews lasted an average of 30 minutes. The collected data, recorded via audio, were transcribed and analyzed using content analysis. Additionally, a group of tourism students was provided information about astro-tourism and Melikler Plateau. They then camped on Melikler Plateau to observe the night sky. Stars were observed with the naked eye, binoculars, and telescopes. The next day, students' opinions on this type of tourism were gathered.

3.2. Instrument and analysis

Thematic analysis follows a systematic process from data collection to reporting, ensuring a structured approach to qualitative research. According to Braun and Clarke (2006) and Boyatzis (1998), this method involves several key steps, including familiarization with the data, generating initial codes, identifying themes, reviewing and refining themes, defining and naming themes, and finally, producing the report. Each stage is essential for ensuring the reliability and depth of the analysis. By systematically examining patterns within the data, thematic analysis allows researchers to derive meaningful insights, making it a widely used qualitative research method in various disciplines, including social sciences and psychology.

Figure 1. Thematic analysis steps



3.3. Research questions

The research questions were formulated as follows:

1. Do you have any information about astro-tourism?

2. Have you ever attended the "Sky Observation Festival" held in Melikler Plateau for the last three years? Do you plan to participate in the future?

3. How do you feel about constructing an observatory and accommodation units in Melikler Plateau and the arrival of tourists here?

4. What do you think about the economic effects (positive/negative) of the development of astrotourism in this region?

5. What do you think about the environmental effects (positive/negative) of the development of astrotourism in this region?

6. What do you think about the sociocultural effects of the development of astro-tourism in terms of the region?

7. What do you think about the studies on the development of astro-tourism in the region?

8. What do you think about developing different types of tourism in the region?

3.4. Demographics of participants

The participant group comprises 12 males and five females, indicating a male-dominated sample. This may reflect the general gender distribution in regional administrative and business positions. However, female representation is notable among faculty members (P5 and P6) and students (P13 and P14). Participants come from a diverse range of institutions, including: Local government (District Governor, Mayor, Information Officer) – 3 participants, Academia (Faculty members and research assistants from ISUBÜ and SDÜ) – 6 participants, Local businesses (Tea house, restaurant, chef) – 3 participants, retired individual from the community – 1 participant, students from SDÜ's Tourism Management Department – 5 participants. This distribution ensures insights from different perspectives, including policymakers, academia, business owners, and students.

Nine participants attended the festival, while eight did not. Local business owners and residents (P9, P10, P11, P12) showed high participation, likely due to their direct involvement or interest in tourism. Government representatives had mixed participation, with the mayor attending but the district governor not. Academic members and research assistants primarily did not participate in it, except for a few students (P13, P17). Local business owners and residents actively participated in the event, suggesting an awareness of its tourism potential. Government involvement is uneven, as the mayor attended but the district governor did not, which might indicate differences in prioritization. Academics had limited participation, which could impact their firsthand understanding of the event's dynamics. Students showed mixed participation, some engaging in the event while others did not, possibly reflecting different interest levels or availability (Table 1).

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Table 1. Demographics of participants

Participants	Institution	Position	Gender	Participation in the sky observation festival
P1	Yenişarbademli District	District governor	Male	No
P2	Yenişarbademli Municipality	Mayor	Male	Yes
P3	Isparta Provincial Directorate of Culture and Tourism	Information officer	Male	Yes
P4	ISUBÜ Faculty of Tourism	Faculty member	Male	No
P5	SDÜ FEAS	Faculty member	Female	No
P6	ISUBÜ Faculty of Tourism	Faculty member	Female	No
P7	ISUBÜ Faculty of Tourism	Research assistant	Male	No
P8	SDÜ FEAS	Research assistant	Male	No
P9	Yenişarbademli - Small business	Tea House business	Male	Yes
P10	Yenişarbademli - Small business	Restaurant business	Male	Yes
P11	Yenişarbademli - People	Retired	Male	Yes
P12	Yenişarbademli - Small business	Chef	Female	Yes
P13	SDÜ Department of Tourism Management	Student	Female	Yes
P14	SDÜ Department of Tourism Management	Student	Female	No
P15	SDÜ Department of Tourism Management	Student	Male	No
P16	SDÜ Department of Tourism Management	Student	Male	No
P17	SDÜ Department of Tourism Management	Student	Male	Yes

