

*Paper*

**Developing a “tourism and environment reporting mechanism” (TOUERM):  
Environmental impacts and sustainability trends.**

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*Introduction*

The demand for tourism and recreation opportunities has grown steadily over the last decades in all European countries, and today tourism development presents itself as a major driving force that, beyond its relevant contribution to national economies, determines pressures and impacts on the main environmental assets (air, water, biodiversity, soil, land), both at destination (local) and global level.

Specific types of tourism and increased frequency of holidays have serious environmental impacts at regional and local level, also depending on the seasonality of tourist flows: recreational, leisure and accommodation infrastructures, modes of transport, especially road and air, energy, food and water supplies related to mass or extreme tourism activities impact directly and indirectly on the quality of environmental assets, the status of natural resources, in destinations such as islands and coastlines or mountain regions as well as the quality of life for citizens when it comes to the most popular touristic cities in Europe. Particularly, destinations are faced with challenges concerning water supply, pressures on the local sources, waste generation and management as well as waste water generation and treatment that may exceed, in some cases, the carrying capacity of the territories (especially small and medium size islands). Also, land take and soil sealing, air and noise pollution from local transportation modes, as well as visual pollution by the increasing built-up areas, represent other, quite commonly traceable consequences of tourism development.

A damaged environment could undermine tourism in the future, since tourism needs a clean and attractive environment; affecting environmental quality and natural resources means also jeopardizing the future development of the tourism sector, which is strongly dependent on the status of these assets. Monitoring and measuring these impacts help redirect tourism related policies and ensure increase sustainability, also from an environmental perspective.

*Policy context*

Global and European statistics, respectively by UNWTO and EUROSTAT, confirm that Europe is at the same time the world’s first tourism destination as well as the main source region of tourists worldwide, generating just over half of the world’s international arrivals (UNWTO, 2016; EUROSTAT, 2016).

From an environmental perspective all that calls for an accurate and regular monitoring of the impacts by tourism in order to correctly steer the management and the future direction of the sector towards an increased sustainability, although a monitoring statistical framework embracing the environmental performance of the sector is still to be completely developed.

From a global policy perspective, due to its multidimensional implications on the three main components of sustainable development, tourism is featured in Goals 8, 12 and 14 of the United Nations 2030 Agenda<sup>1</sup>, as a key sector that can play a crucial role in the achievement of an inclusive and sustainable economic growth, sustainable consumption and production practices, and the conservation and responsible use of oceans, seas and marine resources.

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<sup>1</sup> <https://sustainabledevelopment.un.org/sdgs>

Downscaling to the regional level, it can be observed, firstly, that European tourism policy is mainly focussed on boosting the competitiveness of the sector worldwide and, secondly, that tourism and environment nexus related policy in Europe is not about specific legislation and targets in itself.

All environmental aspects and reference to sustainability challenges related to the tourism sector as a composite of sub-sectors<sup>2</sup> (accommodation establishments, food and beverage, tourism related transport, recreational activities, travel agencies, tour operators, etc.) are fragmented and dispersed across sector-based policies and the *acquis communautaire*.

At the same time many EU environmental sector-based policies such as waste, water, terrestrial and marine biodiversity, air, soil and climate change identify tourism as a sector whose environmental sustainability is seen more and more as an undeniable qualification.

Thus from an EU environmental reporting perspective it may be argued that the tourism and environment nexus policy reporting “drivers” are indirect but still extremely valuable to orientate evidence-based policy decision making for the environmental sustainability of the sector.

However, this fragmentation in the EU tourism related policies negatively affects data availability for the broad spectrum of sectors and the related impacts involved so that the evidence base to track progress towards sustainability is still uneven.

This lack of information on the actual environmental effects of tourism activities also has profound consequences in tourism planning and in coordinating activities between not just public agencies but also between the industry or the public and the private sector.

### *Conceptual approach*

In 2013, in order to contribute to improve the evidence base the European Environment Agency (EEA) started to develop a reporting mechanism to be based on indicators linking tourism and environment (TOUERM or Tourism and Environment Reporting Mechanism) in order to provide a more comprehensive picture of tourism within the more general monitoring processes the EEA is also managing for other European economic sectors<sup>3</sup> (transport, energy, agriculture and industry) environmental performance.

In doing so the EEA is addressing a challenge that is policy relevant especially in the context of the 7th Environment Action Programme – “Living well within the limits of our planet”<sup>3</sup> - as a contribution to monitor progress towards a resource efficient, green and low carbon economy. More specifically, this activity falls into the EEA multiannual work programme 2014-2018 (EEA, 2014) that foresees the development of data sets and indicators to track sustainability trends and the environmental and territorial impacts of land use -dependent economic sectors such as tourism.

In the context of this tourism related analysis land is regarded as a provider of multiple values that, for the full operation of the sector, mainly sustain:

- functional-operational services of the sector (transport infrastructure, accommodation establishments, and recreational facilities);
- attractiveness of places through natural and cultural features of landscape, and their combination in different gradients;
- different ecosystem services (cultural services, regulating and provisioning).

### *Operational approach*

Since 2013 the EEA has been working in cooperation with an Eionet Expert Group representing to a maximum extent all EEA member and cooperating countries (see Fig. 1) and the “European Topic Centre on Urban, Land and Soil systems – ETC ULS” to:

- explore the feasibility of TOUERM as a coherent framework to monitor;
- assess the connection between tourism and environment in Europe;
- identify main topics and indicators to address them.

The framework followed a tiered approach, starting identifying key policy questions, linked to a set of indicators meant to help answer these questions.

