Overtourism as an Emerging Threat for Sustainable Island Communities – Exploring Indicative Examples from the South Aegean Region, Greece

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Abstract. Tourism is admittedly perceived as a key driver for many national economies, displaying a large share in the GDP of many countries around the globe, including Greece. However, evolving trends of the sector and the noticeable, exponentially rising, tourism density and intensity of certain highly-rated destinations – especially of the vulnerable to overtourism coastal and insular ones – create severe concerns as to their ability to cope with the negative repercussions of tourism in environmental, economic, social and cultural terms; and establish the "overtourism" concept, i.e. the alarmingly surpass of destinations' physical, ecological, social, cultural, economic, psychological, etc. capacity thresholds at certain times and in certain locations. Overtourism, as an already visible threat in several highly-rated urban/insular destinations around the globe that largely affects both habitants' quality of life and tourists' experience, is the focus of this paper, aiming to assess spatial and developmental pressures exerted in selected Greek island destinations, i.e. fragile spatial entities in terms of natural and cultural assets. Towards this end, three distinct case studies in South Aegean are explored, namely Mykonos, Paros-Antiparos, and Kos-Nisyros; while a number of literature-proven key indicators are used for demonstrating the trajectory through time of these destinations and the unsustainable tourism pattern they display, especially in an environmental degradation and climate change era.

Keywords: Island regions · Overtourism risk · Indicators · Spatial planning · South Aegean Region

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1 Introduction

Tourism is nowadays perceived as the largest and rapidly growing sector in the global economy [1]; and a sector that generates job and income opportunities in many regions around the globe due to its relatively high-income multiplier and inter-industry linkages [2]. As various studies claim [1, 3] the sector's future dynamics seem to be growing at an exponential rate; while international tourist arrivals are predicted to reach 1.8 billion by 2030 [4]. Sustainability concerns are generated by such a growth, seeking to pave the way towards a tourism development model that respects carrying capacity of destinations in ecological, economic, social, cultural, political, etc. terms [5]. Such concerns are justified by the emerging overtourism threat, i.e. an extremely overcrowded tourism pattern, already visible in many world regions.

Overtourism, as a term only recently introduced in the academic and policy discourse, lacks clarity and a clear-cut definition, while is also difficult to operationalize [6]. In fact, systematic research and relative scientific/empirical works are rather limited; while the same holds regarding the ways this can be estimated and its impacts can be assessed. According to Goodwin [7], overtourism is used to describe destinations in which both hosts and guests, i.e. locals or visitors, are suffering from place overcrowding, which affects in an unacceptable manner the quality of life of the former and quality of experience of the latter. García-Buades et al. [8] claim that overtourism is explicitly linked to the adverse impacts of tourism on residents' quality of life and their protests against tourism, tourists, policymakers, and/or tourism stakeholders. Mihalic [9] defines overtourism as the highly accelerating growth of tourism supply and demand, leading to excessive use of destinations' natural assets, destruction of cultural capital and severe socio-economic impacts. Gössling et al. [10] conceptualize overtourism as a psychological reaction to tourism pressure, in which place-person interrelationships are affected and damaged, shifting thus the residents' attitudes towards tourism. Peeters et al. [11] link overtourism with the multiple dimensions of carrying capacity; and claim that overtourism represents a destination's state, where tourism repercussions – at certain times and in certain locations – actually exceed physical, ecological, social, economic, psychological and/or political carrying capacity thresholds. This is closely related to the number of tourists visiting a destination, the type and frame of such a visit, as well as the fragility of the destination [5].

It should be noted here that although overtourism is a newly emerging term in the literature and the policy realm, the phenomenon this expresses is definitely a pre-existing one, dating back to the '70s and highlighting the pressure exerted by an increasing number of tourists in a destination and the surpassing of its saturation levels [12]. That said, overtourism can be interpreted as a repositioning against an already well-grounded debate, framing this debate with the new perceptions of carrying capacity limits and global sustainability concerns, so that constraints to growth and reckless use of resources to be properly stressed [13]. This view lies in the same direction with similar works [e.g. 5, 14], claiming that overtourism is a new term for an old, currently over-exacerbating, problem that emerges from a combination of factors or enablers, responsible for attracting a perfect 'storm of visitors' to specific sites. Among these factors fall the [14]: rise of low-cost carriers and the more affordable travel; growth of cruise tourism; advent of social media and new IT technologies, promoting destinations through online platforms; lack

of destination's control over tourist numbers, grounded on proper planning both in type of tourism and in spatial terms; rising of the sharing economy, providing alternative and affordable accommodation; power relationships of tourism stakeholders; etc.

