Towards a multidimensional biodiversity conservation index for tourism destinations

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MSc. International Tourism Management

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Content

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Abstract

Tourism is a source of income for different destinations around the world, and it's directly linked to the environment and biodiversity. The existence of this human industry and activity is also enabling the conservation of species and Protected Areas, where tourists also perform leisure activities. Traditional tourism relies on biodiversity in order to have ecosystem services such as food provision, and even as an asset to determine how attractive a destination is. While tourism relies on biodiversity, it can also harm it. Therefore, this thesis aims to propose an initial point for a multidimensional preliminary index to measure how much a tourism destination engages with the conservation of biodiversity.

The index is divided into five criteria that are consistent with literature previously published. The five criteria have their own indicators which are weighted for determining their value in the overall score. The maximum score for this multidimensional preliminary index is 20.85. The current multidimensional preliminary index can be still further developed into a more robust index that could be used in different contexts and destinations around the world.

Towards a multidimensional biodiversity index for tourism destinations

Acknowledgments

For my biggest source of inspiration: my family. To my dad, whose work on education has inspired me to try to bring good to others, to my brothers and sisters who have been role models in my life, and for Emma, whose life has reminded me to try to leave a better world behind my work. Special thanks to my supervisor Dagmar Lund Durlacher, whose guidance has been unvaluable for the development of this thesis. From student to student: go to Ikea on Westbahnhof for working on your thesis.

Towards a multidimensional biodiversity index for tourism destinations

Affidavit

I hereby affirm that this Master's Thesis represents my own written work and that I have used no sources and aids other than those indicated. All passages quoted from publications or paraphrased from these sources are properly cited and attributed. The thesis was not submitted in the same or in a substantially similar version, not even partially, to another examination board and was not published elsewhere.

Date
June 2022

Signature

Dulce Fabiola Vega Posada.

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1. Introduction

Economic growth and tourism have been proven to be positively correlated with effects such as higher employment, income, foreign exchange earnings, and the overall GDP of countries (Enilov & Wang, 2021; Hubert G. Scarlett, 2021; Naseem, 2021; Rasool et al., 2021). Throughout time, developing countries have found tourism an important source of income (UNWTO, 2011), especially developing countries, whose economic growth has tourism as a main contributor (Enilov & Wang, 2021). Particular examples of tourism's and economic growth's relationship have been found in Pakistan (Asif Khan et al., 2020), Mauritius (Ramesh Durbarry, 2004), Costa Rica (David Matarrita-Cascante, 2010), Thailand, India, and the Philippines (A. George Assaf, 2011).

However, tourism impacts can also be noticed outside of the economic sector, particularly on the environment and biodiversity (Hubert G. Scarlett, 2021; Juan Gabriel Brida et al., 2014; Muzafar Shah Habibulla et al., 2016). One of the reasons is because nature and adventure travel have crescent popularity among individuals (Anna Lind Björnsdóttir, 2018) (Balmford et al., 2009), and the activities in which the travellers engage while doing nature or adventure travel can compromise the natural environment in different ways but also ensure economic income for its support and conservation. Some examples of these activities are scuba diving(Toyoshima & Nadaoka, 2015), skiing(Törn et al., 2009), and camping. On the other hand, the development of "traditional" tourism also has an impact on natural areas because of the construction of new facilities, wrong deployment of sewage, increased use of natural resources, and agricultural communities' displacement (Costas Christ et al., 2003). The loss of ecosystems is one example of these impacts. As stated by the (OECD, 2019) globally and during a five year period -between 2010 and 2015- there was a loss of 6.5 million hectares of forests. For other types of ecosystems, such as mangroves, the decline of territory was 20% from 1980 to 2005; while for wetlands was 35% from 1970 and 2015. (OECD, 2019). In fact, worldwide wetlands are "*disappearing three times faster than other ecosystems and up to 40% of all plants and animal species can*

live on them", (UNEP, 2020) this is an example of biodiversity loss. Literature shows that tourism is one of the reasons for this ecosystem loss.

The case of Cancun, Mexico can be a good example of how "traditional" tourism can impact on the environment and natural areas. In this destination, the ratio of tourists to local residents was reported to be 2.6 million visitors a year by more than 300,000 individuals that were permanently residing in the territory (Costas Christ et al., 2003). In other words, in Cancun there are 8.6 tourists for each resident. These high levels have created situations such as low availability of fresh water per person, shortages of water, and degradation of wetlands (Costas Christ et al., 2003).

Another example is the loss of a mangrove that happened during the 2000's in Antigua, which was directly related to the touristic sector's growth, as reported by (UNEP-WCMC, 2016). The same review (UNEP-WCMC, 2016) pointed out that for counteracting this biodiversity loss, several actions should be taken in diverse sectors, including tourism and all its branches. While the relevance of biodiversity loss can be linked at first glance to only the environment, the situation can also be related to social issues such as poverty, gender inequality, low quality in health care, and vulnerability to natural disasters (Dilys Roe, 2019).

On the other hand, tourism, ecotourism, and specifically tourism in Protected Areas, is expected to increase (KC, 2021) and is also becoming more relevant for economic and trend reasons. However, an equilibrium between safeguarding biodiversity and Protected Areas, and tourism promotion to these areas should be achieved. This is why, measuring how much destinations are taking care of their biodiversity becomes important. Nevertheless, as pointed by (KC, 2021) there are several challenges, complexities, and methods when trying to do so.

The aim of this master thesis is to find the most important indicators that must be considered for measuring biodiversity conservation in tourism destinations and to create a condensed preliminary index that can be easily used in diverse world-

destinations. Thus, the research question of this thesis is: Which indicators and criteria for biodiversity conservation in tourism destinations should be considered? For achieving this goal qualitative methods are employed. The research starts with a Literature Review on the topic, followed by a review of indicator systems for sustainability in tourism and for biodiversity, which are then analysed in detail, and then evaluated by experts on the tourism sustainability, certification schemes, and biodiversity. The choice to analyse indicators, criteria and certification systems is due to the fact that these tools can show the reality in a simplified way while at the same time showing an understanding of the context in which they are measured (Anna Torres-Delgado & Francesc López Palomeque, 2018). Considering these characteristics of indicators, this thesis proposes then new condensed indicators and criteria on an easy-to-use index that will be useful for Destination Management Organizations and TourCert. TourCert is an innovation and certification entity for the tourism industry that aims to ensure and assess the continuous development and sustainability performance of tourism businesses and destinations (TourCert, 2021). This thesis considers the UN sustainable development agenda 2030 which highlights the role of tourism in goals related to "*natural resources, work, economic growth, responsible consumption, and production (United Nations, 2018)"*.

2. Methodology

In the present thesis, criteria and indicators for biodiversity conservation in tourism destinations are explored, reviewed, analysed, proposed, assessed, and condensed in an easy-to-use index. For achieving so, a qualitative methods approach is used. The qualitative method of this thesis consists first in an extensive literature review about biodiversity, tourism, their relationship, eight certification and indicators systems from different sources, and about the DPSIR framework.

After the literature review, the qualitative approach continues with eight indicator systems and frameworks regarding tourism and sustainability, and biodiversity. This first analysis resulted in the preliminary choice of indicators based on the availability of information and source. The first analysis results in an overview of 240 indicators.

After the first analysis, the indicators were reclassified according to the DPSIR framework, using the online tool Miró, which allowed the author to classify by colours and overview all the indicators in just one board. This classification allowed to discard 10 indicators that were redundant. The new classification with 230 indicators was then written on Excel as tables. These tables were useful for identifying 44 topics that were repeated throughout the indicators. Then, these topics were ordered in terms of relevance. This relevance was determined by the number of times the topics were repeated through the eight indicator systems. The new classification allows the overview of the role of each topic for biodiversity conservation in tourism destinations according to the DPSIR framework. Then, 12 topics were discarded because they were just mentioned once throughout the 230 indicators. This process resulted in the creation of a first-stage set of 22 criteria and 230 indicators.

Some indicators, specially from the indicator system from (Department for Environment Food & Rural Affairs, 2021), were focused in just one country. Considering that indicators should be relevant and simple (Edith Smeets & Rob Weterings, 1999) for the destination to measure, indicators were discarded because they were focused only in information about United Kingdom. The final count of these indicators analysis is 165 clustered in 22 criteria.

Another qualitative analysis is conducted in the form of literature review about each one of the 22 criteria. Section 5.0 explains which indicators were discarded and the reason. After this analysis, on Section 6.0, a set of five criteria and 27 indicators is proposed.

This set of 5 criteria and 27 indicators is assessed by a panel of experts which were selected following a judgemental criterion. The major criteria for their selection were that they are experts in sustainability certification. The list of 20 international experts was obtained with the help of the current thesis supervisor: Dr. Dagmar Lund-Durlacher. The assessment by the experts is carried out by an online survey of seven

questions on the platform "Survey Monkey". The structure of the survey follows the logic of the identified five criteria and asks for the expert opinion. This process allowed to determine how relevant, significant, and simple the criteria are. The survey overview can be seen on the *Appendix 6* of this thesis. The results and conclusion of this assessment can be seen in Section 7.0 of this document. Finally, Section 8.0 shows the final index proposed of criteria and indicators for biodiversity conservation in tourism destinations, while Section 9, addresses the limitations of this research.

3. Literature review

3.1 Defining biodiversity, tourism, and their relationship

Biodiversity, also known as biological diversity, is defined as the biotic variations that exist through three distinct levels: genetic, species and ecosystem. In other words, this means how many -*Population*- and different -*Diversity*- species of genes, plants and animals exist in a certain area (Hall, 2010b). In even simpler words, biodiversity is all the life that exists on earth, plants, animal, microbes, and fungi, including the genetic differences that exist among the same species. For academic definition, the current document takes into account the one made by (Convention on Biological Diversity, 2016) which is "*variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems*".

Biodiversity is considered as essential to human life because of the services that it provides to humans through ecosystems, such as clean water for human consumption, crop pollination, flood protection, and others (OECD, 2019). Around the world, ecosystem services' economic benefits have been valued to be up to 140 trillion US dollars yearly (OECD, 2019).

The importance of biodiversity has been recognized for several decades. A relevant starting point for recognizing its importance was the creation of the UN List of Protected Areas in 1962, which started with only 2.4 million square meters. In 2018,

the number of Protected Areas grew to 46 million square meters (UNEP-WCMC, 2018). According to (KC, 2021) 15% of the total land existing on Earth is under the protection of a Protected Area or a National Park. Protected Areas are defined as "*a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values*" (UNEP-WCMC, 2018). Protected Areas and Biodiversity concepts are closely interrelated, because the first one exists in order to promote the conservation of the second one. However (KC, 2021) argues that Protected Areas' role needs to integrate economic development.

Biodiversity has been in the spotlight for several years, mostly since the UN's decision to declare that 2010 was the International Year of Biodiversity (Hall, 2010a). However, the loss of Biodiversity is a concerning topic because according to (OECD, 2019) the earth is facing a mass extinction, with more than 60% loss of global vertebrate population, and its mostly because of human activities.

(Dilys Roe, 2019) mentions that besides the emotional connection of extinction of certain animals and species, biodiversity loss is also linked to poverty, gender inequality, health issues, and vulnerability to natural disasters. (OECD, 2019) argues that biodiversity loss will also increase the costs of raw materials in industries such as ecotourism and food production: agriculture, fisheries and aquaculture, industries that are also linked to tourism.

(Hall, 2010b) mentioned that there are five main forces driving biodiversity loss in a significant way, all the forces that are mainly powered by humanity. The five forces are "*habitat change, overexploitation, pollution, invasive alien species, and climate change*" (Hall 2010b). As it will be described further, tourism plays a role in these five forces.

One of the main rationales for biodiversity importance is that diversity can give stability and productivity to several key development sectors (Dilys Roe, 2019).

Biodiversity can give this productivity through production industries and stability because it provides the ecosystem supporting services. The (Secretariat of the Convention on Biological Diversity, 2000) considers that ecosystem services can almost be infinite, nonetheless for a better understanding the ecosystem services are separated into four types: "*provisioning, regulating, habitat, and cultural*" (Secretariat of the Convention on Biological Diversity, 2000). Tourism relies mainly in the latter - cultural- because it's a non-material benefit that humans can take for reasons such as identity, aesthetics, sense of home and spiritual experiences (Food and Agriculture Organization of the United Nations, 2021). The (OECD, 2019) developed a figure for portraying the types and examples of ecosystem services –*(Figure 1)* where one can see that tourism is assigned to cultural services. However, tourism also relies on the existence of provisioning services and regulating services for daily operations. Thus, biodiversity is also crucial for tourism' operations.

As mentioned, the ecosystem services have been also valuated in economic terms reaching values up to 125-140 trillion US dollars in 2011. According to (OECD, 2019) only the "Coral Reef Tourism" had an global estimated generated value of 36 billion US Dollars. It is important to mention that for estimating the value of the ecosystem services, these are classified in direct-use, indirect-use, option, and non-use values (Pearce, 2001). Tourism and recreation are considered to be of indirect use (Pearce, 2001).

According to (OECD, 2019), the Environment Profit & Loss accounting method can be useful for expressing in monetary terms the abundance of species, the potentially disappeared fraction, the natural capital value, and the risk of extinction. The same report (OECD, 2019) considers the Global Biodiversity Score, the Biodiversity Impact Metric, the Product Biodiversity Footprint, the World Data Base on Protected Area for data on policy responses, and the Biodiversity Habitat Index as key for understanding the state of biodiversity in the world.

(OECD, 2019) Types and examples of ecosystem services. Figure 1

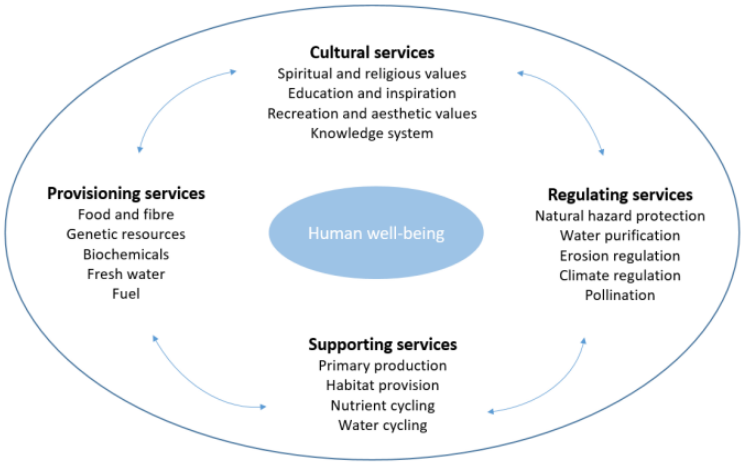


Figure 1 Types and examples of ecosystem services.

3.2 Defining tourism

The most frequently acknowledged description of tourism is the one stated by (UNWTO), organization that defines it as a "*social, cultural, and economic phenomenon which entails movement of people to countries or places outside their usual environment for personal or business and professional purposes*" (UNWTO). In order to this activity to be fulfilled, a complex system exists.

The system can be comprehensively overviewed with the framework from (Prosser, 2012) named as the "*tourism environment*" -*Figure 2*-. The tourism environment can develop or grow in several ways, and one of these ways is the sustainable development, which is "*applicable to all forms of tourism including mass tourism*" (UNWTO, 2021). Also consider that according to (UNWTO, 2021) *"sustainable tourism uses in an optimal way the environmental resources, maintains ecological processes, and preserves natural heritage and biodiversity*" (UNWTO, 2021). Thus, tourism, sustainable tourism and biodiversity conservation are related.

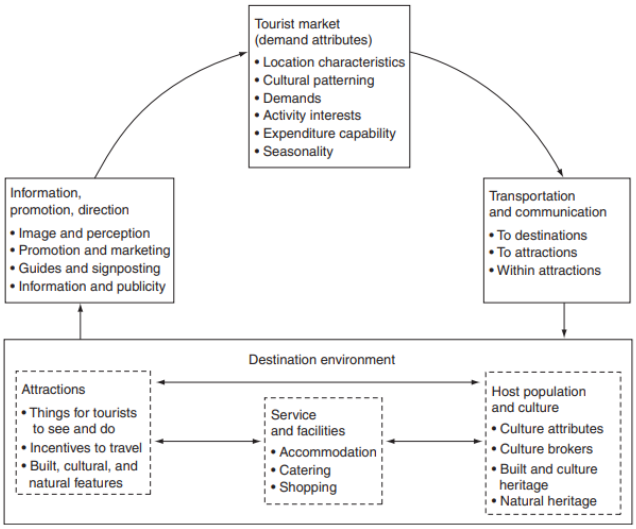


Figure 2 The Tourism environment *(Prosser, 2012)*

It is important to note also the official definition from (UNWTO) for tourism destination which is "*place visited that is central to the decision to take a trip*" (UNWTO). On "*A Practical Guide to Tourism Destination Management*" (UNWTO, 2011) defines it as a physical space with physical and administrative boundaries, with various stakeholders and with any scale. Therefore, whole countries, regions, islands or even cities and self-contained centres can be considered touristic destinations. According to (UNWTO), tourism destinations must have attractions and people should stay at least one day. For this matter, the Destination Management Organisations, or DMOs, become important because while they do not control the activities of the stakeholders and their partners, they can bring together expertise, objectivity, and resource for guiding the strategies and path that a destination can follow. The Destination Management Organisations can be either national, regional or local (UNWTO, 2011).

As seen on *Figure 2*, the destination environment -lower part of the chart- considers biodiversity as "natural features and natural heritage". These natural features can be considered attractions along with the built and cultural ones. Furthermore, the presence of natural heritage is also considered along with the other types of heritage such as built and cultural heritage. It is important to keep in mind that culture attributes

can also be related to nature. This has been called as an integration of cultural and natural heritage by (Ferretti & Comino, 2015).

Ecotourism must be also considered. The official definition of this type of tourism is "*Responsible travel to natural areas that conserve the environment, sustains the well-being of local people, and involves interpretation and education*" (KC, 2021). Since the activities are performed or done in natural areas, this can also happen in Protected Areas. (KC, 2021) mentions that "Protected Areas Tourism" is a subset of ecotourism that is growing at an annual growth rate between 10%-30% and that contributes to sustainable tourism and its three pillars which are economic, sociocultural and environmental. It is important to consider that the incremental popularity of ecotourism and Protected Areas Tourism can be beneficial from an economic point of view but can also be detrimental to biodiversity and sustainability because the carrying capacity can be exceeded (KC, 2021). Furthermore (Coria & Calfucura, 2012) also argues that these types of tourism in some cases have failed to deliver expected benefits, not only to the environment, but also to indigenous communities, whose place of living coincide with the most natural areas (Coria & Calfucura, 2012).

3.3 The Relationship between traditional tourism and biodiversity

Biodiversity faces pressures and threats that can range from climate change, to loss of territory -such as ecosystems, which in turn derives to loss or displacement of species of flora and fauna and fragmentation of ecosystems-, overexploitation of the natural resources, pollution, and to even invasion of foreign species, also called alien species (OECD, 2019). These pressures come from different industries and human activities which range from agriculture (OECD, 2019) to tourism (Coria & Calfucura, 2012).

Some specific examples of the pressures and dangers faced by biodiversity are: that more than 30% of fish stocks are fished at levels that are unsustainable (OECD, 2019), that "*around 8 million tonnes of plastic go into the oceans every year*" (OECD,

2019), and the increase of algae in the sea due to nitrogen and phosphorus introduction from inappropriate sewage systems (OECD, 2019).

The existing relationship between biodiversity, ecosystems, and tourism can be addressed from different perspectives and concepts: from attractiveness of a destination to economic impacts in the GDP, employment, competitiveness, and even marketing (Muzafar Shah Habibulla et al., 2016).

The relationship holds true even if the main attraction or attractiveness of the destination is based on a different characteristic rather than biodiversity because destinations, businesses and human life depend on the existence and quality of biodiversity (World Tourism Organization, 2010). Whether the destination is urban or rural, biodiversity plays different roles for supporting the existence of touristic and non-touristic infrastructure. Some examples of this are the supply chain of food and clean water, services that are named supporting services (World Tourism Organization, 2010). This is why (Hakim, 2017) describes biodiversity as a "backbone" of the touristic industry: because it has aesthetic functions, it can be a resource for goods, as well as be considered as an attraction, and supports processes that are key for the existence of the industry, the environment, ecosystems, and life on earth, such as pollination.