4. Results

According to the research findings, the development of astro-tourism in Melikler Plateau has been categorized under three main themes: *economic, environmental, and sociocultural.* Since these three fundamental aspects are considered in the development of a region, participants' views were evaluated within this framework. In response to the question, *"Have you participated in this festival before?",* Participant (P1) stated that they would be attending for the first time this year since they had recently arrived. In contrast, the Participant (P2) and the official from the Provincial Directorate of Culture and Tourism (P3) mentioned that they had participated since the first event. Faculty members from the tourism management department noted that they had not yet attended the event but had followed it through the media. All those who had not participated expressed their desire to attend in the coming years. Participant 3 commented, *"I enjoy being around people interested in the sky, and as I mentioned, both gaining this knowledge and camping make it an appealing activity for me."*

4.1. Participants' views on astro-tourism in regional economic development

The participants were asked: *"Do you think constructing an observatory and accommodation units in Melikler Plateau, attracting more tourists, would contribute economically to the region's development?"* Most participants expressed a positive attitude toward building an observatory. However, opinions on the construction of accommodation units varied. Some participants supported it, stating that it would enhance the economic well-being of the local people and create employment opportunities. Others, however, argued that since the area is a national park, such development would be impractical and could harm the natural environment.

Some participants suggested accommodations should be built in the district center while allowing visitors to travel to the plateau at night solely for observation. They believed this approach would minimize environmental damage while providing economic benefits. For example, P3 stated: *"Permanent accommodation facilities do not seem very reasonable considering the natural structure of the region. Melikler Plateau is well known among mountaineers in Turkey, who visit the area for tent camping. In this context, I see the development of camping-related services as beneficial. For instance, if toilet, shower, and kitchen infrastructure were provided, along with tent and sleeping bag rental services, the frequency of visits to the area would increase."* Similarly, P1 responded, *"This would play an effective role in the region's development, and we fully support it."*

Participants generally agreed that the development of astro-tourism in Melikler Plateau would contribute economically to the region. Since the area is far from the provincial center and lacks income sources besides agriculture, local authorities and residents view tourism development positively. They believe that as tourism grows, local people will have the opportunity to establish tourism facilities, increase their income, and sell agricultural products, handicrafts, and other goods. Moreover, creating new job opportunities would increase employment and encourage young people to remain in the area rather than seek work elsewhere, thus reducing migration to city centers.

One participant, P3, highlighted this: *"I have seen vendors from nearby districts come to the plateau to sell their products during past festivals. If this event and its commercial system were organized more systematically for visitors, both sides could benefit significantly."* Similarly, P4 listed the economic contributions of tourism, stating: *"The use of local hotels, restaurants, and transportation services by tourists can stimulate economic activity. The local community can generate income by offering tourism-related products and services. New job opportunities can be created, increasing employment, and with the region's promotion, other types of tourism can also develop."* P10 also

emphasized the positive impact on the local community: *"If the region develops, the villagers will earn money by opening their businesses. Young people from the village will not need to leave for work elsewhere."*

4.2. Participants' views on astro-tourism in environmental effects

The prevailing view is that the development of astro-tourism in the region could potentially harm the environment; however, local authorities could mitigate this issue by taking the necessary precautions. Some participants expressed concerns that the construction of facilities might damage natural areas and disrupt the region's ecosystem. Others were worried that such developments could lead to *light pollution,* negatively impacting the primary purpose of astro-tourism—stargazing. For this reason, some participants emphasized the importance of *controlled tourism development.*

Participants who had attended the *sky observation festival* in previous years stated that they had not observed significant environmental damage since the number of visitors was limited. However, they expressed concerns that increasing *visitors* could lead to environmental issues. Some participants noted that tourist density had already resulted in waste and pollution in the area. To prevent this, they suggested that *local governments establish proper infrastructure and that incoming tourists* be educated on environmental responsibility to address the issue effectively. P1 stated: *"Forest fires increase, especially in the summer months, and sometimes participants pollute the environment. However, we are responsible for raising awareness and reminding them to be mindful of their impact."*