But why overtourism is a worrying or better an alarming phenomenon in the planning and policy discourse? The answer rests upon the impacts of overtourism on sustainability objectives of fragile and of limited carrying capacity territories. Thus, in a longer run, the so far purely 'growth-focused' tourism model definitely renders sustainability objectives of a destination at stake by overcoming carrying capacity limits. Among the various risks overcrowded destinations are confronted with are listed the: devastation of the integrity of cultural and natural assets; decline of the quality of life of local population [15]; loss of authenticity, heritage and local identity as well as sense of place [14, 16, 17]; rising costs of living, largely affecting local population subsistence and causing economic inequalities and social exclusion; damages to the land- and sea-scape [18]; overconsumption of scarce resources, e.g. water, energy; pollution of water reserves [19]; severe alterations in destination's real estate market [20]; traffic congestion and air quality worsening; excessive waste volumes; etc. These, in turn, lead also to the degradation of tourist satisfaction, experience and loyalty to the destination [7, 11, 21]; and, in a longer term, to destination's stagnation or decline. Despite the ominous repercussions of overtourism, however, relevant debate still remains in the first policy-cycle stage of agenda-setting, mainly due to the very recent introduction of the overtourism term in the planning and policy discourse and the, so far, limited number of relevant research works on the topic [11].

An area that rates quite high in tourism preferences around the globe is the Mediterranean Region. Tourism is a major pillar for the local economies of states and regions surrounding the Mediterranean Sea, especially in its coastal zones, rendering these regions top-rated tourist destinations [3, 22]. One distinguishable example of areas, endowed with exquisite tangible and intangible, land and maritime, natural and cultural resources, are Mediterranean islands. Based on their extraordinary resources, some of these islands are by far the most attractive and highly appreciated world destinations [18, 19, 23–25]. Therefore, islands, as fragile and geographically confined land compartments, are perceived among places under considerable and steadily increasing risk to overtourism. Such an ascertainment is verified by various studies, rating coastal areas, islands and rural heritage sites as the most vulnerable to overtourism destinations [2, 11, 26, 27]. Speaking of island regions in particular, severe impacts of overtourism on sustainability are largely associated with the constrained carrying capacity and fragile environment of such land compartments [11]. In fact, high vulnerability of island regions to overtourism rests upon five factors, namely the [9, 27]: limited population number, rendering visitors highly visible in the destination; obstructed area, where tourism facilities/infrastructure consume valuable amount of land; confined natural resources for serving the needs of both population and visitors; lack of control over tourism, being largely dependent on off-island forces and agencies, e.g. international airlines and hotel chains, externally-owned ferry companies, higher levels of government; and geographic location, as a factor enabling accessibility of islands by major close markets.

Within such a context, studies relevant to overtourism risk assessment of Greek islands that integrate sector's growth and its spatial repercussions seem to be quite few. In order to partially fill this gap, the focus of this paper is on illuminating risk to overtourism of three insular case studies, located in the Southern Aegean Region, Greece, taking such an integrated sector's view. The paper is structured as follows: in Sect. 2, a literature review is carried out, aiming to identify sets of indicators that can be of relevance for exploring risk to overtourism conditions; in Sect. 3, data used in this respect and methodological approach are shortly outlined; in Sect. 4, risk to overtourism of the specific case study islands is featured that is based on indicators selected from those identified in Sect. 2 as well as additional ones, chosen on the ground of relevance and data availability; in Sect. 5 results are discussed; while, finally, in Sect. 6 some key conclusions are drawn.

2 Assessing Risk to Overtourism – Literature-Based Indicators

Assessment of overtourism per se is a complicated, far from a straightforward, task [28]. In fact, there is neither a commonly accepted set of indicators that can be used in this respect, nor a common approach; while missing are also certain indicator thresholds, beyond which the tourism pattern in a certain destination can be featured as 'overtourism' [5]. Speaking of the approach for assessing overtourism risk, a number of studies attempts to grasp overtourism in an objective and rather quantitative manner, i.e. a set of quantitative indicators, such as tourism density or intensity [11]; while other adopt a more qualitative approach, e.g. by assessing attitudes of local population against tourism/visitors of their place [8], claiming that surveys of residents' or even tourists' perceptions could be more informative in providing the precise image of the number of visitors a destination can bear [29]. Whatever the approach is, however, it is evident that assessment of the overtourism phenomenon and its impacts is strongly linked to the peculiar attributes, as well as the carrying capacity and fragility of a certain destination, i.e. it is a place-based exercise.

This lack of common understanding and approach can definitely hamper a straightforward assessment of destinations that are at overtourism risk or have already entered an overtourism state [11]; while mostly hinders comparison of destinations at risk on a common ground. Realizing the complexity of the overtourism state and its very dependence on destination's attributes, research community is arguing about the establishment of an upper threshold of tourists, beyond which a destination's state is running of overtourism risk.

In seeking to identify risk to overtourism in the case study island regions, a literature review is conducted, leading to the collection of a number of indicators. These are presented in Table 1 and are used for guiding the empirical part of this work.

