Exploring Overtourism in the Mediterranean Region

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Abstract. Overtourism has gained significant attention in recent years, often associated with the rapid growth of tourism in popular destinations. This phenomenon is driven by factors such as increased global travel, the rise of low-cost airlines, and changing consumer preferences. In particular, Mediterranean islands, including Sardinia, experience seasonal peaks in tourist arrivals, placing considerable pressure on local infrastructure, resources, and communities.

This study introduces a place-based methodology to assess overtourism by analyzing a series of indicators and visualizing their spatial distribution using Geographic Information Systems (GIS) and Local Indicators of Spatial Association (LISA) maps. By applying this approach to Sardinia, we aim to identify areas most susceptible to overtourism and inform sustainable tourism policies.

Applying this methodological framework to the geographic context of Sardinia, the objective of this study is to delineate areas exhibiting heightened susceptibility to overtourism. The first results reveal that overtourism in Sardinia is concentrated in specific locations and time periods, primarily during the summer season. This spatial and temporal clustering highlights the need for strategies to distribute tourist flows more evenly throughout the year and across different destinations. The resultant spatial analysis will furnish empirical evidence to inform the formulation of evidence-based policies aimed at fostering sustainable tourism management within the region to promote a more sustainable and inclusive tourism industry in Mediterranean islands.

Keywords: Overtourism · Sustainable Tourism · Spatial Analysis

1 Introduction

Since the latter half of the twentieth century, tourism has been affected by a significant transformation from an activity exclusive to the elite to a widespread, a mass phenomenon acrossing diverse territorial scales, spanning from the global to the local.

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According to the data provided by the United Nations World Tourism Organization (UNWTO), for the year 2023, approximately 1.286 billion tourists engaged in travel, seeking 'the other and the elsewhere', with a notable preference for the European Continent (520 million arrivals). Within this geographical context, tourism has been shown to demonstrate a continuous increase in performance, mainly attributable to the local tangible and intangible heritage. However, the spatial relationships between tourism and territory bring new challenges in terms of 'novel and diversified' economic and social values, for both host and guest community. The economic benefits, including employment growth and the generation of new income, represent a positive contribution to a destination's balance of payments. At the same time, inadequate planning and programming of tourism can lead to negative externalities, potentially causing irreversible impacts on the environmental and social equilibrium of a location. Negative externalities are considered to be among the main factors that determine market failure. The continuous increase in tourism numbers has generated new concerns regarding the future and well-being of resident communities and guests in tourist destinations [1, 2]. Common examples of such externalities include the overexploitation of resources, pollution, congestion, rising living costs, and the emergence of antagonistic sentiments. More precisely, tourists may experience discomfort (psychological carrying capacity), infrastructure may become overloaded (physical carrying capacity), environmental quality may decline (environmental carrying capacity), a perception of excessive tourism development may arise (perceptual carrying capacity), and residents may begin to express rejection towards tourists (social carrying capacity). This may ultimately lead to a decrease in the destination's attractiveness and competitiveness (economic carrying capacity).

Within this context, the term 'overtourism' has been amplified in both media and academic debate, actively engaged in identifying the characteristics of the phenomenon. Overtourism is subject to multiple interpretations, and its prominence is attributed to the acceleration and transformations in tourism supply (growth in accommodation, transportation–particularly low-cost airlines–infrastructure, and intermediary sectors) and demand (global population growth, population ageing, and the emergence of increasingly diverse household structures), particularly evident in urban areas [3]. It should be noted that, along with the excessive volume of visitors [1], other factors must be considered as cause of conflict and environmental degradation of the destination: the escalating rents and real estate prices, touristification, gentrification, homologation of places, overuse of infrastructure and services, loss of cultural identity, and traffic congestion [4–7].

These factors can collectively undermine social relations and local resources. It is important to note that the negative externalities described above are not confined to urban areas. As Peeters et al. (2018), have demonstrated, the phenomenon of overtourism is also observed in coastal, rural, heritage, cultural and protected areas, as well as on islands [8].