Firstly, five main policy questions were identified:

1. What characterizes and drives the demand for tourism?
2. What are the environmental impacts of tourism?
3. Are we getting better at managing tourism demand to preserve natural resources?

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<sup>2</sup> [http://ec.europa.eu/eurostat/statistics-explained/index.php/File:List\\_of\\_tourism\\_characteristic\\_activities\\_2015.png](http://ec.europa.eu/eurostat/statistics-explained/index.php/File:List_of_tourism_characteristic_activities_2015.png)

<sup>3</sup> <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32013D1386>

4. Are we moving towards a better internalization of the external costs of the tourism sector?
5. How effective are environmental management and monitoring tools towards a more integrated tourism strategy?

Those policy questions were complemented by a list of other complementary policy questions. Later 25 priority indicators were identified and “prioritized” according to 1) Data availability, 2) Consolidated methodology, 3) Processing requirements feasible in the frame of the project, 4) Policy relevance, 5) Clarity of the message. Indicators also address the driver-pressure-state-impact-response (DPSIR) analytical framework. Out of 25 priority indicators identified, 18 indicators have been so far developed and are presented in this paper (Table 1).

Driver indicators	Pressure indicators	State indicators	Impact indicators	Response indicators
D1 - Tourism arrivals D2- Overnights spent at tourism accommodation establishments <b>D3 - Seasonality of tourism</b> <b>D4 - Tourism related modes of transport</b> D5 - Tourism related modes of transport (I): Airplane D6 - Tourism related modes of transport (II): Cruises	P1 - Tourism density <b>P2 - Tourism intensity</b> <b>P3 - Occupancy rate in tourist accommodation establishments</b> P4 - Most attractive places P5 - Tourism and leisure pressure on protected areas P6 - Water abstraction by tourism	<b>S1 - Bathing water quality</b>	I1 - Spatial impact of tourism facilities (I): Golf courses <b>I2 - Spatial impact of tourism facilities (II): Marina ports</b> I3 - Spatial impact of tourism facilities (III): Ski resorts	R1 - Percentage of destination that is designated for protection <b>R2 - Tourism enterprises using environmental certification / labelling</b> <b>R3 - Blue Flags for beaches and marinas</b>

Table 1, TOUERM indicators developed, Note: in bold, indicators that have a correspondence with the European Tourism Indicator System (ETIS) (European Commission, 2016). Source EEA/ETC ULS

### *Monitoring and reporting challenges*

The indicators developed so far as proxies and presented in this paper aim at covering a wide range of topics related to tourism such as attractiveness of places, water consumption, biodiversity disturbance, spread of sustainability practises by the adoption of environmental certification schemes and labelling, potentials for ecotourism and -to some extent, initially- land take by development of specific tourism and recreational related facilities (ski area, marina and golf courses).

However, other policy relevant indicators -identified as priority ones by the EEA member and cooperating countries- are still to be fully developed because of some methodological challenges. It is very common in fact in tourism and environment related analysis -also because of the extremely composite nature of the sector- to encounter difficulties in developing appropriate monitoring tools - that allow regular and geographical consistent coverage at Pan-European level assessments- especially because of the lack of statistical data from the official sources.

This is very much the case of many environmental aspects -such as waste and waste water generation, air pollution by transport, energy and water consumption, and land take- from which extracting the touristic share out of available quantitative data is difficult and requires the investment in additional resources (time and expertise) that so far have led to the production of ad hoc basis and specific case research analysis.

Another challenge addressed is the integration of socio-economic information, usually aggregated at administrative level, with environmental data which has a spatial dimension beyond administrative boundaries and is scale dependent. The adoption of a grid of 1x1 km as a reference unit at European level is a common approach to integrate data from different nature and sources<sup>4</sup>. The European Forum

<sup>4</sup> [http://inspire.ec.europa.eu/reports/ImplementingRules/DataSpecifications/INSPIRE\\_Specification\\_GGS\\_v2.0.pdf](http://inspire.ec.europa.eu/reports/ImplementingRules/DataSpecifications/INSPIRE_Specification_GGS_v2.0.pdf)

for Geography and Statistics is working on the direction of reporting statistical information at grid level, instead of administrative unit<sup>5</sup>.

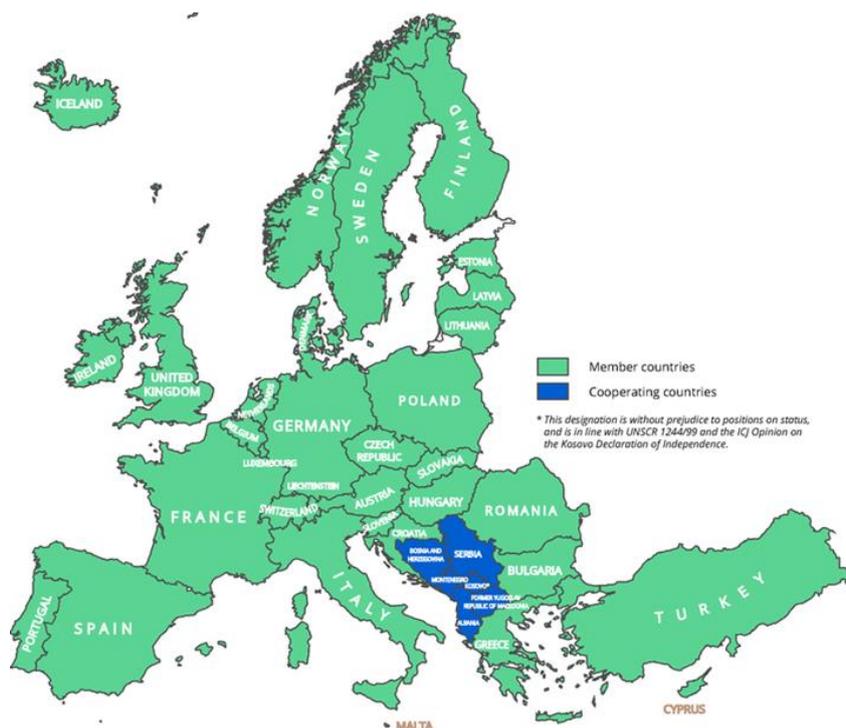


Fig. 1, European Environment Agency Member and cooperating countries. Source:www.eea.europa.eu