Table 1. Literature review on indicators for assessing overtourism and/or risk to overtourism

Author(s)	Scope	Literature-based indicators
[11]	Assessing overtourism trends	• Tourism density (bed-nights per km^2) • Tourism intensity (bed-nights per resident) • Share of Airbnb bed capacity • Share of tourism in regional Gross Domestic Product • Air travel intensity (arrivals by air divided by number of residents) • Closeness to airport, cruise ports and UNESCO World Heritage Sites (in km)
[30]	Assessing overtourism trends	• Tourism density (bed-nights per km^2) • Tourism intensity (bed-nights per inhabitant)
[31]	Assessing overtourism trends	• Number of tourists per surface area of the destination • Number of tourists per local population
[32]	Assessing overtourism trends	• Tourism Intensity Index (TII), based on number of tourist arrivals, destination's population, tourism revenues and GDP • Tourism Density Index (TDI), Inbound plus domestic tourism per local population
[27]	Vulnerability to overtourism	• Location – Proximity to markets (1–3 h), Frequent air/sea access, On Cruise ship itineraries • Population – Concentrated in few locations, Coastal/urban, Dispersed/rural • Island's Size – Small (under 1000 km^2) • Resources – Few/limited/agricultural • Control – Local or regional power only, No control of means of access
[8]	Indirect overtourism measures	• Tourist / resident ratio • Local government management • Tourist behavior • Attitude of residents / effects on their quality of life
[5]	Territorial aspects of tourism	• Tourism accommodation density (usage of the territorial system for tourism)

3 Data and Methodology

The steps of the methodological approach are presented in Fig. 1 below.

The effort to assess risk to overtourism in the case study islands is capitalizing on former research works and relevant indicators so far implemented (Table 1). From this indicators' list, a certain number is selected, based on data availability as well as reflections on tourism supply and demand side. In addition, two more indicators are added, aiming to quantify density of the built-up environment, a choice that is justified by the fact that built-up areas' expansion and/or dispersion is largely due to developments of the tourist sector and exerts pressure on islands' local assets and landscape [33, 34]. Values of these two indicators, coupled with the distribution of accommodation infrastructure (hotel/guesthouses and Airbnb), are used as a proxy for grasping the territorial/spatial implications of tourism development and the intense coastalization pattern and overtourism risk. Thus ten indicators in total are used (Table 2), aiming to demonstrate tourism growth rates in both supply and demand, tourism density and intensity, as well as the territorial implications of tourism in case study islands.

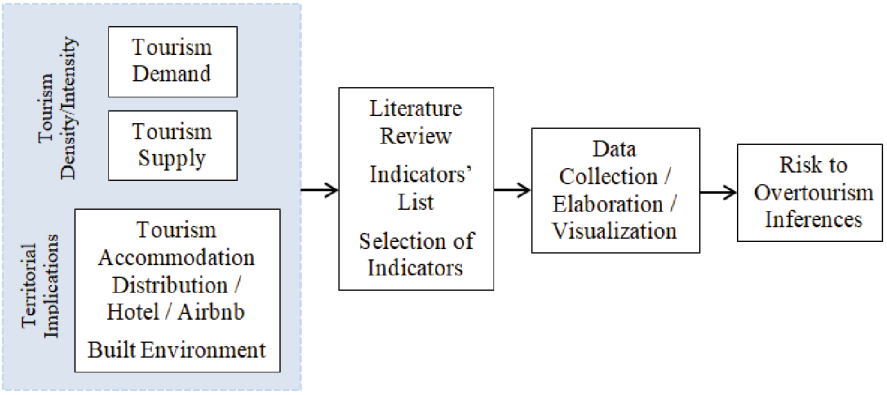

Fig. 1. Steps of the methodological approach, Source: Own elaboration

Data on indicators depicting tourism demand and supply are collected from the INSETE [35] and relate to the time span 2011–2021. However, interpretation of relevant indicators is focusing on the time span 2011–2019 in order for COVID-19-based disturbances to be avoided. Data on Airbnb accommodation (2022 data) is gathered by the Inside Airbnb Platform [36]. As to the territorial dimension, relative data is extracted from the Imperviousness high-resolution set of layers, distributed by the Copernicus Land Monitoring Service [37]. The Impervious Built-up (IBU) 2018 database displays the binary information of 'building' (class 1) and 'no building' (class 0) for the EEA-39 area. Data are provided as a 10 m and 100 m aggregate raster, accounting for the % built-up percentage in each raster cell. In this work, the 100 m raster is used, as it renders possible the differentiation of low density ($1 \leq$ % built-up ≤ 30), medium density ($31 <$ % built-up ≤ 50) and high density built-up areas (% built-up > 50). These data are used

Table 2. Selected indicators for assessing risk to overtourism in the case study islands

View point	Indicators	Data Source
Supply side	- Tourism capacity (Hotel and Guesthouse capacity – number of beds (use of 2021 data)	[35]
	- Airbnb capacity in beds (use of 2022 data)	[36]
Demand side	- % increase of overnight stays* 2011–2019 (bed-nights' growth rate)	[35]
	- % increase of arrivals* 2011–2019 (tourism arrivals' growth rate)	[35]
	- Number of overnights stays* (2019) per surface of the island	[35]
	- Number of overnights stays* (2019) per local population	[35]
	- Number of visitors* (based on arrivals, 2019) per island's surface (km2)	[35]
	- Number of visitors* (based on arrivals, 2019) per local population	[35]
Territorial dimension (density of the built-up environment)	- % of island area affected by built-up structures (2018)	IBU database
	- % low density development (% of total built-up area) (2018)	IBU database

* In the indicators' interpretation, 2011–2019 data are taken into consideration in order for disturbances due to COVID-19 in the time span 2020–2021 to be avoided.

in an effort to draw inferences as to the spatial saturation level of case study islands, a state that sets destinations on a downward spiral to exhaustion or degradation [5].

