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TOURISMO Final Conference

Data-driven solutions for smart crowd flow management.

Visitor counting with sensors and AI at tourism hotspots.

9th of June 2026

Valletta, Malta

Tourism Carrying Capacity Limit (TCCL) tool developed in the TO Care Med project to address over-tourism and its impact on our natural and cultural heritage.

Nicola Camatti, University of Venice

TO CARE MED: Tour.Carrying Capacity

TO CARE MED – an introduction to the Project

AlterEco
AlterEco PLUS
ShapeTourism

Tourism Carrying Capacity (TCC) calculation tool.

TO CARE MED project will give us the opportunity in the next 2 years to **transfer** this tool for calculating the tourist carrying capacity of destinations to a new and more varied group of cities in the Mediterranean

By transfer we mean the sharing and transfer of technical and scientific knowledge for a correct use of this tool among policy-makers and operators in the management of tourist destinations.

What distinguishes our TCC calculation tool from other similar tools is

1) its approach to the TCC problem

2) its ability to formalize the TCC concept into a quantitative model (a linear maximization problem)

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TO CARE MED: Tour.Carrying Capacity

TO CARE MED – an introduction to the Project

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Interreg Mediterranean ALTER ECO PLUS

Tourism Carrying Capacity (TCC) calculation tool.

The socioeconomic TCC is defined as the **maximum number of visitors a city can accommodate without compromising its functionality** (García-Buades et al., 2022)

Scholars like Coccossis and Mexa (2004) consider TCC as the threshold beyond which **the social and economic functions of an area are harmed**, leading to a decline in the **quality of life for the host population.**

UNWTO describes TCC as "the maximum number of people who can visit a tourist destination at the same time **without causing destruction** of the physical, economic, and socio-cultural environment, and without leading to an unacceptable decline in the **quality of visitor satisfaction-** that is another key aspect of the sustainability."

Bertocchi, Giove, van der Borg and Camatti (2020) have described TCC as a "**multidimensional trade-off**" involving various physical, social, and economic effects induced by tourism.

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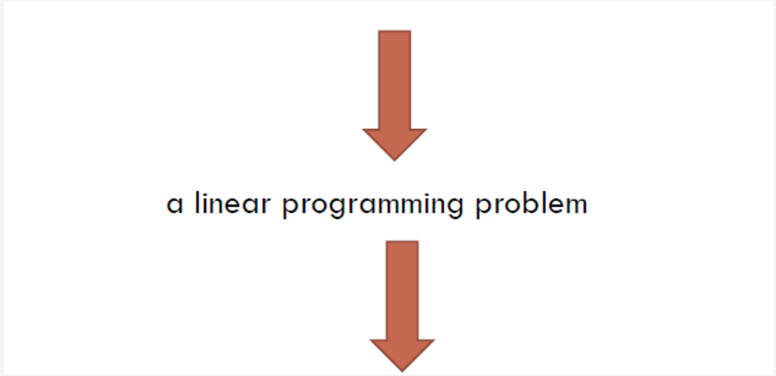
TCC as a “problem of optimization”

i.e. "optimization of the compromise between two opposite necessities:

1. maximizing the monetary gain of the local tourism sectors

2. the control of undesirable effects that this same sector can exert on a destination