Another evidence of their relationship is that the Travel & Tourism Competitiveness Index considers "Natural and Cultural Resources" as one of the four pillars to be evaluated in order to determine the competitiveness of a particular destination (World Economic Forum, 2019), as if it were an asset of the destination. That pillar or subindex considers the number of Natural World Heritage sites declared by UNESCO, the amount in numbers of known species that exist in the destination, the total amount of Protected Areas, how attractive or beautiful these natural assets are, and the digital demand amount for natural tourism (World Economic Forum, 2019).

Furthermore, the index contemplates 10 indicators on environmental sustainability to determine the competitiveness of the destination. The names of the 10 indicators for this pillar are: (World Economic Forum, 2019)

1) "*Stringency of environmental regulations*
2) *Enforcement of environmental regulations*
3) *Sustainability of travel and tourism industry development*
4) *Particulate matter concentration*
5) *Number of environmental treaty ratification*
6) *Baseline water stress*
7) *Threatened species*
8) *Forest cover change*
9) *Wastewater treatment*
10) *Fish stock status*" (World Economic Forum, 2019).

3.4 Tourism positive and negative impacts on biodiversity

Tourism has positive and negative impacts on biodiversity (Pörtner et al., 2021), and ideally the first ones should outweigh the second ones. Overall, tourism has been considered beneficial to nature due to the following facts: it serves as justification for valuing biodiversity in economic terms; it can serve as a source for income for its management and conservation; it can be an alternative to other more detrimental industries; and it has the power to deliver education and awareness to people about biodiversity and its value (Hall, 2010b).

The "positive" economic impacts of biodiversity in tourism are mainly based in the revenues generated for entrance tickets, fees charges for the performance of certain activity, accommodation in or nearby protected areas, concessions, and other commodities. For example, (Steven et al., 2013) analysed the contribution of bird watching to the tourism revenue in natural areas of South America, Africa and neighbouring islands. Their results pointed that there was a contribution from birds to the tourism revenue that oscillated between 36 and 81%. However, the relationship was

also the other way around: their study points out that at least 10% of 41 birds species conservation depends on tourism revenue (Steven et al., 2013).

Another example of this is given by (KC, 2021) who stated that worldwide during 2015, terrestrial Protected Areas generated approximately 600 billion USD in revenue. The same author also argues that the expansion in number and territory of the Protected Areas can be considered as a biodiversity conservation strategy.

The example of the Korean Island called Jeju was taken as a case study by (Kim et al., 2020) as an evidence of how biodiversity is also essential for tourism and for the attractiveness of a destination. Their methodology included the usage of mobile-phone data to determine relationships between natural areas that were visited and the existing biodiversity trade-offs. Their results proved that biodiversity in term of species -that is, how many different species of a certain animal or plant exist in a certain place - had a spatial causality relationship with the areas that were most frequently visited, also in terms of density (Kim et al., 2020). The same holds true for attractiveness of a destination for areas in Indonesia, considered a mega-diverse country, where there is a positive relation between the number of visitors and outstanding biodiversity and landscapes (Hakim, 2017). This also holds true according to (Coria & Calfucura, 2012) who argue that when there is charismatic fauna, there will be higher income flows, thus there is a positive and clear correlation.

However, despite its positive effects and although tourism relies on ecosystems and biodiversity for properly functioning, if poorly managed it can also be a harmful factor to nature. One example is the chain of events that follow unplanned development of hotels and other touristic facilities, which can result in damages or loss of land in areas such as coasts, mountains, and jungles.

(Hakim, 2017) points that if the carrying capacity is surpassed, the environmental quality can be compromised. With the goal of generating more revenue, carrying capacity can be exceeded by attracting more tourists (Coria & Calfucura,

2012). Therefore, environmental degradation can occur. This potential negative chain of events can be triggered when the only source of economic support for natural areas is tourism (Coria & Calfucura, 2012).

Another way in which environmental degradation can happen is that it can divide natural areas in inconvenient ways for the ecosystems for the sake of urbanization and development of infrastructure. This is known as fragmentation (Fred Dyke, 2008). Furthermore, an unplanned development might carry inappropriate dischargement of waste, which derives in a disequilibrium of the existing nutrients and elements in the soil, water, or even air, due to decomposition or other processes. This is also known as pollution (Hakim, 2017).

Another negative impact of tourism in biodiversity is that it represents a major source of introduction of alien species for the sake of decoration or ornamental intentions. Invasive alien species can alter environmental processes, which can impact agriculture, or can even provoke pests and pressure on need of other resources (Shabani et al., 2020). An example is provided by (Haubrock et al., 2022), who found that 27 fish invasive species worldwide could have caused in 2017 an economic loss of $37.08 billion dollars. (Haubrock et al., 2021) also calculated in a more wider sense in Europe, arriving to the conclusion that in six decades Europe's costs of invasive alien species were 140.20 million dollars, although these estimates are considered to be conservative. (Anderson et al., 2015) assures that "*touristic areas*" and "*abundance*" or "*richness*" of non-native species, had a correlation in terrestrial, fresh water, and marine environments.

On the other hand, the human tourism activity affects the usual behaviour of animals. The main reason for this is due to the routes that are followed in tours, for disruption of the sounds and smells of the environment, and even for picking up activities, which can decrease the animal's capacity to eat, reproduce and have a "normal life" (Hall, 2010a). (Moorhouse et al., 2017) concluded that wildlife tourist attractions have negative conservation impacts and negative welfare impacts. The

explanations for this is the large proportion of interactions, inadequate diets of the animal, and disruptions on the daily lives of animals (Moorhouse et al., 2015a).

As (Muzafar Shah Habibulla et al., 2016) found out, international tourism arrivals is positively correlated to threatened species. In fact, the same authors observed that 10% increase in international tourists derives in equivalent biodiversity loss of 2% to 4%. The reasons that the author retrieves (Muzafar Shah Habibulla et al., 2016) – "*habitat disruption due to infrastructure's development, depletion of scarce resources, littering and pollution, and damage to coral reefs*" -are consistent with other literature.

As seen, although tourism has been considered as having a positive impact on biodiversity due to the common justification for valuing on economic terms the value of biodiversity, this industry can also harm it and, in fact, cause biodiversity loss. To try to counteract these effects, monitoring, measuring, and implementing strategies that will help the biodiversity to thrive and be conserved, should exist. However, the tourism industry should also be aware of green-washing practices. As mentioned by (OECD, 2019) consumers expect companies and businesses to be respectful towards biodiversity, however consumers might not be completely trustful that businesses will.

3.5 Certifications and indicators

Indicators are a necessary tool for identifying trends, but also for communicating and summarising trends of a given context or reality (Department for Environment Food & Rural Affairs, 2021). (Gema Florido Trujillo et al., 2018) mention that indicators are tools for measuring and valuing tourism' impact and development over time, although they need to be adaptable for each context and simple. Furthermore, indicators can measure reality or contexts in objective parameters, therefore enabling the comparison and the understanding of the processes that exist in a certain environment or process (Torres-Delgado & López Palomeque, 2018). For (Edith Smeets & Rob Weterings, 1999) indicators are mainly created for communication purposes because they promote information exchange. Therefore,

indicators should be simple, relevant and significant so they also can be compared and shared.

(Edith Smeets & Rob Weterings, 1999) also mentions that environmental indicators are enabling the policy makers to assess the seriousness of environmental problems which in consequence supports the development of policies and the monitoring on the effect and responses of those policies.

According to (Schernewski et al., 2014b), one of the drivers for developing indicator sets is the wish or need to do comparisons. In order to be relevant, indicators should be practical, this way they can be used for improvement of the reality and in the score, ensuring like this immediate benefits (Schernewski et al., 2014b). Furthermore, indicators have been used by the EU Sustainable development goals (Schernewski et al., 2014a).

(Rivero Marcelino Sánchez & Juan Ignacio Pulido Fernández, 2008) argue that for the case of sustainability and sustainable tourism, precise indicators have been difficult to be developed because sustainability is measured by indirect indicators that can be more or less related to sustainability and due to the lack of general agreement of indicators that could be applied to distinct contexts of touristic destinations.

(OECD, 2019) mentions that biodiversity is multidimensional and complex. Therefore, no single measure can capture its status and development, however other indicators on the status of ecosystems, efforts to preserve them and trends of change over time can create a picture of the current panorama. The (OECD, 2019) shares sources of potential data for indicators to measure the state of biodiversity by considering the information from policies of countries, from the Red List of Threatened Species, The Living Planet Index, and the reports from the Food and Agriculture Organization from the United Nations among others.

(Rivero Marcelino Sánchez & Juan Ignacio Pulido Fernández, 2008) argue that in order to achieve sustainable tourism, this should be measured, or at least a change over time in the dimensions of sustainable tourism should be recorded (Fernández & Rivero, 2009). On the other hand, the same authors say that while measuring sustainable tourism, a determination of the characteristics of sustainability and importance of these characteristics should be achieved (Fernández & Rivero, 2009). The main reason for this argument is that there is a need to ensure that programmes and products that are called sustainable are "really sustainable" (Fernández & Rivero, 2009).

(Gema Florido Trujillo et al., 2018) created a list of 12 criteria for the choice of indicators. These criteria are relevance, pertinence, rigor, possibility of application, availability, transparency, efficiency, reliability, clarity, comparability, sensitivity to changes, and participation.

On the other hand, (OECD, 2019) considers that mainstreaming biodiversity impacts and awareness through indicators is a priority for businesses. (Edith Smeets & Rob Weterings, 1999) also mentions that environmental indicators can be used for creating awareness among the public about the environment and its issues.

3.5 The Pressure State Response Impact Model & the DPSIR framework

This model has been used by the OECD for selecting, providing, and organizing indicators for different types of data in a way that is useful for the public, but also for decision makers (OECD, 2019). Although this model is useful for national, international, and global levels of decision making, it can be also used for ecosystems and subnational approaches (OECD, 2019). The proposal of this thesis is to use it for touristic destinations and the development of the biodiversity conservation indicators and criteria.

As its name points, the Pressure-State Response Impact Model is considered a framework for making a distinction between indicators or criteria for environmental

pressures, for environmental conditions and for societal responses (OECD, 2019). It is also useful because it considers the theory of change, which explains how interventions derive in developments or changes which can be analysed according to the evidence of the previous actions (United Nations Development Group). These three categories can be broken down to finance inputs, institutional changes, policies, changes in area coverage of protected areas, impacts of done efforts on awareness, etc. According to the (OECD, 2019) if the responses were effective, there should be an improved state of biodiversity. The Pressure State Model Response Impact Model can be seen in *Figure 3*.

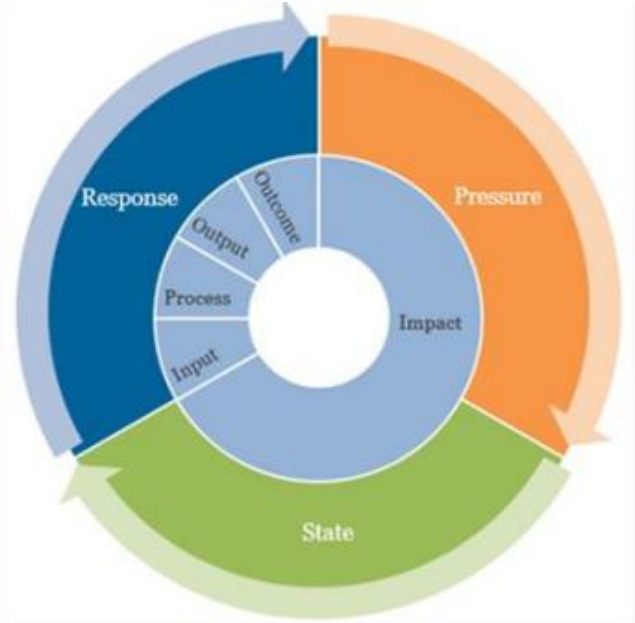
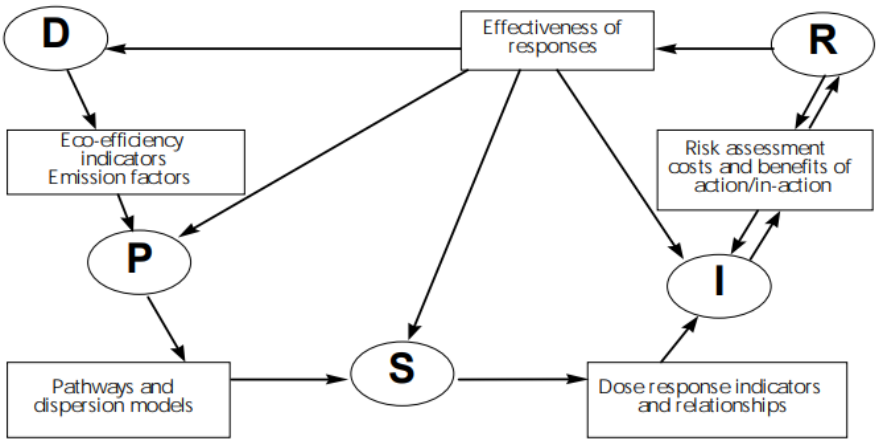


Figure 3 The Pressure State Response Impact Model.

(OECD, 2019) The Pressure State Response Impact Model.

On the other hand the DPSIR framework explained by (Edith Smeets & Rob Weterings, 1999) is used for reporting environmental issues. The framework poses that there is some sort of pressure coming from social or economic developments which makes the state of the environment to change. This change ultimately impacts the human health, along with the ecosystems and the materials that serve as a source for economic or other purposes. This loop completes with a response that feeds driving

forces which in turn also feed the "new" pressures. This process can be seen in *Figure 4* that portraits the Pressure, State, Impacts, Responses, Driving Forces and the linkages or connections.



(Edith Smeets & Rob Weterings, 1999)

Figure 4 Indicators and information linking DPSIR elements (Edith Smeets & Rob Weterings, 1999).

It is important to mention that according to (Edith Smeets & Rob Weterings, 1999) each stage of the DPSIR framework has different criteria. The Driving Forces criteria have to do with population growth, development needs, and activities of individuals and society. The Pressure criteria look after the changes in environmental conditions that might come in form of more emissions, biological agents, and the use of resources of the land. The State criteria describe quantity and quality of physical, biological, and chemical phenomena in a specific area. Impacts might be classified in primary effects, secondary effects, and tertiary impact; it is in the last one where loss of biodiversity lies. Finally, for the Response criteria one can consider that they are the reactions or actions done to "prevent, compensate, ameliorate, or adapt" to the new state of the environment. These actions or reactions can be done by the individuals, society, and governments. Thus, the proposal of this thesis is to use this framework to analyze the criteria and indicators that are identified from the following existing indicators systems for biodiversity, biodiversity conservation and sustainability from different academics and organizations.

Towards a multidimensional biodiversity index for tourism destinations

4. Overview of existing indicators for biodiversity and for biodiversity in tourism destinations

Some indicators and criteria have already been developed around the topic of biodiversity and some others for sustainability of tourism destinations. For the purposes of this master thesis, the already developed indicators and criteria from different organizations and entities will be analyzed applying the DPSIR model. But first, here is an overview.

4.1 The Convention on Biological Diversity

The Convention in Biological Diversity exists since 1993 and it's a legal commitment that serves as an instrument for ensuring three main goals: to make an effort on the preservation of biodiversity, to ensure the equitable sharing of benefits that arise from biological diversity, and to use biodiversity resources and its services in a sustainable manner. This pact was first ideated in 1992, as a sustainable development strategy and it has been ratified for more than 175 countries (Secretariat of the Convention on Biological Diversity, 2000). The CBD agreement considers the following main issues:

1) *"Measurement and incentives for conservation and sustainable use of biodiversity*
2) *Regulation to access of the sources*
3) *Access and transfer to biotechnology and technologies*
4) *Technical and scientific cooperation*
5) *Assessment of impacts and Financial Resources*
6) *Awareness and education*
7) *Reporting"* (Secretariat of the Convention on Biological Diversity, 2000)

Other commitments that the agreement looks upon are:

1) "*Identification and monitoring of biological diversity*
2) *Establishment of Protected Areas, prevention, and eradication of alien species*

3) *Rehabilitation and restoration of degraded ecosystem*
4) *Collaboration of residents*
5) *Maintenance of traditional knowledge about biological diversity and its use*
6) *Homogenization on reporting for biodiversity goals"* (Secretariat of the Concention on Biological Diversity, 2000)

The Conference of the Parties for the Convention of Biological Diversity created a list of goals, targets, and indicators for assessing progress on biodiversity conservation (Convention on Biological Diversity, 2006). The list is resumed in– *Table 1-*.

Blocks, Goals, Targets and Indicators from Convention of Biological Diversity			
Protect components of biodiversity	G1	T - 1.1 10% ecological regions effectively conserved and Target 1.2 areas of particular importance for biodiversity are protected	Coverage PA
			Trends biomes, ecosystems, habitats
			Abundance & distribution of species
	G2	T- 2.1 Restore, maintain or reduce decline populations & target 2.2 Status of threatened species, improved	Abundance & distribution of species
			Change in status of threatened species
			Abundance & distribution of species
			Coverage PA
	G3	T- 3.1 conservation of genetic diversity of crops, livestock, trees, fish and wildlife. Local knowledge maintained	Trends in genetic diversity of domesticated animals, cultivated plants, and fish species of major socioeconomic importance
			Abundance & distribution of species
Promote sustainable use	G4	T-4.1 biodiversity based production from sustainable managed sources and for conservation of biodiversity	Area of forest, agricultural an aquaculture ecosystems under sustainable management
			Abundance and distribution of selected species
			Marine tropic index
			Nitrogen Deposition
			Water quality in aquatic ecosystems
		T- 4.2 Reduced unsustainable consumption of biological resources	Ecological footprint
		T- 4.3 No endangered species of flora or fauna by international trade	Change in status of threatened species
Address threats to biodiversity	G5	T-5.1 Rate of loss and degradation of natural habitats is decreased	Trends biomes, ecosystems, habitats
			Abundance & distribution of species
			Marine tropic index
	G6	T-6.1 Controlled pathways for major potential alien invasive species	Trends in invasive alien species
		T-6.2 Existing management plans for threatening alien species	Trends in invasive alien species
	G7	T-7.1 Maintain and enhance resilience of biodiversity to climate	Connectivity or fragmentation of ecosystems
		T- 7.2 Reduce pollution	Nitrogen Deposition
			Water quality in aquatic ecosystems
Maintain goods and services from biodiversity	G8	T-8.1 Maintain the capacity of ecosystems to deliver goods and services	Water quality in aquatic ecosystems
			Marine tropic index
			Incidence of human-induced ecosystem failure
		T-8.2 Maintain biological resources tha	Health and well-being of locals
Protect traditional knowledge, innovation and practices	G9	T-9.1 Protect traditional knowledge, innovation, and practices	Status and trends of linguistic diversity and numbers of speakers of indigenous languages
		T-9.2 Protect rights of indigenous and local communities	

Table 1 Own compilation with information retrieved from (Convention on Biological Diversity, 2006)

4.2 The strategic plan for biodiversity 2011 – 2020

The strategic plan for biodiversity 2011-2020 is the CBD's plan that has been developed over the years. It contains the review of 20 targets and diverse indicators that consider biodiversity, its conservation, and the awareness of its importance (Convention on Biological Diversity, 2016) .

For each target, the plan has two types of indicators generic and specific (Convention on Biological Diversity, 2016). On *Table 2 and Table 2 Cont*, the indicators that are ready to use with the generic indicators are described along with the target that were aimed for. It is important to note that these targets were supposed to be achieved by the year of 2020, according to the AICHI Biodiversity Targets. (Convention on Biological Diversity, 2011).