These diverse territorial contexts are characterised by a loss of control in tourism management, which exceeds sustainability thresholds. Many are currently implementing measures to generate new value [9], according to the paradigm of sustainable tourism. As a matter of fact, sustainable tourism has prompted numerous actors in recent decades to consider growth and development strategies for destinations that aim to avoid exceeding the territory's carrying capacity.

Within this concise framework, the present study proposes a methodology to evaluate the spatial distribution and autocorrelation of a set of tourism indicators for insular context in the Mediterranean Region. The aim of this study is to explore the potential overtourism phenomena in the Region of Sardinia (Italy), selected as a first case study, to support policies that foster more sustainable tourism practices in accordance with the Sustainable Development Goals (SDGs) set out in the 2030 Agenda. The manuscript is structured in 5 sections: the introduction is followed by an overview of the overtourism phenomenon in island contexts (Sect. 1.1); the proposed methodology (Sect. 2), focused on the definition of KPIs on tourism data and environmental data, is followed by the presentation of the case study (Sect. 3) and the application of geospatial representation techniques highlighting the main results (Sect. 4). The final section is dedicated to the discussion and conclusion of the study (Sect. 5).

1.1 Overtourism in the Mediterranean Region

Islands are complex systems that exhibit both vulnerability, often leading to mainland dependence, and resilience, enabling survival despite geographical isolation. In popular perception, insular environments are primarily associated with marine settings; for numerous islands, coastal zones have undergone significant transformations linked to the tertiary sector and, more frequently, to tourism development [10].

Island territories frequently exhibit a pronounced reliance on tourism, with some having implemented strategies to attract visitors to support a robust economic condition [11]. Exemplary cases of such accomplishments include the Mediterranean islands (e.g., the developing states of the Caribbean, in addition to the autonomous island nations of Cyprus and Malta, as well as other island dependencies; the Spanish Balearic Islands and the Greek islands). Nevertheless, this reliance and expansion of tourism flows (especially in the post-pandemic era) may result in adverse externalities connected to the island's carrying capacity.

In small, densely populated islands such as Malta (316 km^2), a rapidly increasing resident population exceeding 500,000, and an annual tourist influx reaching a record 3,000,000 in 2023, has generated €2.7 billion in total tourism expenditure [12]. The islands' national tourism strategy (2021–2030) acknowledges the challenges posed by overtourism and outlines five reforms to mitigate negative impacts. These include the necessity for carrying capacity assessment and visitor management, promotion of off-peak tourism, environmental sustainability initiatives, diversification of tourism offerings, and infrastructure for carrying capacity monitoring [13].

Other islands have proactively recognised these issues and implemented measures to address overtourism, also to prevent the United Nations Educational, Social and Cultural Organization (UNESCO) from including them in the Register of Natural Heritage in Danger. The Spanish Balearic Islands, particularly Majorca, the largest island, have been a prominent Mediterranean island destination. Research has identified significant impacts of overtourism on the island's finite land resources, transportation infrastructure, environment and biodiversity, and culture. Terms such as 'island invasion' have been used for over three decades to underscore the effect of international tourists on the islands [14, 15]. Indeed, heightened awareness of negative externalities has resulted in protests

by residents demanding alterations to the tourism-dependent economic model of the islands [16].

The Sardinia region, the second largest island in Italy, has a strong tourist vocation, characterized by a marine-seaside tourism model, which reaches its peaks in the summer season. The coastal areas receive 80% of tourist flows and have 90% of the beds offered as tourist accommodation [17].

In this context, the island offers a pertinent case study for evaluating the potential phenomenon of overtourism using the methodology proposed by this research.

2 Method

The present methodology has been developed for the purpose of exploring potential overtourism phenomena in the Mediterranean Region. This is achieved through the definition of a set of indicators (KPIs) and associated spatial representation by geospatial analysis techniques such as Local Indicators of Spatial Autocorrelation (LISA). The objective of this study is to explore the temporal and spatial distribution of tourism flows to provide evidence-based support for policies in alignment with the Sustainable Development Goals (SDGs) of the 2030 Agenda.

The present study draws upon the insights of several authors [18, 19] and research institutions [20, 21] to integrate a set of KPIs related to the tourist overcrowding, organized into two primary domains: tourism and the environment.