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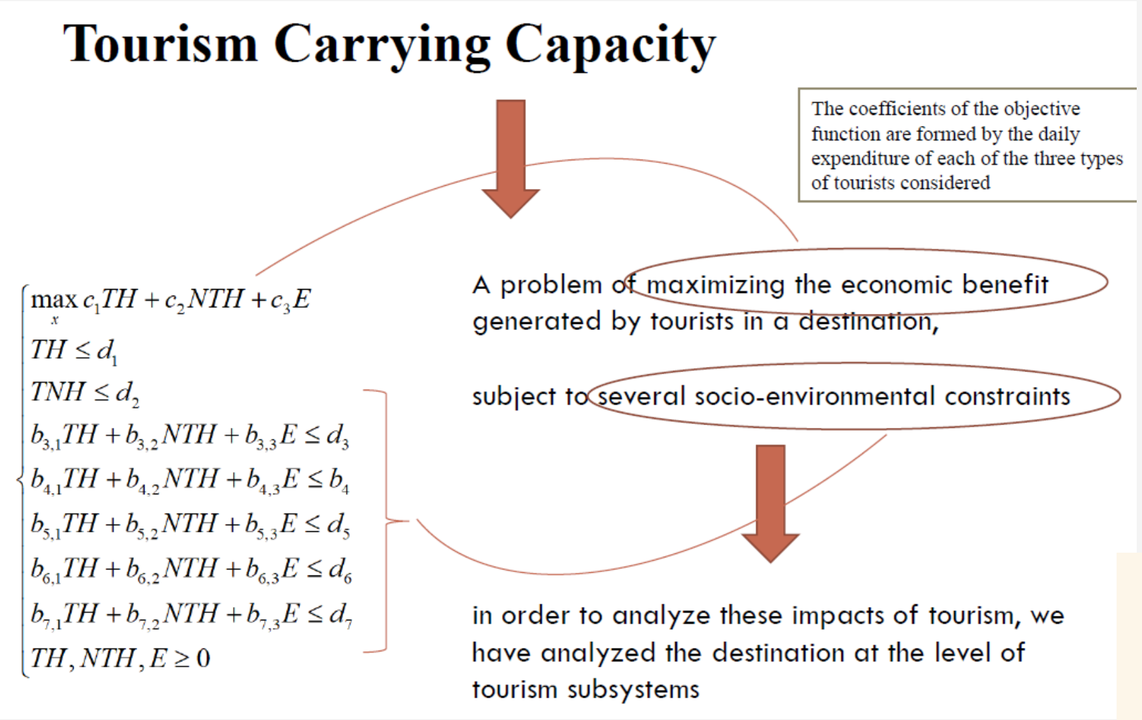

1. **Accommodation sector**
   - **Hotel**
   - **Extra-hotel + Airbnb**
2. **Food and beverage category**
3. **Mobility and transportation facilities**
   - **Capacity of public transportation**
   - **Number of parking place**
4. **Environmental issues and waste management**
5. **Culture sector**
6. **OTHER TOURISM SUBSYSTEMS**

DAILY EXPENDITURE
Information needed for each user profile. It can be derived from the surveys or tourism reports, studies or research

TOURISM FLOWS
Estimation of tourists and visitors who visited the destination. They can be derived from historical data

USAGE RATES
Level of usage of the subsystems by user profile. They can be calculated from the surveys or data from DMOs

REVENUE AS INDICATOR
The quantitative analysis aims to maximize the revenue while considering the daily expenditure for each profile

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USAGE RATES
Level of usage of the subsystems by user profile. They can be calculated from the surveys or data from DMOs

The extent to which visitor profiles use natural and cultural resources. In this sense, the Tool creates a connection between the number of eligible visitors per tourist area (TCC) and specific types of resources.

Usage rates are calculated based on the surveys administered. Administering both of them could implement the quality of the data. Responses have to be profiled.

