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The carrying capacity of a tourist destination. The case of a coastal Italian city

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1. Introduction

In the last decades the world tourist flows rapidly grew and travel and tourism has become one of the world's highest priority industries and employers. According to UNWTO world tourism barometer (2010), in 2008 international tourist arrivals reached 919 million (880 million in 2009, a cause of the international recession), with a growth of about 72% since 1995. Italy, which accounts 43 millions of tourist arrivals in 2009 (UNWTO, 2010), is one of the most preferred destinations; thus, tourist is one of the most important Italian industries.

Tourism gives also an important contribution to the regional and local economic development, but it causes also negative impacts mainly on the environment and social context. In particular, the uncontrolled development of the tourist activities and the intensive land exploitation can cause a rapid degradation and reduction of the environmental, cultural and social resources, with negative effects also on the tourism development till the possible decline of the tourist destination and, more generally, of the economic activity of the area. As a consequence, the relevance of this phenomenon and the simultaneous spreading of the sustainable development concept have pushed towards the identification of a more sustainable process of planning, development and management of the tourist activities. Thus, the tourism carrying capacity (TCC) approach has been developed and has become a real challenge for both planners and managers. In economics terms, the public intervention is needed because the tourist attractions are assets which cannot be reproduced and they should be treated as public goods where market mechanisms do not show their normal allocative functions. Tourism carrying capacity represents a problem of allocation of scarce resources, e.g. protected natural or historical areas, to recreational opportunities that are density dependent (McCool and Lime, 2000).

The TCC assessment differs according to the different type of destinations: coastal areas, islands, protected areas, rural areas, mountain resorts and historical settlements. The present paper focuses on a coastal destination, which is normally associated with mass tourism, large scale construction and infrastructure, intensive land development and extensive urbanisation

(European Commission, 2002). The application of a carrying capacity to this type of destination makes the need to consider tourist density, the use of beaches and tourist infrastructure, congestion of facilities and transport infrastructure, sea pollution, waste production, etc.

After a review of the TCC theory, the paper presents the application of the TCC assessment to a South Italy coastal destination located in the NUTS3 province of Foggia in the core of Gargano Natural Park, aiming at identifying the opportunities and the limits of the tourism development in such a destination and at developing some policy recommendations.

2. A brief review of the concept of Tourism Carrying Capacity

The carrying capacity literature is voluminous; a detailed review on the development and the evolution of this concept can be found, for example, in the works of Stewart (1993) or McCool and Lime (2000). The concept of carrying capacity was initially introduced in biology to indicate the limit or level a species population size attains, given the environmental resistance indigenous to its location (Lein, 1993) or “the capacity of an ecosystem to support healthy organisms while maintaining its productivity, adaptability, and capability for renewal” (Canadian Arctic Resources Committee, 2002). In a planning or environmental management context, carrying capacity has been defined as the ability of a natural or man-made system to absorb population growth without significant degradation (Schneider, 1978), or similarly, the degree of human activity that a region can sustain at an acceptable quality of life in perpetuity (Bishop *et al.*, 1974).

Although the first analyses on the ability of parks and protected areas to absorb tourists and on their impacts was made in the USA in the 1930s (McCool and Lime, 2000), Tourism Carrying Capacity (TCC) emerged as an important concept in the 1970s and 1980s. In literature several definitions of TCC are available (for a review see, among the others, European Commission, 2002; Coccossis and Mexa, 2004); in particular, TCC has not an universal definition, “is centred around tolerance-levels” (Cooper *et al.*, 1998) and it is a dynamic and fluid concept, according to the evolution of the environmental and socio-economic conditions of the destination (Simón *et al.*, 2004). The literature often defines capacity as a numerical constraint to tourist development or as the amount of use that is accommodated without degrading resources. Middleton and Hawkins (1998) define carrying capacity as a “...measure of the tolerance a site or building are open to tourist activity and the limit beyond which an area may suffer from the adverse impacts of tourism”. Chamberlain (1997) defines it as “..the level of human activity an area can accommodate without the area

deteriorating, the resident community being adversely affected, or the quality of visitors experience declining”. Clark (1997) defines carrying capacity as a “...certain threshold level of tourism activity beyond which there will occur damage to the environment, including natural habitats”. He also states that the actual carrying capacity limit in terms of numbers of visitors or any other quota or parameter is usually a judgement call based upon the level of change that can be accepted, regarding sustainability of resources, satisfaction of resource users, and socio-economic impact (Clark, 1997). McIntyre (1993) defines carrying capacity as “the maximum use of any site without causing negative effects on the resources, reducing visitor satisfaction, or exerting adverse impact upon the society, economy or culture of the area”. The World Tourism Organisation (UNWTO, 1981) proposes the following definition of the carrying capacity (also adopted by the MAP's Priority Actions Programme - PAP): “the maximum number of people that may visit a tourist destination at the same time, without causing destruction of the physical, economic and socio-cultural environment and an unacceptable decrease in the quality of visitors' satisfaction”. Coccossis and Parpairis (1992) define TCC as the number of user unit periods that a recreation/tourist area can provide each year without permanent natural/physical deterioration of the area's ability to support recreation and without appreciable impairment of the visitors' recreational experience.

The majority of definitions contain two aspects: “a capacity issue”, e.g. “how many tourists can be accommodated before some negative impacts occur” expressed in numerical terms, and a “perception of capacity” issue, e.g. “how much tourism is acceptable before there is a decline in visitor satisfaction” (Coccossis and Mexa, 2004). The TCC should simultaneously focuses attention, on one hand, on the host destination impacts and population attitudes (Martin and Uysal, 1990) and on the other hand, on tourist satisfaction, two issues interfaced one with the other. In fact, the greater the intensity of tourist use and the level of saturation of the tourist assets are, the more limited becomes the appeal of the tourist attraction, also causing a probable decline of the destination.