The first domain focuses on key tourism performance indicators (t-KPIs), such as tourist density and intensity, accommodation density, and the gross occupancy of both hotel and non-hotel establishments, contextualized with respect to the island area.

The number of tourist overnight stays (presences) represents significant quantitative data to calculate several of these indicators. The tourist presence is defined as the number of nights spent by tourists at a given destination, and it is on this basis that the equivalent inhabitants can be calculated. This data provides insight into the impact of tourist presences relative to the resident population over a 365-day period. For this reason, it is of particular value in the management of tourist flows, as it supports a more congruent planning of service provision, according to the effective demand.

The second domain focuses on key environmental performance indicators (e-KPIs) representative of the tourism phenomenon per equivalent tourist population. These include waste production, water consumption, energy consumption, and CO_2 emissions from aviation and maritime transport [22].

The only exception is the spatialisation of CO_2 emissions from aviation [23] and maritime transport, focused on the components associated with take-off and landing (for aviation) and mooring (for shipping), which primarily affect areas proximal to ports and airports. The calculation of CO_2 emissions from aviation and maritime transport is conducted on a per-passenger basis, employing the following formula: g $\times$ km $\times$ passenger. In this formula, 'g' denotes the quantity of CO_2 produced, while 'km' represents the aggregate average length of routes to and from ports and airports within the insular region.

3 Case Study

The Sardinia Region is the second-largest island in the Mediterranean Sea and the third largest in Italy. The region has a population of 1,569,832 inhabitants and a surface area of 24,090 km^2, resulting in a population density of approximately 66 inhabitants/km^2. This value is projected to increase due to a persistent demographic decline, with the island experiencing a loss of over 88,000 residents between 2016 and 2024.

Connectivity to and from Sardinia is primarily facilitated by eight ports (Cagliari, Olbia, Porto Torres, Golfo Aranci, Portovesme, Oristano, Santa Teresa di Gallura, Arbatax) and three international airports (Cagliari, Olbia, Alghero), that are crucial to guarantee connections with the Trans-European Networks and the broader Mediterranean transport network [24].

The Island is characterized by a predominantly marine-coastal tourism model, with peak activity during the summer months [25]. Regional data on tourist arrivals and departures [26] indicate 7,285,690 arrivals in 2023 (4,743,283 at airports and 2,542,407 at ports), representing an increase compared to 2022 [27] and confirming the summer seasonality (Fig. 1). The majority of these arrivals (6,166,843) occurred during the summer period, with over half (3,755,834) concentrated in June, July, and August, aligning with IATA Northern Winter & Summer Schedules.

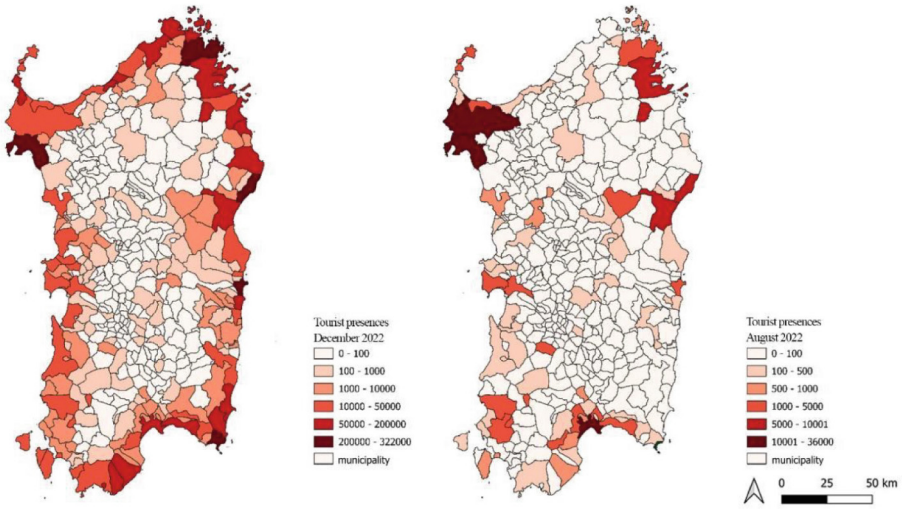

Fig. 1. Spatialization of presences in August 2022 (left) and December 2022 (right). Data source: (Sardegna Turismo-Osservatorio del turismo). Author: Mara Ladu