Before introducing the tables, it is useful to have an overview of the nine targets that were omitted from the tables created for this thesis. They are be listed below:

1) Target 3 of the plan was to erase the subsidies that were harmful to biodiversity (Convention on Biological Diversity, 2016). For the scope of this master thesis, the ready to use indicators of this target will not be taken into account for the analysis because it out of control of the Destination Management Offices.
2) Target 7 of the plan was to ensure the conservation of biodiversity in areas where agriculture, aquaculture and forestry is practiced(Convention on Biological Diversity, 2016). Since this is not in control of the Destination Tourism Office the indicators for this target were omitted in the analysis of this thesis.
3) Target 13 considers the conservation of the diversity of plants that are cultivated for farming and of animals that are domesticated(Convention on Biological Diversity, 2016). Also, it considers a plan for minimizing genetic erosion by 2020. Since this is not under the control of tourism and DMOS, the indicators for this target were omitted.
4) Target 15 was increasing the resilience of the ecosystem through the restoration of 15% of the degraded ones, and improving their contribution to carbon stocks (Convention on Biological Diversity, 2011). No ready to use indicators were available.
5) Target 16 considers that by 2015 there should have been in force a protocol for sharing in a fair and equitable way the benefits of using ecosystems and

biodiversity. And that this protocol needed to be consistent with national legislation of the countries (Convention on Biological Diversity, 2011). Not in the control of Destination Management Offices.

6) Target 17 is that by 2015 countries should have national strategies or action plans developed for having effective participation of diverse stakeholders(Convention on Biological Diversity, 2016). Not in the control of Destination Management Offices but DMO can propose for the destination.
7) Target 18 is that by 2020, the national legislations consider the practices and knowledge of local and indigenous communities into their plans for conservation and sustainability of biodiversity(Convention on Biological Diversity, 2016). Ready to use indicators were not available.
8) Target 19 is that by 2020 the knowledge of the technologies related to biodiversity, its value, its operating status, trends of evolution and existence, and the consequences of biodiversity loss, is shared and applied(Convention on Biological Diversity, 2016). Ready to use indicators were not available.
9) Target 20 says that by 2020 there should be a considerable increase in the availability of financial resources for the effective implementation of the Strategic Plan for Biodiversity 2011-2020 (Convention on Biological Diversity, 2016). Indicators not considered since the target was subject to change.

Strategic plan for biodiversity 2011-2020 Targets, Indicators and Sources		
Targets by keyword - idea	**Generic Indicators**	**Specific Indicators**
1. Awareness of bioiversity value	Biodiversity Barometer	
	Online interes in biodiversity	
	WAZA visitor survey	
2. Biodiversity integrated in planning and strategies	Number of countries using the system of environmental economic accounting	
	Number of countries with biodiversity in National Development Plans	
4. Existing list of steps for sustainable use and production	Trends in population and extinction risk of species	Impacts of utilization - Red List Index
		Percentage of Category 1 Nations in CITES
		Red List Index for species in trade
	Trends in use of natural resources	Ecological footprint
	Ecological limits assesed	Water footprint
5. Halve loss rate of natural habitats	Trends in extent of forest	Trends in tree cover
		Forest area %
	Trends in extent of natural habitats, not forest	Change in extent of water-related ecosystems over time
		Natural habitat extent
		Weland extent
	Trends in extinction risk and population of habitat specialists	Red List Index for specialists
6. Ensure sustainable management and haverst of fish and invertebrate's	Trends in certified sustainable fisheries	MSC certified catch
	Trends in proportion of depleted, target and bycatch species with recovery plan	Number of countries with regulations
	Trends in population and extinction risk in target and bycatch species	Number of countries with policies to minimize the impacts of fisheries
		Number of countries with policies to secure safe biological limits
		Red List Index - Impacts of fisheries
	Trends in fishing practices	Global bottom trawling
		Amount of fishing in vulnerable habitats
		Countries with legislation for protection of water ecosystem
		Number of stoks with adaptative management system-plans
	Trends in proportion of fish stocks outside safe biological limits	Proportion of fish stocks within biologically sustainable levels
	Trends in catch per unit effort	Estimated fisheries catch and fishing effort

Table 2 (Own compilation with information retrieved from Convention on Biological Diversity, 2016)

Strategic plan for biodiversity 2011-2020 Targets, Indicators and Sources. Part II		
Targets by keyword - idea	**Generic Indicators**	**Specific Indicators**
8. Lower pollution levels to non-detrimental levels	Trends in pollutants emissions	NOX
		SOC
		POPs
		Mercury
		Pesticide use
	Trends in extinction risk due to pollution	Red List Index - Impacts of pollution
	Trends in ecosystems affected by pollution	Water Quality Index for Biodiversity
	Trends in nutrient levels	Nitrogen deposition trends
		Loss of reactive nitrogen to the environment trendd
		Global surplus of nitrogen trend
9. Identification and priorization of alien invasive species to be controlled	Trends in eradication of priority invasive alien species	Trends in invasive alien species vertebrate eradications
	Trends in extinction risk and population driven by invasive alien species	Red List Index - Impacts of invasive alien species
	Trends in the numbers of invasive alien species events introduction and establishment events	Red List Index - Impacts of invasive alien species
	Trends in implementation of policy responses preventing the introduction and establishment of invasive alien species	Proportion of countries with legislation for control of invasive alien species
10. Pressures on coral reefs and vulnerable ecosystems are minimized	Trends in extent and condition of coral reef	Proportion of live coral cover
	Extinction risk and population of coral and coral reef dependent species	Red List Index- Reef Building coral species
	Trends in species extinction risk and populations or condition of other vulnerable ecosystem	Climatic Impact Index for Birds
11. Equitanbly management of 17% of terrestrial and inland water. 10% of coastal and marine areas are conserved	Trends in area terrestrial inland water areas are conserved	Percentage of terrestrial and inland water areas covered by protected areas.
	Trends in area of coastal and marine areas conserved	Percentage or marine and coastal areas covered by Protected Areas
		Coverage of protected areas in relation to marine areas
	Trends in ecological representativeness of areas conserved	Protected area coverage of terrestrial and marine ecoregions
	Trends in effectiveness and or equitability of management of conserved areas	Protected area management effectiveness
		The Wildlife Picture Index
12. Prevent extinction of threatened species	Trends in number of extinctions	Trends in abundance of selected species
	Trends in extinction risk and population of species	Red List Index
		Living Planet Index
		Local Biodiversity Intactness Index
		Wild Bird Index
		Wildlife Picture Index
14. Ecosystem restored and safeguarded with the community	Trends in extinction risk and populations of species that provide essential services	Red List Index - species used for food and medicine and pollinating species
		Living Planet Index utilized species
	Trends in benefits from ecosystem services	Better Life Index
		Ocean Health Index
	Trends in the degree to which ecosystem services provide services for vulnerable groups	Prevalence of moderate or severe food insecurity
	Percentage of population with safe drinking water services	WHO

3 *Table 2 Cont, Own compilation with information retrieved from Convention on Biological Diversity, 2016)*

4.3 The ST Index

The ST Index surges as an alternative approach to two worldwide accepted indexes: the one created by the World Travel and Tourism Council, called "Tourism Competitiveness Monitor", and the index created by the World Economic Forum, named as the "Environmental Sustainability Index". The ST Index stands for the "Sustainable Tourism Index", it was created by (Fernández & Rivero, 2009) who argue that this index is more consistent and robust in comparison to the worldwide accepted indexes. The reason it's because it weighs the importance of each indicator according to factor analysis and correlation procedures. As a result, it enables the comparison of tourism destinations in terms of sustainability (Fernández & Rivero, 2009). This index uses four categories for classifying their indicators: driving forces, pressures, state, and responses. *Table 3, ST Index*, shows a list of the indicators (Fernández & Rivero, 2009).

ST Index				
Indicator	**Driving forces**	**Pressures**	**State**	**Responses**
	Total annual tourism expenditure	Potential pressure on natural areas.	Rating of the naturalness of the environment	Hotel establishment certified under environmental management regulation systems
	% of employees in the hotel restaurant sector	Tourist density in urban areas	Water Quality of continental inland bathing areas	Separated collection of packaging waste produced by tourism
	% of equivalent tourism population	Interventions carried our by Seprona on tourism and sport activities in natural areas		
	# of bed places in tourist accomodations per 100 inhabitants	Urban waste production attributable to tourism		
		Electricity consumption attributable to tourism		
		Tourism desitiy in sites of community interest		

4Table 3. Source: Own compilation with information retrieved from (Fernández & Rivero, 2009)

The specific indicators that are related to biodiversity and environment or sustainability are:

1) "*Potential pressure on natural areas.*
2) *Tourist density in urban areas.*
3) *Interventions carried out on natural areas where tourism and sport activities are performed.*
4) *Urban waste attributable to tourism.*
5) *Consumption of urban drinking water attributable to tourism.*
6) *Electricity consumption attributable to tourism.*
7) *Rating of the naturalness of the environment.*
8) *Water quality of continental inland bathing areas*" (Fernández & Rivero, 2009).

4.4 The ISOST Index for sustainable tourism

This index also weighs key variables, but furthermore it also includes the definition of sustainable tourism. In other words, this index considers the economic, social, and environmental dimensions of tourism. The tool was developed with empirical analysis and contains a set of 12 indicators that were applied to 20 destinations in Spain, obtaining information from the Statistical Institute of Catalonia (Anna Torres-Delgado & Francesc López Palomeque, 2018).

For classifying the indicators, the authors have three categories, considering the pillars of sustainability: sociocultural, economic, and environmental, however for their analysis they also considered the DPSIR framework (Anna Torres-Delgado & Francesc López Palomeque, 2018). The indicators can be seen in the *Table 4*, below which also contains how to calculate each indicator.

ISOST Index for sustainable tourism		
dimension	**Indicator**	**Calculation**
Sociocultural	Tourist Population	% Seasonal tourist population
	Diversification of tourism attraction and resources	Number of different types of tourism resources
	Tourism products accessible to disabled	Number of different types of adaptations for the disabled
Economic dimension	Seasonality of tourism offer	% tourism places available, annual mean
	Presence of second homes	% second homes
	Public investment in tourism	% of budget spent on tourism
Environmental dimension	Energy consumption	Consumption Kw h/PTP/day
	Water consumption	Consumption litres/PTP/ day
	Waste generation	Waste kg/PTP/day
	Land use distribution	% urban land use
	Environmentally certified tourism establishments	% environmentally certified tourism establishments
	Environmental criteria applied to tourism planning	Number of tourism plans incorporating environmental criteria

5Table 4 – Information from (Anna Torres-Delgado & Francesc López Palomeque, 2018)

4.5 The UK biodiversity indicators 2021

The United Kingdom has a biodiversity policy considered a shared responsibility between England, Scotland, Wales, and Northern Ireland (Department for Environment Food & Rural Affairs, 2021). Within the policy, some indicators are in process of development, in order to have a record of progress made for the commitments done in the United Kingdom. In the specific case of this report, and according to the authors, the indicators developed are also aimed to enable international

reporting and are suitable to be used for country reporting (Department for Environment Food & Rural Affairs, 2021). For developing them, almost 100 organisations were involved, and each indicator comprises one or more measures that have changed over time (Department for Environment Food & Rural Affairs, 2021). The current thesis lists 27 in *Table 5:* those that are mentioned to have a change over time, omitting the ones without enough data or under development.

UK Biodiversity Indicators		
Indicators	**Type**	**Calculation or source**
Volunteer time spent in conservation	Response	hours spent by volunteers in charities and public bodies
Area of land in agri-environmental schemes	Response	Department of Agriculture, Environment, and Rural Affairs, Governments
Area of forestry land certified as sustainably	Response	Woodland certification schemes / Forest Research
Percentage of marine fish stocks harvested sustainably	Pressure	UK quota. Centre for Environment, Fisheries and Aquaculture science
Percentage of marine fish, quota, stocks of UK interest	State	
Area affected by acidity	Pressure	UK Centre for Ecology & Hydrology
Area affected by nitrogen	Pressure	
Freshwater invasive species	Pressure	Botanical Society of Britain & Ireland; British Trust for Ornithology & UK Centre for Ecology & Hidrology; Marine Biological Association; National
Marine coastal invasive	Pressure	
Terrestrial invasive species	Pressure	
Surface water status	State	Water Framework Directive; Department of
Total Extent of protected areas, on land	Extent-Response	Joint Nature Conservation Committee; Natural England; Natural Resources Wales; NatureScot; Northern Ireland Environment Agency
Total Extent of protected areas, on sea	Condition State	
Condition of Areas/Sites of Specia Scientific Interest	Response	
Status of UK habitats of European importance	State	UK Habitats Directive reports to the EU
Status of UK species of European importance	State	
Relative abundance of priority species	State	Bat conservation Trust, British Trust for Ornithology; Butterly Conservation; UK Centre for
Distribution of priority species	State	Biological records from national schemes and local data centres
Farmland birds	State	British Trust for Ornithology; Defra; Joint Nature Conservation Committee; Royal Society for the Protection of Birds
Woodland birds	State	
Wetland birds	State	
Seabirds	State	
Wintering waterbirds	State	
Insects of the wider	State	Butterfly Conservation; Uk Centre for Ecology &
Mammals of the wider	State	Bat Conservation Trust
Animal genetic resources	State - Benefit	British Pig Association; Defra, Grassroots systems
Plant genetic resources	State - Benefit	Eurisco Catalogue
Fish size classes in the North Sea	State - Benefit	Centre for Environment, Fisheries; and Aquaculture Science; Marine Scotland
Removal of greenhouse gasses by UK forests	Benefit	Deparment of Business, Energy & Industrial Strategy
Status of pollinating insect	State - Benefit	Bees, Wasps & Ants Recording Society; Biological Records Centre; Hoverfly Recording Scheme

6(Table 5 Own compilation with information from Department for Environment Food & Rural Affairs, 2021)

4.6 TourCert

TourCert developed an auto evaluation of sustainability and biodiversity that should be carried out in tourism destinations. It consists of 9 pillars with indicators that are answered by yes or no. An overview is provided in the following *Table 6 (TourCert)*

Tourcert	
Strategy & Planning	Politics and Sustainability Policies
	Tourism strategy
	Communication & Marketing strategy
	Sustainability councils
	Importance of sustainablity
	Sustainability Reports and records
Design of sustainable offers	Sustainable components of tourism products
	Visitor satisfaction
	Quality and innovation
	Information for visitors and sensibilizations
	Accessibility
Economic safety	Sustainable providors
	demand seasonality
Local Well-being	Ciclo economico regional
	Compatible Acquisitions with environment and ecology
	Quality and quantity of employment
Protection of nature and landscape	Tourism impact on nature and environment
	Cooperation of stakeholders of conservation
	Conservation of biodiversity
	Landscape and urban image of the town
	Orientation of visitors in the region and town
Resource Management	Climate actions on climate change
	Concepts of responsible touristic mobility
	Use of environmentally friendly transport
	Responsible mobility in the region - place
	Climate change prevention and environmental conservation in businesses
	Water consumption and waste generation
	Noise, air quality and water quality
Culture & Identity	Protection and conservation of cultural heritage
	cultural identity
Common well-being	Risk management
	Employment quality and goog work conditions for families
	Acceptance of tourism
	Volunteer commitment and local participation
Sustainability Council	Objectives and mission clear
	Groups of stakeholders identified
	Legal Status
	Economic stability
	Sustainable Acquisitions of the Council
	Natural areas and outsise instalations
	Resources consumption
	Friendly-Useful mobility
	Stakeholders behaviour is respectful to environment
	Working conditions
	Justice & Inclusion

7(Table 6 Own compilation with information from TourCert)

4.7 Self-checks by Ecotrans, Adelphi and Global Nature Fund

Ecotrans is non-profit organization that aims to help tourism businesses and Destination Management Organizations to achieve development in the topics of ecology, sustainability, and local development (Ecotrans e.V, 2015). In 2004, they developed DestiNet where they gather and publish information of certifications and indicators systems that are available worldwide. Among the documents, users can find self-checklist for businesses, destinations and tour operators, which were created in collaboration with the independent think-and-do tank Adelphi, and the Global Nature Fund, an international foundation dedicated to nature and the environment (Ecotrans e.V, 2015). Indicators of these self-checklist can be found on *Table 7* (Ecotrans e.V, 2015).

8 (Table 7 Own compilation with information from Ecotrans e.V, 2015)

DestiNet to Tourism 2030 from Eco Trans - Selfcompliance check Businesses, Destinations and TourOperators	
Knowledge & Respect for environmental legislation	
Stablished goals for environmental management	
Annual report on biodiversity evolution	
Information given to tourism providors and stakeholders	
Influences tourism providors to do and promote activities in allowed areas	No tours to sensible areas
Promotion of good catch fish, ecological agriculture, products with animal respect and with green certification	
Promotion for not selling protected products	
Local businesses are motivated to protect ecosystems	
Knowledge and communiction of endangered species	
Knowledge of sensible nature areas from businesses, guests and tour providors know	
Tourist receive infor about nature and recieve information on how to act	
No animal spectacles are offered	
Ecotouristic options are offered	
Education & formation on sustainability is offered	
Protection of ecosystems and species with extinction risk	
The destination has made a compromise to cooperate with local actors for freeing transgenic	
Corporate volunteering	
Promotion of natural design of external instalations	
Knowledge of protected areas influences landscape development	
Close contact with authorities for environmental conservation	
Monitoring of tourism impact in biodiversity	
Use of information from monitoring for creating policies	
Management pressures government for waste management instalations	
Management pressures government for water management instalations	
Office supplies are certified or recycled	
No souvernirs are made from animals	
No plastic	
Ornamental plants are native	
Food waste reduction	
Biodegradable detergent	
Organic cotton	
Satisfaction survey includes biodiversity	
Gathering information of species in the instalations	
Construction made with responsible materials, no from the ones prohibited by CITES	
Knowledge about sustainable tourism certificates	
Stablishments of environmental protection and species conservation practices	
Hiring businesses with sustainability labels and that respect biodiversity	
Guests can participate in conservation projects or support them	

(Ecotrans e.V, 2015)

4.8 Sustainable urban cultural destinations

(Gema Florido Trujillo et al., 2018) proposed another approach to measure the sustainability in urban cultural destinations that attempts to be realistic and practical. Their indicators are divided in the four sustainability pillars: economic, governability, sociocultural, and physical – environmental. An overview of the table translated to English can be seen in *Table 8 and Table 8 Continuation*.