4 Assessing Overtourism Risk in Case Study Islands – Empirical Results

Greece is one of the top-rated tourism destinations in the Mediterranean, with tourism contributing about 27% of GDP in 2017 [37]. Attractiveness of the Greek destinations resulted in record number of visitors in 2019 – 31 million tourists, almost three times the state's population [38, 39] – a number that displays further dynamism in the current year. The three most popular Greek Insular Regions (NUTS2), i.e., Crete, Ionian and South Aegean Regions, account for the 42% of inbound tourism arrivals, 52% of the overnight stays and 60% of total tourism receipts; while they manifest particularly high seasonality peaks during the summer period [32, 40]. However, several Greek destinations, especially insular ones, are featured as quite tourism-saturated places, running the risk

of overtourism. In the following section, three distinct examples of island case studies in the Southern Aegean Region are discussed, namely Mykonos, Paros-Antiparos and Kos-Nisyros (Fig. 2), through the 'lens' of overtourism risk.

4.1 Case Study Islands

South Aegean Region consists of the Cyclades and Dodecanese island complexes. The Region is a highly-reputed Mediterranean destination, with a local/regional economy displaying a strong dependence on the tertiary sector (77.8% of total employment in 2011). Tourism development in, among others, the islands of Mykonos, Santorini, Kos, Rhodes and Paros, poses a heavy burden on the natural/cultural and human capital; while gives rise to land use conflicts as well as environmental and landscape degradation. In addition, climate change impacts (heat, extreme wind and storm surges, sea-level rise, drought, etc.) are predicted to strongly affect tourist demand and attractiveness of several destinations of this Region. Finally, signs of overtourism are already visible in certain islands of South Aegean Region, with Santorini and Mykonos being mentioned as distinguishable examples in this respect [11, 40]. In fact, these two islands are, since 2020, subject to temporary banning of new building permits for tourism facilities in areas outside of the settlements' boundaries by the Greek Government, in order for the ongoing environmental degradation to be restrained, until a new spatial plan is accomplished.

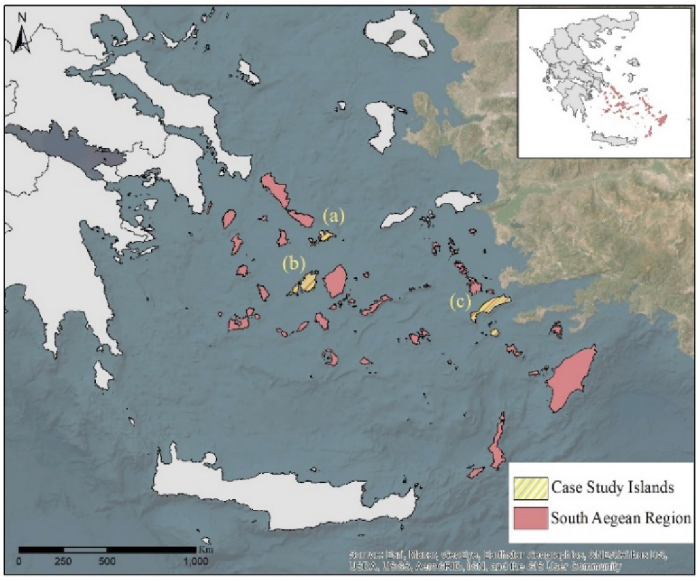

Fig. 2. Islands of the Region of South Aegean (NUTS2) and selected case study islands: (a) Mykonos, (b) Paros-Antiparos, (c) Kos-Nisyros, Source: Own elaboration

Within such a scene, as case study islands for assessing overtourism risk are chosen the islands of Mykonos, Paros and Kos. All three islands are highly acknowledged

destinations at the regional, national and international level with high accessibility (ports and airports). These islands witness a steadily rising environmental pressure and urban sprawl [34, 41], calling for a certain control of future tourist development pathways and handling of spatial bottlenecks. Of remarkable value are also the rich natural and cultural resources these case study islands dispose. In fact, Paros and Mykonos are institutionalized as landscapes of outstanding natural beauty, with a great variety of zones (natural, cultural, archaeological) being set under a protection status.

The islands of Paros and Kos in this study are complemented by the smaller ones of Antiparos and Nisyros islands, due to data availability reasons (tourism data are provided by the INSETE database at the regional unit level and not at the level of each single island). Antiparos and Nisyros are smaller islands, exhibiting a less intense tourism development pattern; however, they are functionally, administratively and economically dependent on Paros and Kos core islands respectively.

Mykonos Island (85.5 km^2, 9.802 inhabitants in 2021 Census) is a top-rated tourism destination. Mykonos, along with the nearby islands of Delos (part of the UNESCO World Heritage Sites) and Rineia are featured as a landscape of exceptional natural beauty. The island is endowed by wild life repositories, archaeological sites, settlements under protection due to traditional architecture, etc. Total population displays a certain decrease (3.3%) in the time span 2011–21, while employment in the tertiary sector reaches 75.3% (2011 Census), coupled with a high percentage of employment in the secondary sector (21.8%) that is mostly attributed to the construction sector. The rapidly accelerating spread of tourism facilities is regulated first in 2005, posing several constrains on building regulations; while currently a new Special Urban Plan is in progress.