Seasonal tourism remains the predominant form of tourism [17]. Preliminary data for 2024 indicate a surge in tourist arrivals, with 4,007,181 visitors recorded at the island's ports and airports during the peak months of June, July, and August. The regional census on annual customer movements in accommodation facilities reveals 3,902,458

arrivals and 16,585,664 overnight stays (presences) in 2023, representing a significant increase compared to 2022 [28]. The distribution of presences is thus 9,515,977 in hotel facilities and 7,069,687 in non-hotel facilities. The most significant change observed in comparison with 2022 is the increase in arrivals (30.66%) and presences (35.84%) in private rental accommodations (non-hotel facilities).

This signifies a substantial evolution in Sardinia's tourist accommodation provision in recent years, characterized by a marked increase in alternative accommodation options such as B&Bs, farmhouses, private rentals and holiday homes [29].

Within this regional context, overtourism may be correlated to a temporal and spatial concentration: temporally, with the majority of tourist movements occurring during the summer season, peaking in June, July, and August; and spatially, with this tourist presence primarily concentrated in coastal areas.

Despite its temporal and spatial concentration, this tourism model has the potential to generate a number of negative impacts, including environmental concerns such as soil erosion, pressure on water and energy resources, waste generation, air pollution, climate change, ecological imbalances, and biodiversity loss. Furthermore, it can also have significant economic and social impacts on infrastructure and local communities.

Consequently, defining approaches and methodologies to explore the dynamics of tourism development and monitor its effects on people and places represents a significant challenge, particularly in insular contexts [30, 31].

4 Results

The present study applies the methodology focusing mainly on the first domain related to the key tourism performance indicators (t-KPIs), such as tourist density and intensity, accommodation density, and the gross occupancy of both hotel and non-hotel establishments, contextualized with respect to the Sardinia island. For each indicator proposed by the methodology, the data and the related sources are indicated in Table 1. The present research used these data (year 2022), to calculate the indicators included in the tourism domain.

Table 1. Data sources related to each KPIs proposed by the methodology.

Domain/data	KPIs Insular Region	Source
Tourist data	Tourist density (presences/km^2)	Sardinia Region_Sardegna turismo: http://osservatorio.sardegnaturismo.it/it
	Accommodation density-hotel and non-hotel facilities-(beds/km^2)	
	Tourist intensity (presences/population)	
	Gross use-hotel and non-hotel facilities—[(presences/(beds + 365)] 100	

The main data source for calculating the number of arrivals and presences recorded each month in each municipality in Sardinia is the database provided by the Sardinia Region (SIRED) and, in particular, the regional tourism dashboard [32], which is also the main source for the number of beds per accommodation facility (hotel and non-hotel facilities), together with the Regional Register of Accommodation Facilities and private accommodation [33].

The study presents the results of the application of spatial autocorrelation techniques (LISA) related to two key performance indicators (KPIs) relevant to the tourism domain-tourism intensity and accommodation density-(Fig. 2).

Significant values of autocorrelation are identified in coastal municipalities located in the north, north-east, east, and south-east. This suggests that the hinterland municipalities may serve as a source of demand for coastal tourism. On the contrary, inner areas are characterised by a low level of autocorrelation.

The western side of Sardinia shows no significant autocorrelation. Consequently, it can be deduced that there are no phenomena attributable to overtourism. Conversely, the northern and southeastern regions are indicative of a potential overtourism phenomenon. On the eastern side, despite the presence of municipalities characterised by high values of accommodation density, as well as significant autocorrelation, the value and autocorrelation of the tourism intensity data appear to be negligible. This suggests that the potential overtourism phenomenon is less relevant in comparison to the Northern and Southeastern sides.