9 Table 8 Own compilation with information from Ecotrans e.V, 2015 10 Table 8 Continuation Own compilation with information from Gema Florido Trujillo et al., 2018

Sustainable urban cultural tourism destinations			
Dimension	**Indicator**	**Criteria**	**Source**
Environmental	Air quality	Mean particle value of NO2 and PM10	Air quality monitoring and control networks
	Noise Pollution	Decibel level in points of high tourist affluence. Critical	Noise pollution monitoring and control networks
	Illumination of unique heritage assets	Number of heritage properties with aesthetic lighting	Field work - direct observation
	Quality of illumination of heritage properties and spaces	Traditional character and degree of adaptation according to conditions of the environment of the heritage	Field work - direct observation
	Degree of conservation of the landscape of heritage interest tourism	Elements of landscape deterioration of the heritage-tourist spacio with respect to its original state	Field work - direct observation
	Environmental quality of	Degree of monitoring of the regulation on the physical	Planning special urban planning and field work (direct observation)
	Accesibility and mobility regulation	Count of roads with pedestrian and motorized use	Mobility plans and field work - direct observation
	Public parking facilities	Número de aparcamientos públicos en entornos	Mobility plans
	Public transport in tourist heritage tourist heritage sites	Lines and routes of public transport and number of seats available	Municipal transportation companies
	Degree of adaptation to disability	Compilation of adapted landmarks: urban environment, transport and	Existing regulations (transport) and field work (direct observation).
Economic	Supply of regulated tourist accommodation by type of establishment	Establishments by category and number of bedplaces. Dynamics of the hotel plant	Regional statistical services according to CNAE (section I, division 55).
	Relative weight of accommodation supply	Total number of tourist vacancies / Population by right.	INE: Hotel Occupancy Survey and Municipal Register of Inhabitants.
	Occupancy level of accommodation establishments.	Total number of overnight stays.	INE: Hotel Occupancy Survey by tourist points
	Average length of stay of visitors in the destination	Average length of overnight stays in lodging establishments.	INE: Hotel Occupancy Survey by tourist destinations.
	Income from lodging establishments	Revenue per available room	INE: Hotel Occupancy Survey by tourist destinations.
	Employment in the tourism activity as a percentage of total employment	(Population employed in the tourism sector / Total employed population) * 100	Autonomous statistical services: Affiliated to the Social Security by branches of activity
	Nature of the tourist trade and hotel and catering trade.	Specific orientation and qualification of the establishments.	Autonomous statistical services and field work.
	Increase in non-traditional activities in the area of analysis	Presence of commercial chains. Relative loss of traditional economic activities in a given period.	Autonomous statistical services and field work

Table 8 Own compilation with information from (Gema Florido Trujillo et al., 2018)

Social	Real estate assets with administrative recognition	Number of elements recognized by protection figures	Heritage catalogs and urban planning
	Visitable elements and places of interest	Number of visitable heritage elements in relation to the total number of visitable elements	Municipal tourist observatories
	Number of users in visitable elements	Number of visitors in heritage elements with regulated visitor counts	Municipal tourist observatories
	Diversification of the tourism product	Basic types of tourism products. Quantification and basic description.	Tourism statistics and field work
	Reception and visitor information equipment.	Number of facilities and their equipment.	Municipal tourism observatories and field work. Direct observation and questionnaires.
	Special events of tourist interest.	Number of events	Programming of municipal and private events
	Relationship between visitors and resident population	Characterization of the use of properties	Field work - direct observation
	Degree of tourism specialization	Relative weight of tourist activity compared to other uses	Directory of establishments with economic activity. Field work
	Perception of the local community on tourism activity.	Resident population's assessment of tourism activity, users and impacts on the physical and social environment.	Field work - questionnaires
	Users' perception of the tourist experience.	Visitors' assessment of the heritage environment, local way of life, tourist services, attitude of the local population	Field work - questionnaires
Governance	Structure for the management of urban-tourist destinations	Existence of specific agencies for tourism development	Municipalities
	Existence of management by means of public planning instruments.	Compilation of physical urban and tourism planning instruments: contents and coordination.	Autonomous Communities and Municipalities
	Mobility planning	Existence and nature of mobility plans.	City councils
	Quality distinctions	Recognition of environmental and tourist quality obtained by	Quality certifications
	Dissemination and promotion of the destination	Means of dissemination and degree of adaptation of the information to the reality of the destination.	Municipalities and tourism service companies. Field work - direct observation.

Table 8 Cont own compilation with information from (Gema Florido Trujillo et al.,

2018)

5.0 Analysis of Indicators

In order to analyse the previous indicator models the following process was followed. First, an overview of the eight tables was done using the online platform Miró, which allows the user to create dashboards with images and tables. The overview is included in *Appendix 1*. The dashboard for this thesis consisted of 8 tables with 240 different indicators. Each of the indicators was analysed and classified according to the DPSIR framework model. In other words, the 240 indicators were classified one by one as Driver, Pressure, State, Impact, and Response. Ten indicators were dropped because they were repetitive. This process allowed the author to identify 44 different sustainability topics that the indicator models considered.

The next step was to discard elements, the first criteria was repetition, those topics that were repeated at least twice were kept, and some others were integrated in other topics because they were related. This resulted in 22 criteria left, a bar plot was created – *Graph 1: Figure 5*-. The height of the bars represents the percentage in which each topic was mentioned in relation to the 230 indicators.

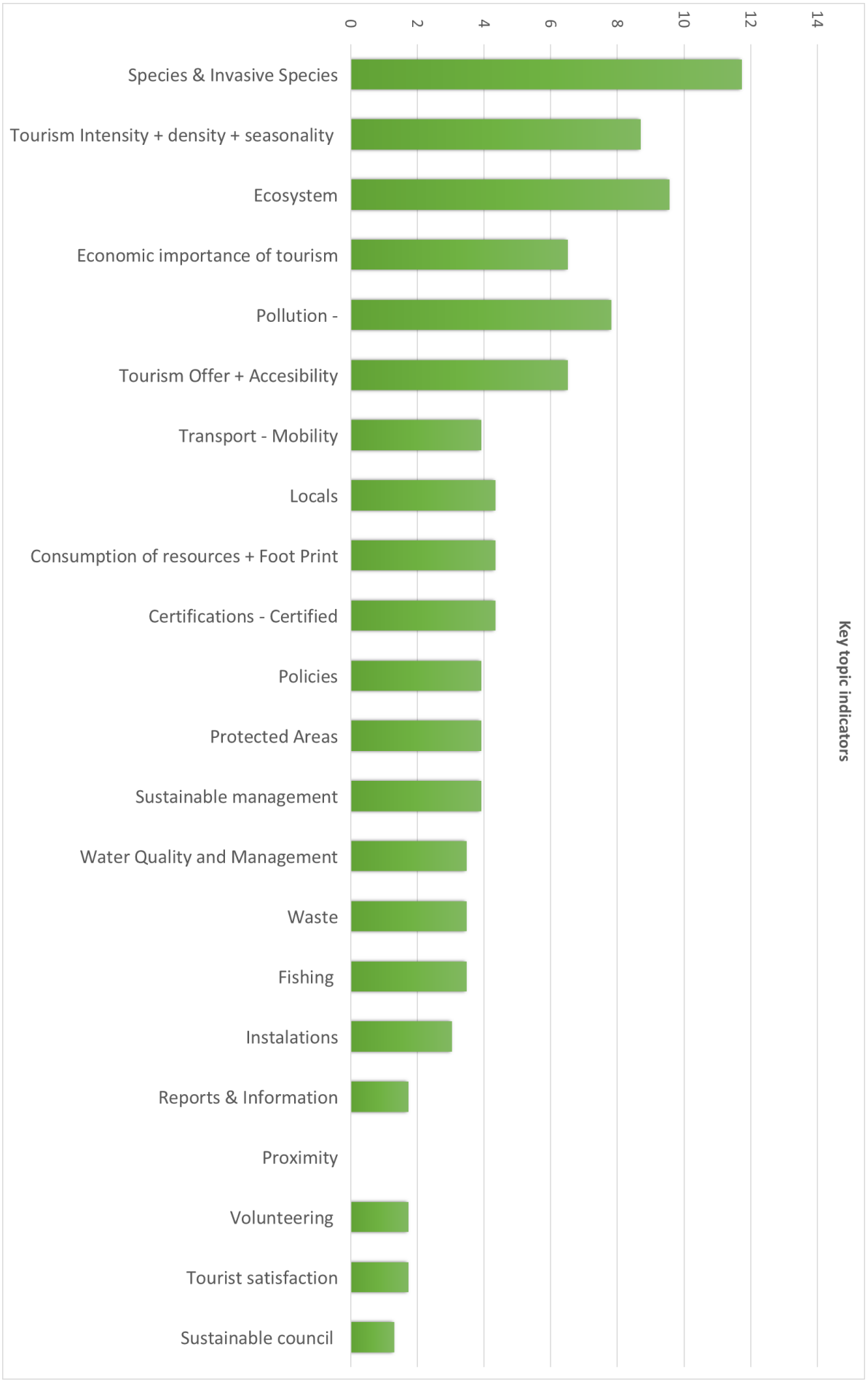

0
2
4
6
8
10
12
14
Species & Invasive Species
Tourism Intensity + density + seasonality
Ecosystem
Economic importance of tourism
Pollution -
Tourism Offer + Accesibility
Transport - Mobility
Locals
Consumption of resources + Foot Print
Certifications - Certified
Policies
Protected Areas
Sustainable management
Water Quality and Management
Waste
Fishing
Instalations
Reports & Information
Proximity
Volunteering
Tourist satisfaction
Sustainable council
Key topic indicators

Figure 5 Graph 1 Source: Own elaboration.

A round of iteration of analysis was done and indicators were discarded once more due to repetition, ambiguity and irrelevance. The indicator list dropped to a total number of 165 indicators, which were again classified in 22 criteria. The process of this elimination process is explained from Section 5.1 to Section 5.22. The repetition of each criterion in relation to the 165 indicators throughout the analysed frameworks is showed in *Graph 2 – figure 6.*

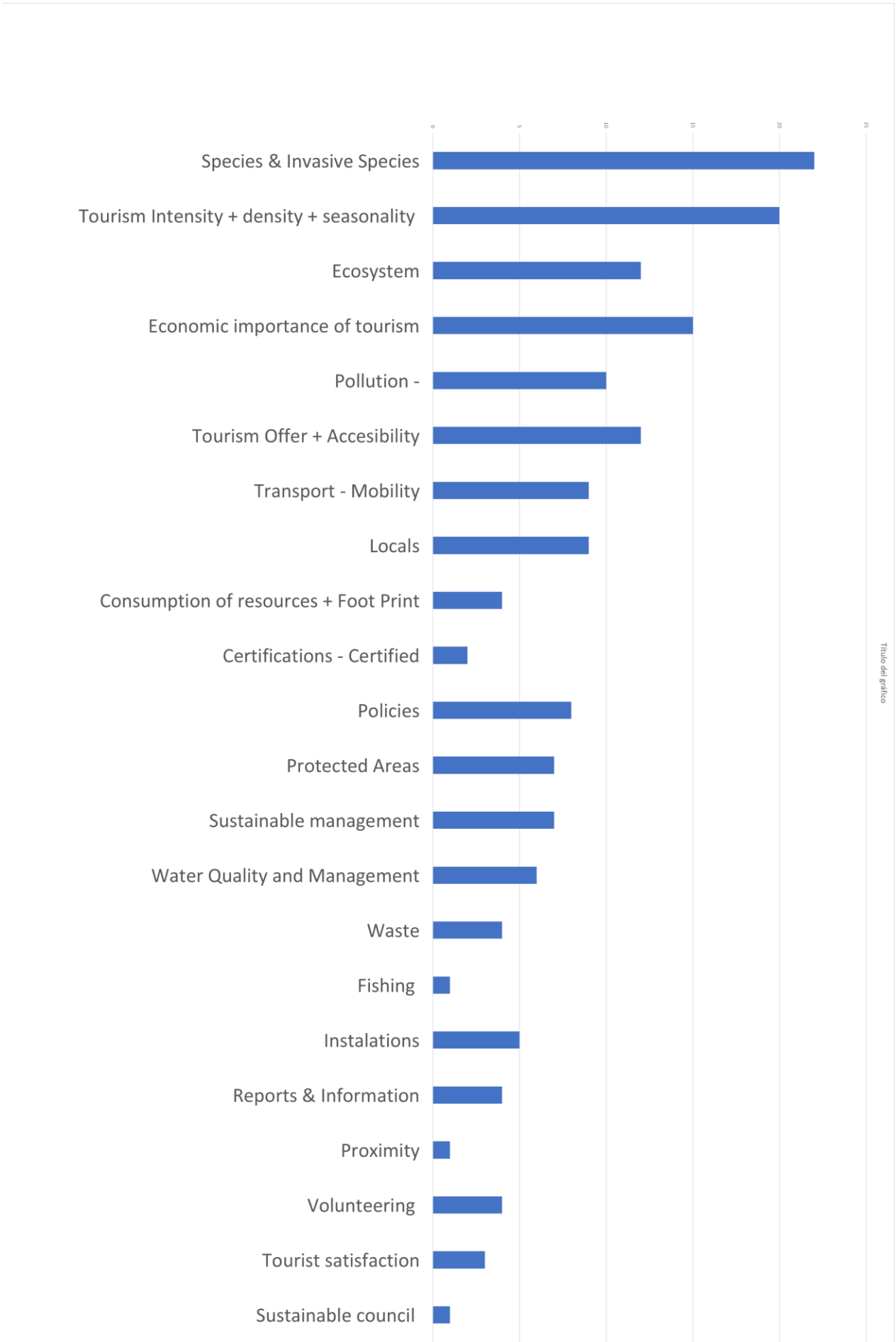

0
5
10
15
20
25
Species & Invasive Species
Tourism Intensity + density + seasonality
Ecosystem
Economic importance of tourism
Pollution -
Tourism Offer + Accesibility
Transport - Mobility
Locals
Consumption of resources + Foot Print
Certifications - Certified
Policies
Protected Areas
Sustainable management
Water Quality and Management
Waste
Fishing
Instalations
Reports & Information
Proximity
Volunteering
Tourist satisfaction
Sustainable council
Título del gráfico

Figure 6. Graph 2. Source: Own elaboration.

In order to analyse the rest of the indicators left, a deeper understanding of each of the criteria is needed. Thus, the existence of the following subsections.

5.1 Criterion Species and invasive species

The indicators contained in the criterion of "species and invasive species" are 27 and are part of the state, pressure, and impact categories. Out of the 27, four were discarded because of lack of information source (plant genetic resources, animal genetic resources, Marine trophic levels, and Proportion of fish stocks within biologically sustainable levels (Convention on Biological Diversity, 2016)); one more was discarded because it was only focused on the UK (Status of UK species).

This criterion has 22 indicators regarding abundance of species, status of threatened species, extinction risk, endangered species, the essential services that species provide to humans, priority species, and invasive alien species for freshwater, marine coastal areas, terrestrial zones and their potential impacts.

(Fred Dyke, 2008) argues that biodiversity variety exists at multiple biological levels and that indices should "represent features of biodiversity, not biodiversity itself" and also that single statistic cannot describe the complex phenomena of diversity. One of the levels of biodiversity are the species. Species are named by the binomial nomenclature originally developed by the botanist Carol Linn. On the Conservation Biology Book (Fred Dyke, 2008) continues arguing that viewing species as evolutionary units implies the need to preserve the organism, its ability to respond to environmental change, its population, its capacity to create new species, and its potential to enhance the sum of biodiversity. This is called the "conservation management unit".

The conservation management unit is useful for identifying population or groups of population that show evidence of genetic relatedness and that are spatially arranged so that they can benefit from a common management strategy. One common

management strategy can be the establishment of protected natural areas, concept that is also is part of several indicator models. However, other management practices that (Fred Dyke, 2008) mentions as typical are habitat manipulation, introduction of organisms, and controlling hunting, fishing and trapping. It is important to note that species diversity and evenness decrease with forest fragmentation or pressures such as hunting.

Another point that (Fred Dyke, 2008) shares is that endemic species also need more attention, however areas with high rates of endemism for one species might not have other endemic species and thus, be “poor” in diversity. For some areas such as islands, the authors share strategies such as eliminating introduced competitors – invasive alien species-, predators, and protect from human hunting, collection, and disturbance. At regional levels, they share the suggestion to select sites where species are "most dissimilar to one another” to contribute to biodiversity conservation. Among the best practices, according to (Fred Dyke, 2008), there is the need to introduce zero exotic plants species in gardens and properties.

Considering the reviewed literature, the following points are deemed to be important:

1) Tourism businesses do not promote hunting as a leisure activity.
2) Tourism businesses do not promote trapping as a leisure activity.
3) Tourism businesses that promote fishing as a leisure activity are only operating on allowed areas and under regulation.
4) Tourism businesses and stakeholders are aware of Protected Areas.
5) Tourism businesses and stakeholders know endemic species of the area.
6) Tourism businesses and stakeholders know endangered species of the area.
7) Tourism businesses and stakeholders know extinction risk species of the area.
8) Tourism businesses and stakeholders know the invasive species of the area and their impact.
9) Tourism businesses and stakeholders know how to preserve endemic species of the area.
10) Tourism businesses avoid exotic plants or alien species plants for decoration of their installations.

5.2 Criterion Ecosystem

The indicators contained in the criterion “Ecosystem” are 20 and they are present in state, pressure, impact, and driving categories. Out of the 20, eight indicators were discarded due to inexistent or unclear sources and calculations.

Environment key topic has 12 indicators regarding extent of forests and wetlands, habitats with extinction risk, vulnerable ecosystems such as coral reefs, the presence of natural areas outside of touristic installations, knowledge of sensible nature areas, protection of ecosystem through legislations, change in extent of water related ecosystems and incidence of human induced ecosystem failure, according to case studies.

As (Fred Dyke, 2008) explains, biodiversity is complex and it can be affected by several factors, including latitude, altitude, and temperature. As an example, the case of plants is that they tend to be more diverse at low to middle latitudes (Fred Dyke, 2008), where as in marine environments, coral reefs, estuaries and tropical marine ecosystems have more diversity.

(Fred Dyke, 2008) explains that there are four levels of habitats: local, intermediate, coarse, and regional. These levels contain functional conservation areas which are geographic spaces that have focal ecosystems, species and ecological processes that are delineated by sites, landscapes, and networks.

Ecosystems or habitats can be degraded or destroyed by three different processes: loss, isolation, and fragmentation. Fragmentation happens when a habitat is reduced in territory and it is broken into several smaller patches which can also continue decreasing in size and number, thus becoming vulnerable (Fred Dyke,2008) . For such reasons, (Fred Dyke, 2008) argues that the best conservation strategy is preventing fragmentation. Corridors are believed to be useful measure, however, calls for attention on their implementation due to the need of more evidence to prove their effectiveness in connecting fragments at large scales (Broadbent et al., 2012) .

(Broadbent et al., 2012) considers that nature-based tourism has been effective in Costa Rica for conservation of species and biodiversity, thus offering these options is important for destinations that want to halt biodiversity loss.

On the other hand (Ai et al.)propose landscape restoration with native plants and adopting replenishment programs for beaches along with fences along native or new vulnerable vegetation, which is also a suggestion of best practices according to (Fen Wei, 2012).

After analyzing how tourism can reduce the effectiveness of soil carbon nitrogen in urban parks, (Zeng, 2018) suggests that warning signs are important for visitors to take care of trees, flowers and plants. Also, that areas that are disturbed should be frequently threated with fertilizers, and new fast-growing trees and shrubs.

Considering the reviewed literature and the existent indicators of the frameworks, the following points are deemed to be important.

1) Tourism businesses and stakeholders actively engaging in landscape restoration.
2) Tourism businesses and stakeholders warn visitors to take care of flora and fauna.
3) New tourism developments consider mitigation of ecosystem fragmentation.
4) There is legislation available against fragmentation of ecosystems.
5) Number of natural areas outside tourism businesses installations, in km2.
6) Number of tourism businesses that know the sensible natural areas of the destination.
7) Number of local businesses actively engaging in protection of ecosystems and species.
8) Large accommodation businesses are aware of their role in connectivity and fragmentation of ecosystems.

9) Number of tourism businesses that know about trends in extent of natural habitats of the destination.
10) Number of tourism businesses and stakeholders are informed about the forest, coral reefs, and or wetland area of their destination.
11) Tourism businesses consider the naturalness of the environment as an asset.
12) Tourism businesses know about risks and population of vulnerable ecosystems.
13) Tourism businesses are aware of the change in extent of the destination ecosystems over time.

5.3 Criteria Tourism intensity and density

The criteria tourism density and the criteria intensity have 20 indicators, and they are present in driving and pressure categories. No indicators were discarded.

This criterion category contains indicators regarding arrivals, bed nights, length of stay, the air travel intensity, the share of capacity between Airbnb, second homes and accommodation businesses, occupancy rates, number of visitors, ratio visitor tourist, and spatial distribution of bed spaces.

Tourism intensity and density are related to overtourism, however the term is not included in any of the frameworks. (Peeters et al., 2018) defines overtourism as "*The situation in which the impact of tourism, at certain times and in certain locations, exceeds physical, ecological, social, economic, psychological, and/or political capacity thresholds".* Since the ecological term is included, overtourism can also be considered as a driver for biodiversity loss or harm.

Although carrying capacity is not mentioned in any of the frameworks, its' theoretical concept can be taken into account. Ecosystems and species adapt to physical and biological species, which also means that the number of individuals of one species or more changes according to how the ecosystem is disturbed (Josef Zelenka & Jaroslav Kacetl, 2014).