Initially, TCC was concerned with environmental considerations, but more recently, according to the sustainable development concept, it has been recognised the need of a multidimensional approach combining simultaneously social, economic and environmental dimensions. Consequently, most destinations recognise that their competitiveness cannot survive without sustainability (Ritchie and Crouch, 2000).

The aim is to determine the upper desirable limits of development, that is, the optimal use of tourism resources (UNEP/MAP/PAP, 1997). In fact, “the carrying capacity cannot be really separated from the use limit decision because one is linked to the other” (McCool and Lime,

2000). Nevertheless, there were multiple carrying capacities, i.e. “no single capacity can be assigned to an entire area” (Lime, 1970); so TCC is a very complex concept. Its object can be summarised as the search of the right balance between the often conflicting aims of its different components and, particularly, between the three subsystems of which it is composed (O’Reilly, 1986):

- the physical carrying capacity: “the maximum number of people who can use a site without an unacceptable alteration in the physical environment and without an unacceptable decline in the quality of experience gained by visitors” (Mathieson and Wall, 1982; Simón et al., 2004);
- the social carrying capacity: the level of tolerance of the host population for the presence and behaviour of tourists in the destination area;
- the economic carrying capacity: the ability to absorb tourist functions without squeezing out desirable local activities and avoiding the decline of the tourist destination caused by the disruption of the local attractions.

In particular, three basic dimensions compose TCC: physical-ecological, socio-demographic and political-economic dimension (UNEP/MAP/PAP, 1997). The first dimension refer to all fixed and flexible components of the natural environment (ecological capacity, the natural heritage capacity, length of the coastline, climate, etc.), as well as infrastructural systems (water supply, sewerage, electricity and gas supply, transportation, public services, etc.). The socio-demographic dimension, indeed, is associated to all the elements which concern social communities, as well as the problems of interrelation between local resident population and tourists; it comprises, for example, available man power, educational level of workers, cultural identity of the local population, tourist experience, and the absorptive capacity for receiving new workers and tourists.

The last dimension (political-economic dimension) primarily refer to the anticipated investment and economic measures for tourism development.

The importance of these three issues differs according to the different characteristics of the tourist destination (local resources, the vulnerability of local natural ecosystems, population size, economic structure, culture and local heritage, etc.), the characteristics of the tourists and of the existing different types of tourism in each destination and the life-cycle phase of tourism (European Commission, 2002; O’Reilly, 1986; Martin and Uysal, 1990). As a consequence, the TCC should be applied to each destination using an individual approach that is tailored to its specific feature (UNEP/MAP/PAP, 1997).

Although at the beginning the TCC concept was applied to single resources, such as parks, beaches, historical buildings or sites, recently a systemic approach prevails: the TCC should

be applied to the whole tourist destination or area, considering by an integrated way all its resources and assets.

TCC developed, largely, in response to the perception that tourism cannot continue to grow forever without causing irreversible damage. There should be limits to tourism development in specific locations. In fact, the term carrying capacity also applies to “the maximum rates of growth above which the growth process itself would be unduly disruptive” (Dekadt, 1976).

However, it soon became clear that the concepts of TCC are difficult to apply; in particular, there is the impossibility of assigning an objective scientific value to TCC and to apply a rigorous analysis (among the others, Washburne, 1982; Stankey and McCool, 1984). For this reason, some authors criticise this concept (among the others, Papageorgiou and Brotherton, 1999; Buckley, 1999).

Nevertheless, we agree with the researchers who state that TCC should be viewed as mainly a planning process and a systematic strategic policy tool for sustainable tourism development and not as a scientific measure or a unique number (among the others, Linderberg, 1997; Coccossis and Mexa, 2004; Miller, 2001; Abernethy, 2001). In fact, the need of a limit of tourism development is highly recognised in order to contain its negative impacts on natural resources, social structures, cultural patterns, economic activities and land uses in local communities. Nevertheless, “capacity cannot be used as an absolute limit but as a means to identify critical thresholds which need attention and by so doing removing obstacles where possible or applying controls” (O’Reilly, 1986). McCool and Lime (2000), according to Stankey and McCool (1984), suggest to “focus not on *how many* people can an area sustain, but rather on the social and biophysical *conditions* desired or appropriate at a destination”, given the goals and objectives for an area.

3. Presentation of the case study

As stated before, the main purpose of the paper is to apply the TCC process to an empirical case in order to analyse the sustainability of the tourist development of an Italian coastal town and to discover a variety of interactive processes and the factors involved in an in-depth study of a destination.

According to the European Commission (2002) approach, which states that the scale of TCC should be limited, it has been chosen a small city: Vieste, located in the province of Foggia, in the Apulia region (South-East of Italy), in one of the most important Italian tourist area, the National Park of Gargano (Map 1). The reasons of this choice are multiple: Vieste is one of the most beautiful coastal town of the South, with both natural and historical attractions; its

economy is mainly based on tourism and in the last decades the rate of tourist arrivals has strongly increased, augmenting the pressure on the environmental, social and economic features of the municipalities.

A part of the Rimini case (Centre of Italy), which is very different both in geographical dimension and in the characteristics of the destination (European Commission, 2002; Conte *et al.*, 2001), Vieste is the first Italian coastal case analysed with the carrying capacity approach. Vieste, located on a peninsula jutting out into the Adriatic sea from the east coast of Apulia region and bordered by two long sandy beaches, is one of the 18 Municipalities of Gargano, a wide isolated mountain massif made of highland and several peaks. Most of the upland area of Gargano Promontory, about 1,200 km² (460 sq mi), is part of a national park, the “Parco Nazionale del Gargano”, created by article 34 of Italian Law No. 394 dated 6th December 1991; so, it is an important wildlife reserve to be preserved (www.parcogargano.it).