Paros Island (193.3 km^2, 14,290 inhabitants in 2021) is also a well-known destination, marked by a rather rough morphology, two major ports – Paroikia and Naousa – and several smaller inland and coastal settlements. Total population demonstrates a certain growth rate (4.2%) in the time span 2011–2021, while employment in the tertiary sector reaches 68.4% (2011 Census). Antiparos Island is considerably smaller (45.1 km^2, 1264 inhabitants); however, it also displays a population growth rate of 4.4% in 2011–2021, and employment in the tertiary sector of 67.6% (2011 Census), coupled with a relatively high employment in the primary sector (13%). Paros Island disposes abundant natural and cultural resources (wild life repositories, monuments and archaeological places). A General Urban Plan was adopted in 2012, identifying different types of natural protection zones; and specifying regulatory measures regarding tourism facilities, vacation housing and other land uses, especially in the rather overcrowded coastal part.

Kos Island (295.3 km^2, 36,986 inhabitants in 2021) is characterized by a relatively smooth geomorphology in the northern part, combined with a mountainous protected area in the southeastern part. Total population demonstrates a steady growth rate during the last two decades (9.6% in 2001–2011 and 10.9% in 2011–2021); while the percentage of employment in the tertiary sector is extremely high, reaching 85.4% (2011 Census) and being directly linked to intense tourism activity. The island displays an urbanization pattern, with the major urban area of Kos hosting about 60% of total island population; featured also by a number of smaller inland and coastal settlements. Nisyros Island is much smaller (41.26 km^2, 1043 inhabitants in 2021), demonstrating though a population

growth rate of 3.8% in 2011–2021 and a percentage of employment in the tertiary sector of 70.7% (2011 Census). The Kos-Nisyros complex contains three Natura 2000 sites, covering the whole island of Nisyros and most of the southeastern part of Kos; while a total of ten wild life repositories is also reported. Spatial planning in Kos is up to now fragmented and incomplete, covering only certain zones of the island; while environmental and land use pressures from the mass tourism model are particularly high. The island can be characterized as a "hotspot" of international tourism, reaching about 1.3 million arrivals in 2019.

4.2 Pattern of Tourism Activity

Results regarding the tourism pattern (supply, demand, density and intensity, Hotel and Airbnb bed capacity, etc.) are presented in Table 3; while tourism bed-night stays in the time slot 2011–2021 are presented in Fig. 3.

Table 3. Comparative data for tourism activity in the case study islands

Indicator	Mykonos	Paros – Antiparos	Kos – Nisyros
Hotel and Guesthouse capacity in beds	25,010	22,472	62,868
Airbnb capacity in beds	14,375	11,906	2,313
% increase of overnights stays*	219.10	89.0	81.3
% increase of arrivals*	251.90	71.3	104.0
Overnight stays / surface of the island (km^2)	24,115	2,519	25,401
Overnight stays / local population	211.3	39.5	225.7
Number of visitors / surface of the island (km^2)	7,174.2	657.1	3,840.7
Number of visitors / local population	62.9	10.3	34.1
% of island area affected by built-up structures	41.7	15.0	6.2
% low density development (% of total built-up area)	58	75.6	68.8

Inspection of results manifests an incremental growth (peak) in tourism arrivals in all case study islands in the time span 2016–2019; while quite evident are the COVID_19 results in 2020 (Fig. 3). A similar trend is reported in overnight stays, where in the time span 2011–2019: Kos-Nisyros Islands count for 8.58 million overnight stays in 2019, thus presenting an overall growth rate of 89.0%; Mykonos Island exceeds the 2 million overnight stays in 2019 (2.07 million), with an overall growth rate of 219.1%; while Paros-Antiparos Islands display 613.8 thousand overnight stays in 2019 and an overall growth rate rising to 89.0%.

In addition, data show that Mykonos Island scores considerably higher in the visitors/island's surface (km^2) indicator, with 7,174 visitors per km^2; followed by the Kos-Nisyros complex, with 3,840 visitors per km^2. In the Paros-Antiparos complex this indicator is considerably lower, reaching 657.1 visitors per km^2. Similarly, the number

