How to account for nature-based tourism in Europe. An operational proposal

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Abstract

Europe is a leader in the tourism industry, with half of the world's international arrivals in 2018. Nowadays tourism activities related to the enjoyment of nature, Nature-based tourism (NBT), are amongst the main tourism markets worldwide. NBT represents both a challenge and an opportunity. In fact, on the one hand, it contributes to creating new markets and spurring job growth, especially for small businesses and, on the other hand, it might impact the environment and local communities. What's more, it is extremely difficult to quantify the role of nature in traditional economic accounting. In this context, the System of Environmental-Economic Accounting (SEEA) covers this gap by reporting information not included in the traditional system of economic accounts. The Central SEEA framework was adopted by the UN Statistical Commission in 2012 and the Ecosystem Accounting module (SEEA EA) has recently been adopted to quantify the role of ecosystems. In this study, we fine-tune a methodology applied to account for daily outdoor recreation to measure the contribution of nature to the tourism sector respecting the SEEA EA rules.

The approach was tested in Italy, which in 2019, had more than 430 million nights per year spent in the country for tourism. In our exploratory study, 56.69% (246 million) of the overnight stays were allocated to NBT. Our analysis shows that 43% (more than 30 million) of the overnight stays in the Veneto Region were allocated to nature; 75% (more than 39 million) in Trentino Alto Adige and 61.6% (29 million) in Tuscany.

The top ranked municipalities, with very high numbers of overnight stays and very low share of NBT are cities of art: namely: Venice (Veneto Region), Milan (Lombardy Region) and Florence (Tuscany Region) and sea locations on the Adriatic Sea, specifically San Michele al Tagliamento and Jesolo (Veneto Region). On the contrary, the top-ranked locations with very high numbers of overnight stays and very high share of NBT are mountain, lakes and sea locations that have natural protected areas or other key iconic landmarks in their proximity and endorsed specific types of travel accommodation, such as camp sites.

Based on our exploratory study, we argue that this approach allows us to disentangle the contribution of ecosystems to tourism. Not only is it compliant with the requests of the SEEA EA framework, but, thanks to the spatially-explicit outputs, it allows us to further explore the environmental and social impacts of tourism in a multi-scale perspective. In this study, a biophysical map developed at the EU level was used for illustrative purposes. In order to become operational at the national or local level, we suggest creating biophysical maps starting from local detailed datasets and, successively, to implement the methodology described in this paper.

Keywords

cultural ecosystem services, nature-based tourism, ecosystem services mapping, integrated accounting system

Introduction

Tourism refers to the activity of visitors taking a trip to a destination outside their usual environment, for less than a year. It can be for any main purpose, including business, leisure or other personal reasons (EUROSTAT 2021).

According to the United Nations World Tourism Organization (World Tourism Organization (UNWTO) 2019), in 2018, the EU accounted for half of the world's international arrivals (710 million, 51%) and represented almost 40% of international tourism receipts. France, Spain, Italy and Germany are amongst the top 10 world tourist destinations. The year 2018 was the ninth year in a row of sustained tourism growth in Europe, the world's most visited region. Southern and Mediterranean Europe led the results, with most destinations enjoying double-digit growth. Amongst the larger destinations, Italy, Greece, Portugal and Croatia saw a robust performance (World Tourism Organization (UNWTO) 2019). The EU's tourism industry in the strict sense of the term (traditional providers of holidays and tourism services) is made up of 2.3 million businesses, primarily small and medium-sized enterprises (SMEs), employing an estimated 12.3 million people. In 2018, the 'travel and tourism' sector directly contributed 3.9% to EU's GDP and accounted for 5.1% of the total labour force (which equates to some 11.9 million jobs). When we take into account the close link with other economic sectors, the sector's figures increase significantly (10.3% of GDP and 11.7% of total employment, which equates to 27.3 million workers) (European Parliament 2022).

Tourism is, therefore, a key economic sector in the EU. Between 2005 and 2019, the number of nights spent at EU tourist accommodation establishments showed an upward trend (+ 2.5%) reaching more than 2.9 billion nights in EU-27 (EUROSTAT 2021). Moreover, in 2018, 2.3 million enterprises employed 12.3 million people. Nature is a crucial part of tourism in Europe, the Eurobarometer (European Union 2016) reported that, amongst the main reasons for going on holidays, respondents mentioned sun/beach

(48%); nature/mountain (31%) and sport-related activities (scuba-diving/cycling) (12%), thus being directly or indirectly nature-related.

Nature-based tourism (NBT) is the segment of tourism in which people travel with the purpose of visiting and enjoying destinations characterised by the presence of natural resources (Kuenzi and McNeely 2008). NBT covers different types of activities, ranging from hard adventure activities, such as climbing, trekking and mountain biking; and soft adventure activities, such as walking and bike tours, canoeing or camping (Fennell 2000, Buckley and Coghlan 2012). Relevant sub-sectors of NBT are ecotourism, defined as "responsible travel to natural areas that conserves the environment and sustains the well-being of local people" (Christ et al. 2003) and sustainable tourism, defined as a way of travelling that "seeks to minimise the negative footprint of tourism developments and, at the same time, contribute to conservation and community development" (Christ et al. 2003). In other words, sustainable tourism is described as " *...an aspiration for the impacts of all forms of tourism to be sustainable for generations to come"* (UN-WTO 2005). The role of nature is crucial in these types of tourism and drives the industry that relies on them. However, it is difficult to appropriately quantify and record the importance of nature, because what is officially reported as the wealth of a country is conventionally limited to traditional economic reporting methods, such as the contribution of tourism to the GDP or the number and share of jobs supported by tourism (Jus and Misrahi 2022).

Integrated accounting systems are meant to consistently report relevant data and information which are not part of the traditional system of economic accounts. The United Nations Statistical Division (UNSD) coordinates the System of Integrated Environmental and Economic Accounting (SEEA) which specifically considers environmental data and information. The Central Framework (United Nations 2014) of the SEEA was adopted as a standard framework by the UN Statistical Commission in 2012 as the first international standard framework for environmental-economic accounting. The Ecosystem Accounting module (United Nations 2021) was adopted as the standard framework by the UN Statistical Commission in 2021. Cultural ecosystem services (ES), related to recreation, are part of the SEEA EA (United Nations 2022). In the SEEA EA, recreation-related services are defined as " *… the ecosystem contributions, in particular through the biophysical characteristics and qualities of ecosystems, that enable people to use and enjoy the environment through direct, in-situ, physical and experiential interactions with the environment. This includes services to both locals and non-locals (i.e. visitors, including tourists) …* " (Table 6.3. in United Nations 2022). In order to be compliant with the SEEA EA framework, Supply and Use Tables (SUT) have to be filled in. The Supply table shows which ecosystem type (such as cropland, grassland, woodland, wetland etc.) provides a quantified amount of service. The Use table shows which economic unit (such as agriculture, manufacturing, households etc.) uses the provided amount of service. The ES that is included in the SUT is called "actual flow" (United Nations 2021). The Supply table follows the Ecosystem Type classification used in both Extent and Condition accounts; the Use table follows the conventional Economic Unit classification of Economic accounts. SUTs represent the accounting module that effectively conveys the ecological content into the economic context.

NBT, as illustrated above, is a cultural ES offered to locals and non-locals including visitors and tourists (United Nations 2010). A visitor is a traveller taking a trip to reach a destination outside his/her usual environment for less than a year; a visitor can be classified as a tourist if the trip includes an overnight stay, as a same-day visitor (or day-tripper) if the trip does not include an overnight stay. A commonly used proxy measure*[3] for NBT as ES is the number of overnight stays in hotels, hostels, camping grounds etc. with the purpose of spending time in nature. More sophisticated approaches exist to measure NBT as ES; for instance, Shrestha et al. (2007) analysed the visitors' demand for nature-based recreation in the Apalachicola River region of Florida using the travel cost method, but they require an extremely demanding effort to be implemented consistently and over time across Europe.