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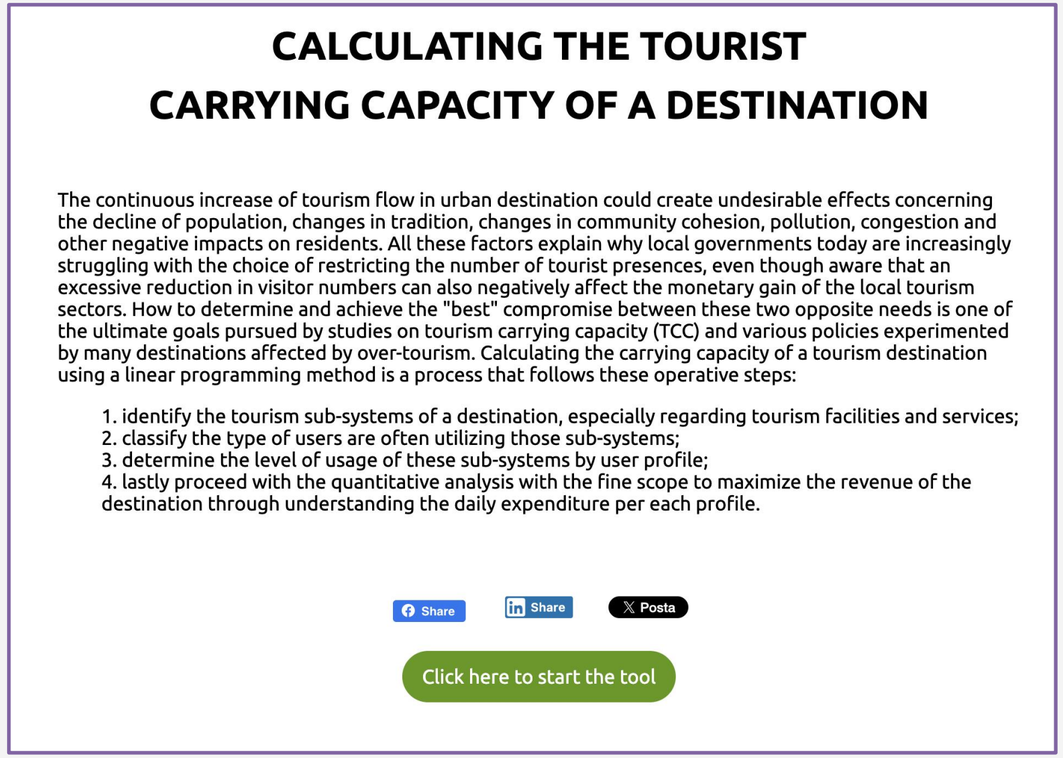
TO CARE MED: Tourism Carrying Capacity

What distinguishes our TCC calculation tool from other similar tools is fundamentally its ability to deliver **estimates** and **simulations** of the maximum number of tourists a destination can support **per day** based on quantitative calculations that go into detail about the carrying capacity of the so-called **tourism subsystems** (i.e. the specific transport subsystem, the attractions supply subsystem, the food and beverage services and accommodation subsystem etc..)

LINK to the ONLINE TCC limit calculation TOOL

https://quantitas.it/dev/to-care-med-landing/carrying-capacity-tool2.html?scenario=Venice&country=Italy&img=Venice.png



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TO CARE MED: Tour.Carrying Capacity

The ONLINE TOOL for calculating the TCC limit

TYPE OF USERS

Fill with the daily average expenditure per tourists and day visitors

Hotel tourists	B&B, Airbnb tourists	Day visitors
210	180	60

TOURISM SUB-SYSTEMS AND UTILIZATION RATE

Set the limits and the utilization rate of every sub-system.