A renowned marine resort in Gargano, Vieste has often received Blue Flags for the purity of its waters from the Foundation for Environmental Education (www.vieste.it/htmen/index.htm). Vieste has a surface of 167.34 km², of which the 84% located in a Protected Area (Map 2), and a population of 13,763 residents with a density, in terms of km² per habitant, of 82,2. In the last four decades, conversely to the other municipalities of Foggia province, the population has grown thanks to its tourism development.

Till a few decades ago, its main resources were fishing and agriculture. Now, however, the great development of tourism has transformed both the appearance of the place and its economy and style of life.

The coast is very interesting from a geological point of view. Even if next to the town there are two long straight and large beaches, rest of the coast presents several gulfs and many small, hidden, sandy beaches. The erosion by water and winds has shaped the calcareous rock into grottoes and arches. Since the coast is steep, some of the finest sights can be reached only by sea. The most notable natural attraction of Vieste is “Pizzomunno”, a calcareous rock more than 20 metres high, with an incredible shape.

Vieste is also an important historical centre, with its castle and cathedral of XI century; it is an intricate path including several small narrow roads, gracious alleys, staircases and white houses built upon rock fragments. In Vieste there is also the oldest evidence of Christians arrival on the Gargano: the Necropolis of Salata, dated back to IV-VI century A.D.

It is easily accessible by car, train or plane from the airports of Foggia or Bari.

4. The economic impacts of tourism on Vieste

Owing to its favourable position, its mild climate, its natural beauty, lavish cultural and built heritage, Gargano is one of the most important tourist region in the south of Italy, attracting the 89% of the tourist arrivals of its province (Table 1). Vieste is the main tourist centre of Gargano and of the province of Foggia, particularly in terms of average length of stay (8.47 number of overnight stays per tourist), which nearly doubles the average stay length of the area (4.95) and of the province (4.72). In terms of tourism arrivals, Vieste is the second Gargano town after S. Giovanni Rotondo, which, nevertheless, has a low average stay length because of the high number of daily visitors going to the religious site.

Table 1: Tourist demand in Gargano Area (2007)

Municipalities of Gargano Area	Number in 2007		% on Gargano		% on province		Average length of stay (a/b)
	Arrivals (a)	Number of tourist overnight stays (b)	Arrivals	Number of tourist overnight stays	Arrivals	Number of tourist overnight stays	
Cagnano Varano	6,136	51,619	0.8%	1.4%	0.7%	1.3%	8.41
Carpino	1,102	1,806	0.1%	0.0%	0.1%	0.0%	1.64
Ischitella	3,232	25,381	0.4%	0.7%	0.4%	0.6%	7.85
Isole Tremiti	18,755	101,112	2.4%	2.7%	2.2%	2.5%	5.39
Manfredonia	39,827	161,560	5.2%	4.2%	4.6%	3.9%	4.06
Mattinata	21,814	153,403	2.8%	4.0%	2.5%	3.7%	7.03
Monte Sant' Angelo	11,466	33,846	1.5%	0.9%	1.3%	0.8%	2.95
Peschici	63,855	543,066	8.3%	14.2%	7.4%	13.2%	8.50
Rignano Garganico	-	-	-	-	-	-	-
Rodi Garganico	43,928	310,694	5.7%	8.1%	5.1%	7.6%	7.07
S. Giovanni Rotondo	335,171	593,421	43.5%	15.6%	38.6%	14.5%	1.77
S. Marco in Lamis	7,803	15,739	1.0%	0.4%	0.9%	0.4%	2.02
S. Nicandro Garganico	1,692	8,176	0.2%	0.2%	0.2%	0.2%	4.83
Vico del Gargano	13,040	100,928	1.7%	2.6%	1.5%	2.5%	7.74
Vieste	202,171	1,713,150	26.3%	44.9%	23.3%	41.8%	8.47
Total Gargano	769,992	3,813,901	100.0%	100.0%	88.7%	93.0%	4.95
Total Foggia Province	868,283	4,101,437			100.0%	100.0%	4.72

Source: our elaboration on data IPRES (2009) and “APT” (Tourist Office) of Vieste

Referring to the accommodation enterprises, nearly the half of the total establishments of Gargano and of the Foggia Province are located in Vieste (Table 2). More precisely, Vieste is the first town in terms of tourism accommodation supply and has a very high presence of “other collective accommodation establishments”. In fact, the 58.5% of the total bed places

(27,096 bed places in absolute terms) is in the tourism camp-sites (Table 3); the tourism villages follow with 10,044 bed places (22% on the total).