In Europe, in fact, there is the need to compile the SUTs using data consistently available in each Member State (MS) across time. In July 2011, the European Parliament and the Council of the European Union adopted a new Regulation (EU) No 692/2011 (European Parliament, Council of the European Union 2011) concerning European statistics on tourism. This regulation came into force for the reference year 2012 and requires EU MS to provide a regular set of comparable tourism statistics on occupancy of collective tourist accommodation, specifically the number of arrivals (at accommodation establishments) and the number of nights spent by residents and non-residents (EUROSTAT 2021). In tourism statistics (specifically when looking at accommodation related data), residents refer to the arrivals and nights spent by residents of the country where the establishment is located. This is also the case for regional data: i.e. the resident concept is to be considered at national level and not at regional level, so arrivals from another region of a given country will be in the residents' category. Non-residents refer to arrivals and nights spent by residents of a country different from the one of destination (EUROSTAT 2015).

From an accounting perspective, the " *number of nights spent for tourism purposes* " has been selected to quantify the contribution of the ecosystems to the tourism economic sector, following the rationale proposed by the SEEA EA framework. Nevertheless, three crucial challenges still exist to be fully consistent with the SEEA EA:

- How can the flow of service that depends on biophysical characteristics of ecosystems be estimated to report on NBT?
- How to fill in the Supply Tables by allocating the NBT flow of service to the different Ecosystem Types?
- How to fill in the Use Tables by allocating the NBT flow to the suitable economic sector(s) and, more specifically, what sector(s) is/are affected by NBT?

This study addresses these questions by fine-tuning the methodology developed within the the Integrated System for Natural Capital Accounts (INCA, European Commision 2022) project. The INCA project was launched by the EU Commission in 2015 to test and implement the SEEA EA guidelines and produce at European level pilot applications of ecosystem accounting (La Notte et al. 2017, Vallecillo et al. 2018, Vallecillo et al. 2019b,

Vysna et al. 2021, La Notte et al. 2021). One key element of the INCA approach is to base the assessment of the ES flow on spatially explicit biophysical characteristics of ecosystems (La Notte et al. 2017).

This study aims to explore to what extent the INCA-based approach can be used to account for NBT. In INCA, an assessment of daily outdoor recreation was implemented. Daily outdoor recreation is part of the "Recreation-related" services in the SEEA EA framework (United Nations 2021, section 6.4.4) and refers to all type of nature-related activities that people can enjoy daily in a relatively close proximity. Households were selected as an economic sector for daily recreation to fill in the Use Tables (Vallecillo et al. 2018). In INCA, the ES flow was based on the ESTIMAP-recreation model (Zulian et al. 2013, Zulian et al. 2014, Paracchini et al. 2014, Zulian et al. 2017). This model combines several nature-related characteristics of the territory (for instance, the presence of forests, natural riparian areas, protected areas, high nature value farmland, bathing water quality) and human-related inputs (road network and settlements) to measure the spectrum of opportunities for outdoor nature-based activities provided in each given location. The final outcome is the Recreation Potential Map (RP), a raster map which classifies the land in nine categories from low recreation value easily reachable to high recreation value located in remote areas*[4].

In previous applications, the model was used to analyse recreation related services in several ES assessments at EU level (Liquete et al. 2016, Grizzetti et al. 2017, Mouchet et al. 2017, Maes et al. 2019, Maes et al. 2021). The approach was also down-scaled at regional and local level to address different research questions. In Zulian et al. (2017), a collection of local applications is presented, together with a framework for the adaptation of the model to specific settings. The authors show the examples of three National Parks (Cairngorms National Park, UK Kiskunság National Park, Hungary; Costa Vicentina Natural Park, Portugal); several urban areas (Sibbesborg, Helsinki Metropolitan Area, Finland; Trnava, Slovakia; Oslo, Norway; Barcelona Metropolitan Region, Spain) and a touristic region characterised by the presence of a lake (Loch Leven, UK). The method was also adapted to analyse urban ES (Baró et al. 2016, Cortinovis et al. 2018, Maes et al. 2019, Maes et al. 2021) and to evaluate the contribution of cultural ES to the deployment of the regional green infrastructure in Lombardy Region, Italy (Zulian et al. 2021).

As mentioned above, in 2018, the ESTIMAP recreation was used for the accounting of daily-based recreation in Europe (Vallecillo et al. 2018, Vallecillo et al. 2019a). In the present study, the ESTIMAP-recreation model and the rationale proposed in INCA have been adjusted to account for NBT.

Italy was used as a case study to investigate the validity of the methodology; specifically, how accurately the method estimates the contribution of ecosystems to the tourism sector. Strengths and weaknesses of the approach are discussed together with the data needed, the most convenient scale of analysis and the future developments needed to implement the approach. The final aim of this study is to provide a methodology, compliant with SEEA EA requirements, that countries can apply to consistently account for NBT.

Material and methods

In order to develop a replicable framework to account for NBT, a 2-step procedure was implemented:

A) biophysical data and data on tourism activities were prepared to fill in the SUT tables at national level, as requested by the SEEA EA framework;

B) biophysical data, data on tourism activities and other additional information were further analysed in a multiscale perspective to explore the validity of the method.

Study area and territorial levels

To illustrate the approach, the methodology was implemented in Italy using tourism data available on the Institute of Italian Statistic (ISTAT) website. Italy, as an EU MS, is required to provide, on a regular basis to EUROSTAT, a set of comparable tourism statistics (EUROSTAT 2021). In addition to the aggregated information transmitted to EUROSTAT, ISTAT provides detailed datasets to describe the tourism sector (ISTAT 2022a). Italy was chosen to test the application for many reasons. Italy is amongst the most popular tourism destinations in Europe. Together with Spain, Italy shows the highest ranking in terms of million of nights spent in a country (EUROSTAT 2021) with more than 430 million nights per year in 2019 (more than 220 million considering only non-residents). Tourism is one of the most important economic sectors of the national economy. The tourism sector generates 5% of the national GDP and 6% of the employment (Petrella and Torrini 2019).

Italy hosts 2637 Natura 2000 sites considering: Special Protection Areas (SPAs); Special Areas of Conservation (SACs) and Sites of Community Importance (pSCIs). The sites cover a terrestrial surface of 5,844,708 ha (19.4% of the territory) and a marine surface of 2,071,689 ha (13.42%) (Ministero della Transizione Ecologica 2022). Additionally, Italy hosts 58 UNESCO World Heritage Sites*[1], of which 53 are classified as cultural and five as natural. Italy has more than 8000 km of coastline and hosts countless interesting tourist locations.

Moreover, an extremely detailed dataset is available, with information provided at different territorial units (see section below) which allows the methodology in a multi-scale perspective (ISTAT 2022a). The SEEA EA general framework requests information to be reported at national level. Nevertheless, in order to further discuss the most convenient scale of analysis, the approach was implemented with data gathered at four different territorial levels: national, regional, provincial and local.

Data sources

Table 1 shows the datasets used in this study, with the detailed list of data used to prepare the biophysical map being available in Suppl. material 3.