Accommodation sector - Hotel

1 Hotel tourists | 0 B&B, Airbnb tourists | 0 Day visitors | 18,400

Accommodation sector - B&B, Airbnb and similar

0 Hotel tourists | 1 B&B, Airbnb tourists | 0 Day visitors | 25,500

Food and Beverage facilities - Restaurants

0.75 Hotel tourists | 0.65 B&B, Airbnb tourists | 0.2 Day visitors | 240,000

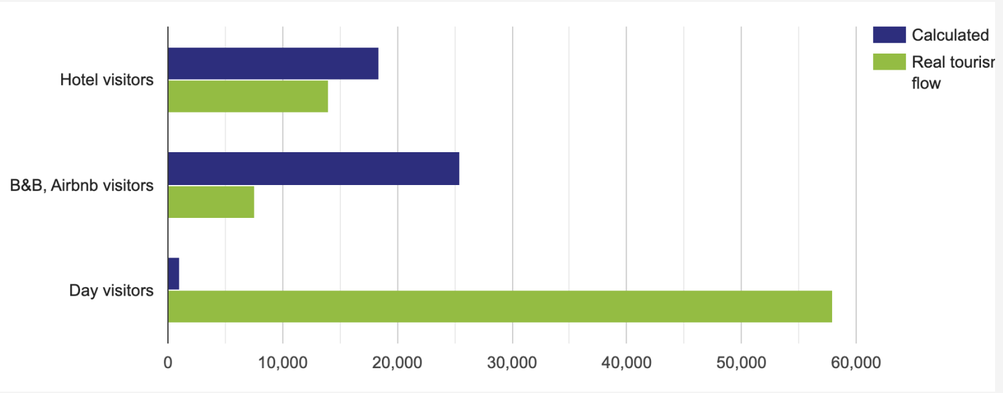
RESULTS

Press *compute* and see the optimal level of tourist flows in your destination.

COMPUTE

Category	Calculated	Real	Real/ Calculated	Result
Hotel tourists	18,400	14,000	0.76	
B&B, Airbnb tourists	25,500	7,612	0.30	
Day visitors	1,050	58,000	55.24	
Total	**44,950**	**79,612**		

Total revenue = 8,517,000



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OUTCOMES foreseen by TO CARE MED

1

We expect to have **calibrated, adapted and applied our TOOL** to the specific geographical and social contexts of application of our project that means to have extended the application of the Tool to different groups of types of tourist destinations, with a particular focus on the protected areas of the MED space.

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OUTCOMES foreseen by TO CARE MED

2

We expect to have successfully completed the **transfer** of our Tourism Carrying Capacity (TCC) calculation tool to the destinations identified in the project.
A successful transfer means more than just providing access to the tool—it involves transferring the **knowledge** behind it. This includes training both policymakers and tourism operators on how to use the TOOL effectively.

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OUTCOMES foreseen by TO CARE MED

3

Our goal is for the destinations to be able to calculate the optimal number of tourists they can accommodate and, equally importantly, to understand how to use this data **to develop informed policies and strategic interventions**.

We envision our TOOL becoming an integral part of the **day-to-day planning** instruments used by these destinations.

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TO CARE MED: Tour.Carrying Capacity

OUTCOMES foreseen by TO CARE MED

4

We expect that the TO CARE MED **experience can inspire other MED destinations** that have problems of overtourism and tourist pressure.
With the TO CARE MED project we plan to achieve this goal through a **'cascade training model'** that we have designed to transfer our TOOL among the cities of the EURO MED PROGRAM: a training model that aims to train not only the end user of our TOOL but also local trainers in each partner destination of our project who will have the task of promoting our tool and in turn training other people on its use and its potential.

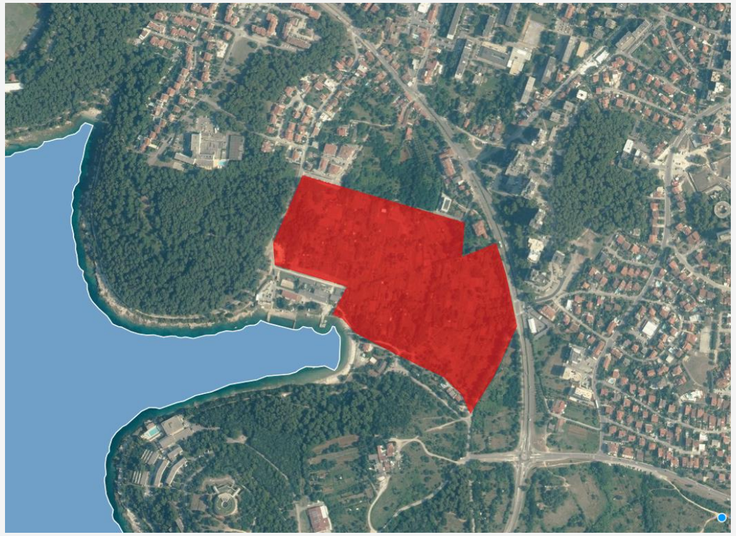
TCC TOOL RESULTS

TCC TOOL: SOME RESULTS

PP2 - Valsaline - Pula, Croatia

Objective Function: Z = 199·TH + 140·NTH + 55·E | Baseline solution: TH = 2,800 · NTH = 6,089 · E = 0 → Z = 1,409,644