Table 2: Tourist accommodation supply in Gargano Area (2008)

Municipalities	Hotels and similar establishments		Other collective accommodation establishments		Total collective accommodation establishments		% on Gargano	% on Foggia Province
	N° enterprises	N° bed places	N° enterprises	N° bed places	N° enterprises	N° bed places		
Cagnano Varano	-	-	8	1,793	8	1,793	1.9%	1.8%
Carpino	2	80	-	-	2	80	0.1%	0.1%
Ischitella	4	238	11	1,404	15	1,642	1.8%	1.7%
Isole Tremiti	21	697	21	787	42	1,484	1.6%	1.5%
Manfredonia	13	1,929	13	2,205	26	4,134	4.4%	4.2%
Mattinata	11	1,011	48	4,689	59	5,700	6.1%	5.7%
Monte Sant' Angelo	5	473	6	1,416	11	1,889	2.0%	1.9%
Peschici	32	2,544	38	11,326	70	13,870	14.8%	14.0%
Rignano Garganico	-	-	1	12	1	12	0.01%	0.01%
Rodi Garganico	24	1,719	32	4,744	56	6,463	6.9%	6.5%
S, Giovanni Rotondo	98	5,492	76	820	174	6,312	6.7%	6.4%
S, Marco in Lamis	4	275	3	18	7	293	0.3%	0.3%
S, Nicandro Garganico	1	22	4	661	5	683	0.7%	0.7%
Vico del Gargano	8	543	12	2,903	20	3,446	3.7%	3.5%
Vieste	50	6,863	172	39,149	222	46,012	49.0%	46.3%
Total Gargano	273	21,886	445	71,927	718	93,813	100%	
Total Foggia Province	325	25,169	557	74,102	882	99,271		

Source: our elaboration on data IPRES (2009) and "APT" (Tourist Office) of Vieste

Table 3: Collective tourist accommodation establishments in Vieste (2007)

	Typologies	N° enterprises	N° bed places
Hotels and similar establishments	Hotel	42	5,642
	Similar establishments	6	1,357
Other collective accommodation establishments	Landlords	1	22
	Tourism camp-sites	43	27,096
	Holiday dwellings	55	1,898
	Bed and breakfast	11	106
	Farm holidays	5	92
	Tourism villages	52	10,044
	Total	215	46,257

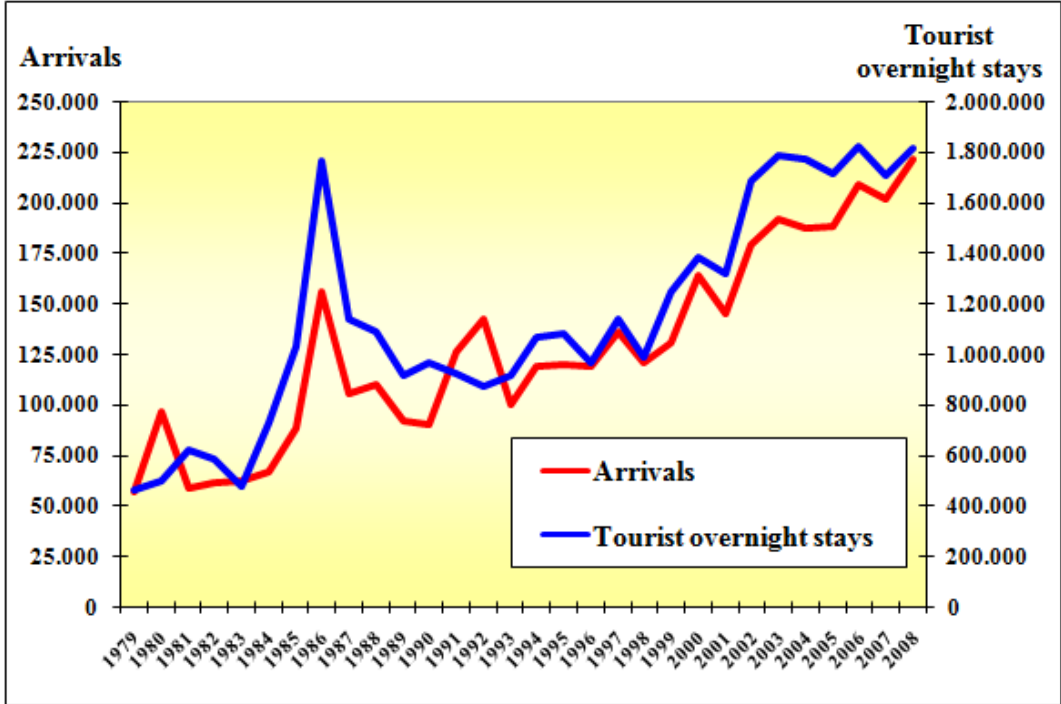
Source: our elaboration on data IPRES (2009) and "APT" (Tourist Office) of Vieste

The accommodation and recreation industry is the main economic sector of Vieste in terms of employment (76% of the total employment of the municipality); other industries, indirectly linked to tourism, such as commerce, construction and real estate services industries, follow.

The tertiary sector represents the 84% of the total value added of Vieste.

The tourism development of Vieste has begun at the end of the seventies years, has grown much more rapidly in the eighties and more recently it has continued to growth. In particular, between 1979 and 2008, the number of tourist overnight stays increased from 464,688 to 1,821,932, the average annual rate of increase being 7% (Figure 1). Over the same period, the number of tourist arrivals passed from 56,870 to 222,173 at the average rate of 8%.