Tourism data

Tourism data, in the form of arrivals and nights spent for touristic purposes, are collected by the Italian Institute of Statistics (ISTAT 2022a) and are available at national, regional, provincial and local level. Fig. 1 shows that, between 2014 and 2019, at national level, a slight upward trend characterised tourism. The total nights spent for tourism in fact increased by 15.6%, respectively, 13.1% for residents and 18.1% for non-residents (ISTAT 2022a). Likewise, in 2020, the Covid crisis caused a drastic decline in the tourism sector with a serious loss of overnight stays (-52.2%, respectively, -33.8% for residents and -70.3% for non-residents).

For this application, tourism data in 2019 were analysed. The year 2019 was selected because the Covid 19 emergency impacted tourism starting from 2020, especially in the first quarter of the year. For this reason, 2020 does not provide a realistic overview of national and international tourist arrivals, departures and spending.

SUTs were completed considering residents, non-residents and total tourism movement, with data aggregated at regional (NUTS2) level. NUTS 2 was chosen for demonstrative purposes because it is the lower territorial level in which tourism data are available at EU level (EUROSTAT 2021).

Additional analyses (see section on Spatial and statistical analyses) were implemented with data aggregated at provincial and local level. These exercises were performed for illustrative purposes; in this case, only non-residents tourism data were used.

Tourism overnight stays data are publicly available on the ISTAT website. In their original form, data are reported at national, regional, provincial and local level. At local level, data are available at municipal scale in 3288 municipalities (41.6% of the Italian municipalities) plus 101 aggregated territorial units (Suppl. material 1). When data are not available for each municipality, they are aggregated at provincial level and described as “Other municipalities of *name of the province”. The official dataset provides the correspondence between the category “Other municipalities of *name of the province” and the list of municipalities included in the specific aggregated entity. Using this correspondence, the original polygons were dissolved in 101 aggregated areas. Fig. 2 shows the spatial pattern of overnight stays at local level in 2019. Ultimately, the analyses at local level were implemented considering the municipalities (when possible) complemented by additional 101 territorial units.

Other descriptive data, such as the “ *Municipalities' Classification by type of tourist area and type of tourist attraction (ISTAT 2022a)* were used. The dataset classifies Italian

municipalities according to the type of tourist attraction in nine categories: 1. cities not classified; 2. cities with no specific interest; 3. art cities; 4. hill locations; 5. lake locations; 6. sea locations 7. mountain locations; 8. cities with religious interest; 9. thermal baths locations. The original dataset classifies the municipalities each year, from 2002 to 2015. In this study, we used the last dataset available (2015). In the 101 aggregated areas per province, for which tourism data were not available at municipal level, the classification by type of tourist interest was based on the share of the dominant category. Fig. 3 shows the spatial distribution of the municipalities classified per tourist interest. Amongst the 7903 municipalities, 4891 were not classified (62%); 62 locations were classified as "chief town with no specific interest" (1%), 2677 municipalities were classified with reference to specific tourist category (34%) and 273 municipalities were not included in the original table (no data) (3%).

Nature-based tourism - biophysical mapping

The biophysical mapping is based on the ESTIMAP recreation model (Zulian et al. 2013, Zulian et al. 2014, Paracchini et al. 2014, Zulian et al. 2017). The model, developed in 2013, depends on several inputs and is based on the “Advanced multiple layers Look-Up Tables” (Advanced LUT) method. Advanced LUT assigns ES scores to land units based on cross tabulation and spatial composition derived from the overlay of different thematic raster maps. In Advanced LUT, convolution kernels (also known as moving windows) and proximity analyses are also used to identify areas that provide different levels of opportunities for outdoor recreation. The ES scores for each input layer are derived from literature and from an expert-based approach (Zulian et al. 2017). The model depends on two main sections: the Ecosystem-Based Potential Map (EB-P Map) and the Human Inputs Map. The EB-P Map is based on three components:

1. Suitability of land to support recreation, which includes Land-use data, the High Nature Value Farmland data and the presence of natural riparian zones.

2. Inland nature-related elements: consisting of other features that play a role in the provision of nature-based opportunities, such as the presence of natural protected areas (Nationally designated protected areas and Nature 2000 network).

3. Water nature-related elements: which includes sea coastal and inland elements. The first group is represented by geo-morphology of coast, proximity to sea-coast and presence of marine protected areas. The second group is represented by the proximity to lakes. Bathing water quality, compliant with the EU Bathing Water Directive is also considered for both inland and sea-coast locations.

The Human Inputs Map depends on the distance from local roads and distance from residential areas.

For this study, a new version of the RP map was calculated, using the updated releases of all input data. All data sources used for this application, a detailed workflow of the model and a schematic example of the RP map are available in Suppl. material 3.

The SEEA EA- ES logic chain (Suppl. material 2) states that the recreation-related services depend on the extent and condition of ecosystems and sea-landscape. Key factors determining the use of the recreation services are: the location of users and the accessibility of the recreation sites. The ESTIMAP model embeds the above-mentioned concepts and, for this reason, it was included in the Guidelines on Biophysical Modelling for Ecosystem Accounting published in 2022 (United Nations 2022) and was selected in this application.

Extracting the actual flow of NBT

According to the SEEA EA framework, the ES flow accounts collect the supply of ES by ecosystem assets (Supply Tables) and the use of ES by economic units (Use Tables), including households (United Nations 2021).

Fig. 4 provides a graphical example of the adaptation of the INCA approach for the physical ES flow account applied to recreation-related services. In order to compile the SUT, a significant amount of information was needed:

1. Potential capacity of ecosystems to provide the service
    - expressed by a biophysical model (P in Fig. 4)
      Potential capacity of ecosystems to provide the service expressed by a biophysical model (P in Fig. 4);
2. The Service Providing Area (SP-a/SP-b in Fig. 4)
    - Spatially-explicit map, depends on the biophysical model
3. The assets (CLC L1 in Fig. 4)
    - Spatially-explicit map
4. A Potential physical metric for the ES (M-a/ M-b in Fig. 4)
5. The actual flow of service (AF-a/ AF-b in Fig. 4)
6. The users of the service (Users in the Use tables in Fig. 4).

In the application implemented in INCA for daily outdoor recreation, the potential capacity of ecosystems to provide the service was modelled by the ESTIMAP RP-map (P in Fig. 4); the service providing areas for daily recreation were defined by selecting the RP with high opportunities for recreation close to roads and settlements (only one category, called: 'area for daily recreation') (SP-a in Fig. 4); the assets were represented by the ecosystem types (CLC L1 in Fig. 4); the metric for the ES was “potential visits by inhabitants” (M-a in Fig. 4); the actual flow of service was the potential visits to the 'areas for daily recreation' (AF-a in Fig. 4); and the users were the households (Vallecillo et al. 2018).

In the adaptation to NBT: the potential capacity of ecosystems to provide the service is still modelled by the ESTIMAP RP-map (P in Fig. 4), but the service providing areas for NBT are defined by selecting the RP with medium and high opportunities for recreation close and proximal to roads and settlements (fourcategories) (SP-b in Fig. 4); the assets are represented by the ecosystem types (CLC L1 in Fig. 4); the physical metric for the ES are the overnight stays, (M-b in Fig. 4); the actual flow of service are the overnight stays allocated to the service providing areas (AF-b in Fig. 4); and the users are 'tourism accommodation' defined as "*any facility that regularly or occasionally provides overnight accommodation for tourists* " (European Parliament, Council of the European Union 2011).

The biophysical component (which is a key element in the SEEA EA approach) is maintained; nevertheless, the extent of SP is expanded, going from one to four RP categories (see Fig. 2 in Suppl. material 3).