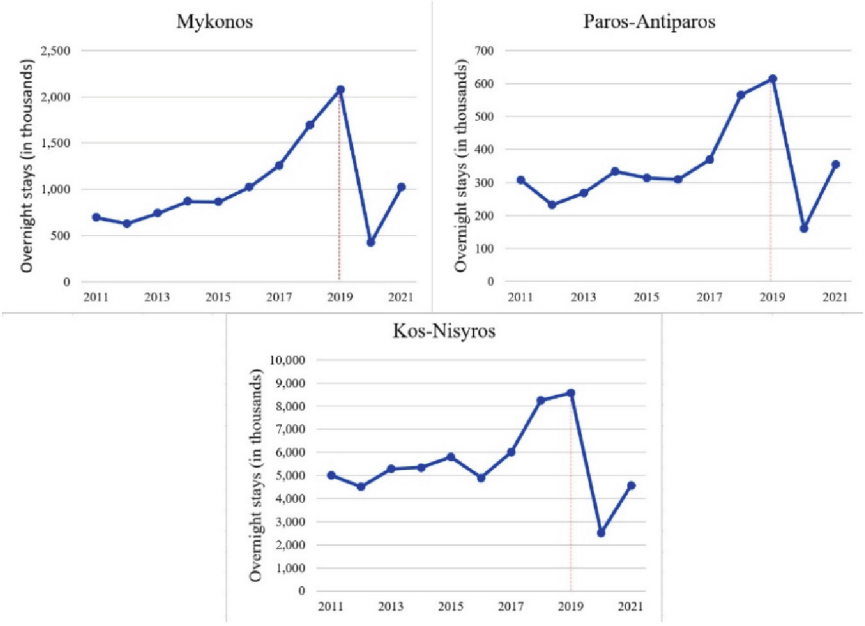

Fig. 3. Overnight stays (in thousands) in case study islands in the time slot 2011–2021, Source: Own elaboration

of visitors per local population in Mykonos is about six times higher than in Paros-Antiparos (62.9 and 10.3 respectively); while the Kos-Nisyros complex appears to be an intermediate case, with 3840.7 visitors per km^2 and 34.1 visitors per local population.

Airbnb and hotel/guesthouse distribution across the case study islands' area is presented in Fig. 4. Since INSETE data lack a spatial reference, the spatial distribution of hotel facilities in case study islands is approximated through the Open Street Map data. These data include a sufficient sample of existing hotel/guesthouse registrations.

Of critical importance is the Airbnb listings/distribution in the case study islands, an issue quite relevant to overtourism risk. In fact, interpretation of Airbnb data demonstrates the following: Mykonos reports 3,927 Airbnb listings in 2022, with a total capacity estimated as 14,375 beds (i.e. almost half of the hotel and guesthouse beds' capacity); and with 88% of the listings being located close to the coast (in the 1km zone from the shore) (Fig. 4). Paros reports 3,617 Airbnb listings in 2022, with a total capacity estimated as 11,906 beds (also half of the hotel beds' capacity), while 82% of the listings are located in the 1 km zone distance from coast (Fig. 4). Thus, the spread of Airbnb in those two islands adds up considerably to the total capacity of tourism accommodation infrastructure, accounting for about 35% of total beds in each case. A different situation is observed in Kos-Nisyros, where Airbnb penetration in tourism accommodation is considerably smaller. More specifically, data shows that 900 Airbnb listings have been registered, with a total capacity of 2,313 beds, corresponding to only 3.5% of total beds' capacity in tourism accommodation facilities; while a different spatial pattern is also displayed, with Airbnb spreading both in coastal and inland areas.

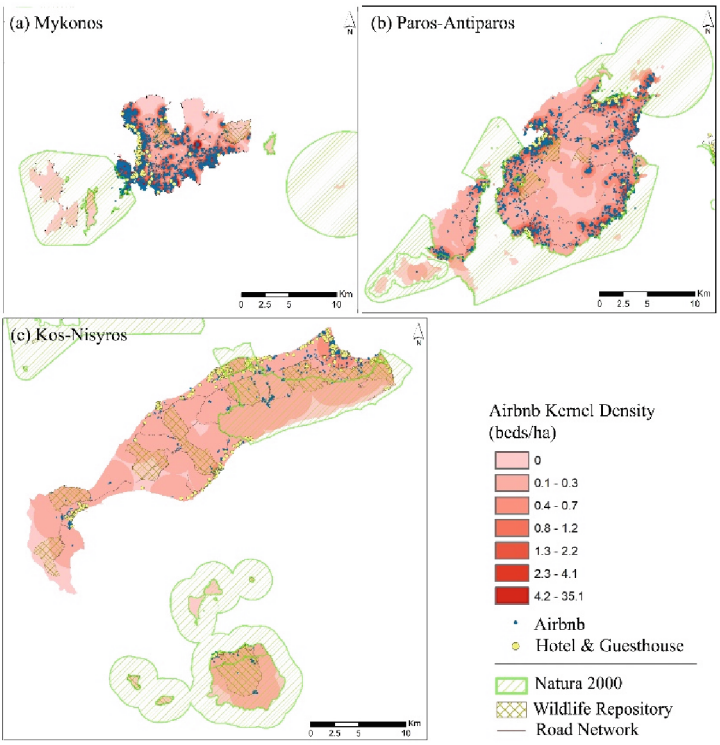

Fig. 4. Distribution of Airbnb in case study islands, overlaid on a Kernel density estimation map (created in ArcMap software), Source: Own elaboration

As inferred from Fig. 4, the coastalization pattern is particularly intense in the case of Paros Island, with tourism facilities forming a relatively dense "ring" along the whole coastline. In Mykonos, only the northern part of the island remains undeveloped, with the south coast displaying a pretty dense tourist development pattern, leading to a high saturation level. In Kos, tourism development appears to be concentrated in specific zones, with hotel and guesthouse facilities spreading mainly along the north-eastern coast, leaving a large part of the central/southern island intact. Airbnb is mainly developing within existing settlements (also inland ones), while the largest concentration is noticed in the port city of Kos.