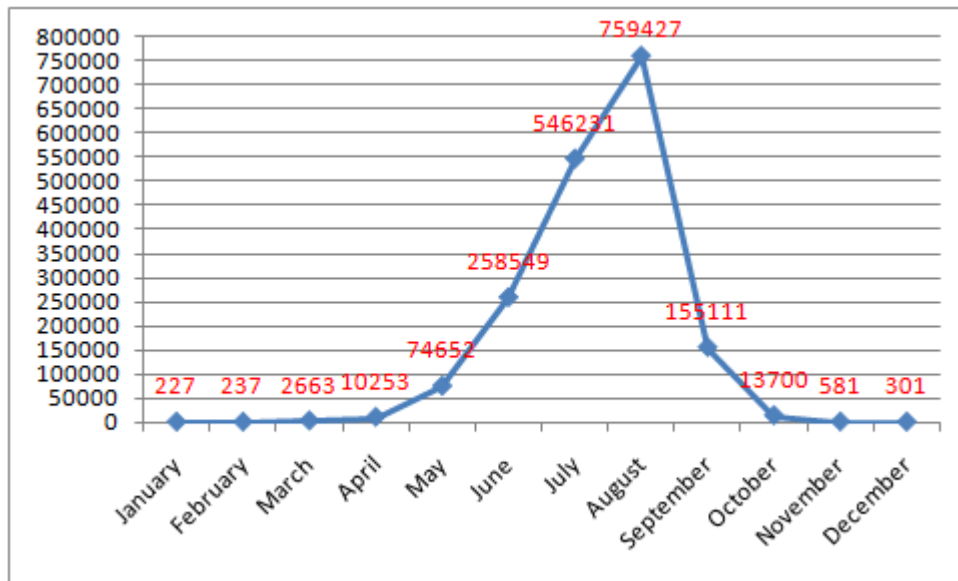
Figure 1: Tourist arrivals and overnight stays in Vieste (1979-2008)



Source: our elaboration on data of “APT” (Tourist Office) of Vieste

Vieste, such as the other coastal destinations, presents a big problem of seasonality: the arrivals and the tourist overnight stays (Figure 2) are concentrated in the summer months, with a strong peak in August, a cause of climate and institutional factors. In fact, the rate of seasonality is 334,549, the intensity is 759,200 and the ratio between the maximum and the medium value of tourist overnight stays is 5.

Figure 2: Seasonality of tourist overnight stays in Vieste (2008)



Source: our elaboration on data of “APT” (Tourist Office) of Vieste

These increasing tourist flows has created a growing pressure on the natural, social and economic dimensions of the destination, causing an intensive and frequently uncontrolled land and natural resources exploitation and low level of tolerance of the host population for the presence of tourists in the summer season.

5. The socio-environmental impacts of tourism on Vieste

In order to estimate the socio-environmental pressure of tourism on the destination, some factors and indicators have been elaborated.

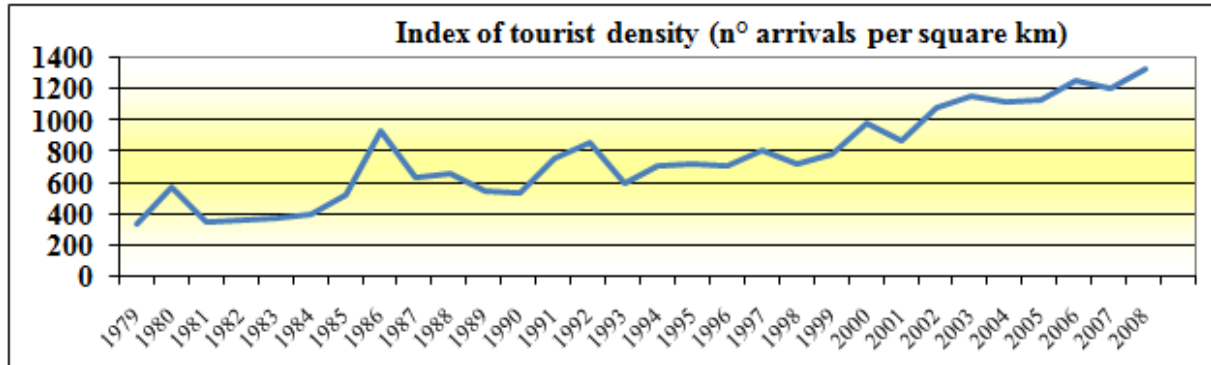
First of all, the number of secondary homes has been calculated: according to the data of the last Istat (Italian Statistic National Institute) Census, the secondary houses are 2,534, i.e. the 36% of the total houses of Vieste (in the province of Foggia this percentage is lower: 26%). If the average rate of occupancy of each home is 3,5 persons, in the summer months the population increases from 13,763 to 22,500 habitants. Thus, including the tourist arrivals, in August the total population is 4-5 times higher than in the winter months.

Secondary, the following index has been elaborated:

- The index of tourist density: number of tourist arrivals per km² (Figure 3) and number of overnight stays per km²;
- The index of land use: the sum of arrivals plus population per km² (Figure 4).
- The index of number of bed places per population;
- A first index of saturation: number of arrivals divided by number of inhabitants (Figure 5);

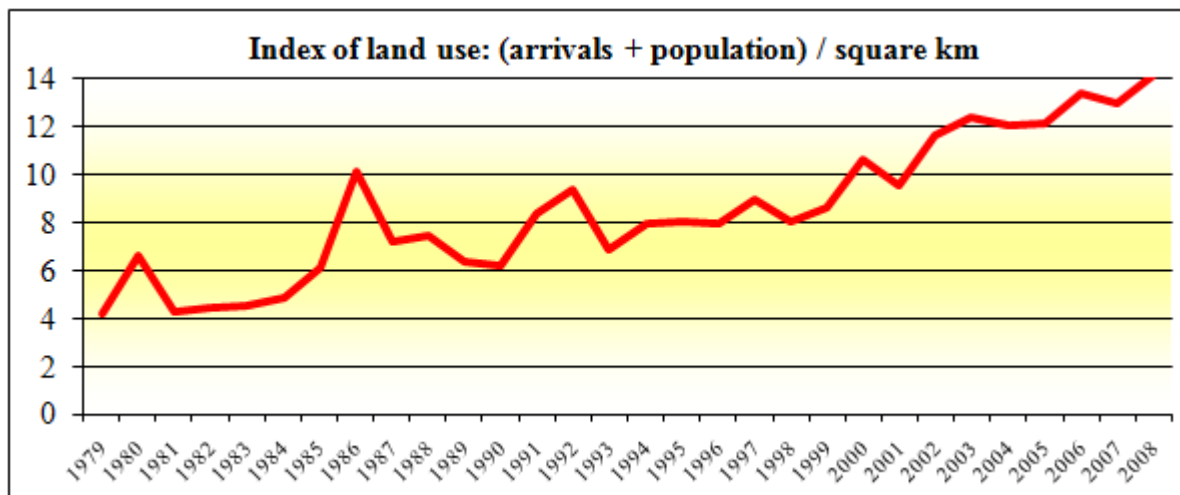
- A second index of number of tourist overnight stays per 1000 residents night stays (Figure 6).