### *Methodological approach*

Several indicators rely on EUROSTAT database, showing also consistency with the European Commission’s European Tourism Indicator System (ETIS). Whenever gaps in the available statistical databases were found, national statistics or sectoral yearbooks were used to fill the data gaps. Other indicators are based on available spatial data or big data sources providing evidence of the intensity of tourism activities. In combination with protected areas and other areas of environmental interest, indicators about potential pressure of tourism activities can be deduced. In the following pages each indicator is presented with a focus on the policy relevance and some technical specifications.

### *Indicators developed*

#### **D1 – Tourism arrivals**

##### **Key policy question**

What are the most tourism intensive regions in Europe?

##### **Rationale**

Being a very general indicator, it informs about the global tourism attractiveness of each country and region, and its evolution over time. Moreover, it also distinguishes between domestic tourists (short distance tourists) and international tourists (longer distance tourists). This indicator complements the overnight stays indicator, since tourism arrivals measures the total number of trips to a country, while overnight stays measures the length of stay (in days) of those trips.

##### **Policy context**

EC and national policies on tourism and sustainable tourism.

##### **Data sources**

Data is extracted from Eurostat: Arrivals at tourist accommodation establishments by NUTS 2 regions (code our\_acc\_arn2). Frequency update: annual.

##### **Methodology for indicator calculation**

No further processing is required. Data is reported as total number of tourist arrivals per NUTS 2 and year, and the share of domestic/international tourists by country and year.

<sup>5</sup> <http://www.efgs.info/wp-content/uploads/geostat/1b/GEOSTAT1B-final-technical-report.pdf>

## D2 – Overnights spent at tourist accommodation establishments

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### **Key policy question**

What are the most tourism intensive regions in Europe?

### **Rationale**

This indicator could be considered a proxy of the attractiveness of each region, and its evolution over time. It also informs about the origin of the visitors, distinguishing between domestic tourists (short distance tourists) and international tourists (longer distance tourists). Compared to the indicator on tourism arrivals, overnights spent are more site-specific or linked to a particular place. Therefore the link between driver, pressures and (potential) impacts could be better analysed.

### **Policy context**

EC and national policies on tourism and sustainable tourism.

### **Data sources**

Data is extracted from Eurostat: Nights spent at tourist accommodation establishments by NUTS 2 regions (code tour\_occ\_nin2); Nights spent at tourist accommodation establishments by coastal and non-coastal area and by NUTS 2 regions (tour\_occ\_nin2c). Frequency update: annual.

### **Methodology for indicator calculation**

No further processing is required. Data is reported as number of overnights spent at NUTS 2 level and the share of nights spent in coastal areas by NUTS 2.

### **Uncertainties**

Data only takes in consideration official commercial establishments. It does not cover other types of tourism accommodation (B&B, sharing economy establishments, second homes, etc.).

## D3 – Seasonality of tourism

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### **Key policy question**

Do we better spread the tourism season over the year?

### **Rationale**

The concentration of tourism trips into certain periods of the year has a major effect on sustainability. Not only does it seriously reduce the viability of enterprises and their ability to offer year round employment, it can also place severe pressure on communities and natural resources at certain times while leaving surplus capacity at others. It is important to know the distribution of overnight stays all over the year in each destination, region and country, in order to promote, if necessary, actions to reduce seasonality and spread tourism activity over the year. This indicator has its correspondence with the indicator B.1.1. (Number of tourist nights per month) from the ETIS system (Section B: Economic value).

### **Policy context**

EC and national policies on tourism and sustainable tourism.

### **Data sources**

Data is extracted from Eurostat: Number of nights spent by month of departure by country (code tour\_dem\_tmnd). Frequency update: monthly.

### **Methodology for indicator calculation**

Data is reported as relative share of each month per country. In addition, seasonal deviation is computed as the average of the absolute deviation of monthly data from the annual mean.

## D4 – Tourism related modes of transport

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### **Key policy question**

Are we using more environmentally friendly modes of transports for tourism?

Are we going better at managing the tourism mobility?

### **Rationale**

Transport and tourism are two interlinked sectors. In all the tourism flows transport has a key role, while in a good number of transport movements tourism and recreation are also one of the main reasons of those movements. It is important to know when analysing the tourism – environment relationships the main characteristics of the tourism mobility, especially the type of transport used by tourism flows (ie. there are some types of transport more polluting -and contributing to climate change- than others, such as air travel), as well as its evolution. This indicator has its correspondence with the indicator D.1.1. (Percentage of tourists and same-day visitors using different modes of transport to arrive at the destination) from the ETIS system (Section D: Environmental impact).

### **Policy context**

EC and national policies on tourism, sustainable tourism, and transport.

**Data sources**

Data is extracted from Eurostat: Number of trips by mode of transport -differentiating between air, land, railways or bus/coach (code tour\_dem\_ttr). Frequency update: annual. The data provides the share by type of transport used by European residents when they travel inside their country (domestic trips) and outside their country (outbound trips).

**Methodology for indicator calculation**

No further processing is required. Data is reported by country and, also, aggregated at European level.