As estimated by the IBU 100m built-up density database (Fig. 5), 40.5% of Mykonos territory is already affected by built-up structures (as calculated on the 100x100 m raster resolution). In Paros-Antiparos complex, this rises to 15%, demonstrating an intense coastalization pattern, with the central mountainous part remaining largely undeveloped. In Kos-Nisyros, only 6.2% of total area is affected by built-up structures. This small percentage is related to the large size of the island and the concentration of urban and tourism development in specific zones. However, in all case study islands, low density built-up development, related to urban sprawl, appears to be very high. Thus, 58% of

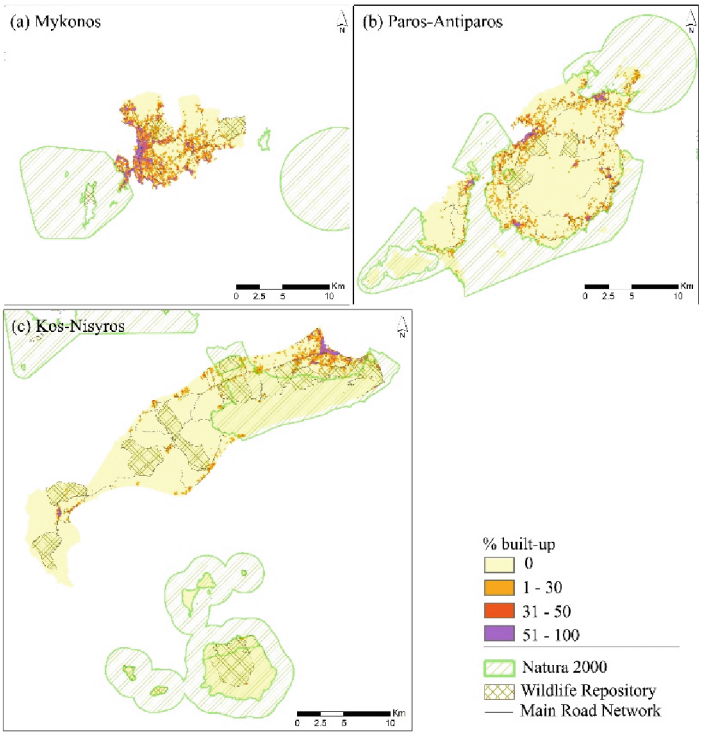

Fig. 5. Distribution of built-up density in case study islands based on IBU 2018 data: low density ($1 \leq$ % built-up < 30), medium density ($31 <$ % built-up ≤ 50) and high density built-up areas (% built-up > 50). Source: Own elaboration

total built-up area in Mykonos, 75% in Paros-Antiparos and 68% in Kos-Nisyros are classified as low-density built-up land.

5 Discussion

Overtourism seems to gain importance in the scientific and the policy discourse [42], being grasped as a source of social and environmental pitfalls that can potentially outweigh economic benefits of tourism for the host communities [2]. Of crucial importance in this respect is the identification of a number of problems that act as barriers in order for the overtourism phenomenon to be fully grasped and assessed; coupled with factors that can act as enablers to further acceleration of overtourism trends.

One of the main barriers relate to data availability at the specific spatial level – island context, in this respect – being a considerable deficit for a place-based approach. This holds true in the case of the present study as well, where tourism supply and demand data are provided at the regional unit level in the INSETE database; this fact resulting to a certain weakness to downscale tourism data to the specific territorial context, namely the islands of Paros and Kos. This data-availability problem, has led the present work to the study of Paros-Antiparos and Kos-Nisyros as island complexes.

A second barrier emanates from the way most tourism destinations are managed. The rather 'growth-based paradigm' [11] seems to value destinations' performance in terms of e.g. number of visitors' arrivals, leaving aside aspects of carrying capacity, fragility of natural and cultural resources, local identity and values, capacity to deal with overtourism repercussions, other policy objectives, etc. However, such an approach seems to ignore the very essence of islands' tourist attractiveness, thus condemning, in a long term, these islands to withering and loss of their social and economic identity, cohesion and ownership of their place. This seems to be the case of Mykonos, taking into consideration its top position in the global tourist market as well as the previous analysis, demonstrating a pattern that goes beyond the island's carrying capacity limits. Same holds for the rest two case studies, which seem to follow a similar trajectory in a rather slower pace.

A third barrier relates to the approach adopted for studying islands' overtourism. Island areas in fact constitute complex, heterogeneous and quite dynamic territorial systems, displaying formal and functional specificities, relevant to their morphological attributes. Thus a 'micro-destination' approach would be more relevant to explore overtourism, focusing on specific islands' compartments [43]. Such an approach could unveil compartments of more homogeneous areas under tourism pressure or overtourism risk. The analysis conducted in this work confirms the need for such an approach, designating coastal parts of case study islands as places that need specific attention, when exploring risk to overtourism. Exceptional examples are the islands of Paros and Kos, where the high tourism infrastructure load is concentrated along the coast. In case of Mykonos, over-saturation of the coastal part features built-up expansion towards the inland zones, further commercializing the island's territory.