(Bhakti Chougule, 2011) mentions that as a tool, carrying capacity can protect biodiversity and also manage satisfaction of the visitor and the local population, especially for the case of ecotourism. According to (Josef Zelenka & Jaroslav Kacetl, 2014), this concept is essential for protecting biodiversity, but the method in which it was calculated should be done according to the destination and the goal of the management, not randomly (Josef Zelenka & Jaroslav Kacetl, 2014). According to (Zhao & Jiao, 2019) the carrying capacity for environmental ecotourism's definition is the "*acceptable number of tourists that can be accepted in an area that protects environments, reduces the impact of tourists and meets the benefits of them and the tourism industry*".

The proposal is to follow the methodology created by (Zhao & Jiao, 2019) who divide Ecotourism Environmental Carrying Capacity in four: "*resource, ecology, psychology, and tourism environmental carrying capacities"*. Each one has a comprehensive formula that can be used with information obtained from businesses and destinations. Furthermore, the formula considers using information from length of stay, number of visitors and spatial distribution among other of the indicators.

Considering the reviewed literature, the following information is considered to be important:

1) Tourism Carrying Capacity and Environmental Carrying Capacity of the destination are calculated and reality does not exceeds it.
2) Tourism Carrying Capacity of the destination is calculated (Zhao & Jiao, 2019) .
3) Environmental Carrying Capacity of the destination could be computed following the method by (Zhao & Jiao, 2019). The method is the following: considering the minimum values for the Resource Environmental Carrying Capacity (RECC), Ecology Environmental Carrying Capacity (EECC), Psychology Carrying Capacity, and Tourism Environmental Carrying Capacity (TECC) (Zhao & Jiao, 2019). The calculation for each one, according to (Zhao & Jiao, 2019) is the following:

a. "$RECC = (tourist\ area\ in\ m2\ \times opening\ hours) \div$
$(per\ capita\ area\ occupied\ by\ tourists\ in\ m2\ \times$
$time\ required\ for\ a\ tourist\ to\ visit\ the\ area)$)" (Zhao & Jiao, 2019)

b. "$EECC = \min(WECC, AECC, SWCC)$
$WECC = (daily\ sewage\ treatment\ level\ \div daily\ sewage\ production)$
$AECC = (tourist\ area\ m2 \times forest\ coverage\ ratio) \div$
$(per\ capita\ green\ areas)$(Zhao & Jiao, 2019)
$SWCC = (\ total\ amount\ of\ daily\ disposed\ solid\ waste$
$\div total\ per\ capita\ daily\ disposed)$"(Zhao & Jiao, 2019)

c. "$TECC =$
$(daily\ cost\ of\ supplying\ the\ amount\ of\ \ basic\ service\ facilities\ in\ the\ touristic\ area\ \div$
$per\ capita\ demand\ of\ basic\ service\ facilities\ in\ the\ touristic\ area)$" (Zhao & Jiao, 2019)

d. "$PECC =$
$surveys\ and\ questionnaires\ from\ locals\ and\ tourists.$" (Zhao & Jiao, 2019)

5.4 Criterion Tourism Offer

This criterion category contains ten indicators. One was discarded due to repetition. The nine indicators left contain topics about landscape and urban image, quality and innovation, animal spectacles, diversification for tourism, tourism products for disabled, attraction concentration, historic site prevalence and events, and information for tourists.

Tourism offer should be varied and diversified. In fact (Weidenfeld, 2018) argues that diversifying the tourism offer promotes a sustainable tourism development because it helps to protect natural resources. Furthermore, the study from (Hernández-Calzada et al., 2019) arrives to the conclusion that diversifying tourism products also helps for achieving social sustainability and inclusion of different types of tourist, including the disabled ones. However, the diversification of tourism products has to also consider animal welfare, so the new offers are not objectifying the animals (Winter, 2020). (Moorhouse et al., 2015b) conducted a study that shows the negative impacts on the welfare of animals that arise from tourism attractions that have wildlife as their main component, and thus on biodiversity, plus, most of these negative impacts are not recognized by the tourists.

Urban biodiversity has also be taken into consideration (Peter Werner & Rudolg Zahner, 2009) mention that urban biodiversity can be defined as all the flora and fauna that lives in a determined area that could be a city, town or neighbourhood. In turn, biodiversity in urban landscapes helps to shape the culture and perception of it from their citizens (Nilon, 2011). (Nilon, 2011) shares that mapping and other type of projects can help to first identify the places that gather relevant flora and fauna in a city, and from there management and conservation approaches can be developed.

(Ziegler et al., 2022) consider that social innovation is important to find solutions towards the crisis of biodiversity loss. (Pörtner et al.) identified in their report that there are five reasons for biodiversity loss. These reasons can be tackled by social innovation, which must be promoted at organizational and legislation level (Pörtner et al.). The reasons or drivers for losing biodiversity in certain areas are: "*change of use of land towards agriculture or industrial goals, exploitation of fisheries, climate change, pollution and invasive alien species*" (Pörtner et al.; Ziegler et al., 2022).

Considering the reviewed literature and analysis, the following points are important to be taken in consideration:

1) The touristic destination aims for diversification of its touristic products, including ecotourism options.
2) Share of ecotourism options offered in the destination, calculated by $Amount\ of\ ecotouristic\ options\ offered\ \div\ amount\ of\ touristic\ options\ offered$
3) Animal welfare is a primordial requisite for any type of touristic product. Thus, no animal spectacles are offered in the destination.
4) Incentives for innovative social initiatives for conservation of biodiversity and sustainability are promoted.
5) The destination has identified urban biodiversity hotspots in the destination.

5.5 Criterion Locals

This criterion category contains 10 indicators. Categorized in impact, pressure and state. Two were merged because they represent the same idea: acceptance of tourism and perception of local community of tourism. This process left this category with 9 indicators regarding topics such as: social justice and inclusion, locals health and wellbeing, linguistic diversity, food insecurity, cultural identity, residents' satisfaction, the relationship between visitors and residents, and how local businesses protect ecosystems. These topics are related to biodiversity in the sense that they are impacted by it.

That is the case of food security, which relationship can be both sided because the expansion of croplands promotes food security, but it can also affect highly biodiverse regions, which points the need for appropriate strategies (Cramer et al., 2017). On the other hand, (González-Marín et al., 2017) also analysed how wetlands were important sources of food for locals in coastal plain of Veracruz, México, and that the main problem causing a decrease in wildlife population of Amarillo, duck and Mesoamerican slider were pollution, hunting, and deforestation. For the case of well-being the linkage is explained by (Naeem et al., 2016), who says that every ecosystem has primary functions such as nutrient cycling which ultimately help with clean water, fertile soils, and capture fisheries, which improve health and well-being. Also, biodiversity contributes to poverty alleviation. Health and well-being need to be defined and it is multidimensional: food security exists among the dimensions of well-being, according to (Degarege, 2019) tourism and food security are related through the impacts that the first has, such as social, cultural and economic. (Degarege & Lovelock, 2021) also states that there are five main links between tourism and food security, those are context, livelihood assets, moderating institutions, processes, and livelihood activities.

Considering previous literature and analysis of indicators from other sections, the following points are considered to be important:

1) Education and formation on sustainability is offered, at least in touristic enterprises.
2) Tourism businesses consider well-being of locals for developing their activities.
3) Tourism businesses protect local ecosystems.
4) Tourism businesses promote inclusion and condemn racism.
5) Tourism industry is aware of "*status and trends of linguistic diversity and number of speakers in indigenous languages"* (Convention on Biological Diversity, 2006).
6) Tourism businesses are aware of their role in ensuring food security for locals.
7) Tourism businesses are aware of how biodiversity is embedded in cultural identity of the destination.

5.6 Criterion Policies

This criterion category contains 9 indicators categorized in pressure and state. One of them was discarded due to lack of clarity on how to measure it: use of information for creating policies. The topics that are included in this category are regarding national strategies and policies about biodiversity, sustainability, conservation of cultural heritage, fishing, securing safe biological levels and controlling invasive alien species.

(Simmons et al., 2018) assessed the impact of one policy called The Vegetation Management Act (TVM) using causal inference techniques. The TVM is a policy stablished in Australia since 1999 for regulating deforestation on private lands and specifically forbidding broad-scale agriculture and pasture. The result was a positive correlation; however, the impact is lower than expected. The authors call for causal inference methods to analyze policies per case and country. (Andam et al., 2008) argue that appropriate empirical methods can also be enough for policy makers as guidance for stablishing protected areas. Furthermore, (Andam et al., 2008) also calls for assessment on how to protect the land that is outside Protected Areas, since the policies might have spill over effects, whether positive or negative (Börner et al., 2017).

Payments for Environmental Services can be also taken into account in this section. According to (Arriagada et al., 2012), the impact of these payments has been moderate in Costa Rica, where they found a net increase in total forest cover within the farms present in the study. Although Payment for Environmental Services, also known as PES, has no exact definition; their implementation its popular because they aim to support the generation of positive externalities (Karel Mayrand & Marc Paquin, 2004). The principle of PES is that "*those who are providing the environmental services, should receive a payment that cover the costs of delivering those services*" (Karel Mayrand & Marc Paquin, 2004); on the other hand, the beneficiaries should be the ones paying. Their implementation and success depends on the context of the service and the location. (Karel Mayrand & Marc Paquin, 2004) argue that the best results are obtained when beneficiaries have economic resources, clear property rights, are coordinated and organized, and when there are legal frameworks. It is important to note that services that can be considered in PES "*are classified in four categories: water services, carbon sequestration, biodiversity conservation and landscape beauty*" (Karel Mayrand & Marc Paquin, 2004). Each one of them have different markets that should be comprehensively understood. (Börner et al., 2017) also considers that in order to be effective, PES design should incorporate local participation, recognize cultural values, have low transaction costs, strong institutions and clear land tenure.

(Van Hieu et al., 2020) reviewed PES in the tourism industry and explains that the concept englobes different services for consumption, non-consumption and landscape beauty. Some examples shared on the paper are the higher payment requested to tourist if they spot an endangered species and the payment that tour operators will do to villagers, who in turn also need to take care of the landscape by avoiding farming in designated areas. (Kira de Groot, 2011) argues that one of the best strategies of PES in the particular case of Vietnam was bundling PES tourism payments with the PES from hydro power plants for delivering benefits to locals surrounding the Ba Be National Park in Vietnam. (Karel Mayrand & Marc Paquin, 2004) argues that while bundled PES are easier to manage and even with less transaction costs, merged bundles can be

less effective. Thus, a basket approach is suggested by (Karel Mayrand & Marc Paquin, 2004).

Another tool used as a policy are the offsetting for biodiversity. In general terms this tool pursues growth and development with low environmental impact. Off settings are designed to compensate for adverse impacts and effects in one place and at a particular time, by creating others positive impacts in another place (Business and Biodiversity Offsets Programme [BBOP], 2012). The main goal is to have No Net Loss and they aim to secure the conservation of water areas, habitats, and species through restoration and preservation (World Bank Group & PROFOR, 2016).In theory, biodiversity offsets should be additional, equivalent and permanent (World Bank Group & PROFOR, 2016). (Velonaki & Stone, 2015) made a review on why the implementation of offsetting schemes in aviation industry have not been particularly successful: the main takeaway is that the offsetting is sold as an extra to the consumer, who might not understand the concept entirely since "*the relationship between price and the precise carbon offsetting remains unclear*" (Velonaki & Stone, 2015). While the tool has gained popularity, (Guillet & Semal, 2018) concluded that it actually has a negative influence on biodiversity and thus it is a "relatively inefficient tool".

Considering the review of literature, the following points are considered to be important.

1) PES are considered for conservation of biodiversity in the destination.
2) The country or state considers biodiversity in National Development Plans.
3) The country or state has policies for protecting and conservating natural and cultural heritage.
4) The DMO communicates to the tourism businesses and stakeholders information about the policies and regulations and only promotes those businesses that execute them.
5) The country, state or destination has policies for minimizing the impact of fisheries.
6) The country, state or destination has regulation against invasive species.

7) There is communication between experts on biodiversity, DMOs and government to develop biodiversity and tourism policies.
8) The country, state or destination has policies for regulating the development of new products and touristic infrastructure.

5.7 Criterion Transport-mobility

This criterion topic contains nine indicators categorized in pressure and response. None of them were discarded. The specific topics on this category are environmentally friendly transport, user friendliness, mobility in the region, public parking and transport, adaptation to disability, and means of transport covered by tourists.

Transporting in vehicles is known to be a main user of fossil fuels, thus one of the biggest generator of Greenhouse Gases. Just as an example, the second principal energy-consumer sector in Europe is road transport. In fact, tourism impacts the local environment with "*more air pollution, energy consumption*" (Aguiló et al., 2012; Yue Gue & S. Page, 2009) and "*congestions*" (Saenz-de-Miera & Rosselló, 2012; Yue Gue & S. Page, 2009). According to (Shun Zhang, 2019) 75% of the emissions attributed to tourism are created by the transportation sector and this could be tackled by governments and interregional cooperation. Air transport corresponds to more than 90% of the contribution to climate change from a typical journey, from and to a destination (Colin Hunter & Jon Shaw; Stefan Gössling et al., 2002).

The CIVITAS DESTINATIONS project analyzed the connections between tourism in urban areas and the mobility within them. Mobility solutions are perceived to be important for strengthening factors of touristic destinations such as sustainability, attractiveness, accessibility, and efficiency of transport (Theocharis Tsoutsos, 2022).

(Claudio Mantero, 2022) mentions that tourism and transport sectors have shared growth dynamics due to their interconnection. Another thing to consider is that at a destination level, the tourism sector uses transport as a tool because it is considered a way by which touristic experiences are delivered (Claudio Mantero, 2022). In

consequence, there are common issues faced by locals and tourists, such as traffic congestion. Also, transport changed how vacations are because of the mobility independence of family and individuals, which is performed with low consideration of the environmental and quality life impacts this will have on locals (Claudio Mantero, 2022). CIVITAS DESTINATIONS project implemented and evaluated 83 different sustainable mobility measures which were considered relevant for lowering impact on CO2 emissions and the amount of saved energy and fossil fuel. Thus, attracting tourist towards mobility alternatives that result in less pollution and with more innovation technology and business dynamics can also impact on how tourist and resident coexist.

Still (Claudio Mantero, 2022) CITIVITAS project included different measures for mobility improvement. For example, public e-bike systems and expansion of bike-sharing systems which avoided the emission of 364 tons of Co2 in a year. This was achieved via more kilometers of cycle paths and addition of number of bikes available and the average numbers of additional users in one year. As for clean vehicles, promoting the use of electric cars and their rental had an outcome of avoiding 774 tons of co2, but also saving 2,800 MWh of energy. Numbers achieved with only 50% of additional electric vehicles. Finally, public transport measures were also done and assessed. Some of them were the use of hybrid buses for the urban fleet, which were also allowing bike transportation on them, the redesign and improvement of the routes of public transport to the tourists, including the procedures of the tickets and timetables. This had the outcomes of avoiding 162 of Co2 emissions in one year by only incrementing 10% of customers in the public transportation. However, (Claudio Mantero, 2022) also noted that public transport and ride-sharing schemes do not consider tourists as target groups due to lack of information, tackling these could be beneficial for alleviating congestion.

Another thing is that 33% tourists prefer to walk when they are in touristic destinations (Claudio Mantero, 2022). However, certain circumstances, such as a lack of integration of public transportation, can influence their choice of transportation from private to cars, for example, when they arrive to the destination to the airport and this

one is far from the touristic area, or the city center (Claudio Mantero, 2022). Simple information for transport solutions and mobility is considered relevant, along with the improvement of accessibility for impaired people. Successful and sustainable mobility systems are always focused on locals needs and adapted with relevant interventions aimed at touristic patterns. An idea shared by (Claudio Mantero, 2022) is to put the transport of the tourist as part of their experience, which could be iconic and relevant for their trip, at the same time this could encourage a more sustainable lifestyle among the users of the transports, whether they are tourists or locals.

On the other part, (Eleni Farmaki et al., 2022), evaluated with ten criteria the sustainability of urban mobility. Among the major takeaways from their research is that well-being of local communities and quality of life are the top priorities of stakeholders when it comes to developing Sustainable Urban Mobility Plans (Eleni Farmaki et al., 2022). "*Society and Environment*" and "*Society and Mobility*" are the two main categories of criteria considered as important by the stakeholders (Eleni Farmaki et al., 2022). Furthermore, giving information, personalizing plans and smart apps can be useful for sustainable mobility. Other preferred policies, according to the study of (Eleni Farmaki et al., 2022) were having a transport that would be multimodal, which should consider coordination of different measures such as the travel plans, the safety and secutiry, and even spatial planning for the mobility management. (Eleni Farmaki et al., 2022) also noted that the tourism sector group of stakeholders show a preference for criteria that were focused on the environment such "*environmental pollution, accessibility, safety, energy, and traffic conditions*" (Eleni Farmaki et al., 2022).

The transportation methods differ depending on if the area is urban or rural (Gini & Ambrosino, 2022). In rural areas destinations and activities are more separate between each other, thus the design ot the public transportation has to be tailored to the different user groups, from locals to tourists of the rural area. (Gini & Ambrosino, 2022) suggest incorporation fleet that could be occasional for the different modes of transport from public, to ride and personal mode; also targeting different user groups

via the monitoring of the services that could be used and useful for the target user groups.

Transportation systems are key for the daily life of citizens, and it is changing in terms of how they offer their services. However, there is a lack of integration of mobility services because the planning of the routes for the transport services suffers an absence of coordination, collaboration and of policy and methods (Gini & Ambrosino, 2022).

(Sessa, 2022) also says that the transport infrastructure is used by both: residents and tourists, and that mobility is key for daily experiences. However, medium size tourist destinations can face challenges due to seasonal demand.

This can lead to problems such as congestion, parking issues, pollution, accessibility problems, especially in historic centres, especially during high-season months such as summer(Maas & Attard, 2022). This idea is consistent with (Aryblia et al., 2022) who also argue that traffic congestion, noise and air pollution from *"cities and metropolitan areas contribute to climate change*". However, after applying their own set of indicators for measuring the relationship between transportation, the environment, and Madeira's, Portugal society, during the summer months – season of the high touristic demand - they concluded that the assumption that air pollutant increases dramatically, is false (Maas & Attard, 2022).

(Maas & Attard, 2022) argue that alternative modes of transport can increase attractiveness of a destination while reducing pollution, traffic and congestion. They mention the avoid-shift-improve approach. Avoiding travel far with the creation of more dense developments, diversifying the land use, using technology to substitute trips. Shifting to walking, cycling and public transportation. Improving fuel technologies for electric, hybrid and hydrogen-fuelled vehicles.

Shared mobility is again mentioned for efficiency and reducing consumption because it is flexible, short-term and it can be mixed with other public transportation (Maas & Attard, 2022). Such as bicycle sharing. It is also costs and time saving and provides health benefits. Also, environmental because it reduces congestion and improves environmental quality. The author also shares a national policy in Malta that puts bicycle forward for normalizing cycling around among locals and tourists (Maas & Attard, 2022). However, this might be a useful policy just among some group of tourists and locals, since bicycle sharing is more probable to be used among people that are in the 18 - 34 year old groups and with post-secondary and tertiary education (Maas & Attard, 2022). To encourage the use is to pay attention on the safety for the cyclists because a lack of infrastructure keeps them away from using it. Some strategies for this are mentioned on their paper still: creating cycling paths, reduction of speed limits, also offering training and programmes, raising awareness are among the most popular, however restrictions on private car use, parking restrictions and fees are deemed to be important (Maas & Attard, 2022).

Considering the literature and the analysis, the following points of information are important:

1) Environmentally friendly transport is available for tourists in the destination.
2) Means of transport covered by tourists are identified.
3) Public transport routes also consider tourist routes.
4) Bike transportation is available on buses.
5) Infrastructure for bike riding for tourists and locals is available at the destination.
6) Speed limit of cars is reduced.
7) Restrictions for parking and private car use are done at the destination level for tourists.

5.8 Criterion Protected Areas

This criterion category has nine indicators categorized in state and response. Two were discarded due to lack of source information: these were “management effectiveness of the protected area”, and “status of sites of special scientific interest”.