**Uncertainties**

The indicator does not include data from non-European residents travelling to and within Europe.

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## D5 – Tourism related modes of transport (I): Airplane

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**Key policy question**

What are the changes in the number of passengers per airport?

**Rationale**

It is recognised that Europe’s aviation sector brings significant economic and social benefits. However, its activities also contribute to climate change, noise and local air quality impacts, and consequently affect the health and quality of life of European citizens, particularly taking into account the steady increase in air traffic over the last few years in Europe.

**Policy context**

EC and national policies on tourism and sustainable tourism. Environmental Noise Directive (Directive 2002/49/EC) and Regulation (EU) No 598/2014 on the procedures concerning the introduction of noise-related operating restrictions.

**Data sources**

Data is extracted from Eurostat: Annual passenger data per airport (code avia\_paoa, total carried passengers). Location of airports is extracted from GISCO (airport layer).

**Methodology for indicator calculation**

Annual passenger data per airport were linked to the airport layer (GISCO). Then, data is reported as total passengers carried by NUTS 2, and by airports (including changes between two reference years).

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## D6 – Tourism related modes of transport (II): Cruises

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**Key policy question**

What are the changes in cruise passenger per port?

**Rationale**

Since the cruise industry adds significant economic value to EU Member States, cruise tourism is an important sector for coastal regions and islands to attract. Nevertheless, it also leads to unwanted externalities, as cruise ships create air emissions, waste and noise in EU ports and seas. The Communication ‘An integrated Maritime Policy for the European Union’ (COM (2007) 575 final) stresses the importance of reconciling economic development, environmental sustainability and quality of life within coastal regions and islands. Due to the lack of accessible data on cruise ship routes, the number of passengers visiting or embarking/disembarking is a reasonable approximation of the pressure that cruise tourism is exerting to the ports and the surrounding areas in terms of air pollution, waste and noise.

**Policy context**

The Integrated European Maritime Policy to reconcile economic growth and environmental sustainability (Blue Growth). International efforts to reduce air emissions and improve waste treatment for cruise ships.

**Data sources**

Data is extracted from Eurostat: Maritime transport - Passengers - Annual data - All ports - by direction (code mar\_pa\_aa). Location of ports is extracted from GISCO (port layer).

**Methodology for indicator calculation**

Annual passenger data per port were linked to port layer (GISCO). Then, data is presented as number of cruise passengers per port and changes between two reference years.

**Uncertainties**

Still missing values due to lacking reporting may occur.

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## P1 – Tourism density

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Sub-indicators:

- Number of bed-places in tourist accommodation establishments per km<sup>2</sup> by NUTS 2 (global, in urban areas, in rural areas, and in coastal areas)
- Number of overnight stays per km<sup>2</sup> by NUTS 2

### **Key policy question**

How is tourism concentrated in space?

### **Rationale**

This indicator shows the relative importance of tourism accommodation supply as well as total annual overnight stays in each territory in relation to its surface (pressure indicator). Tracking the number of available beds in a destination is also a way of measuring the potential impact of tourism on residents' way of life.

### **Policy context**

EC and national policies on tourism and sustainable tourism. Different targets depending on the region / country. For example, some mountain and rural regions, as well as some coastal regions show a high number of tourism supply and overnight stays in relation to their territory. It would seem that in those areas it would be recommendable to control further growing in order to avoid the exceeding of the social carrying capacity. On the contrary, some rural regions have a low density of tourism lodging supply and overnight stays. They would apparently have space to grow in the future, though specific assessments should be done in each case, considering specific territorial and environmental constraints.

### **Data sources**

Data is extracted from Eurostat: Number of establishments, bedrooms and bed-places by NUTS 2 regions (code tour\_cap\_nuts2); Number of establishments, bedrooms and bed-places by coastal and non-coastal area and by NUTS 2 regions (code tour\_cap\_nuts2c); Number of establishments, bedrooms and bed-places by degree of urbanisation and by NUTS 2 regions (code tour\_cap\_nuts2d); Nights spent at tourist accommodation establishments by NUTS 2 regions (code tour\_occ\_nin2); NUTS 2 (2010). Frequency: annual.

### **Methodology for indicator calculation**

Both sub-indicators referred to units per area of NUTS 2 region. The indicator was presented at NUTS 2 level.

### **Uncertainties**

Data only takes in consideration official commercial establishments. It does not cover other types of tourism accommodation (B&B, sharing economy establishments, second homes, etc.).

## **P2 – Tourism intensity**

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Sub- indicators:

- Number of tourism arrivals per 100 residents
- Number of overnights spent per inhabitant
- Number of bed-places in tourist accommodation establishments per 100 residents by NUTS 2 (overall, in urban areas, in rural areas, in coastal areas)

### **Key policy question**

What are the most tourism intensive regions in Europe?

### **Rationale**

This indicator shows the relative importance of tourism demand in each territory in relation to its inhabitants (pressure). Tracking the number of tourists and (especially) overnight stays in a destination is also a way of measuring the relative impact of tourism on residents' way of life, local environment and resources. Despite the difficulties of quantifying the real impact of tourism on the environment, any increase in the number of tourists and people in a certain area undoubtedly has an impact on environmental variables such as waste generation, water consumption and energy consumption (in terms of volume and local level), as well as air quality affected by local transport pollution. The sub-indicator 1 has its correspondence with the indicator C.1.1. (Number of tourists/visitors per 100 residents) from the ETIS system (Section C: Social and cultural impact).