Summarising, in order to fill in the SUTs, a two-step procedure was implemented in each territorial unit considered:

1. RP raster map was combined with the CLC classes Level 1 (raster data were cross-tabulated);
2. the share of each possible combination was calculated;
    1. only data related to service providing areas for NBT were retained
3. the fraction of NBT overnight stays is computed by allocating the overnight stays in proportion to the share service providing areas in each CLC Level 1 land type. From now on, the actual flow is called Actual flow (a).
4. the total actual flow (a) is then allocated to the tourism/accommodation economic sector.

Spatial and statistical analyses

For illustrative purposes, additional spatial and statistical analyses are performed using the non-residents' data. The order of magnitude for overnight stays is, at national level, similar between residents and non-residents (216 million residents and 220 million non-residents). In the paper, we propose and discuss an approach for the accounting of NBT and the results of this work are not intended to be used in any official documents or national statistics.

The actual flow of NBT was computed at four territorial levels (national, regional, provincial, local) and results, aggregated at national level, were compared to verify the difference in order of magnitude.

The results obtained at the local level were further explored.

Firstly, municipalities with relatively high and low share of NBT were analysed for what concerns overnight stays. This analysis was carried out as follows:

• the share of NBT was classified in four classes (using the quartiles),

• the overnight stays were classified in four classes (using the quartiles).

Classified data were cross-tabulated with the objective to explore the characteristics of the top performing municipalities. Amongst the 16 combinations, three groups were retained:

1. Very-low/low/medium share of NBT and a very-high/high/medium number of overnight stays
    - in these locations, tourism is primarily not driven by nature-based opportunities
2. Very-low/low share of NBT and a very-low/low number of overnight stays
    - in these locations, tourism activity is not relevant
3. Very-high/high/medium share of NBT and a very-high/high/medium number of overnight stays
    - in these locations, tourism is primarily driven by nature-based opportunities.

From now on, this phase of the analysis will be called gap analysis. The gap analysis technique allows us to identify processes and compare existing performances, with the aim of identifying best practices. In the results, the top municipalities in classes 1 and 3 are presented and the main characteristics discussed.

Secondly, the difference between the share of NBT amongst municipalities classified by type of tourist attraction was explored. The classification of municipalities is independent from the share of NBT (see Tourism data section). A Shapiro-Wilks test was applied to test the hypothesis of normality, with a significance level of 0.05; as the normality of the distribution was not verified for any/all groups, a Kruskal-Wallis test was applied to test if there was a significant difference between the groups. Subsequently, the pairwise Wilkox test was carried out to compare all combinations of groups amongst each other, to give a more accurate description of the differences amongst them.

For this final part of the analysis, 3300 local territorial units were included and classified with respect to the class of tourist attraction. The nine tourist classes were grouped into seven classes: 1. cities not classified or with no specific interest (for these municipalities, no classification was provided); 2. cities with religious interest; 3. art cities; 4. hill and mountain locations; 5. lake locations; 6. sea locations; 7. thermal bath locations.

Spatial and statistical analysis are carried out using GRASS-GIS 7.8 (Grass Development Team 2020); Python (Python 2020) and R (R Core Team 2020).

Results

Results are presented in a multi-scale perspective in order to provide a full overview of NBT in Italy and discuss the proposed methodology at all territorial levels.

SUTs of NBT in Italy in 2019

Table 2 presents the Supply Table for the touristic flow in Italy in 2019. The values reported in the Table result from the assessment, based on the natural characteristics of the territory and their accessibility, as explained in the previous section.

Table 3 shows the Use Table for NBT in Italy in 2019. The Use Table allocates the ES to the primary users. In this case, the tourism sector is selected as primary user, with a specific reference to the tourism accommodation.

In order to discuss the methodology, the analysis was implemented at different spatial levels. Table 4 shows the actual flow considering (a) and not considering (b) the RP Map.

Fig. 5 shows the difference between the ratio calculated amongst the actual flow (a) and actual flow (b) and the total overnight stays, aggregated with reference to different territorial levels.

Results from data gathered and analysed at different territorial levels present small differences in terms of order of magnitude. On the contrary, the two types of actual flow differ consistently and an overestimate of actual flow (b) is evident. This second option, in fact, does not take into account any key factors determining supply and use of the service.

Data gathered at regional level offer a more detailed overview of NBT. In Fig. 6, Italian regions are ranked by the total number of overnight stays (red line). Emilia-Romagna, Lombardy, Tuscany, Trentino-Alto Adige and Veneto are the five top-ranking regions (with more than 40 million overnight stays). Trentino-Alto Adige and Tuscany show the higher share of NBT (respectively, 75% and 61.6%) and, together with Veneto, in the three regions, non-resident tourism exceeds domestic tourism (twice that in Veneto). Veneto Region presents the highest total overnight stays with a medium share of NBT (43.3%). Other regions (such as Sicily, Sardinia, Campania) exhibit a relatively high share of NBT (higher than 60%), but a relatively low number of overnight stays if compared with the top regions.

Data analysed at municipal level allow us to unbundle the dynamic. Fig. 7 shows the spatial pattern of the Share NBT computed at local territorial level. A very high share of NBT (> 67%) characterises the Alps and pre-Alps, the Lakes Region (north of Italy) and the Apennine Mountains (Central Italy). Very high share of NBT identifies also the Italian coastal areas, with the exclusion of the northern part of the Adriatic Sea. This area, in fact, is characterised by a tourism industry, based on human-based infrastructure, that attracts residents and non-residents. Results from the gap analysis (see section below) demonstrated that also the Adriatic coast has municipalities with very high NBT, but they are not the majority of the locations. The coastal tourism of the northern Adriatic Sea depends mostly on the availability of facilities, infrastructure and human-based opportunities and less on ecosystems.

Fig. 8 presents the results of the gap analysis. A total of 28.66% of the locations are characterised by very high overnight stays and a very low share of NBT. Most of the locations grouped in this category are art cities. A total of 17.98% of the locations are characterised by very high overnight stays combined with a very high share of NBT. They are located in the Alps (Trentino Alto -Adige; Val d'Aosta or north of Lombardy, Piemonte and Friuli Venezia Giulia Regions), in the proximity of Lakes or along the coast.

Table 5 and Fig. 9 show the ten top-ranked locations with a very high number of overnight stays and very high or very low share of NBT. The non-domestic tourism is prevalent in all the top-ranked locations. Seven of the ten municipalities are located in the proximity of sea, lakes, hills or mountain locations. Three of the five municipalities with high overnight stays and low share of NBT are cities of art (Venice, Florence and Milan), the other two are sea locations with low opportunities for NBT (San Michele al Tagliamento (Bibione) and Jesolo Fig. 9b).

In all groups, the variable is not normally distributed (none of the categories passed the normality test). Locations described with reference to nature-based characteristics (presence of hills, mountains, sea lakes and thermal areas) are characterised by a higher mean and median share of NBT.

In Fig. 10**,** the box plot of the share of NBT computed by tourism class is presented. Not classified cities and art cities show a higher variability amongst the values.

Municipalities not classified or with no specific tourist attraction (the majority of the cases, 48.8%) have an average value of 50.8% and a median of 51.9%. Additionally, the distribution presents a relatively high interquartile range (54.49%), showing a wide spread of the middle half of the data, thus a relatively high variability. This is expected because this group covers the most part of the territory, even areas with very high tourism relevance, but not classified in this release of the dataset. This result implies that also the municipalities not yet classified potentially have a medium-high share of NBT.

Art cities (8.8% of the cases) show a moderately low median value (36.47%) and mean value (38.38%). The interquartile range (47.09%) demonstrates a relatively high dispersion of the distribution. This means that, in art cities, one can have a very high or low share of NBT, depending on the characteristics of the location (in Tuscany Region for instance, art cities might have areas with nature-related attractions within their administrative boundaries, Venturi et al. 2021).