Figure 3: Index of tourist density



Source: our elaboration data of “APT” (Tourist Office) of Vieste and ISTAT

Figure 4: Index of land use

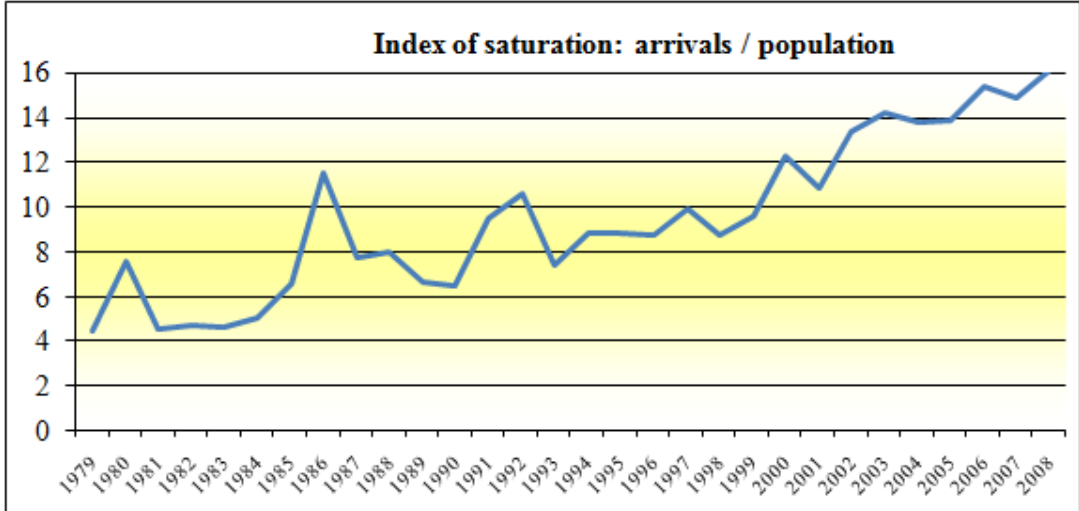


Source: our elaboration data of “APT” (Tourist Office) of Vieste and ISTAT

The figures show that a) between 1979 and 2008 the density of the tourist on the territory increased from 340 to 1,328; b) the intensity of land use by tourists and residents is now 10 times higher than in 1979; c) the level of saturation measured in terms of arrivals has grown four times and d) the level of saturation in term of tourist overnight stays increased from 101 to 363. In 2008 the ratio of residents to tourists was 1 : 16, while in 1979 it was 1 : 4.

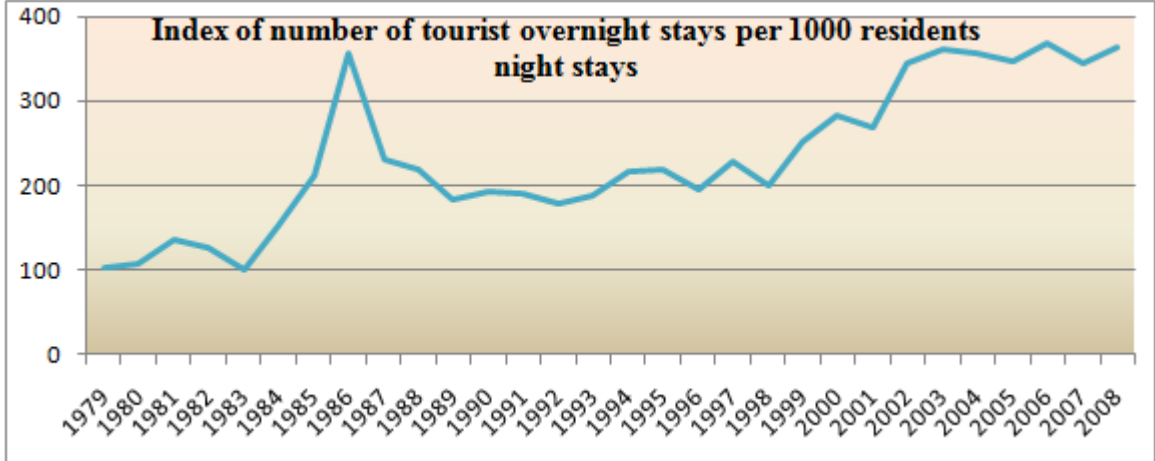
These data highlight that the pressures of tourism development on the destination has rapidly grown, causing an increasing demand for public services, such as water, electricity and gas supply, sewerage and transportation, especially in August and in the other summer months.