The topics regarding protected areas are about their coverage, and conservation in different environments, such as marine, coastal and terrestrial.

According to (IUCN, 2008) Protected Areas are "*clearly defined geographical spaces, recognised, dedicated and maintained through legal or other effective means, to achieve the long term conservation of nature with associated ecosystem services and cultural values*". Their certification list, name "Green List of Protected and Conserved Areas", is a database with all the areas that are fairly and effectively managed or governed around the world (IUCN and World Commission on Protected Areas [WCPA], 2017). This list contains 59 sites in 16 countries. Each of the sites on the list receive their distinction after four themes are analized by the IUCN: "*good governance, sound design and planning; effective management; and successful conservation outcomes*" (IUCN, 2008). Since all the 17 criteria must be fully achieved for being part of the list, tourism organizations can have a close cooperation with the management of Protected Areas. Especially for the third pillar: Effective Management where the 3.6 criterion explains the need for managing access, resource use and visitation (WCPA, 2017). For fulfilling this standard Protected Areas must have evidence of relevant information from environmental impact studies and experts, description of permitted visitor access, visitor records, response surveys, access control, and constant consultation with representatives of tourism industry (WCPA, 2017). These consultations can be on how to enhance tourist satisfaction, since this is considered to be crucial for the sustainability of Protected Areas (Oviedo-García et al., 2019), and it can be improved by information and/or food services. It is also important to mention that Protected Areas need expertise in service quality and management.

(Steven et al., 2013) showed that Protected Areas can contribute to the conservation of threatened birds, mammals, and frogs through tourism revenue. Although according to their research, 43% of bird species are not present in any Protected Areas, which shows that it also important to enhance the conservation outside Protected Areas. Furthermore, their results point that conservation of around 10% of global bird species relies in tourism revenue. For (Geldmann et al., 2019) Protected Areas are effective

when there is a focus on integrating quality and quantity. The same author also mentions that PA are important for preventing biodiversity loss. A conclusion to which they arrive after data compilation from more than 12,300 PAs in 152 countries. In 2019, 15% of the world is protected by PA network. The presence of PAS contributes to biodiversity persistence and they remain important for flagship species (Geldmann et al., 2019). Marine protected areas creation is also suggested against global change. (Allemand & Osborn, 2019) One tool that can be used for the conservation of Protected Areas is visitor management (A. N Candrea & A. ISPAS)where tourism manager and planners monitor and regulate visitor numbers, leisure activities that can be performed, behaviour of the visitors and the tourism providers, and understand the expectations and motivations from the visitors and tourists in the destination.

Considering the literature and analysis, the following indicators are proposed:

1) Tourism managers monitor and regulate visitor numbers to Protected Areas.
2) Tourism managers regulate the leisure activities allowed on Protected Areas.
3) Tourism managers know how to protect the Protected Areas.
4) Tourism managers communicate to visitors on adequate behaviour for the conservation and protection of nature that exist inside and outside Protected Areas.
5) Tourism managers create strategies according to the capacity that Protected Areas can manage and the expectations of the visitors.
6) Destination Management offices have a record of protected areas evolution in their destination.

5.9 Criterion water quality and management

This criterion contains nine indicators. Two were discarded due to lack of information and broadness: Water Quality and Water Quality for Biodiversity. The topics mentioned in water are water footprint, access to water, the quality of water in aquatic ecosystems, the management of water in installations, in inland bathing areas, legislation of protection of water, and the surface water status.

(H. Liu et al., 2021) explain that water is essential for tourism because tourists make use of this resource but also the businesses because they need to provide clean

installations and some types of recreational and entertainment activities are water-related. Another thing to consider is that in some areas, like Chinese Mountains, islands, and deserts are popular among tourists and these areas are usually water-scarce.

Water footprint accounts for the "*volume of freshwater used, in order to produce some product or even service*" (Arjen Hoekstra et al., 2009). This measurement considers the whole supply chain. There are different types of water footprint. Blue water footprint is the direct consumption of water as a resource from sources such as groundwater, while grey water footprint is linked to the volume of water that will assimilate the pollution, finally the green water footprint refers to the green water resources such as the one that comes from the rain (Arjen Hoekstra et al., 2009). According to (Arjen Hoekstra et al., 2011) footprint are "*volumetric measures for water consumption and pollution*", and they are not measuring how severe are the impacts of these consumption and pollution of water.

For (Cazcarro et al., 2014) the water footprint of tourism is the volume of water that is needed for producing services and goods that are consumed by tourists, whether they are national on international. (Cazcarro et al., 2014) aimed to measure the water footprint of a whole country – Spain- that has a tourism reliance for their national GDP. They argue that tourism affects footprint through indirect and direct uses. Among the findings from (Cazcarro et al., 2014) is that hotels, and bed and breakfasts have the higher intensity of direct litre water use per euro. However, transport, hotels and restaurants present a high ratio of embodied domestic water and water use. Some solutions listed by the authors that have been used are the dual-flush toilets, towel reuse, which reduce the input and also to impulse a water saving policy that would be beneficial for the efficiency of agricultural sector, since it's the main direct consumer of water in their case study country – Spain-.

In order to have a proper management of water resources, the tourism sector must satisfy natural, social and economic conditions of the environment in which is located(H. Liu et al., 2021). The same authors argue that water saving policies are

important for the sustainable development of tourism, although it has to be congruent and sensible. Water intake quotas and fees or licenses for enterprises are popular initiatives in China.

(Gössling et al., 2012) says that tourists can consume from 84 to 2,000 litres per day and that the staff can use up to 250 litres per working day. However, hotels with spas and more than one swimming pools are using more water resources. If the installations are having landscapes that require irrigation, or health centres, the consumption of water will also increase because of laundry needs. However, the areas in which the most water was used differs depending on the country, hotel infrastructure and classification, and tourist. Therefore, the authors suggest some approaches to water management. Some of them are selecting drought resistant and native plants, reduce the water consumption for landscaping, avoid evaporation from fountains, waterfalls and pools with night covers and drainage barriers, install dual, reduced flush or dry composting toilets, design efficient cooking practices and using efficient dishwashers, install spray valves and flow control regulators, engage with soil moisture measurements, make use of treated wastewater, include educational programmes for staff and visitors. (Gössling et al., 2012). On the other hand (Gössling, 2015) also suggest to pay attention to the indirect uses and impact of tourism to water resources, although there is yet not enough literature about the topic. As part of (Gössling, 2015)'s final notes the author suggests to address the existence of all inclusive tourism models because these are promoting more food consumption which in turn results in more energy and water use in indirect and direct ways.

Considering the literature and the analysis of the indicators, the following points of information are proposed.

1) Solutions for water saving are policy and common practice within touristic businesses, especially for accommodation ones.
2) Hotels and Resorts or Attractions with green areas have control systems for irrigation, laundry and maintenance of water.
3) Ornamental plants are either native or drought resistant.

4) Night covers are used to avoid evaporation from fountains, waterfalls and pools.
5) Efficient cooking practices trainings are given to personnel of the businesses.
6) Installations of kitchens and toilets have flow control regulators in sinks and dishwashers.
7) Hotels make use of treated wastewater.
8) Touristic businesses have educational programmes for staff and visitors.
9) All hotels have strategies for avoiding waste of water and resources.
10) Electricity installations in guest areas are designed for saving energy.

5.10 Criterion Consumption of resources

Out of the ten indicators distributed in the different analyzed frameworks, six were discarded because they were analyzing the same topic. This criterion category ended with four indicators regarding energy efficiency and renewable energy use, ecological footprint, energy consumption and consumption of paper.

(Avishek Khanal et al., 2021) showed that in the long-run tourist arrivals and energy consumption is related in destinations and countries. Also, topics such as GDP, and financial development. For this matter, policy makers should incentivize the use of cleaner energies and carbon neutral transportation in the tourism industry, which can lower their carbon emission reduction. As a suggestion, (Avishek Khanal et al., 2021) share that accommodation businesses should use power from renewable sources.

(Valentina Castellani & Serenella Sala, 2008) followed a method for assessing the sustainability on an Italian destination. The ecological footprint method that they followed looks into the correlation of lifestyle and the quantity of natural resources that are used to support it. The result comes from an aggregated index that considers the extent of the natural bioproductive area and biocapacity that is needed to absorb the waste that is generated due to this lifestyle and to provide the resources that are being consumed. The ecological footprint method considers five clusters: food, housing, transportation, goods, and services. Their analysis points out that “housing is the most relevant cluster” (Valentina Castellani & Serenella Sala, 2008). Which means that the

ecological footprint changes depending on where the tourist decides to stay. Four stars hotels consume more energy that Bed and breakfasts, and camping sites. Second houses, and one or two stars hotels have a smaller ecological footprint also because less people are using them – due to their size- and also are used for a shorter period of time. (Valentina Castellani & Serenella Sala, 2008) suggest to promote these accommodations.

(Stefan Gössling et al., 2002) also agrees that the higher the class of the hotel, the higher ecological footprint of them. (Stefan Gössling et al., 2002)used the ecological footprint method to assess the situation at Seychelles. Although useful, both authors faced the challenge of lack of information which limits the assessment and the objectives of it. The authors also point that Ecological footprint assessment is not suitable for measuring the local consequences of tourism. Moreover, the method is complicated to be applied because of databases and lack of cooperation and transparency. However, some of the interesting points from this paper is that five-star accommodations increases ecological footprint on islands, mostly due to development of new infrastructure and air travel. For (Stefan Gössling et al., 2002) the energy saving devices and renewable energy sources are contributing -marginally- to the savings of resource consumption.

(Valentina Castellani et al., 2017) conducted an analysis for calculating the footprint of 19 food commodities. Among the results, there was a recognition of higher impact to biodiversity originated from the production of meat and dairy. Furthermore, (Valentina Castellani et al., 2017) also identified that tackling water eutrophication, either by recovering nutrients from the urine of animals or improving the wastewater treatment, has higher efficiency when reducing the impact of those foods.

(János Csapó, 2013) shared best practices for energy efficiency in the travel industry. According to this author, the energy efficiency can be present in any aspect of the touristic sector. In the catering area restaurants could use local products for their offerings, while the accommodation sector could integrate smart systems for lighting

and thermal insulation. Also, the heating insulation of the building and the hot water supply can be tackled. Waste management is also mentioned. According to the review of (János Csápo, 2013) the laundry costs can be lowered by 30% when the towels and bed linen are reused for the same guests, while incandescent light can last longer. Also, the management of water use is important since most of it is deployed in gardens, bathrooms, kitchens and laundry. The use of only environmentally friendly supplies for cleaning is reccomended, along with compost and waste management, and using renewable sources of energy as well as environmentally friendly heating system (János Csapó, 2013).

When it comes to energy efficiency, (He et al., 2020) defines it as "*using smaller amount of energy to achieve the same output*". Energy efficiency is also an indicator for economic development. From a macro-economic point of view, energy efficiency can have four determinants: capital investment, structure effects, labour, and technology effects. As explained by (He et al., 2020), efficient technologies should enable the saving of energy, and this energy can be in the form of capital labour, investment or even electricity. It is important to remember that tourism is seen as a high intensity labour industry due to the number of hours that workers do, and the nature of the activities performed (World Tourism Organization and International Labour Organization, 2014). Overall, energy efficiency is the ratio of the revenue to the total energy consumption. According to the same authors, increasing tourism revenue or value can improve efficiency. The authors recognize that there is potential for optimizing tourism investments and for reducing energy consumption and generation of waste.

Energy is presented in distinct ways from infrastructure, to electricity, fuels, heating, cooling, and even human(He et al., 2020). As stated by (He et al., 2020) energy is the main source of environmental problems such as pollution in the atmosphere due to greenhouse gases, acid rain and even dust.

Within the tourism industry, hotels have a considerable opportunity area for incorporating energy efficiency measures (Hotel Energy Solutions, 2011). Even those that are individually, or family owned. Hoteliers are more convinced to take more "immediate actions" rather than long time investments. Among the main reasons to integrate energy efficiency solutions are to reduce operational costs, increase competitiveness and deliver environmental benefits that will ultimately benefit the image of the hotel. Some of the actions are to use fluorescent bulbs, which according to the report by (Hotel Energy Solutions, 2011) it has a return of investment of less than three years; encouraging guests to save electricity, incorporating solar water heating and heat pumps, using sensors for building management and training the team. The report of (Hotel Energy Solutions, 2011) also makes emphasis on incorporating small and medium enterprises to the environmental and social awareness because they usually are more reluctant since they thing their company is small for complicated management approaches. (Hotel Energy Solutions, 2011).

Considering the literature and the analysis of the indicators, the following points of information are important.

1) Accommodation businesses use power from renewable sources.
2) Destination Management Offices promote Bed and Breakfasts, camping sites, second houses and one or two star hotels to tourists.
3) Bed and Breakfasts, camping sites, second houses and one or two star hotels staff and management receive training on energy efficiency and saving of resources.
4) Energy saving devices and renewable energy sources (such as solar water heating and heat pumps) are implemented in the accommodation and touristic businesses.
5) Restaurants and hotels are offering local ingredients and more plant-based dishes.
6) Smart systems for lighting are used in touristic businesses.
7) Thermal insulation of buildings is done with smart systems.

8) Towels and bed linen are reused for the same guests.
9) There is a responsible for management of water and resources in the hotel or attraction management office.
10) Environmentally friendly supplies for cleaning are used.
11) Touristic businesses do compost and other waste management practices.
12) Touristic businesses use fluorescent bulbs.
13) Accommodation businesses encourage guests to save electricity.

5.11 Criterion Pollution

This criterion has 18 indicators. All of them categorized as an impact. Five indicators were discarded due to repetition. One, mercury levels, was discarded because there were no sources of literature that relate how can tourism decrease the levels of mercury, however the literature points that mercury levels affect tourism via decreasing fishing activities and landscape (Jozef M Pacyna et al., 2009; Leah Hagreen & Leslie Kulperger, 2004). On the other hand, pesticides and persistent organic pollutants are considered in the same category since the first are also considered a Persistent Organic Pollutant(Fitzgerald & Wikoff). The ten indicators left address the following topics: impacts of pollution, air pollution, nitrogen deposition, persistent organic pollutants, plastic use, biodegradable detergents, secondary organic carbon levels, noise pollution, light pollution and area affected by acidity.

(Rabindra Nepal et al., 2019) analyzed the relationship between tourism and carbon emissions. The result of their is study is that the two are related because an increase of just 1% in tourist arrivals increases the co2 emissions by .98%. This case is analyzed for Nepal, where the use of kerosene and firewood lead to more Co2 emissions. In destinations with the same conditions, the government should push for a green tourism agenda in which energy efficiency building, green urban parks, and environmental responsible practices are promoted. It is important to note that tourism contributes to co2 emissions in the long term due to infrastructure development, increase in energy consumption, and aggregate output (Katircioglu, 2014), thus the development of tourism must be planned with renewable energy resources.

Pollution can also be in the form of plastics. The accumulation of plastics affects the ecosystem structure, but also their services and functions (Thushari & Senevirathna, 2020) . The plastics can be found in different sizes categorized as megaplastic, macroplastic, mesoplastic, and microplastic (Thushari & Senevirathna, 2020). In any of its forms, plastics represent a threat to biodiversity. Nonetheless it can also affect tourism and economic activities such as fishing, but ultimately also human health. Some practical approaches for managing this issue are identifying the sources of plastic pollutants, incorporate the reduce, recycle, reuse approach, create awareness and capacity towards this approach, and adopt policies, and initiatives that aim to reduce plastic disposal in marine and coastal zones. Just one of the analyzed indicator systems considers plastic pollution.

(Churchill et al., 2022) found that air pollution affects tourism arrivals. Their research examines how carbon dioxide and particulate matter emissions are affecting the international tourist arrivals to countries of the G20. Among the reasons the author mentions is that environmental conditions are a factor that influence the decision of tourists because it affects attractiveness of the destination. (Churchill et al., 2022) mentions that literature points that landscape is the most important characteristic influencing the decision of tourists.

PM2.5 emissions are suspended in air and reduce visibility, while Co2 is responsible for greenhouse effect. (Fan et al., 2021) also reviewed the impacts of pollution to tourism in China, where they found that those tourists that encountered a destination with air pollution are more than 92% less likely to revisit the same destination, also the same country. However, the relationship of tourism and air pollution is not unidirectional but bidirectional since tourism also affects the environment. Their proposals to manage this issue are by taxation and subsidies for green tourism goods; also, investment in innovations for low carbon emissions and for initiatives that promote sustainable tourism. Secondary Organic Carbon (SOC) is also related to air pollution since it generates haze, although the primary emissions seem to be more relevant. Furthermore, SOC formation strengthens in the harvest seasons (Xu

et al., 2018). Tourism businesses and Destination Management Offices must support agricultural businesses that lower their impact and emissions through ecological and biological processes.

Nitrogen deposition contributes to the eutrophication of coastal marine environments. (Baker et al., 2013)The authors claim that monitoring the nitrogen stable isotope values can be a measurable way to identify the impacts of tourism to the ecosystem. Among the main reasons for nitrogen deposition are the deficient sewage management. Thus, large resorts and hotels need to include a wastewater management into their installations. The increase of nitrogen in the water contributes to an overgrowth of algae and loss of diversity and coral covers. For the case of Akumal in Mexico, the authors (Bakers et al., 2013) suggest that tourist visitations should be limited to less than 150,000 per year or that wastewater management installations should be done.

Pesticides and herbicides are also a threat to biodiversity while organic farming and alternative agricultural schemes promote biodiversity (Geiger et al., 2010). In fact, from the three components of agricultural intensification that the authors studied, pesticides are having the most negative effects. These effects even impact soil invertebrated organisms (Brühl & Zaller, 2019). Herbicides on the other hand are also affecting phytoplankton (Rumschlag et al., 2020). Ultimately, herbicides and pesticides are also a threat to human health due to their toxicity (Jayaraj et al., 2016). Pesticides are included in the Persistent Organic Pollutants, which are also considered a threat to wildlife because it affects a wide range of species through impaired reproduction, birth defects, and overall population declination (Fitzgerald & Wikoff). Thus, hospitality sector can also put pressure on the use reduction of these substances. Methods can range from buying ingredients mostly from organic producers, and avoiding the use of pesticides and herbicides in their installations or opting for organic herbicides and pesticides.

Pollution can also be noise pollution which creates adverse effects on the life quality of the citizens and even visitors. If the noise is higher than the thresholds 55Db settled by the European Noise Directive, it can be harmful for humans (Deniz Sari et al., 2014) but also to biodiversity (Sordello et al., 2020). According to (Sordello et al., 2020) the noise becomes a problem when they affect the communication, reproduction and normal life of animals, for example birds, amphibians, reptiles and mammals. Noise pollution can arise from entertainment venues, traffic, ships, aircraft, and industrial activities. Control measures are needed especially in the summer and night hours according to the authors of both papers.

Oceans and in turn coral reefs are affected by acidification. Ocean acidification happens when carbon dioxide dilutes in the ocean water which results in a change in the pH. This phenomenon can affect corals and fish species (Allemand & Osborn, 2019). Promotion of blue economies is perceived as a key from the authors (Allemand & Osborn, 2019), who argue that incorporation of sustainability principles and regulation of activities such as diving could be beneficial. Also, it is important to reduce carbon dioxide emissions.

Light pollution is considered a threat because it affects usual behaviours of diverse animals, insects and plants, but it can also contribute to erosion (Franz Hölker et al., 2010). However, (Hölker et al., 2021) also argued that the impacts of light pollution is yet to be completely understood, and this lack of understanding impedes the creation of proper regulation. Usually light pollution occurs in cities with high urban areas and commercialized areas (Lim et al., 2018). (Challéat et al., 2021) proposes the Dark Environmental Networks for creating unlit refuges which will reduce the impact of habitat fragmentation and should be carried with a balance with human needs. Some specific actions are avoiding to put light nearby bats habitats, and avoid light between midnight and four a.m.

Considering the literature and the analysis of the indicators, the following points of information deemed as important.