In the northern part, the extensive coastline facilitates greater tourist distribution, consequently yielding lower values of the data analysed with the LISA method. In the southern part, some centralities emerge. The municipality of Castiadas, in the south-east, has recorded high values with regard to tourism intensity. The municipalities of Orosei and Dorgali, located on the central-eastern side of the region, demonstrate the highest levels of tourism and accommodation density in comparison to other areas on the eastern side.

The phenomenon of overtourism may be observed in those areas close to Sardinian ports and airports. These geographical areas can be defined as “airport/port regions”, identified with 1-h isochrones by private car. According to the Italian National Airports Plan (Piano Nazionale degli Aeroporti) 2022 [34], the proportion of the Italian population residing within 1 h’s reach of the nearest airport is 80%. By contrast, only 26% of residents can access the airport within the same timeframe using public transport.

In this sense, the phenomenon of overtourism is contingent upon the availability of air and maritime transport. As a matter of fact, no significant KPIs related to the tourism domain/data have been recorded in the Alghero airport region, due to a more limited flight offer at the same airport (Fig. 3), according to the Local Connectivity Index and the Regional Accessibility Index proposed by the Italian National Airports Plan (Piano Nazionale degli Aeroporti) 2022 [34].

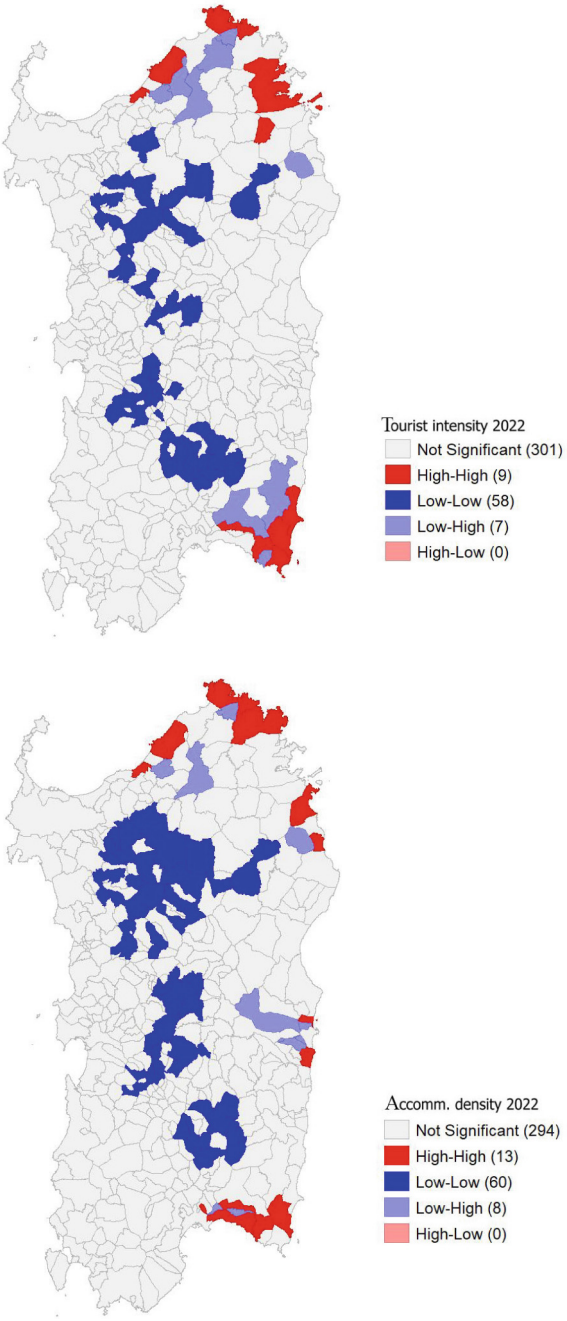

Fig. 2 (**a, b**). Spatial autocorrelation and spatial representation of (**a**) tourist intensity (presences/population) and (**b**) accommodation density (beds/km^2). Authors: Ginevra Balletto and Mara Ladu