### **Policy context**

EC and national policies on tourism and sustainable tourism. Different targets depending on the region / country. For example, some mountain regions (i.e. Alps), as well as some coastal regions (i.e. coastal Croatia, Balearic, Canary, Greek islands, etc.) show a high number of tourism demand in relation to their population. It would seem that in those areas it would be recommendable to control further growing in order to avoid the exceeding of the social and environmental carrying capacity. On the contrary, the

territorial fringe that goes from Southern Finland to Northern Greece has a low intensity of tourism demand. It would apparently have space to growth in the future.

#### **Data sources**

Data is extracted from Eurostat: Arrivals at tourist accommodation establishments by NUTS 2 regions (code tour\_occ\_arn2); Nights spent at tourist accommodation establishments by NUTS 2 regions (code tour\_occ\_nin2); Number of establishments, bedrooms and bed-places by NUTS 2 regions (code tour\_cap\_nuts2); Number of establishments, bedrooms and bed-places by coastal and non-coastal area and by NUTS 2 regions (code tour\_cap\_nuts2c); Number of establishments, bedrooms and bed-places by degree of urbanisation and by NUTS 2 regions (code tour\_cap\_nuts2d); population on 1<sup>st</sup> January (tps00001).

Frequency: annual.

#### **Methodology for indicator calculation**

All the sub-indicators are presented as relative units per residents by NUTS 2.

#### **Uncertainties**

Data only takes in consideration official commercial establishments. It does not cover other types of tourism accommodation (B&B, sharing economy establishments, second homes, etc.).

### **P3 – Occupancy rate**

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#### **Policy question**

What are the most tourism intensive regions in Europe?

#### **Rationale**

While a count of the total number of bed places may be of interest in relation to the capacity of different regions to respond to tourism demand, those working within the tourism industry are more likely to be interested in net occupancy rates for bedrooms (room rates are often considered the preferred measure insofar as the turnover of a double room is often similar irrespective of whether the room is occupied by one or two persons). It also provides indirect information on how efficiently the available facilities are used. This indicator has its correspondence with the indicator B.2.2. (Occupancy rate in commercial accommodation per month and average for the year) from the ETIS system (Section B: Economic value).

#### **Policy context**

EC and national policies on tourism and sustainable tourism. In terms of economic sustainability, the main target for the tourism industry would be to increase net occupancy rates at all levels (local, regional, and national), although this should be well balanced with environmental and social sustainability of tourism activity.

#### **Data sources**

Data is extracted from Eurostat: Net occupancy rate of bed-places and bedrooms in hotels and similar accommodation (NACE Rev. 2, I, 55.1) by NUTS 2 regions (from 2012 onwards) (tour\_occ\_anor2)

#### **Methodology for indicator calculation**

No further processing is required. Data is presented as bedroom occupancy rates in hotels and similar establishments by NUTS 2.

#### **Uncertainties**

Data only takes in consideration official commercial establishments. It does not cover other types of tourism accommodation (B&B, sharing economy establishments, second homes, etc.).

### **P4 – Most attractive places**

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#### **Policy question**

Where are the most attractive places?

#### **Rationale**

People are attracted by different values, some of them inherent to the place like nature, cultural values, aesthetics, but also for the possibility to develop certain activities (like golf courses or hiking). The combination of these elements results in hot spots, i.e. places where more people feel attracted and the need to share on the social networks. Attractive places reflect areas with higher probability of tourism presence and, therefore, higher pressure either to the environment but also potential social conflicts with residents.

#### **Policy context**

EC and national policies on tourism and sustainable tourism. EU regulations regarding coastal and marine ecosystems: Marine Strategy Framework Directive, Habitats Directive. National and sub-national spatial planning regulations

#### **Data sources**

Primary data is based on density of pictures uploaded to Panoramio. Panoramio is a geolocation-oriented photo sharing mashup owned by Google that has been integrated to Google Maps from November 2016. The site's goal is to allow Google Maps and Google Earth users to learn more about a given area by viewing the photos that other users have taken at that place. Metadata of each photo within the full European extent has been downloaded, which includes: coordinates, unique user ID (anonymised), and time when the picture was uploaded to Panoramio.

#### **Methodology for indicator calculation**

Point data was aggregated at 1 x 1 km European Reference Grid allowing for representation at different reporting units (grid, NUTS3, NUTS2). In order to identify areas with higher concentration of spatially correlated pictures, the Getis-Ord  $G_i^*$  statistic was applied. These areas could be considered hot spots or more attractive areas. Since urban areas tend to concentrate a higher number of pictures, this could obscure rural hot spots. Therefore the Getis-Ord- $G_i^*$  has been applied separately to urban areas and to rural areas according to the classification "Degree of urbanisation classification" developed by DG Regio.

#### **Uncertainties**

The growth of social media and access to them by most part of the population is generating new sources of information that can provide insights on people's preferences and behaviour. Although the use of social media is still restricted to certain segments of population (technological divide) and not all those using this social media can be considered tourists, there is already some evidence on the potential uses and pitfalls. In this case, it is assumed that the most photographed areas are hot spots of tourist attraction. However, other factors may have strong influence like accessibility, cultural aspects, use of other social networks etc. As a first validation, though, it has been found that the number of pictures per NUTS2 region shows a positive correlation with overnights spent (0.73).

## **P5 – Tourism and leisure pressure on protected areas**

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### **Key policy question**

Where are the potentially most frequented Natura 2000 sites?

### **Rationale**

People is attracted by different values, some of them inherent to the place like nature, cultural values, aesthetics, but also for the possibility to develop certain activities (like golf courses or hiking). The combination of these elements results in hot spots, i.e. places where more people feels attracted and the need to share on the social networks. Attractive places reflect areas with higher probability of frequency and, therefore, higher pressure either to the environment but also potential social conflicts with native people. The growth of social media and access to them by most part of the population is generating new sources of information that can provide insights on people's preferences and behaviour. Although the use of social media is still restricted to certain segments of population (technological divide), there is already some evidence on the potential uses and pitfalls.