1) Firewoods nearby Protected Areas or within them are prohibited.
2) Using kerosene for lighting firewoods is discouraged.
3) Sources of plastic pollutants are identified and managed through the reduce, recycle, and reuse approach.
4) Campaigns for creating awareness, capacity and implementation of the reduce, recycle, and reuse approach are done.
5) Taxation for tourism is done.
6) Subsidies for green tourism goods exist.
7) Investment in innovations for low carbon emissions are available.
8) Initiatives that promote sustainable tourism are supported.
9) DMOs support agricultural businesses with low emissions to connect them with potential clients in the tourism industry and for growing their market capacity.
10) Large resorts and hotels have a wastewater management in their installations.
11) Environmental and Tourism Carrying capacity is stablished and respected.
12) DMOs, accommodation and restaurant businesses buy mostly from organic producers.
13) Accommodation and restaurant services avoid the use of pesticides and herbicides.
14) The noise in the destination is controlled for less than 55Db, especially during summer and nights.
15) Regulation for activities such as diving are existing.
16) Unlit refuges exist in areas nearby protected areas.
17) Lighting is avoided between midnight and 4 a.m.

5.12 Criterion Installations

Installations criterion contains seven indicators. Two were discarded due to repetition. The indicators are categorized in driving and state. The topics regarding installations are Construction made with responsible material, Promotion of natural design with the use of native ornamental plants, Use of sustainable office supplies, Souvenirs offered are not from endangered animal or plant species, and Gathering

information of species in the installations. This criterion category has five indicators left.

Sustainability in construction and the materials employed for it is important because it concerns the health of occupants, energy consumption and the environment. Constructions and buildings can be catalogued as green buildings, these should exhibit six features: "*water efficiency, energy efficiency, atmosphere, material and resources, sustainable sites, indoor environmental quality and innovation in design*" (Achintha, 2016) . As for the use of metals for sustainable construction, a major focus on preventing corrosion and using recycled metals. According to (Achintha, 2016), doing this requires an additional initial investment which is offset in the medium-long run. (Lambert, 2016). The use of timber and wood is also reliable for sustainable construction, although the management should make sure that the source of the material is sustainably sourced, this can be tackled through a chain of custody certification. Wood and timber are sustainable for diverse reasons, such as the low levels of co2 that embodies on its creation and manufacture, its production requires the growth of threes which absorb Co2, and it can be recycled in other products or biomass (Woodard & Milner, 2016).

Selecting the materials for the creation of new buildings is seen as an important step for environmental quality in building and construction (Bennacer et al., 2016). According to (Achintha, 2016) an appropriate use of glass is beneficial for energy efficiency matters, it also can be used for employing renewable energy methods such as solar energy technologies for electricity or heat. The use of waste glass can also be employed in the roads of the big resorts (Achintha, 2016).

Fibre resources for either building details and products, or even office supplies can also be considered as sustainable. The vegetable fibres can produce durable goods and its production contains low levels of embodied CO2 (Savastano et al., 2016).

Souvenirs within installations of tourism businesses such as hotels or even touristic agencies must inform and prohibit the sale of souvenirs that are created with endangered species of animals and plants. Natural souvenirs hinder natural environment and biodiversity conservation (Pabian et al., 2020). In other words, this action can compromise biodiversity. Some examples found in the literature is the case of Philippines, where tourists purchased dead species of butterflies, which could be contributing to the 49% of the butterfly taxa that are endangered in Philippines (Catibog-Sinha, 2011).

Using ornamental plants for the design and decoration of the touristic businesses and even destination remains as an effective initiative for protecting biodiversity. (Mohamad et al., 2013) researched which species in urban parks were better for birds and found that native plants and trees are providing better food and nesting areas to local birds. On the other hand, (Wilde et al., 2015) affirms that exotic species in the design of landscapes can harm trophic levels of plants, insects and herbivores. This is also confirmed in the research from (Burghardt et al., 2009), which was focused in the Mississippi River and found that native plants support the life and well-being of caterpillars, birds, biomass and other native species.

Considering the literature and the analysis of the indicators, the following initiatives or actions are considered as relevant information. The indicators are:

1) Construction made with responsible material.
2) Promotion of natural design with the use of native ornamental plants.
3) Use of sustainable office supplies.
4) Souvenirs offered are not from endangered animal or plant species.
5) Gathering information of species in the installations.

5.13 Criterion Importance of tourism

This criterion topic has 17 indicators, classified in Driving, Pressure and State. 1) Significance of tourism in regional economy determined by the share of regional

GDP 2) Percentage of employment 3) Economic cycle of regions 4) Quantity and quality of employment 5) Employment quality and good working conditions 6) Economic stability 7) Working conditions 8) Tourism spending or revenue 9) Percentage of employees in the hotel restaurant sector 10) Total annual expenditure in tourism 11) Public investment in tourism 12) Income from lodging establishments 13) Employment in the tourism activity as a percentage of total employment 14) Degree of tourism specialization 15) Structure for the management of urban tourist destinations 16) Nature of the tourist trade and hotel and catering trade 17) Increase in non-traditional activities in the area of analysis.

All the indicators will be kept because they depict the Driving forces that put Pressure on biodiversity or that dictate the current state of biodiversity.

5.14 Criterion Waste

This criterion has eight indicators, categorized in response and pressure. Four were discarded due to repetition. This criterion has now three indicators. The topics relevant to this category are waste production or generation in tourism, sewage treatment, and waste management and separated collection of packaging waste.

Waste is an important topic to address because tourists could generate more than the double of waste than local residents (Styles D et al., 2017). This waste is mostly generated in hotels. Thus, accommodations and restaurants can contribute to the solution of the problem. The waste comes in different materials and its considered as a inefficiency of material usage(M. R. Dileep) . (Styles D et al., 2017) points that reducing, reusing, sorting and recycling are priority for waste management. As the report points, prevention measures are contributing to the reduction of the waste in hotels and other accommodation places. This also goes along with (M. R. Dileep)'s research. Special attention should be paid to packaging because it can account for up to 40% of the total waste from a business. Also, individual portions in food and for hygiene products should be replaced. The avoidance of waste should be measured in weight. Other types of waste should also be tackled (glass, organics, cardboards, paper,

metals, plastics, etc). Monitoring and reporting remain crucial. Waste waters are also an important factor to be considered. According to (Styles D et al., 2017) the best practices are settling a pre-treatment system for the individual hotel or campsites, however sludge systems or centralised systems are also suitable.

(M. R. Dileep) argues that waste can be efficiently and effectively managed through minimization of waste, maximization of reusing and recycling, promotion of adequate disposal practices and extension of waste services. Anaerobic digestion is one of those good practices, along with integrated solid waste management. Littering has a high impact also contributing to visual pollution, it should be tackled for rapidly biodegradable waste, biodegradable waste and non-biodegradable waste, according to (M. R. Dileep). Zero waste is an economical method of waste management.

Considering the literature and the analysis, the following indicators are proposed:

1) Hotels have waste management areas and specialists.
2) Hotels follow an approach for reducing, reusing sorting and recycling.
3) Avoidance of weight is reported and measured.
4) Treatment water systems of pre-treatment systems are available.
5) Minimization of waste practices are done.
6) Promotion of adequate disposal practices is done for guests and staff.
7) Littering is not allowed.
8) Waste managers consider diverse types of waste, from water, to solid, to food, organic, plastics, and cardboards.

5.15 Criterion Certifications

This criterion category has 9 indicators divided in state, pressure, and response. Two were discarded because they are looking into the same topic. This key topic category ends with seven indicators regarding the following topics: knowledge about sustainable tourism certificates, sustainable fishing, sustainable establishments, green certifications for food products and recognition of environmental and touristic quality.

However, the decision will be to measure only two indicators, due to what the literature about the topic says. The indicators will be: presence of Green certificates and green awards, and presence of the Marine Stewardship Council label.

Sustainability Certification Schemes are processes for achieving determined standards or complying with specific criteria in products or services(Mori Junior et al., 2016). For the Sustainability Certification Schemes to be more effective, credible, and strong, (Mori Junior et al., 2016) argue that they should have basic key components, which are "*sustainability awareness, market access, management systems and productivity, social, environmental and economic impacts, monitoring outcomes, competition, overlapping and interoperability, stakeholder participation and accountability and transparency.*" (Mori Junior et al., 2016).

Another important factor about Sustainability Certification Schemes is that those that deliver better results are those that are performance-based because they can influence the practices within companies (Gulbrandsen, 2005). Also, that managing and measuring a few indicators that are relevant is better for small organizations, businesses or entities, although for bigger organizations a different level of performance can be also offered (Mori Junior et al., 2016). (Amundsen & Osmundsen, 2020a) shared that a standardized set of global indicators can create compromise and adaptation towards a sustainability certification scheme. Furthermore, the same author considers that collaboration between different types of certification schemes can be beneficial.

The Marine Stewardship Council, also knows and MSC label, is a guarantee for sustainable seafood sourcing (Marine Stewarship Council). Furthermore, the MSC label is one of the most recognized labels world-wide. According to the research done by, certified firms from the Spanish fishing industry have better economic outcomes than those that are not, although these results are through higher prices and sales, rather than reduction of costs (Peiró-Signes et al., 2020). For the matters of this thesis, the proposal is to use the presence of MSC labels in kitchens from touristic businesses as an indicator of sustainable fishery. Another indicator will be the presence of green

certificates and awards in the hotel industry, since these are positively impacting how consumers perceive the value of a certain product or service (Amundsen & Osmundsen, 2020b). Improvement track can be made through the increase of number of establishments that comply with the requirements from the MSC labels.

Considering the literature and analysis, the following indicators are proposed:

1) Presence of Green certificates and green awards,
2) Presence of the Marine Stewardship Council label

5.16 Criterion Fishing

This criterion category has eight indicators categorized in Pressure, Driving and Response. The indicators listed here are: 1) Promotion of good catch fish, ecological agriculture, products with animal respect and with green certification 2) Number of stocks with adaptative management system plans 3) Estimated fisheries catch and fishing effort 4) impacts of fisheries 5) Global bottom trawling 6) Amount of fishing in vulnerable habitats 7) Regulations for recovery plan of fisheries 8) Policies to minimize fisheries impact. All the indicators were discarded because they can be tackled through just one indicator: the presence of MSC labels or other accredited certification of sustainable fishing schemes.

5.17 Criterion Sustainable management

This criterion topic has nine indicators classified in driving and response. Two were discarded because they can be considered in just one indicator called sustainable providers are hired, the two discarded were 1) Compatible Acquisitions with environment and ecology 2) hiring businesses with sustainability labels that respect biodiversity. This key topic ends with seven indicators 1) Stablished goals for environmental management 2) Environmental criteria applied to tourism planning 3) Risk Management 4) Sustainable components of tourism products 5) Tourism strategy focused on sustainability 6) Sustainable providers are hired 7) Communications and management focused on sustainability.

Sustainable development's definition was established since 1987 and is "*the development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" (United Nations World Commission on Environment and Development, 1987). On the other hand, according to the UNWTO (UNWTO, 2021), sustainable tourism "*meets the needs of present tourists and hosts regions while protecting and enhancing opportunity for the future*." (United Nations, 2007). Furthermore, sustainable tourism manages all the resources, so that cultural integrity, ecological processes, and biodiversity are maintained while fulfilling also the economic, social and aesthetic needs.

(Dangi & Jamal, 2016) made a review of the evolution of the definition and application of sustainable tourism and community-based tourism. The result of their research was an integrated framework named as "sustainable community-based tourism" with three pillars and 11 criteria. The pillars are: Economic with four broad-criteria: economic benefits, local jobs and participation, institutional mechanisms to ensure economic benefits, visitor management**;** Ecological with four criteria: protection of natural environment, reducing waste and emissions, adaptative planning to environmental-friendly plans, assessing and monitoring; Social Cultural with three criteria: community well-being and satisfaction, community participation and empowerment, visitor satisfaction (Dangi & Jamal, 2016). All of them are addressed in different sections of this master thesis. Furthermore, the research supports the indicators of stablishing goals for environmental management, environmental criteria applied to tourism planning, and sustainable components of tourism products.

On the other hand, (Baum et al., 2016) make a statement of the importance of workforce and conditions when talking about sustainable management and thus tourism. (Baum et al., 2016) suggest the incorporation of bonding, bridging and linking to enhance a sense of ownership in natural resources, to spread education and awareness about tourism and the environment for building trust and finally involving also the community members in decisions. This will be helpful for addressing the issues

that some destinations face such as child labor, low wages, high rotation, and excessive time for work.

The risk management indicator is supported by (Farrell & Twining-Ward, 2005) because they argue that resiliency planning, risk assessment, hazard mitigations and adaptive planning are important to the complex system that sustainable tourism is. (Dangi & Jamal, 2016) argues that sustainable tourism should take a holistic view on which all the usual-businesses activities are performed with consideration of all the stakeholders involved, where the environment and local communities are also considered as one (Dangi & Jamal, 2016). This supports the indicators of having a tourism strategy and communications and marketing that are focused on sustainable tourism.

5.18 Criterion Reports & information

This criterion topic category contains four indicators 1) sustainability records and reports 2) Information is given to tourism providers and stakeholders 3) Information for visitors and sensibilization 4) Information influences tourism providers to do and promote activities in allowed areas. These key topics can be condensed in two: Tourism businesses offer sustainability records and reports, and information for tourists and tourist providers is sustained on reports and existent evidence.

Reporting is an important tool for Corporate Social Responsibility, which usually has a triple-bottom-line that includes sustainability and the environment. According to (Moravcikova et al., 2015)reports provide help for identifying success, and opportunity areas and future risks. These reports usually have information on how the company has impacted the environment that surrounds them.

According to (Székely & vom Brocke, 2017) the topics of the reports are focused on the three pillars of sustainability. Within the environmental pillar, reports usually expose information about conservation of resources, waste management,

control, life cycle analysis, and environmental performance, where biodiversity is considered. It is important to note that according to their analysis of 9,514 reports, "*biodiversity receives little attention in reports by organizations, along with renewable energy*". (World Travel & Tourism Council, 2017) also pointed that "*biodiversity value of water bodies and habitats affected by run-off and discharge*" was a less common but emerging indicator among sustainability reports from the travel industry. However, it is important to say that biodiversity loss can occur when there is a high demand and use of resources and consumption, or high levels of pollution, topics that are already been mentioned in the sustainability reports. (Székely & vom Brocke, 2017)

These reports must have the following characteristics: credibility, completeness, significance, and an appropriate form. (Moravcikova et al., 2015). In case some of these characteristics are missing, the sustainability reports could be considered as an example of green washing (Moravcikova et al., 2015). Also, the (World Travel & Tourism Council, 2017) considers it as fundamental that reports are created to be relevant to different stakeholders such as customers, investors, employees, raters, analysts, communities, advocacy and media groups, suppliers, industry peers, industry sustainability experts, arlines, competitors, and more.

Greenwashing is defined by as the ambiguous or misleading actions or companies to make consumers believe that their products or processes are good for the environment, while they are not (Magali A. Delmas & Vanessa Cuerel Burbano, 2011). (Magali A. Delmas & Vanessa Cuerel Burbano, 2011) researched the drivers for companies to engage in the practice of communicating good environmental performance, while they actually have poor environmental performance, and organized them in external, organizational and individual. The main drivers are: limited information about punishment or consequences of greenwashing, lack of information about the environmental performance of the company and its processes, restricted decision framing, and bias of being optimistic(Magali A. Delmas & Vanessa Cuerel Burbano, 2011).

Reporting can help to identify key issues to businesses and the whole sector, which can be addressed by analysis, and creation of policies (World Travel & Tourism Council, 2017). According to (World Travel & Tourism Council, 2017)reporting for sustainability is not yet a common practice in the travel and tourism industry. For example, (World Travel & Tourism Council, 2017) shares some critical issues for the industry and degradation of nature and harm to ecosystems along with biodiversity loss is considered a major one because it can also affect the attractiveness of destinations.

Considering the literature and analysis, the following indicators are proposed:

1) Tourism businesses offer sustainability records and reports.
2) Information for tourists and tourist providers is sustained on reports and existent evidence.
3) DMOS encourage and incentivize the creation of sustainability reports and records.

5.19 Criterion Proximity

Although this criterion has one indicator, it was considered due to the literature review. The indicator is proximity to cruise port, airport and UNESCO world heritage.

Spatial proximity from the ecosystem service and the area of biodiversity conservation is perceived as important by (Y. Liu et al., 2016). One of the reasons is that the land use and it's changes for urban expansion and agriculture deteriorates or impacts biodiversity (Y. Liu et al., 2016). They also argue that the proximity is important when planning for conservation because the landscapes that are adjacent to each other are important for biodiversity conservation strategies and policies.

The indicator considering the airport proximity to natural areas as important can be sustained by the idea that it is an artificial new landscape or cover type, the more artificial it is, the more impact it has on the biodiversity (Y. Liu et al., 2016); and also it can be related to noise pollution (Alquezar & Macedo, 2019). Excessive noise can affect animals on their reproductive behaviours and also cause them to escape, or act constantly. (Alquezar & Macedo, 2019) propose to reduce the noise on aircrafts, and

to do operational changes such as trainings for pilots to land at 4.5 inclinations to reduce the noise, also to do manoeuvres at a minimum altitude.

World Heritage Sites are recognized for having exceptional and outstanding biodiversity. There are currently more than 250 sites in more than 100 countries. Although tourism can provide income for it conservation, tourism is also considered as a threat to these places, therefore measures should be taken into account to take care of them (Osipova et al., 2020). Besides promoting its conservation via practices and communication, their existence could be used for creating and elevating awareness on how climate change acts, its impacts and how to mitigate it, even outside of the particular or specific World Natural Heritage (Samuels, 2017).

For the case of cruise ports and cruise tourism, (Carić & Mackelworth, 2014) reviews that the impacts of this type of tourism are wide. It can come in form of air emissions, waste that can also be chemicals or wastewater, biocides, which will affect sensitive ecosystems such as corals or other animals such as cetaceous, or even collisions or other type of physical disturbances, such as noise or even light. A realistic analysis of their benefits and impacts is necessary to avoid the case of Croatia, where the cost is seven times higher than the economic benefit, according to (Carić & Mackelworth, 2014)

Considering the literature, this section has the following indicators proposed:

1) Excessive noise due to aircrafts is reduced through operational changes.
2) World Heritage sites are used for creating and elevating awareness on how climate change acts and how to mitigate it.
3) An analysis of the benefits and impacts of cruise ports and tourism is carried for mitigating the impacts and elevating the benefits in the destination.

5.20 Criterion Volunteering

This criterion indicator has four indicators all in response category. 1) Volunteer time spent in conservation 2) Volunteer commitment and local participation

3) Corporate volunteering 4) Guests can participate in conservation projects or support them.

(Schmeller et al., 2009) argue that the role of volunteers is important for different aspects. One of them is the monitoring of changes and status of nature. According to (Schmeller et al., 2009) the monitoring with volunteers is successful in several ways because they can provide reliable data without unbiased results. However the methodology should be properly designed. (Ganzevoort et al., 2017) also call for taking into account that volunteers are motivated by their interest, their connection and concern for nature, thus they participate as volunteers. (Ganzevoort et al., 2017) shares those volunteers, also need to be considered as owners of the data they gather so they can also commit more to their volunteering.

Considering the literature, the following indicators are proposed:

1) Projects with clear guidelines and methodologies for corporate volunteering exist
2) Projects with clear guidelines and methodologies for tourist volunteering exist
3) Projects with clear guidelines and methodologies for local volunteering exist.

5.21 Criterion Tourist satisfaction

This criterion category has four indicators that are in pressure and impact. One was discarded due to repetition. The key topic category ends with three indicators: Visitor satisfaction, orientation of visitors in the region and town, user's perception of the tourist experience.

5.22 Criterion Sustainable council

This criterion topic category has three indicators 1) sustainability council existence and proper establishment, 2) the legal status of the Sustainable council is properly established 3) and their objective and missions are clearly established. These three indicators can be condensed in one: existence of a sustainability council with proper legal and identity status.