Figure 5: Index of saturation in terms of arrivals



Source: our elaboration data of “APT” (Tourist Office) of Vieste and ISTAT

Figure 6: Index of saturation in terms of tourist overnight stays



Source: our elaboration data of “APT” (Tourist Office) of Vieste and ISTAT

As concerns waste production, Table 4 shows that between June to September the 60% of total undifferentiated waste is produced (26% only in August). The per capita waste production of the peak month of tourist arrivals (August: 7.99) is about three times higher than the average value (2.51) and seven times higher than the value of low seasonality (January and February). The rate of recycled waste is very low, i.e. only the 11% of the total waste. At present, the management of waste is very critical, because the capacity of the disposal site, which is located 15 km far from the centre town and serves also other 7

municipalities of the area (Sannicandro Garganico, Peschici, Vico del Gargano, Carpino, Rodi Garganico, Ischitella e Cagnano Varano) is nearly depleted.

Indeed, as concerns water demand, during the summer months water supply is exacerbated by tourist flows for use in hotels, swimming pools and other tourist structures, leading to water shortages and over-extraction. In fact, about the 80% of the total annual water consumption is due to tourism. The maximum capacity of the water depuration refers to 60,000 inhabitants, while, as stated above, the total water users of Vieste during summer months amount to 70,000.

Table 4: Production of undifferentiated waste in Vieste (2008)

Months	Monthly production	Monthly production on total annual production (%)	Monthly production / average annual production	Monthly per capita production (kg/habitants*day)
January	549,770	4.37%	0.52	1.33
February	494,960	3.93%	0.47	1.20
March	628,940	5.00%	0.60	1.52
April	704,480	5.60%	0.67	1.71
May	980,060	7.78%	0.93	2.37
June	1,255,000	9.97%	1.20	3.04
July	1,933,770	15.36%	1.84	4.68
August	3,300,720	26.22%	3.15	7.99
September	1,037,900	8.24%	0.99	2.51
October	613,250	4.87%	0.58	1.49
November	527,070	4.19%	0.50	1.28
December	564,595	4.48%	0.54	1.37
<i>Total</i>	<i>12,590,405</i>	<i>100.00%</i>	-	<i>2.51</i>

Source: our elaboration on data of Apulia Region Ecology Department

In high seasonality months also the main beaches of Vieste present high level of saturation: in fact, applying three square meters of beach per person as minimum sustainability standard, in at least five beaches the number of real users, calculated on the number of bed places of the accommodation establishments located near the beach, is higher than the number of the maximum sustainable users (Table 5). Moreover, considering also the daily visitors and the residents of other neighbouring areas, probably other four beaches are almost saturated.

Table 5: The most saturated beaches of Vieste

Name of beaches	Length of beach coastline (m)	Tourism square meters	Max number of users (A)	Effective users (B)	Difference (A-B)
Sfinalicchio	460	11,920	1,385	1,577	-192
Crovatico	320	10,996	535	475	60
Chianca	216	9,430	850	720	130
Scialmarino	2,850	133,090	15,570	19,692	-4,122
Molinella	380	21,850	1,515	1,650	-135
Braico Defensola	100	7,388	950	947	3
S. Lorenzo Defensola	195	2,920	194	186	8
Baia San Felice	120	1,600	400	1,344	-944

Source: our elaboration on data of maritime property office of Vieste municipality

Finally, the conservation of the natural resources of Vieste is threatened by another big problem: between 2000 to 2007 around the 13% of the land has been burned by man-made fires; only in 2007 the 7.8% of the total area was destroyed (Table 6 and Map 3). In 2007, in fact, the bigger fire of the last 30 years concerned the Gargano area.

Table 6: The burned land of Vieste

Year	burned ha	% on total ha
2000	375.51	2.2%
2001	299.75	1.8%
2002	0.94	0.01%
2003	100.40	0.6%
2004	19.30	0.1%
2005	23.04	0.1%
2006	18.90	0.1%
2007	1305.00	7.8%
Total	2142.84	12.8%

Source: our elaboration on data national forest department

More in depth, Map 2 show in green the extension of the natural protected areas of “Parco Nazionale del Gargano”, SIC and ZPS and Map 3 the burned zones with different colours corresponding to the different years of the above indicated period (2000-2007).

6. Conclusions

The size of the tourism phenomenon, the characteristics of its product and the complex and transversal dimension of the tourism industry are the main drivers for local sustainability considerations.

The present paper has investigated the main problems, threats and impacts of tourism which can compromise the sustainable development of one important coastal destination of the South Italy. The aim was to apply the tourist carrying capacity tool in the phase of critical analysis in order to supply important information to the public and private policymakers who have to plan a strategic sustainable development of the town. In fact, the inclusion of Carrying Capacity Assessment in the process of integrated planning and management is a necessity for successful tourism (UNEP/MAP/PAP, 2007), and for further economic development of the south Italian destinations in the future. The TCC is an essential instrument able to give indications on the maximum limit of the tourism development, which should not be overcome in order to preserve the natural, social and economic resources, simultaneously maintaining the satisfaction of the tourist demand and supply and of the local population. Although this methodology is not easy to apply, in the last years several empirical studies are spreading, because TCC is considered by an increasing number of researchers a useful tool able to represent and monitor the dynamic evolution of the local destination.

The present empirical analysis have highlighted that the strong tourism development and the high problems of seasonality of Vieste has caused several environmental and social impacts which can be managed, mitigated and controlled, but cannot be avoided. Particularly, the negative effects can be managed based on established objectives or an understanding of the biophysical or social conditions desired. Recreational activities can disrupt the ecological and social system of Vieste in a variety of ways; at present, most pressure is concentrated on the natural resources, the beaches and the public services.

The present paper is a preliminary work; further research is needed in order to design probable future different scenarios of development and to be able to consequently identify the right ways of preservation of the local sustainability. In fact, as stated by Weldford & Gouldson (1993, p. 31), “prevention is better than cure”.

References

Abernethy V.D. (2001), Carrying capacity: The tradition and policy implications of limits. *Ethics in Science and Environmental Politics ESEP* 23, 9–18.