### **Policy context**

EC and national policies on tourism and sustainable tourism. EU regulations regarding coastal and marine ecosystems: Marine Strategy Framework Directive, Habitats Directive. National and sub-national spatial planning regulations.

### **Data sources**

Primary data is based on density of pictures uploaded to Panoramio (see P4). Metadata of each photo for the full European coverage was downloaded, which included: coordinates, unique user ID (anonymised), and data when the picture was uploaded to Panoramio. Delineation of Natura 2000 sites are extracted from BISE (Biodiversity Information System for Europe).

### **Methodology for indicator calculation**

Number of pictures per Natura 2000 site were calculated by overlying the layer with density of photographs (from Panoramio, indicator P4) with the boundaries of Natura 2000 sites. Percentage of Natura 2000 site covered by hot spots (see the methodology of indicator P4 – Most attractive places) was obtained by overlying the delineation of Natura 2000 sites with the layer of rural hot spots.

### **Uncertainties**

The same as P4.

## P6 – Water abstraction by tourism

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### **Key policy question**

Are we reducing pressures on the natural resources?

### **Rationale**

Water, and especially freshwater, is one of the most critical natural resources. The tourism industry generally overuses water resources for hotels, swimming pools, golf courses and personal use of water by tourists and this results in water shortages and degradation of water supplies. The impacts from tourism occur when the level of visitor use is greater than the environment's ability to replenish the natural resources, creating enormous pressure on water resources.

### **Policy context**

Implementation of Water Framework Directive: 2000/60/EC and COM(2014)86: A European Strategy for more Growth and Jobs in Coastal and Maritime Tourism

### **Data sources**

Data has been extracted from Eurostat: Population on 1 January by age, sex and NUTS 2 region (code demo\_r\_d2jan dataset), nights spent at tourist accommodation establishments by NUTS2 regions (tour\_occ\_nin2 dataset), total nights spent by non-residents including nights spent at tourist accommodation establishments - monthly data at the country scale (code tour\_occ\_nim dataset). Swimming pool data has been taken from <sup>1</sup> Living conditions - functional urban areas (code urb\_llivcon dataset). Spatial data for the golf courses has been prepared by the ETC ULS (see I1).

### **Methodology for calculation**

Water abstraction has been estimated for the tourism sector and tourism infrastructure:

- Total water abstraction for households has been allocated to the number of nights spent of tourists and local resident while water abstraction for service sector has only been associated to the number of night spent of tourists
- As for water use for golf courses, theoretical water requirements for irrigation of golf courses has been estimated based on the grassland as reference crop suggested by FAO in accordance with Blaney-Criddle method.
- Based on the technical specification provided by the European Swimming Pools Association, it was estimated the water requirement to fill up the public swimming pools and further escalate the rotation period to refresh the water in the swimming pools.

### **Uncertainties**

It is assumed that water use per capita is the same between tourist and local resident, despite existing literature suggests that one tourist can use around three times more water compared to local resident. The monthly data on nights spent at tourist accommodation establishments - at the country scale has been disaggregated to the NUTS2 scale in order to obtain the number of tourists per NUTS2 region on monthly scale. It is assumed the theoretical existence of one-to-one proportional relation between population of cities and number of tourist received by the respective cities. The assessment of water used for irrigation of golf courses in this analysis is certainly underestimated as many golf areas have sprinkler type of irrigation. However, the level of underestimation could not be escalated. Quantification of water abstraction for private swimming pool is incomplete due to the lack of full data coverage. There is no possibility to get the data e.g. on type of swimming pools or outdoor/indoor as well as on “private swimming pools”. Thus, the proxy used in this study for the swimming pool had to remain quite rough, even though it may be argued that private swimming pools in many water scarce prone areas may have impacts on freshwater resources.

## S1 – Bathing water quality

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### **Key policy question**

Is bathing water quality improving?

What is the performance of the waste and wastewater treatments of tourism?

What are the impacts of tourism development (construction, activities and infrastructure development) on the natural environment?

What are the reverse impacts of the environment on tourism?

### **Rationale**

Some of the most attractive tourism destinations are located in coastal areas or in interior regions that have inland beaches (in lakes, dams, or rivers). For many destinations the quality of the beach and in particular the water itself is a significant factor of choice of destination for tourists. The state (quality) of the water is an indicator of environmental management of waters (sewage treatment, pollution, etc.).

Tourism can contribute to this pollution, but at the same time it can also be negatively affected by a low quality of bathing waters (negative perception by the tourists). This indicator has its correspondence with the indicator “Level of pollution in seawater per 100 ml (faecal coliforms, campylobacter)” from the ETIS system (Section: Supplementary indicators – Maritime and coastal tourism).

#### **Policy context**

Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality.

#### **Data sources**

WISE bathing water quality database (data from annual reports by EU Member States). The EU Bathing Waters Directive requires Member States to identify popular bathing places in fresh and coastal waters and monitor them for indicators of microbiological pollution (and other substances) throughout the bathing season which runs from May to September. Thus, results of the analysis are used to assess the quality of the bathing waters, classifying them as Excellent, Good, Sufficient, or Poor quality.

#### **Methodology for indicator calculation**

Data has been aggregated at European level to present trends over a period of 5 years. In addition, data is presented at country level to show current state. All results are presented as share of bathing water sites according to quality status.

## **I1 – Spatial impact of tourism facilities (I): Golf courses**

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### **Policy question**

Are we reducing the spatial pressure from tourism infrastructures?