An enabler that largely accelerates risk to overtourism, as various studies claim [11, 32, 44], seems to be the development of various platforms, such as Airbnb. Such an enabler brings on board diversifying individual forces, namely non-institutionalized forms of tourism accommodation, which result in overdevelopment of destinations. As noticed in the literature [27, 44], massive proliferation of such – of small scale and privately-owned – properties, hosting part of tourism flows is nowadays immensely escalating, earning thus a large portion of customers, occasionally larger than the one of conventional accommodations (hotels). In addition, these are, many times, the source of failure of sustainable spatial planning of tourism and related policies. This kind of development is noticed in all case study regions of this work, especially in Mykonos and Paros (Fig. 4), further reinforcing the heavy overcrowded coastalization pattern and burdening the fragile coastal land of these islands.

A comparison among the specific case study examples leads to the following conclusions: Mykonos Island stands out as a prominent example of an island territory, exhibiting overtourism signs. Compared to the rest of islands explored, Mykonos scores higher in 'visitors per island's surface', reaching a value of 7.174,2 people/km^2. This, according to other empirical works from Greece [32], is classified as "high". Mykonos Island also counts for the highest value of 'visitors per local population' indicator (62.9). The expansion of the built-up environment affects over 40% of the island, mainly in the form of low-density development; while the spread of tourism facilities, including Airbnb, is

very high and tourism demand is accelerating, with over 200% increase in arrivals and overnight stays in the 2010–2019 period.

The Kos-Nisyros complex appears to be an intermediate case. This island complex scores pretty high in indexes related to both tourism supply and demand. 'Visitors per island's surface' indicator reaches a value of 3,840, also classified as "high" [32]; while 'visitors per local population' indicator is also considerably high (34.1). Tourism development, though, appears to be more concentrated in specific zones, and only a minor part of the islands' area is (up to now) affected by built-up structures. However, the over 100% increase in tourism demand (as quantified by the growth in arrivals in the period 2011–2019) clearly connotes a high risk to overtourism, unless specific policy measures are put in place. A micro-destination approach would be quite appropriate for downscaling overtourism risk assessment to specific Kos Island's compartments.

Finally, the Paros-Antiparos complex appears to be in a transitional stage, since most variables examined, such as 'visitors per local population' and 'visitors per island's surface' are considerably lower with respect to the rest case study areas. More specifically, the 'visitors per island's surface' indicator is 657.1, classified as "medium" [32]; while the 'visitors per local population' indicator is relatively low (10.3). Nevertheless, urban sprawl already affects mainly the coastal zone of Paros island, a fact also outlined by other research works [34]. The considerable increase in tourism demand during the past decade in Paros-Antiparos (over 100%) also witnesses that pressures posed on the natural and cultural environment will accelerate in the near future.

6 Conclusions

Insular regions are nowadays confronted with harsh dilemmas and difficult decisions as to their future developmental pathways [45]. This holds even truer in case of Mediterranean islands, i.e. hot spot land parcels in many respects. These regions, as geographically-fragmented and lagging-behind areas due to insularity structural drawbacks, are currently highly specializing and are largely dependent on tourism, namely a quite resource-intensive sector, but also a vulnerable one to various external crises, e.g. climate crisis, COVID-19 health crisis. The commodification of islands' highly appreciated natural and cultural resources and sceneries by the tourism sector has so far been guided by a rather short term and opportunistic 'growth-based' policy view, a view largely grounded on economic profit. This has definitely ignored aspects of islands' identity, historical path and traditions, outstanding landscape as well as natural and cultural qualities; and has, in many cases, led to overtourism pathways. Such pathways, though, violate the 'rights' of both the nature and island communities for a durable development; and leave aside equal rights and opportunities of future generations. Taking also into consideration the confined carrying capacity of islands in ecological, physical, social, economic etc. terms; and the continuously escalating number of tourist flows, concerns as to overtourism and threats to sustainability objectives in that kind of territories are imperatively raised. The role of a multi-level integrated territorial governance for more sustainable spatial planning of tourism is crucial in this respect [46], providing a regulatory framework and related spatial tools for: restraining uncontrolled development; managing the accelerated spread of tourism facilities; handling land use conflicts; and relieving pressures exerted on natural and cultural assets.

As various studies show, overtourism is currently placed high in the academic and policy agenda; and is calling for a paradigm shift in handling the triangle 'tourism, sustainability and carrying capacity' of destinations and their interrelationships. Such a shift is far from one-size-fits-all recipe; while it is also framed by difficulties that are associated with the very nature of tourism and its reliance on factors controlled outside the destinations – e.g. Airbnb, TripAdvisor –, which seem to play a decisive role in triggering or accelerating overtourism trends. That said, there seems to be a dire need to: assess and monitor, in a more systematic, integrated and data-enabled manner the issue of overtourism, with an emphasis on the coastal and marine part as well as the vulnerable to overtourism ecosystems these host; and sketch out of this effort the most proper, place-based and human-centric policy decisions in order for the natural and cultural assets as well as the distinct insular identity to be protected and sustainably managed. Such an effort definitely implies adoption of the quadruple helix approach – decision makers, research community, stakeholders and local communities – in tourism planning processes in order to realize and embed constraints, values, views and expectations in the way local resources and identity are handled; and establish community-driven, qualitative and authentic, long lasting tourism products. In addition, it needs to handle tourism as one sector of a diversified insular economy, which, furthermore, follows a just pattern and spreads its benefits sectorally, spatially and temporally.

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