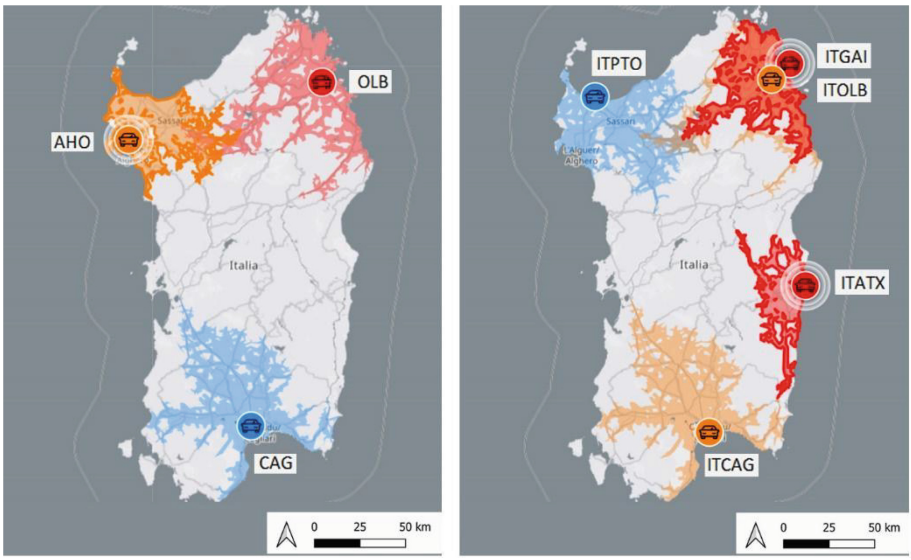

Fig. 3. Airport regions (on the left) and port regions (on the right). Authors: Mara Ladu and Ginevra Balletto.

5 Discussion and Conclusions

The present study defined a set of KPIs specific to the management of tourism in the Mediterranean Region to identify potential areas of overtourism using spatial analysis techniques such as LISA (Local Indicators of Spatial Association).

The manuscript enhanced the theoretical and scientific context, associating the study with overarching theories on sustainable tourism and destination management.

The specific individual Key Performance Indicators (KPIs) related to island regions have been organized in two domains (tourism and environment).

In the field of tourism, the key metrics encompass tourist density and intensity, alongside accommodation density and gross use of hotel and non-hotel facilities. The environmental factors under consideration are as follows: waste production; water consumption; energy consumption; and CO_2 production from aviation and maritime transport. However, the study presented the results of the application of Local Indicators of Spatial Association (LISA) tool to the case study (Sardinia region), considering mainly the first domain (tourism) to facilitate the identification of areas most vulnerable to overtourism, thereby supporting the development of revised tourism management policies.

The results reveal distinct spatial patterns for each specific KPI, highlighting variations in tourism pressure within the Island. More precisely, the study clearly indicates a concentration of tourism activities along the Sardinian coast, particularly in the north, northeast, east, and southeast, where the tourism intensity and accommodation density demonstrate higher values. The spatial autocorrelation LISA of KPIs highlights the clustering of high tourism values in specific coastal areas. This finding indicates that tourism development in these areas is not a random phenomenon, but rather is part of a larger spatial pattern.

In contrast, inner areas show lower tourism values and less or no significant spatial autocorrelation, suggesting a less pronounced tourism presence. This observation validates the assumption that tourism in Sardinia remains predominantly coastal and beach-oriented. More generally, the first results indicate that Sardinia does not suffer widespread overtourism.

The patterns resulting from the spatial autocorrelation suggest to manage tourism growth and mitigate negative effects in the North, Northeast, South, and Southeast Sardinia. Targeted interventions are necessary in these areas. As a matter of fact, notwithstanding the imposition of initial access limitations in certain protected areas, the increasing volume of tourists necessitates the formulation of a novel strategy, encompassing a regional spatial plan to identify overtourism risks and promote sustainable practices. Key actions to be implemented should include the new approach of the tourist tax, also to support the reduction of waste production, the optimisation of energy efficiency, and the protection of natural and cultural resources.

The objective of forthcoming research endeavours is to apply the methodology for KPIs related to the environmental domain, to face the climate crisis that represents a further challenge for coastal tourism. Moreover, the study will implement the dataset to achieve a multidisciplinary comprehension of the potential impacts of tourism flows.

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