Conversely, the four groups related to nature-based recreation opportunities have skewed distributions, with high mean and median values and relatively small interquartile ranges, which implies that they are characterised by a relatively higher share of NBT, compared to the others. Hill and mountain locations (28.7% of the municipalities) and lake locations (3.2% of the cases) have similar mean and median values (respectively, mountain: 73.5% and 80.5%; lakes: 78.8% and 81.8%) and the smaller interquartile ranges. Moreover, both the categories present outliers. These latter locations are due to the presence of areas with high potential for nature-based recreation, but not easily

accessible (remote) in the RP map. Sea locations (7.8% of the municipalities) and thermal bath locations (2.3% of the municipalities), despite having high mean and median values (respectively, sea: 66.4% and 75.0%; thermal: 63.9% and 67.9%), show a less skewed distribution.

The difference amongst the seven groups was tested with the Kruskal-Wallis test. Results from the Kruskal-Wallis test (chi-squared = 535.78; df = 6 and p-value < 2.2e-16) shows a p-value that is smaller than the significance level 0.05; therefore, we can conclude that there are significant differences (at least one group is different from the other six) between groups of municipalities with different type of tourist opportunities. The result is confirmed by the pairwise Wilkox test. Table 6 shows the reciprocal differences amongst categories, excluding cities with religious interest where a limited amount of data was available. Only sea locations do not show significant differences.

Discussion

The SEEA EA framework requires the quantification of the flow of tourism that depends on ecosystems for a selected accounting period. In order to fulfil this requirement for NBT, we used the overnight stays. Table 2 and Table 3 show an example of SUTs filled in to report on NBT in Italy in 2019. In our exploratory study in Italy, the actual flow (Supply Table) is predominantly determined by the forest ecosystem type. Non-domestic NBT exceeds the domestic flow in forest and semi-natural areas and water Ecosystem types. In the other ecosystem types, the actual flow is almost equal for residents and non-residents. To fill in the Use Table, Table 3, we suggest to attribute NBT to the tertiary sector and specifically to Tourism, sub-sector accommodation. This choice respects the principle to allocate ESs to primary users. In this case, the fact that tourists are spending money to travel, domestically or from abroad, feeds a range of economic activities, such as hotels, camp sites, bed&breakfast and other accommodation providers. Although the final beneficiaries are individuals, who enjoy nature-based opportunities, from an economic perspective, the primary users of NBT are the economic activities that host the individuals. Tourism, in fact, can provide a remarkable share of the national economy and, for this reason, it is strategically important to estimate the share of tourism dependent on ecosystems.

When the assessment of recreation-related services embeds all the components (tourism, daily trip from non-residents and daily enjoyment by residents), then it is understandable to consider people as users (see the INCA application, Vallecillo et al. 2018). However, in this case, NBT is measured using overnight stays; for this reason, tourism accommodation owners are the primary users and people are the final beneficiaries. As stated in the SEEA EA, ESs differ from benefits and, in turn, primary users may differ from beneficiaries (United Nations 2021).

The analyses performed at different territorial levels provide an outcome of similar order of magnitude. For this reason, one could infer that national level data could be directly used to account for NBT. On the contrary, we strongly recommend starting the analysis at

the lowest possible territorial level, that allows us to analyse several aspects of NBT. As already illustrated by Peeters et al. (2018) in his work on the impacts of over-tourism in Europe, even information gathered at the regional level (NUTS2) is not detailed enough to properly capture the tourism phenomenon and unbundle its environmental, social, cultural and economic impacts.

For what concerns the methodologies proposed to estimate the actual flow, we affirm that the actual flow (b), computed without considering the nature-based opportunities, clearly overestimates NBT. This extremely simplified approach, in fact, does not consider any of the key factors determining the service supply and service use; for instance, extent of ecosystems, the presence of iconic landmarks, the landscape characteristics or accessibility (United Nations 2021). All factors selected for Recreation-related services in the SEEA EA are reported in Suppl. Material 2. The principle, whereby a certain percentage of ES is allocated to a given ecosystem type without considering any factor determining the service supply and use, can provide misleading messages.

For instance, highly-urbanised coastal areas cannot be considered able to provide the same nature-based opportunities as coastal areas located in proximity of semi-natural/ natural contexts. This approach could act as an incentive for converting natural areas into highly developed areas without implementing any action of sustainable management. This principle is highlighted by the results of the gap analysis (Figs 7, 8 and Table 5). The five top-ranked locations with a very high number of overnight stays and very high share of NBT are: Cavallino-Treporti; Limone sul Garda; Malcesine; Castelrotto and Tyrol. The four municipalities are very famous mountain, sea or lake locations. Cavallino-Treporti is located in the the Venice Lagoon and hosts important Natural Reserves and a Nature 2000 site *[5] (Fig. 9b); Limone sul Garda and Malcesine are both close to the Garda Lake (Fig. 9c), the first one is a picturesque small village famous for the cultivation of lemons and the second one is a village located between the blue lake waters and the massive mountain ridge behind. Castelrotto and Tirol are small villages in the South Tyrol Dolomites (Fig. 9c). The five top-ranked locations with a very high number of overnight stays and very low level of actual flow are: Venice; Milan; Florence (Fig. 9a); San Michele al Tagliamento (Bibione) and Jesolo (Fig. 9b). While the first three locations attract tourists predominantly for their cultural outstanding offers, the last two are very famous sea locations. Nevertheless, both Jesolo and San Michele al Tagliamento (famous for the sea village Bibione Sabbiadoro) base their tourism industry on the presence of facilities and infrastructure.

Taking as an example the case of Jesolo Lido and Cavallino Treporti, Table 7 and Table 8 show that they differ for what concerns the type of accommodation offer. Cavallino Treporti hosts mainly camping with an accommodation capacity 1.8 times higher than Jesolo. Jesolo, on the other hand, bases the offer on hotels and summer houses. In fact, as shown in Table 8, only 5.54% of the overnight stays in Jesolo are allocated to camping that, in Cavallino Treporti represent 85.7% of the overnight stays. The development of campsites in Cavallino Treporti goes back to the 60s/70s. Nowadays, camping, together with campsites, provide bungalows and mobile-houses (Ballarin 2019). Traditionally, the campsites are associated with a lower environmental impact if compared to hotels (Bacsi

and Szanati 2021). Nevertheless, looking at the tourism intensity figures in Cavallino (Table 8), we notice a very high share of arrivals and overnight stays per resident, which is a proxy of high environmental and social impact (Peeters et al. 2018). Cavallino Treporti hosts three important Natura 2000 sites. Almost half of its surface is covered by the Venice Lagoon; and, in addition, it hosts important coastal biotopes (10 habitats and 23 species protected by the Habitats Directive European Commission 1992). Conversely, Jesolo developed other aspects of the tourism industry in terms of type of accommodation establishments and type of attractions (mostly based on night-life and infrastructures). This explains the low share of NBT reported in our study.

The statistical analysis showed that there is a significant difference in the share of NBT amongst locations characterised by different types of tourism. All municipalities identified by the presence of sea, mountain and lakes show a higher share of NBT. The Kruskal-Wallis H and the pairwise Wilkox test showed that there was a statistically significant difference amongst groups of municipalities with different characteristics. Hill and towns, mountain-towns or municipalities close to lakes presented a relatively high share of overnight stays allocated to NBT compared to the others. The sea-municipalities, while presenting quite a high score, have a higher variability. This is probably caused by the heterogeneous characteristics of the Italian coastal areas; for instance, along the Adriatic Sea coast, different types of tourism industries are developed, not all based on nature.