### **Rationale**

Golf courses are important tourist attractions over all Europe. The golf resorts not only include the greens, but also - and most importantly in Mediterranean countries – they are the central part of touristic urbanisations and second home developments. The ratio of golf courses per administrative region (NUTS3) is seen as the most important attribute to illustrate in terms of spatial impact of this tourism facility.

### **Methodology for indicator calculation**

Due to the lack of consistent official data sources on golf courses, the spatial data for golf courses in Europe have been extracted from Openstreetmap (OSM), using the descriptor “golf\_course”. The resulting file of polygons for golf courses was cleaned from polygons not closely related to the extent of the golf course (buildings, access roads) and validated. The area was calculated for the final polygon layer and divided by the area of the corresponding NUTS3 region.

### **Uncertainties**

Being OpenStreetMap a voluntary mapping effort, the completeness and correctness of the dataset cannot be ensured completely. Nevertheless, visual tests have shown a very detailed delineation and a good coverage of golf courses around Europe.

## **I2 – Spatial impact of tourism facilities (II): Marina ports**

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### **Key policy question**

Are we reducing the spatial pressure from tourism infrastructures?

### **Rationale**

Marinas are important tourist attractions on the coast since they provide added value to the services offered in a particular place and tend to attract people with a specific tourism demands. The construction of the marinas often affects coastal ecosystems and has impacts the coastal morphology. However, the size of the marina in terms of moorings is an important indicator of the intensity of use. The more moorings a marina port has, the higher is the potential pollution by boat maintenance activities and the higher the potential pressure of recreational shipping activities. Studies have shown that anti-foulants residues are present in many port sediments, but the mobilization of pollutants bound in surface sediments in the frequently disturbed port environment represents a serious threat for the local marine environment in general. Finally, since the indicator is aggregated at NUTS3 level, the number of moorings is provided per km of coastline in order to have comparable figures. This indicator has its correspondence with the indicator “Number of berths and moorings for recreational boating” from the ETIS system (Section: Supplementary indicators – Maritime and coastal tourism).

### **Policy context**

COM(2014)86: A European Strategy for more Growth and Jobs in Coastal and Maritime Tourism  
MSFD: DIRECTIVE 2008/56/EC

Habitat Directive: Council Directive 92/43/EEC

IMO. 2005. International Convention on the control of harmful antifouling systems (AFS) on ships. 2005 Edition. IMO, London, 69pp.

#### **Methodology for indicator calculation**

Yachting harbour location and its size in terms of moorings have been extracted from different sources for the Mediterranean coast (Plan Bleu, National marina port associations, Portbooker.com). The EEA coastline dataset was split by NUTS3 regions in order to obtain the length of coastline within each NUTS3 region. The number of moorings corresponding to the NUTS3 regions was divided by the length of its coastline.

#### **Uncertainties**

Data for Spain come from the National Federation of Yachting harbours, hence are validated. Data for other countries is taken from a regional assessment (Plan Bleu) and a commercial web portal, hence attached with certain uncertainty as it does not represent official reporting data. The exact impact on coastal and marine environment has still to be validated by further studies. Available research already shows the impact on shoreline dynamics by the construction of marina ports and the existence of pollutants related to boat maintenance in the seabed.

### **I3 – Spatial impact of tourism facilities (III): Ski areas**

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Three sub-indicators:

1. Length of Ski slopes per km<sup>2</sup>
2. Length of Ski lifts per km<sup>2</sup>
3. Ski areas' pressure on Natura 2000 sites

#### **Key policy question**

Are we reducing the spatial pressure from tourism infrastructures?

#### **Rationale**

Three sub indicators are proposed to describe the pressures skiing exerts on mountain environments. The length of slopes and lifts is an indication of the physical impact and intensity of use of the skiing resorts. The longer the slopes the higher the fragmentation of habitats and the risks of avalanches. The longer the lift lines, the higher the amount of sealing of land and the infrastructures needed for construction. Based on these two sub indicators the ski area can be mapped which provides a rough information about the overall area of pressure of this form of winter tourism. When applying a potential pressure area around the ski area, the potential impact on Natura 2000 area can be mapped and analysed.

#### **Policy context**

- Habitat Directive
- Carpathian Convention
- Alpine Convention

#### **Methodology for indicator calculation**

There is no Pan-European layer for ski slopes, lifts or areas. Data on ski runs and lifts are extracted and filtered from OpenStreetMap (OSM) data. The lines related to ski runs and lifts are tagged accordingly in the OSM files. The different line features can be summarized and overlaid with the EEA Reference grid to map the length of ski slopes and lifts per square kilometre. For the ski area, the convex hull of the line features is calculated and taken as polygon of the ski area. The potential pressure on Natura2000 site is based on a smoothing methodology elaborated originally for land cover data (see references). The results are expressed in percentage of the area of a polygon that is overlaid with the smoothing area.

#### **Uncertainties**

Urban areas related to the ski area may not be part of the convex hull around the ski runs and lifts. Being OSM a voluntary mapping effort, the completeness and correctness of the dataset cannot be ensured completely. Not all ski areas may have been mapped in OSM, especially in remote mountain areas.

### **R1 – Percentage of destination that is designated for protection**

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#### **Key policy question**

What is the potential for promoting nature-based tourism in each territory?

#### **Rationale**

The more the territory under any nature protection scheme (Natura 2000, national and regional protected areas, etc.) is protected, the highest the probability to increase its use for nature-based tourism or ecotourism, as protected areas are the key destinations for these types of tourism.

**Policy context**

EC and national policies on tourism and sustainable tourism. EU regulations regarding terrestrial and marine ecosystems: Marine Strategy Framework Directive, Habitat Directive. National and sub-national spatial planning regulations.