- Bishop A., Fullerton H. and Crawford A. (1974), *Carrying Capacity in Regional Environmental Management*, Government Printing Office, Washington D.C.
- Buckley R. (1999), An ecological perspective on carrying capacity. *Annals of Tourism Research* 26(3), 705–708.
- Canadian Arctic Resources Committee (2002), *Carrying capacity and thresholds: theory and practice in environmental management*, Macleod Institute, Calgary.
- Chamberlain K. (1997), Carrying capacity, *UNEP Industry and Environment* 8 (January-June 1997), UNEP, Paris.
- Clark J. (1997), *Coastal Zone Management Handbook*. Lewis Publishers, Boca Raton.
- Coccosis H.N., Parpairis A. (1992), “Tourism and the Environment: Some Observation on the Concept of Carrying Capacity”. In Briassoulis H. and van der Straaten J. (eds), *Tourism and the Environment: Regional, Economic and Policy Issues*, Kluwer Academic Publishers, Dordrecht.
- Coccosis H. and Mexa A. (2004), *The Challenge of Tourism Carrying Capacity Assessment: Theory and Practice*, Ashgate, Basingstoke, Hampshire.
- Conte G., Cipriani E., Dodaro G., Leonelli M., Mirulla R. and Satta A., (2001), *Un'applicazione dell'approccio UNEP per la valutazione della capacità di carico del turismo: la metodologia proposta per la Provincia di Rimini*. International Conference on Sustainable Tourism in Rimini, www.provincia.rimini.it/turismo/conferenza/testi/contenuto/contenuto.htm
- Cooper, C., Fletcher, J., Gilbert, D., Shepherd, R., & Wanhill, S. (1998), *Tourism principles and practice* (2nd ed), Longman, Harlow.
- Dekadt E. (1976), *Tourism, Passport to Development?, Perspectives on the Social and Cultural Effects of Tourism in Developing Countries*, Oxford University Press, Oxford e New York.
- European Commission (2002), *Defining, measuring and evaluating carrying capacity in European tourism destination. Material for a document*, prepared by Coccosis H., Mexa A. and Collovini A, University of the Aegean, Department of environmental Studies, Laboratory of Environmental Planning, Greece.
- IPRES – Istituto Pugliese Ricerche Economiche e Sociali (2009), *Puglia in cifre, 2008*. Cacucci Editore, Bari.
- Lein J.K. (1993), Applying Expert Systems Technology to Carrying Capacity Assessment: A Demonstration Prototype. *Journal of Environmental Management* 37, 63-84.
- Lime D.W. (1970), Research for determining use capacities of the Boundary Waters Canoe Area. *Naturalist* 21 (4), 9–13.

- Linderberg K., McCool S., Stankey G. (1997), Rethinking Carrying Capacity. *Annals of Tourism Research* 24 (2), 461-464.
- Martin B.S. and Uysal M. (1990), An examination of the relationship between carrying capacity and the tourism lifecycle: Management and policy implications. *Journal of Environmental Management* 31, 327–33.
- Mathieson A. and Wall G. (1982), *Tourism. Economic, Physical and Social Impacts*, Longman.
- McCool S.F. and Lime D.W. (2000), Tourism Carrying Capacity: Tempting Fantasy or Useful Reality? *Journal of Sustainable Tourism* 9 (5), 372 — 388.
- McIntyre G. (1993), *Sustainable Tourism Development: Guide for Local Planners*, World Tourism Organization, Madrid.
- Middleton V.C. and Hawkins R. (1998), *Sustainable Tourism: A Marketing Perspective*, Butterworth-Heinemann, Oxford.
- Miller G. (2001), The development of indicators for sustainable tourism: Results of a Delphi survey of tourism researchers. *Tourism Management* 22, 351–362.
- O'Reilly A.M. (1986), Tourism carrying capacity. Concepts and issues. *Tourism Management* 7(3), 254-258.
- Papageorgiou K. and Brotherton I. (1999), A management planning framework based on ecological, perceptual and economic carrying capacity: The case study of Vikos-Aoos National Park, Greece. *Journal of Environmental Management* 56, 271–284.
- Ritchie J.R.B. and Crouch G.I. (2000), The competitive destination: A sustainability perspective. *Tourism Management* 21, 1–7.
- Schneider D. (1978), *The Carrying Capacity Concept as a Planning Tool*. American Planning Association, Chicago.
- Simón F.J., Narangajavan Y. and Marqués D.P. (2004), Carrying capacity in the tourism industry: a case study of Hengistbury Head. *Tourism Management* 25 (2004), 275–283.
- Stankey G.H. and McCool S.F. (1984), Carrying capacity in recreational settings: Evolution, appraisal and application. *Leisure Sciences* 6 (4), 453–73.

Stewart C.J. (1993), *Recreational and Developmental Carrying Capacities of Coastal Environments. A Review of Relevant Literature and Research*, Report prepared for Atria Engineering Hydraulics Inc., Mississauga, Ontario, Canada.

UNEP/MAP/PAP (1997), *Guidelines for Carrying Capacity Assessment for Tourism in Mediterranean Coastal Areas*, Priority Action Programme, Regional Activity Centre, Split.

UNWTO (1981), *Saturation of Tourist Destinations*, Report of the Secretary General, Madrid.

UNWTO (2010), *UNWTO World Tourism Barometer*, interim update, April 2010.

Washburne R.F. (1982), Wilderness recreation carrying capacity: Are numbers necessary? *Journal of Forestry* 80, 726–8.

Weldford R. and Gouldson A. (1993), *Environmental management and business strategy*. Pitman, London.