With our study, we provide a methodology to fill in the SEEA EA tables. Nevertheless, this approach does not limit the accomplishment of SEEA EA requirement. In fact, as demonstrated through the gap analysis, it provides additional useful information for a wider tourism assessment. The methodology can unbundle tourism from several perspectives. It allows us to explore the share of tourism flow, related to nature and might support additional analysis that focus on local development, impact on degraded ecosystems or over-use of the resources. For instance, one could be interested in exploring the over-tourism/overcrowding phenomenon in areas with a high share of NBT. Moreover, one could be interested in monitoring over time the tourism activity in specific ecosystem types (e.g. coastal areas; wetlands; forests or agro-ecosystems). The spatially-explicit outcomes of the method proposed in this paper can be used to assess the negative environmental impacts of tourism (including, for instance, the use of natural resources and waste production) and can be part of a wider monitoring system.

Despite the strengths discussed above, the method could be improved. In general terms, a more sophisticated procedure to move from CLC Level 1 to an accurate ecosystem typology could be part of future enhancement of the procedure. This transition has been already included in the EU methodology to map and assess ecosystem condition (Vallecillo Rodriguez et al. 2022). Moreover, it would be important to integrate the current biophysical map with details on the shore-face (see Liquete et al. 2016) and consider multi-purpose trips.

Most importantly, to properly apply the methodology at national level (or any local level), the biophysical model should be downscaled using local detailed data (see Zulian et al. 2017 and Zulian et al. 2021 for practical examples of downscaling). Moreover, the model

could be improved using additional information, such as the condition of ecosystems, the presence of specific landmarks or the presence of facilities to enjoy nature (see Zulian et al. 2021) in order to provide a more realistic estimate of the potential capacity of ecosystems to provide opportunities for NBT. Tourism surveys could be used to adjust models' parameters and to select the facilities related to NBT that could be included (see Maes et al. 2019, Maes et al. 2021, Zulian et al. 2021). Results should be validated using *ad hoc* surveys (which are expensive and demanding) or data collected officially (such as, for instance, the survey on families' expenses and touristic movements*[6]).

Conclusions

When considering data aggregated at macroeconomic level, it is important to monitor the trends of tourism driven by nature in any country. Changes in land-use/land-cover or unsustainable management practices could damage the NBT which represents a large component of the tourism industry, an economic sector that is important for European national economies. From a policy perspective, the EU Tourism policy aims to maintain and improve the leader position of the EU on the tourism industry. Security and safety, namely environmental, political and social security, are amongst the main challenges recognised at EU level.

In 2010, the EU Parliament discussed a motion for a resolution on "Europe, the world's No. 1 tourist destination – a new political framework for tourism in Europe - 2010/2206 (INI)" (European Parliament 2011). Amongst others, the need to promote "the development of sustainable, responsible and high-quality tourism" was identified as a key priority action. In March 2021, the EU strategy for sustainable tourism was approved (European Parliament 2021). The strategy recognises tourism as "a cross-cutting economic activity with a wide-ranging impact on the environment and climate and on the EU's economy as a whole…", which should contribute to the conservation of biodiversity, social welfare and the economic security of local communities. The strategy aims at strengthening a transition to sustainable, responsible and smart tourism; in particular, article 24 highlights the need to "develop policies for preserving natural heritage and biodiversity, respecting the sociocultural authenticity of host communities" (art. 24). In addition, sustainable tourism is embedded in the UN agenda for 2030 in Goals 8, 12 and 14*[2] .

The methodology proposed in this study to estimate the actual flow that depends on biophysical characteristics of ecosystems is extremely important to monitor the implementation of sustainable tourism practices. Natural capital accounting is gaining growing importance and attention. Since the SEEA EA was adopted as a standard framework in March 2021, an increasing number of studies and initiatives proposed methods, proxies and techniques to assess and value ESs for accounting purposes. Amongst the list of ESs included in the SEEA EA, this paper focuses on cultural ES-recreation and specifically on NBT. We showed that the procedure is feasible and consistent with the SEEA EA general framework.

Conflicts of interest

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Endnotes

*1 https://whc.unesco.org/en/statesparties/it

*2 Goals 8 (Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all), 12 (Ensure sustainable consumption and production patterns) and 14 (Conserve and sustainably use the oceans, seas and marine resources for sustainable development) https://sdgs.un.org/goals.

*3 Eurostat has created a Task Force to prepare a legal proposal for the implementation of ecosystem accounting. The text is currently under internal consultations within the Commission (in and between the various Directorates General). The number of overnight stays is proposed to measure the recreation service.

*4 Although the logic of the model did not change, the terminology used in INCA for accounting purposes was slightly different compared with the one formulated initially for the ecosystem mapping. The former ROS map in INCA is now called the RP map.

*5 N2K IT3250003 dataforms (europa.eu)
Rete EA (arpa.veneto.it)

*6 INDAGINE SULLE SPESE DELLE FAMIGLIE https://www.istat.it/it/archivio/71980

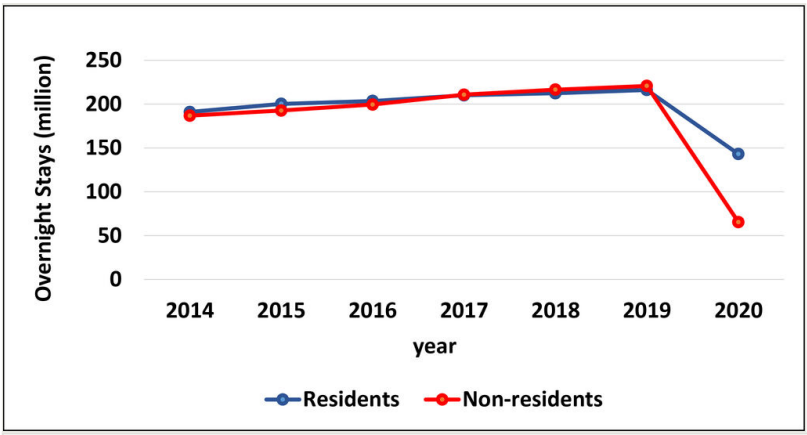

Figure 1.

Overnight stays (million) in Italy (2014-2020) Source: ISTAT 2022a

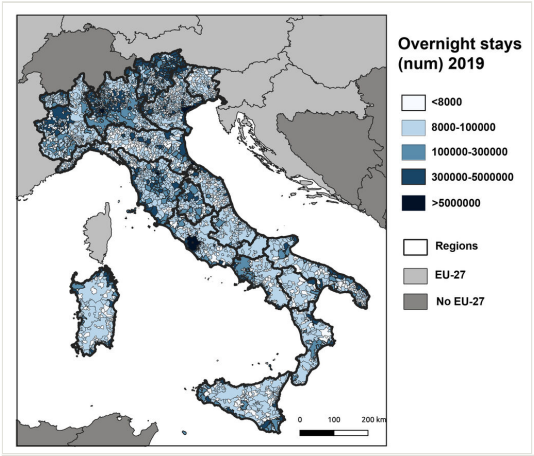

Figure 2.

Overnight stays in Italy in 2019. Source: ISTAT 2022a.

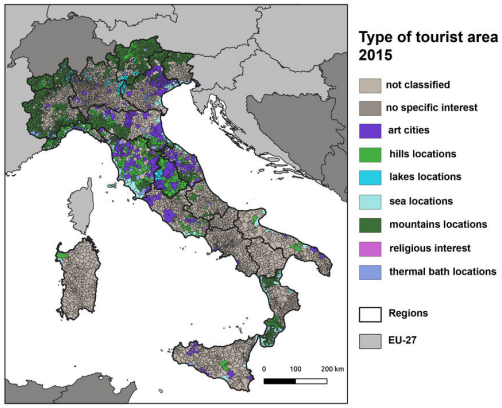

Figure 3.