**Methodology for indicator calculation**

Delineation of designated areas under national legislation, under EU Directives and under international conventions and initiatives are extracted from the Common Database on Designated Areas (EEA). The Europarc Federation provides the data on ECST awarded protected areas (European Charter for Sustainable Tourism).

**Uncertainties**

Not all the ecotourism and nature based tourism activity takes place inside protected areas, nor all the protected areas receive the same level of tourism visitation. Not all the protected areas that promote sustainable tourism have been awarded with ECST (there is a strong bias depending on the countries). However, it can be considered an indicator of commitment towards sustainability from management authorities and related stakeholders.

## **R2 – Percentage of tourism enterprises using environmental certification / labelling**

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**Key policy question**

Are tourism companies more environmentally responsible?

**Rationale**

Environmental certification or labelling in the tourism sector is one of the ways to assess the extent to which enterprises (especially in the tourist accommodation subsector) are actively incorporating sustainability principles into their operations and if they are involved in recognised (or qualified) eco-certification programmes and sustainability reporting procedures. This indicator has its correspondence with the indicator A.1.1. (Percentage of tourism enterprises/establishments in the destination using a voluntary certification/labelling for environmental /quality/sustainability and/or Corporate Social Responsibility) from the ETIS system (Section A: Destination management).

**Policy context**

EC and national policies on tourism, environment and sustainable tourism. Targets Increase significantly the implementation of EU Eco-label and EMAS in the tourism sector.

**Methodology for indicator calculation**

Data is extracted from DG ENV (European Commission).

**Uncertainties**

There exist many different types of certification tools for the tourism sector in Europe, especially for the accommodation sector. Most of them, though, are regional or for some specific country, while others are thematic (created and conceived for a specific type of tourism lodging -ie. rural tourism, camping sites, etc.). This makes very difficult to have a complete register of all the certified tourism enterprises at European level.

## **R3 – Number of Blue Flag awards**

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**Key policy question**

How effective are environmental management and monitoring tools towards a more integrated tourism strategy?

**Rationale**

Blue Flag is the most renowned eco-label in the world, specifically created for beaches and marinas. It is an indicator of environmental (and safety and services quality) performance for coastal destinations. This indicator has its correspondence with the indicator “Percentage of beaches awarded the Blue Flag” from the ETIS system (Section: Supplementary indicators – Maritime and coastal tourism).

**Policy context**

EC and national policies on tourism, environment and sustainable tourism, even though Blue Flag is a voluntary certification system.

**Methodology for indicator calculation**

Total number of beaches and marinas per country provided by the Foundation for Environmental Education. Sub indicator on share of marina port capacity with Blue Flag: percentage of marinas port capacity with Blue Flag in relation to the total marina port capacity of the region. Further work Data needs to be regularly updated. This will allow analysing trends. A new sub indicator could be also created, calculating the number of Blue Flags (beaches) per km of beach.

## Uncertainties

Not all the countries (and regions within a country) promote at the same level of intensity the application for the Blue Flag awards.

## Conclusions

Tourism is an important sector for the European economies but also a major driving force determining pressures and impacts on the environment. Despite many environmental related policies acknowledge these pressures and impacts and call for the sector to become more and more environmentally sustainable it is still quite difficult to define a baseline and to measure to what extent this sustainability goal is being progressively achieved and where in Europe, despite some scattered cases of ad hoc EU funded and sector based projects (soft mobility, energy saving in hotels, waste management)<sup>6</sup> and the relevant number of destinations that have on an ad hoc basis so far voluntarily adopted ETIS<sup>7</sup> This difficulty lies partially in the complex and cross-cutting nature of the sector that involves many other sectors in the challenge for sustainability. Another limitation is posed by the remarkable amount of socio-economic information about tourism that reflects the particular emphasis of the current European policy to boost the competitiveness and growth of the sector on the global markets but that is not yet particularly suitable for the environmental dimension - also for a matter of reporting units - although useful to delineate a picture of the socio-economic drivers and- with dedicated efforts - profiles of prevailing consumption patterns. The lack of environmental policy targets is thus reflected in the fragmented available environmental data on tourism.

Currently methodologies presented to developed proxies and ancillary data from emerging sources (e.g. Big data or open source geographic data) provide an opportunity to downscale existing information and develop first assessments. As a consequence, a first indicator based framework is provided. However, this is a first stage of a process that should continue on time and consolidate an increasing number of indicators and data that should allow to report on the tourism and environment relationships in Europe, while awaiting that European statistics may in the future also better represent the environmental dimension of tourism impacts, as recently recommended by the European Commission<sup>8</sup>.

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<sup>6</sup> For example, such as ERNEST project (<http://www.ernestproject.eu/coalap/pages-ernest/551.jsf>) on sharing knowledge, SCOW project (<http://www.biowaste-scow.eu/>) on waste, project NEZEH (<http://www.nezeh.eu/home/index.html>) on energy saving in hotels, Project Starter (<https://ec.europa.eu/energy/intelligent/projects/en/projects/starter>) and Project SEEMORE (<https://ec.europa.eu/energy/intelligent/projects/en/projects/seemore>) on soft mobility at destination level.

<sup>7</sup> The first version of ETIS (2013) was voluntarily and successfully implemented in 2 pilot phases (2013-2015), by over 100 destinations (including non-EU destinations). This allowed to review the system and to launch a new one in 2016 (European Commission, 2016).

<sup>8</sup> COM(2016) 489 final. REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL on the implementation of Regulation (EU) No 692/2011 of the European Parliament and of the Council concerning European statistics on tourism.