4.3. Participants' views on astro-tourism in socio-cultural impact

The consensus is that tourism development in this region will *not disrupt the socio-cultural structure* of the local community. For instance, P2 stated: *"The local people would welcome astro-tourism in our district. The cultural interaction between tourists and locals would be an added advantage for us."* Participants from local authorities and the local community expressed that the region has its own social and cultural structure, which they aim to pass on to future generations. They believe that incoming tourists will enrich their culture rather than disrupt *it*. Additionally, they noted that seeing social media posts shared by tourists about their region would bring them *emotional satisfaction.* P4 emphasized the *positive impact,* stating: *"The local people will be able to interact with tourists and learn about different cultures. This will contribute to cultural diversity and promote the region."*

However, some participants voiced concerns that tourism development could *negatively impact* the local community's socio-cultural structure. *Participant 4* also shared this concern: *"The lifestyle and traditions of the local people may change under the influence of tourists. This could lead to socio-cultural conflicts."* Some participants suggested that the local community should be *informed* about the diverse cultural backgrounds of tourists to help them better understand and accept different behaviors. They also recommended *providing basic tourism education* to minimize potential conflicts. Moreover, the local people's traditional handicrafts, lifestyle, and cuisine are among the unique aspects that attract tourists to the region. Since many tourists visit rural areas specifically to *experience an authentic, unspoiled culture,* tourism could actually contribute to the preservation of local traditions rather than their deterioration.

When asked about the ongoing efforts to develop astro-tourism in the region, the Mayor responded: *"Necessary discussions are being held with key institutions, including the Isparta Governorship, Süleyman Demirel University, the Ministry of Industry and Technology, and the Western Mediterranean Development Agency. Our university is preparing project proposals, and significant steps have been taken for ministerial applications through proper reporting."* Another question raised was whether *other types of tourism* were being considered for development in the region. Given that the area is *rural and still largely untouched by human activity,* it was suggested that various forms of *nature-based tourism* could flourish here.

A *representative from the Provincial Directorate of Culture and Tourism* provided insights on this topic, stating: *"Natural formations such as Yaka Canyon, Dedegöl Mountain, Yeşilgöl, and Karagöl serve as significant attractions for hiking activities. Additionally, Pınargözü Cave, the longest cave in Turkey, is located very close to the plateau and has the potential for cave tourism. The Isparta Governorship has also identified and made available hiking trails, mountain biking routes, and photography spots for visitors."*

As part of the project, *tourism management students* camped overnight in Melikler Plateau. After the experience, students were asked about their impressions. In general, students reported being *happy with the camping experience,* stating that it was a *unique and enjoyable activity*. However, they also mentioned that they would *only want to camp for one or two nights* due to the *lack of other activities* in the area. Additionally, students highlighted issues such as *insufficient infrastructure, extremely cold temperatures at night,* and *inadequate heating in their tents,* which made them reluctant to stay for an extended period.

5. Discussions and conclusions

Globally, regions with astro-tourism potential are typically rural areas such as deserts and mountains, where human settlements are nonexistent or limited (Iwanicki, 2022). To develop astro-tourism and attract more visitors, these regions establish observatories, Dark Sky Parks, and planetariums while also offering various accommodation options such as glass igloos, luxury tents, and tiny houses. Additional experiences like thermal pools at night, romantic stargazing

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events, and local cuisine are also provided for tourists. However, such facilities are currently lacking in Melikler Plateau, located in Yenişarbademli district of Isparta, which boasts a clear sky free from light pollution, fresh air, and natural beauty. This study analyzed the current state of astro-tourism in the region based on information gathered from local stakeholders and residents. The following conclusions can be drawn:

- All stakeholders are aware of what astro-tourism is.
- All parties support the development of tourism in the region.
- All participants recognize the potential environmental impact of astro-tourism but believe the government can address these issues.
- The economic benefits of tourism are widely acknowledged, particularly its contribution to rural development (Demir & Aracı, 2022).
- The local population, which has no income sources besides agriculture, sees tourism as a means of increasing employment opportunities.
- The region offers various nature-based tourism opportunities in addition to astro-tourism.
- The local community supports tourism development in the area and does not believe it will negatively impact their cultural values.