Municipality classified by type of tourist attraction (ISTAT 2022a) (2015).

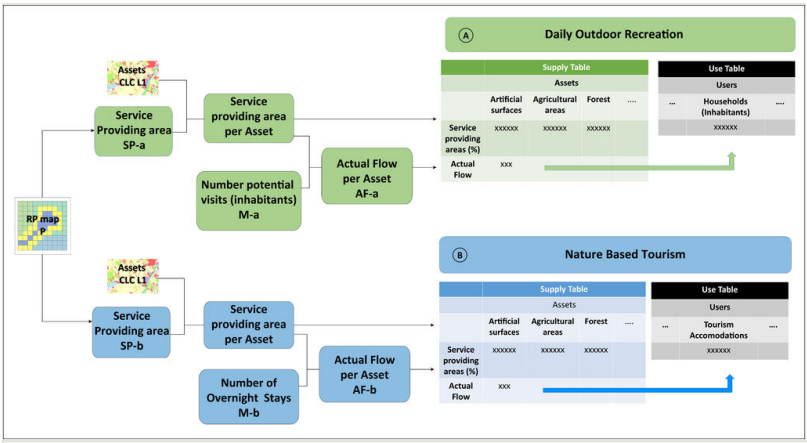

Figure 4.

Accounting components of the "Recreation-related" services. Schema of the adaptation of the INCA approach for the physical ES flow account applied to NBT.

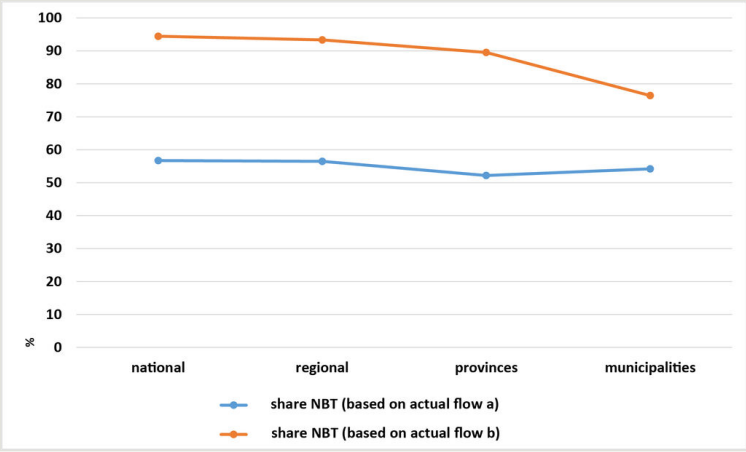

Figure 5.

Comparison between share NBT derived by data gathered at different territorial levels.

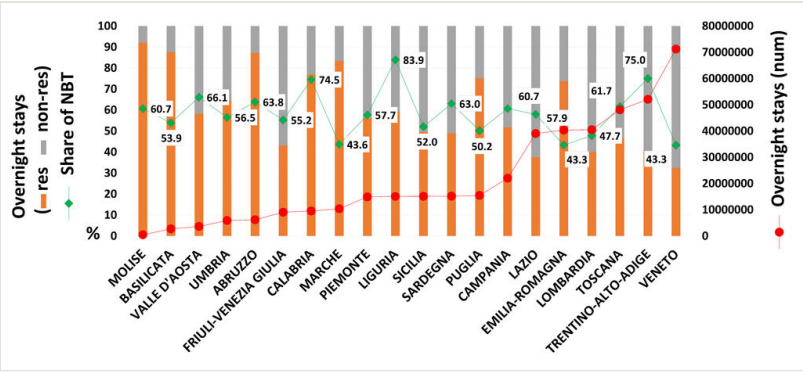

Figure 6.

NBT at Regional level. The stacked bars show a comparison between the share of residents (orange) and non-residents (grey) overnight stays; the green line shows the share of NBT (%) and the red line shows the total overnight stays.

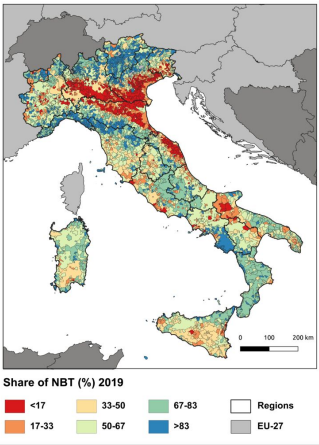

Figure 7.

Share NBT, non-residents at municipal level (2019).

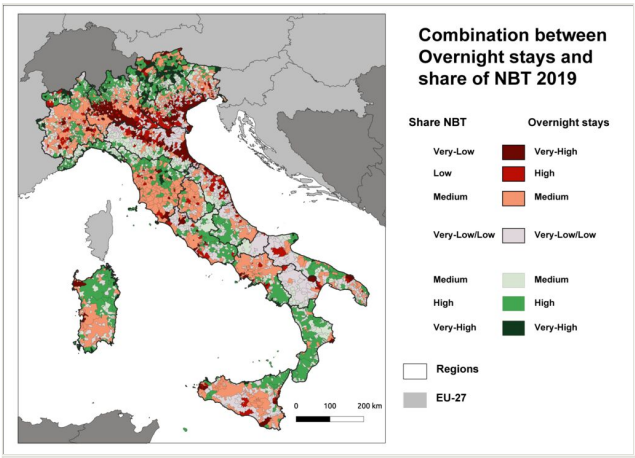

Figure 8.

Combination between overnight stays and share of NBT (2019, non-residents).

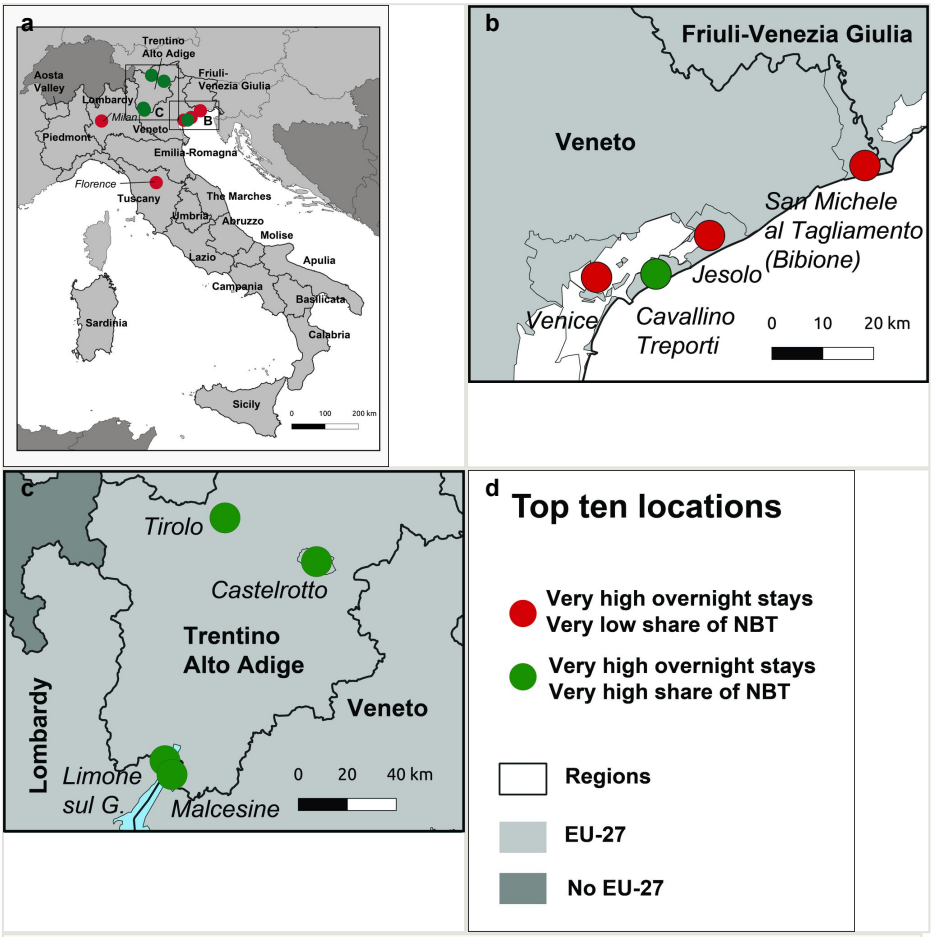

Figure 9.