2,800	6,089	0	1,409,644
Hotel Tourists (TH)	**Non-Hotel Tourists (NTH)**	**Day Visitors (E)**	**Destination Revenue (Z)**
at hotel capacity	*near non-hotel limit*	*blocked by Arena constraint*	*baseline value*



Subsystem Status

Accommodation (Hotels)
2,800 / 2,800 (100%)
AT LIMIT / BINDING

Parking
2,933 / 3,200 (92%)
NEAR LIMIT

Public Transport (Bus)
7,111 / 17,000 (42%)
WITHIN CAPACITY

Main Attraction (Arena)
8,000 / 8,000 (100%)
AT LIMIT / BINDING

Key Finding

Two binding constraints operate simultaneously: hotel accommodation (at 2,800 cap) and the Arena as main attraction (at 8,000 limit). No day visitors can enter because the Arena is already saturated. Parking is near-full (92%) and will bind quickly if any visitor type increases. Bus capacity is the only substantial slack in the system.

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TCC TOOL RESULTS

PP3 – VARNA, Bulgaria

Objective Function: Z = 180·TH + 140·NTH + 110·E | Baseline solution: TH = 10,000 · NTH = 7,143 · E = 0 → Z = 2,800,000

10,000	7,143	0	2,800,000
Hotel Tourists (TH)	**Non-Hotel Tourists (NTH)**	**Day Visitors (E)**	**Destination Revenue (Z)**
at capacity limit	*catering binding constraint*	*excluded by catering*	*baseline value*

Subsystem Status

Accommodation (Hotels)
10,000 / 10,000 (100%)
AT LIMIT / BINDING

Catering & Restaurants
12,000 / 12,000 (100%)
AT LIMIT / BINDING

Parking
13,714 / 40,000 (34%)
WITHIN CAPACITY

Main Attraction
15,429 / 55,000 (28%)
WITHIN CAPACITY

Key Finding

The catering/restaurant subsystem is the binding constraint — it limits total visitors to 17,143 (10,000 hotel + 7,143 non-hotel). No day visitors can be accommodated. Parking and the main attraction have substantial unused capacity, suggesting that catering is the strategic bottleneck. Ecotourism interventions should prioritise expanding local food service capacity or redistributing visitor feeding demand.

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TCC TOOL RESULTS

PP3 – MONEMVASIA, Greece

Objective Function: $Z = 90 \cdot TH + 70 \cdot NTH + 30 \cdot E$ | **Baseline solution:** $TH = 800 \cdot NTH = 1{,}300 \cdot E = 826 \rightarrow Z = 187{,}788$

800	1,300	826	187,788
Hotel Tourists (TH)	**Non-Hotel Tourists (NTH)**	**Day Visitors (E)**	**Destination Revenue (Z)**
at hotel capacity	*at non-hotel capacity*	*limited by parking*	*baseline value*

Subsystem Status

Accommodation (Hotels)
800 / 800 (100%)
AT LIMIT / BINDING

Accommodation (Non-Hotel)
1,300 / 1,300 (100%)
AT LIMIT / BINDING

Parking
1,354 / 1,354 (100%)
AT LIMIT / BINDING

Main Attraction (Peninsula)
2,341 / 3,000 (78%)
WITHIN CAPACITY

Key Finding

Monemvasia is a very small, capacity-constrained destination. Both accommodation types are fully saturated. Parking is the binding constraint for day visitor access (E limited to 826). The main attraction (fortified peninsula) has remaining capacity, suggesting that the bottleneck is access infrastructure, not the heritage site itself. Catering and transport have substantial slack.

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THANK YOU!

Nicola Camatti, University of Venice

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Making the Mediterranean Green Transition happen