Yenişarbademli is a small, rural, and sparsely populated district far from the city center. Its pristine nature, along with attractions such as Dedegöl Mountain, Beyşehir Lake, and Pınargözü Cave, could increase future demand for tourism in the area. Investing in infrastructure, encouraging local entrepreneurship, and securing government support, the region's existing tourism potential can be leveraged to boost rural development through astro-tourism (Joseph et al., 2022). However, the lack of necessary infrastructure—such as planetariums and observatories—currently limits tourism growth in the region. A collaborative project involving *the Isparta Governorship, Isparta Municipality, Yenişarbademli Municipality, universities, and other stakeholders* could help attract both domestic and international tourists to the area. Such a project would not only promote regional development but also create new job opportunities for the local community and young people. However, it is crucial that any project is implemented *without harming the environment and by taking inspiration from global best practices* in astro-tourism.

5.1. Theoretical implications

This study contributes to the existing literature on astro-tourism by exploring its potential economic, environmental, and socio-cultural impacts in rural areas, particularly in regions with limited tourism infrastructure. Previous studies have emphasized the significance of astro-tourism in promoting sustainable tourism practices, but there has been limited research on its role in rural development. By examining the case of Melikler Plateau in Turkey, this study extends the theoretical understanding of how astro-tourism can function as a catalyst for rural economic diversification. Additionally, the study aligns with the theory of sustainable tourism development, which emphasizes the balance between economic benefits, environmental protection, and social well-being. Findings indicate that while astro-tourism can contribute significantly to local economies, its success depends on well-managed infrastructure and environmental policies to prevent ecological degradation. The study also reinforces theories of cultural exchange in tourism, suggesting that interactions between tourists and local communities can enhance cultural appreciation without necessarily leading to cultural erosion. Future theoretical frameworks on astro-tourism should incorporate a multi-stakeholder approach that includes local governance, environmental regulations, and tourism demand trends to create a more comprehensive understanding of its development in rural contexts.

5.2. Practical implications

From a practical standpoint, this study offers valuable insights for policymakers, tourism planners, and local communities interested in developing astro-tourism. First, it highlights the need for strategic infrastructure investments, such as the establishment of observatories, Dark Sky Parks, and appropriate accommodation facilities, while maintaining environmental sustainability. Given the concerns about light pollution and ecological disturbance, regulatory measures should be implemented to ensure minimal environmental impact, such as designated observation zones and eco-friendly accommodation units. Moreover, local communities should be actively involved in the planning and development process to maximize economic benefits. Training programs on hospitality and tourism management could equip local residents with the necessary skills to engage in tourism-related entrepreneurship, such as offering guided stargazing tours, camping services, and local food experiences. Additionally, marketing strategies that leverage social media and digital platforms can enhance the visibility of Melikler Plateau as a prime astro-tourism destination. Collaborations between local governments, universities, and private stakeholders are essential in ensuring a holistic development approach that balances economic growth with environmental and cultural preservation.

5.3. Limitations and suggestions for future studies

Despite its contributions, this study has several limitations. First, the research focuses on a single case study, limiting the generalizability of the findings to other regions with different socio-economic and environmental conditions. Future studies should conduct comparative analyses across multiple astro-tourism destinations to identify common patterns and region-specific challenges. Second, the study primarily relies on qualitative data obtained from interviews with local

stakeholders, which may introduce subjectivity. Future research could incorporate quantitative methods, such as surveys and economic impact assessments, to provide more robust conclusions on astro-tourism's financial and social effects. Lastly, the study does not explore the long-term sustainability of astro-tourism initiatives in the region. Future research should adopt a longitudinal approach to examine how astro-tourism evolves over time and assess the effectiveness of implemented policies. Investigating the role of technology, such as augmented reality experiences in stargazing, could also provide new insights into the modernization of astro-tourism offerings. By addressing these limitations, future research can enhance our understanding of astro-tourism's potential and its broader implications for rural tourism development.

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Author contribution

The authors conducted the research design and implementation, analysis, and article writing equally without using AI applications.

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Ethics committee approval

The study received approval from the Süleyman Demirel University's Social and Human Sciences Ethics Committee under protocol number 157/21 and dated 29.11.2024 and adhered to the guidelines outlined in the Declaration of Helsinki for research involving human subjects.