Italian Regions and top ten locations ranked by overnight stays and share of NBT.

a: Italian Regions and top ten locations ranked by overnight stays and share of NBT.
b: Locations in Veneto Region (Venice; Cavallino Treporti; Jesolo and San Michele al Tagliamento (Bibione)
c: Locations in Trentino, Alto Adige (Tirolo and Castelrotto), Veneto (Malcesine) and Lombardy (Limone sul Garda)
d: Legend.

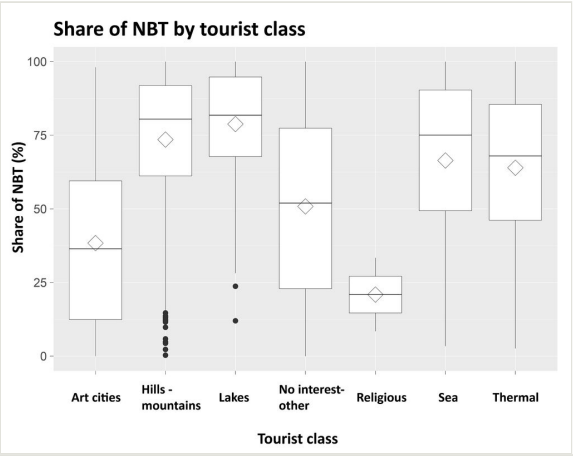

Figure 10.

Box plot of share of NBT by tourist class.

Table 1.

Input data.

Data	Data owner	Reference	Level
Corine Land Cover	European Environment Agency	European Environmental Agency (2019)	European
Italian territorial units	ISTAT	ISTAT 2022b	National Regions Provinces Municipalities
Occupancy in collective tourist accommodation - yearly data	ISTAT	ISTAT 2022a	National Regions Provinces Municipalities
Municipalities' Classification by touristic area and type of tourist setting - [data available from 2002 to 2015]			Municipalities

Table 2.

Supply Table 2019, the actual flow (overnight stays allocated to the service providing areas) is reported per Ecosystem Type for residents, non-residents and for the total touristic movement.

		settlements	cropland	woodland and forest	wetland	water
	Ecosystem Type (%)	0.67	20.79	34.81	0.15	0.27
Non-residents	Nature-based tourism (overnight stays per service providing areas)	1395234.72	39021663.47	83152399.73	359683.09	719164.11
Residents		1418372.94	41547689.79	78048060.69	390896.33	662203.17
Total		2813608.34	80569374.06	161200495.23	750579.57	1381367.55

Table 3.

Use Table 2019, the total actual flow (overnight stays allocated to the service providing areas) is allocated to the tertiary sector, tourism accommodation considering: residents, non-residents and for the total touristic movement.

		sectors					households
		primary	secondary	tertiary			
				tourism		other	
				accommodation	other		
Non-residents	Nature-based tourism (overnight stays per service providing areas)			124648145.12			
Residents				122067222.93			
Total				246715424.74			

Table 4.

Total actual flow for non-residents reported using the data gathered at the four territorial levels. Actual flow (a): considers the contribution of ecosystems and the proximity to users; Actual flow (b): does not consider the contribution of ecosystems and the proximity.

Territorial unit	Actual flow (a)	Actual flow (b)
national	125110460.02	208405772.51
regional	124648145.12	205907753.69
provincial	115119206.40	197596929.03
municipalities	119556005.40	168656107.10

Table 5.

Top-ranked municipalities with very high number of overnight stays and very high or very low ratio between actual flow and overnight stays. For each municipality, the Table reports: non-residents overnight stays; the share of NBT, the actual flow (a) ratio residents-non residents and non-residents and the tourist category reported by ISTAT.

Category	Municipality	total overnights	share of NBT	actual flow (a) ratio residents-non residents	touristic location
High overnights-high actual flow	Cavallino-Treporti	5190799	94.335	4.81	sea
	Limone sul Garda	1098311	99.036	15.81	lakes
	Malcesine	1046212	98.304	12.45	lakes
	Castelrotto	1002314	85.474	1.7	mountain
	Tirolo	804532	96.526	25.11	mountain
High overnights-low actual flow	Venice	11029885	21.209	5.74	artistic value
	Milan	8104378	11.277	1.8	artistic value
	Florence	7990576	33.86	2.69	artistic value
	San Michele al Tagliamento (Bibione)	4149777	24.022	2.43	sea
	Jesolo	3164921	26.655	1.39	sea

Table 6.

Combination of groups with significant and not significant differences ($p \leq 0.05$)

	no_interest_other_no_classified	Art cities	Hill and mountain locations	Lake locations	Sea locations
no_interest_other_no_classified					
Art cities	0.0000				
Hill and mountain locations	0.0000	0.0000			
Lake locations	0.0000	0.0000	0.0288		
Sea locations	0.0000	0.0000	0.0019	0.0003	
Thermal locations	0.0005	0.0000	0.0019	0.0001	0.3297

Table 7.

Accommodation establishment (2019) in Cavallino Treporti; Jesolo and Venice Province (data: ISTAT 2022a).

	hotels			camping			other extra hotel		
	num	beds	accommodation capacity	num	beds	accommodation capacity	num	beds	accommodation capacity
Cavallino-Treporti	22	1852	84.18	29	63814	2200.48	771	5744	7.45
Jesolo	345	32166	93.23	10	11644	1164.40	4287	26470	6.17
Provincia di Venezia	1190	100355	84.33	77	133948	1739.58	32714	197302	6.03

Table 8.

Tourism intensity (2019) in Cavallino Treporti; Jesolo and Venice Province (data: ISTAT 2022a).

	average stays (total)	arrivals/ inhabitant	overnight stays/ inhabitant	overnight stays in extra hotel accommodation (camping)
Cavallino-Treporti	8.02	57.87	464.13	95.9 (85.7)
Jesolo	4.63	45.11	208.72	33.4 (5.54)
provincia VE	3.80	11.69	44.47	58.9 (18.28)

Supplementary materials

Suppl. material 1: number and share of municipalities per Province

Authors: Grazia Zulian
Data type: table
Brief description: number of municipalities per province with aggregated data on tourism in 2019.
Download file (7.03 kb)

Suppl. material 2: SEEA-EA online supplement ecosystem services logic chain

Authors: SEEA-EA
Data type: excel file
Brief description: Online supplemental materials (in Excel), available on the SEEA-EA web site https://seea.un.org/ecosystem-accounting.
Download file (20.52 kb)

Suppl. material 3: Nature-based recreation biophysiscal model

Authors: Grazia Zulian
Data type: word document
Brief description: the basic rational of the biophisical model and the input data used for thid application are reported.
Download file (1.69 MB)