(Kılıç et al., 2021) argues that for the case of tourism and hospitality industries, the existence of a sustainability committee is crucial since they are more prone to issue reports about the subject and to follow guidelines and reporting activities that will be helpful for achieving sustainability goals. Sustainable councils can serve as guides and leaders for the knowledge about biodiversity. Even though this indicator appears relatively in low repetition times throughout the indicator systems.

6.0 Summary of findings for criteria and indicators for biodiversity in tourism destinations

In the previous section of this thesis, indicators and criteria for biodiversity protection were proposed and analysed based on their theoretic importance. Contemplating the connections between the previous criteria the current section contains five condensed criteria that considers these connections within the DSPIR framework model. The main biodiversity criteria proposed are:

1) Species and invasive species
2) Mass tourism avoidance and regulation
3) Pollution and waste management
4) Ecosystem and Protected Areas
5) Consumption of resources and water management.

These criteria are proposed due to their relevance on the indicator schemes analyzed, the literature review done, and the connections they have with other biodiversity criteria. This makes the proposed criteria and indicators related between each other.

Species and Invasive Species is the main criterion that is mentioned throughout different schemes. The analysis in this thesis considers that this criterion reflects a state, a pressure, and an impact. Five main indicators are proposed for it for whose enforcement and compliance tourism businesses and stakeholders are responsible. The indicators are:

1) Prohibition of hunting, trapping, and fishing of endangered species for leisure, tourism, and souvenir creation.

2) Avoidance of exotic and invasive species in ornamental purposes.

3)Awareness of the Protected Areas, biodiversity hotpots, endemic species, endangered species and extinction species of the destination.

4) Conservation activities for the Protected Areas, biodiversity hotpots, endemic species, endangered species and extinction species of the destination.

5) Documenting and awareness from tourism stakeholders of native species and how to take care of them is important for biodiversity.

Mass tourism avoidance and regulation is a criterion named after the key topics of tourism density, tourism intensity and tourism offer. Mass tourism is considered to be state, driving and pressure criterion. Three indicators are proposed:

1) Tourism and environmental carrying capacity are key concepts, both must be calculated and respected in the destination, since exceeding it generates more negative impacts than benefits for the environment and the locals.

2) The development of a destination is important, thus aiming for diversification of the ecotourist products and options of the destination and incentivizing them is necessary.

3) Regulation of tourism development and activities should exist according to seasonality, infrastructure available, and carrying capacities. Destination Management Offices, in collaboration with the government and tourism businesses are responsible of this indicator.

Pollution and waste management are related criteria for pressure, impact, and response. Stakeholder involved in the measurement of this criterion are hotels and restaurants, although Destination Management Offices in cooperation with the government are also part of the stakeholders involved.

1) Accommodation and food and beverage services should have waste management areas or specialists who will conduct the efforts and reporting on the activities done for minimization or even avoidance of waste and pollution, considering diverse types of waste, and the different publics involved, such as visitors and staff.

2) Waste management specialists should be in close communication with Destination Management Offices and Protected Areas management to develop rules and policies that will lower pollution. These could be the prohibition of firewood, plastics, taxation, investment incentives, creation of campaign awareness and, following the reduce, recycle, and reuse approach.

3) Government and Destination Management Offices in collaboration with private stakeholders develop a trustable scheme of incentives and penalties related to pollution in the tourism industry.

Ecosystem and Protected Areas can be considered as one criterion too, these are related to state and pressure. Among the indicators proposed are:

1) The Government has legislation and incentives for tourism businesses to restore landscape but also for mitigating ecosystem fragmentation.

2) Destination Management Offices know the level of awareness from tourism businesses about the natural areas, sensible areas and change of ecosystems overtime; and monitor that the average km2 of tourism businesses with natural areas outside installations increases.

3) Tourism businesses and Destination Management Offices consider naturalness of the environment as an asset.

4) Protected Areas have a clear monitor, regulation, and communication of a code of conduct and conservation of the area.

Consumption of resources and water management criterion is considered a pressure. Considering that hotels and businesses of tourism have specialists regarding waste management, the properties are responsible for the compliance of the following indicators.

1) Renewable energy use and saving is implemented.

2) Restaurants and hotels offer plant-based dishes.

3) Smart systems for efficient lighting are implemented.

4) There is a responsible for management of water and resources in businesses.

5) Cleaning supplies are environmentally friendly.

6) Solutions, policies, and strategies for water saving in touristic businesses exist.

7) Large resorts developments consider a pre-treatment water system in their installations.

8) Water treatment installations are available for all businesses in the destination.

These criteria and indicators will be assessed by experts who will assess their relevance and importance for measuring the level of biodiversity protection in a destination.

7.0 Results and discussion of expert survey

The set of indicators and criteria proposed is disseminated to a panel of 20 experts. The assessment by the experts is carried out by an online survey of seven questions on the platform "Survey Monkey". The structure of the survey follows the logic of the found criteria and indicators and asks for extra opinion. The questionnaire can be seen in *Appendix 6* of this thesis. The expert evaluation points to certain conclusions about the most important subject areas and indicators for biodiversity conservation in tourism destinations. Out of the 20 surveys that were sent, 12 were answered. From their answers conclusions can be gathered. The expert assessment is carried out for determining which criteria and indicators are considered as the most relevant and significant.

Although the literature review and the indicators system say that invasive species and attention to species is relevant for biodiversity conservation, 33.33% of the experts selected "Prevention and Regulation of Mass Tourism" as the most important criterion for biodiversity conservation in tourism destinations. This might be due to the fact that

experts that participated in the survey have a focus on tourism, while the schemes that were analyzed have a focus on biodiversity.

Survey Monkey shows the results with average and weighted scores, therefore one can see that "Prevention and "Regulation of Mass Tourism" has a high score of importance: 5.42. The scores were automatically calculated by the platform Survey Monkey which follows the following procedure: Average Ranking. Because the questions were ranking questions that asked respondents to rank the given criteria in order of importance, Survey Monkey automatically calculates the average rank for each of the respondents' choices to determine which of the criteria was ranked highest or preferred overall. (Survey Monkey). "*The answer choice with the largest average ranking is the most preferred choice. The average ranking is calculated as follows:* $1w1 + x2w2 + x3w3 \dots xnwn \div Total\ response\ count$*, where: w = weight of ranked position and x = response count for answer choice. Weights are applied in reverse. Thus, the respondent's most preferred choice has the largest weight, and their least preferred choice has a weight of 1*" (Survey Monkey). The default weights cannot be changed by the user. This procedure was also applied on the indicators. The results can be seen on the tables and figures of this section.

"Mass tourism Prevention and Regulation", is followed by "Ecosystem and Protected Areas" with 25% of the votes. However, the result with the weighted scores is also 5.42.

The next most important criteria are "Species and Invasive Species" and "Consumption of Resources and Water management", both with a total score of 16.67%. However, when looking at the weighted score, "Consumption of Resources and Water Management" has a higher one: 5.25. Therefore: Consumption of Resources and Water Management is the next most important.

"Pollution and Waste management" is the next most important criterion. It is important to note that, even if it received a total score of 8.33% for being the first most

important indicator, the weighted score is 4.75. Finally, "Regulation of Invasive Species and native species conservation" is the least important criterion according to experts.

	1	2	3	4	5	6	7	TOTAL	SCORE
Another (please specify)	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0	0.00
None of them	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0	0.00
Pollution and waste management	8.33% 1	25.00% 3	25.00% 3	16.67% 2	25.00% 3	0.00% 0	0.00% 0	12	4.75
Regulation of Invasive species and native species conservation	16.67% 2	0.00% 0	16.67% 2	16.67% 2	50.00% 6	0.00% 0	0.00% 0	12	4.17
Resource and water management	16.67% 2	25.00% 3	25.00% 3	33.33% 4	0.00% 0	0.00% 0	0.00% 0	12	5.25
Ecosystem and Protected Areas protection	25.00% 3	25.00% 3	25.00% 3	16.67% 2	8.33% 1	0.00% 0	0.00% 0	12	5.42
Prevention and regulation of mass tourism	33.33% 4	25.00% 3	8.33% 1	16.67% 2	16.67% 2	0.00% 0	0.00% 0	12	5.42

11Table Results Own information via Survey Monkey

According to the results the importance of the criteria are ordered in the following way:

Criteria for the preliminary index	Score
Prevention and regulation of mass tourism	5.42
Ecosystem and Protected Areas protection	5.42
Resource and water management	5.25
Pollution and waste management	4.75
Regulation of Invasive species and native species conservation	4.17

12Table own information via Survey Monkey

Criteria have their own indicators which were also evaluated by experts. The results for each one are the following.

The most important indicator for "Mass Tourism Prevention and Regulation" is:

1) Tourism and Environmental Carrying Capacities are measured and respected at the destination level, with a score of 3.1

The previous indicator is followed by "Development of Tourism and its activities are regulated according to seasonality challenges of the destination, tourism carrying

capacities and available infrastructure of the destination" and "The destination regulates visitor intensity affluence in order to avoid or diminish mass tourism". With a score of 2.7 each.

Indicator for Mass Tourism Prevention and Regulation	Score
Tourism and environmental carrying capacity are measured and respected at the destination level.	3.1
Development of Tourism and its activities are regulated according to seasonality challenges of the destination, tourism carrying capacities and available infrastructure of the destination	2.7
The destination regulates visitor intensity affluence in order to avoid or diminish mass tourism.	2.7
At the destination level, there are a variety of ecotourism products and opportunities to promote them	1.5

13Table, own information via Survey Monkey

The importance of the indicators for "Ecosystem and Protected Areas" has a similar score, all being between 2.0 and 2.7. The most important is "Tourism businesses are aware of the natural areas, sensitive ecosystems and how ecosystems change over time". Followed by the relevance of "Incentives and legislation for restoration of landscape and mitigation of ecosystem fragmentation exist at a destination level" with 2.6, and "There is a code of conduct and conservation efforts for protected areas that is monitored, regulated and communicated at a destination level", with 2.5.

Indicators for Ecosystem and Protected Areas	Score
Tourism businesses are aware of the natural areas, sensitive ecosystems and how ecosystems change over time.	2.7
Incentives and legislation for restoration of landscape and mitigation of ecosystem fragmentation exist at a destination level	2.6
There is a code of conduct and conservation efforts for protected areas that is monitored, regulated and communicated at a destination level.	2.5
Nature is seen and valued as an asset or important feature of the destination by the tourism stakeholders of the destination	2.2

14Table Own information via Survey Monkey

The four most important indicators for the criteria "Consumption of Resources and Water Management" are the following: 1) Tourism businesses and the destination management office have policies and strategies for water conservation. 2) Systems and strategies for renewable energy and energy saving are in place at a destination and

business level. 3) Hotels and tourism businesses have a specialist or team of specialists for water management in their facilities 4) Hotels and restaurants offer plant-based and local options for their menus. These four indicators, if completed, also cover the needs of the remaining five indicators.

Indicators for Consumption of Resources and Water Management	Score
Tourism businesses and the destination management office have policies and strategies for water conservation.	6.9
Systems and strategies for renewable energy and energy saving are in place at a destination and business level.	6.8
Hotels and tourism businesses have a specialist or team of specialists for water management in their facilities	6.2
Hotels and restaurants offer plant-based and local options for their menus.	5.1
Smart systems for efficient lighting are used in the tourism businesses of the destination.	5
Tourism businesses use only environmentally friendly cleaning products.	4.4
There are pre-treatment water systems in large resorts of the destination	4.3
Water treatment facilities are available for all tourism businesses in the destination.	3.5
Only native plants are used for ornamental purposes at a destination and business level	2.8

15Table 12, Own information via Survey Monkey

The most important indicator for "Pollution and Waste Management" is "Government and Destination Management offices work with private stakeholders to develop and enforce a trustworthy system of incentives and penalties related to pollution in the tourism industry at the destination level" with a score of 4.11.

For the final index, two indicators of "Pollution and Waste Management" can be merged into one: "Hotels and tourism businesses in the destination have waste management specialists as part of their management team", and "the waste management specialists are in close contact with destination management offices and management of protected areas in the destination".

Indicators for Pollution and Waste Management	Score
Government and Destination Management Offices work with private stakeholders to develop and enforce a trustworthy system of incentives and penalties related to pollution in the tourism industry at a destination level.	4.11
The approach of prevent, reduce, and recycle approach is pursued at a destination level.	3.11
Hotels and tourism businesses in the destination have waste management specialists as part of their management team.	2.89
The waste management specialists are in close contact with destination management offices and management of protected areas in the destination.	2.56
Firewood, the use of plastic, littering, and improper disposal of waste are prohibited in destinations.	2.33

16Table 13 Own information via Survey Monkey

The most important indicator for "Species and Invasive Species" is 1) Conservation measures and efforts for protected areas, biodiversity hotpots, endemic species, endangered species, and species threatened with extinction exist at the destination level and are well-documented. None of the respondents marked the "control of invasive species" as the most relevant for biodiversity conservation, which is contradictory with the literature review (Anderson et al., 2015; Fred Dyke, 2008; Hall, 2010a, 2010b; Haubrock et al., 2021; Haubrock et al., 2022; Shabani et al., 2020).

Indicators for Species and Invasive Species	Score
Conservation measures and efforts for protected areas, biodiversity hotpots, endemic species, endangered species and species threatened with extinction exist at the destination level and are well-documented.	3.7
The prohibition of hunting, trapping, and fishing of endangered species for the purposes of leisure, tourism, and souvenir making is enforced at a destination level.	3.5
Tourism businesses and tourists are aware of the protected areas, biodiversity hotpots, endemic species, endangered species, and species threatened with extinction of the destination.	3.4
Evidence of documentation of species living in the destination and awareness campaigns towards native species conservation exists at the destination level.	2.86
Measures to avoid exotic and invasive species for ornamental purposes are implemented at a destination level	2.1

17Table 12 Own information via Survey Monkey

For validating the relevance and importance of these indicators a comparison with those proposed by (Global Sustainable Tourism Council, 2019), which are considered as the minimum criteria that a destination should have or aspire to have in order to be sustainable. The main reason that this document was selected for comparison and validation of the indicators and criteria proposed is because the (Global Sustainable

Tourism Council, 2019) argues that it was created for providing guidance for sustainability standards in the world and among industries and sectors. Section 8.0 contains the final indicators with their equivalents, their role on the DPSIR framework and weighted averages.

8.0 Conclusions and final proposed index

Biodiversity and tourism have impacts on one another, and tourism impacts on biodiversity can be harmful, but can also be beneficial. There is a need for developing a system of criteria and indicators that are easy to use, applicable in different contexts and based in research and evidence. This master thesis conducted a survey with experts after doing an extensive analysis and literature review about biodiversity conservation in tourism destinations. The result is a set of 5 criteria and 27 indicators proposed in an index for measuring biodiversity conservation in tourism destinations. The proposal is that the indicators are answered with yes, which has a value indicated on the index, or no, which has a value of 0, and supporting evidence. The indicators can be answered by different stakeholders in the tourism destinations, from hotel managers -whom may have information about the presence of a specialist in waste management-, or by DMOs who could gather all the information for measuring this index. According to the literature and the expert survey, the indicators and criteria have different importance when measuring the biodiversity conservation in tourism destinations. Therefore, scores were obtained from the answers of the expert survey and the 5 criteria and 27 indicators were weighted according to these scores. If an assessment were to be conducted, the value of each indicator would be either 0 or the defined value -existence or inexistence-. The proposed index is built by using the weights-scores of expert opinions-. To achieve the index for a destination, the first step is to collect the values of the indicators and then weight them according to the index model.

Four criteria have a weight of 1, since all had a similar value range, except for Species and Invasive Species, which has a deviation of 20%, therefore, its weighted value its 0.8. The highest achievable index, if all indicators are answered with yes, has the value of 20.86, which in other words means that the destination has a high standard on biodiversity conservation.

For the case of the weights of the indicators the following process was followed: the highest value of indicators was taken as the reference, that is 100%, for calculating the equivalent value in percentage of the other indicators. For example, 3.7 is the highest total score of the indicator obtained from the expert survey, this indicator is named: "*Conservation measures and efforts for protected areas, biodiversity hotpots, endemic species, endangered species and species threatened with extinction exist at the destination level and are well-documented"* from the criterion Species and Invasive Species, and it was taken as 100%. Thus, other indicator of the same criterion Species and Invasive Species: "*Evidence of documentation of species living in the destination and awareness campaigns towards native species conservation exists and is done at the destination level*.", that has a total score of 2.86 obtained from the expert survey, has a value in percentage of 77%, rounded to 80%. The results for each indicator of this proces can be seen in *Appendix 7.*

The preliminary index also shows the criteria, indicators, their equivalent according to the information from the GSTC, and their role on the DPSIR framework. The preliminary index, *Table 18 – Preliminary Index for Biodiversity Conservation, Own elaboration,* is shown here as an image but the document in excel is also provided for its use. A plausible next step for developing this research further is the application on pilot destinations and data gathering to assess the extent to which the proposed indicators are easy to use for tourism stakeholders.

Table 18 Preliminary Index for Biodiversity Conservation - Own elaboration

Towards a multidimensional biodiversity index for tourism destinations

# & letter GSTC	Equivalent on GSTC	Criteria	Highest achievable index for the subject area	Indicators	DPSIR	Weight of the indicator	Evidence (insert link)	How to measure and potential sources of information
D2. a.	Monitoring of visitor flows and impact on natural sites, with results shared across the destination.	Prevention and Regulation of Mass Tourism	3.5	Tourism and environmental carrying capacity are measured and respected at the destination level.	R-D-P	1		A potential method to calculate ecological carrying capacity is: EECC=min(WECC,AECC,SWCC)
				Development of Tourism and its activities are regulated according to seasonality challenges of the destination, tourism carrying capacities and available infrastructure of the destination.	I-P-D	1		**WECC**=daily sewage treatment level in the destination ÷ daily sewage production in the destination. **AECC**=(tourist area m2×forest coverage ratio) ÷ (per capita green areas) **SWCC**=(total amount of daily disposed of solid waste ÷ total per capita daily disposed of waste)
C6. a.	Monitoring of visitor flows and impact on cultural sites, with results shared across the destination.			The destination regulates visitor intensity affluence in order to avoid or diminish mass tourism.	R-P	1		
				At the destination level, there are a variety of ecotourism products and opportunities to promote them.	S-R	0.5		Field Work, DMO, Local policies and strategies of the destination .
D1. a.b.c.d .e.f	List of natural heritage sites and assets, indicating type, conservation status and vulnerability. Programmes to conserve biodiversity and natural heritage. Programmes to eradicate and control invasive species. Action to identify, monitor and mitigate tourism impacts on biodiversity and natural heritage. Mechanisms for using income from tourism to support conservation of natural assets. Communications with visitors and enterprises on reducing spread of alien species.	Ecosystem and Protected Areas	4	Government and Destination Management Offices work with private stakeholders to develop and enforce a trustworthy system of incentives and penalties related to pollution in the tourism industry at a destination level.	S-P	1		National legislation, DMOS, Local government, Field Work
				Tourism businesses are aware of the natural areas, sensitive ecosystems and how ecosystems change over time.	S-D	1		Field work and DMO
				Nature is seen and valued as an asset or important feature of the destination by the tourism stakeholders of the destination.	I-S	1		National legislation, Protected areas management, DMO, surveys
				There is a code of conduct and conservation efforts for protected areas that is monitored, regulated and communicated at a destination level.	R-I	1		Protected areas management, DMOs, Local and national legislation
D4. g.	Enforcement of legislation to ensure that any hunting activity is part of a scientifically based, properly managed and strictly enforced approach to conservation.	Species and Invasive Species	4.2*0.8 = **3,36**	Conservation measures and efforts for protected areas, biodiversity hotpots, endemic species, endangered species and species threatened with extinction exist at the destination level and are well-documented.	R-D-P	1		Field Work, Protected Areas Managemen, National Legislation and Local government
				The prohibition of hunting, trapping, and fishing of endangered species for the purposes of leisure, tourism, and souvenir making is enforced at a destination level.	R-D-P	1		National, local and municipal legislation
				Tourism businesses and tourists are aware of the protected areas, biodiversity hotpots, endemic species, endangered species and species threatened with extinction of the destination.	I-S	1		DMOs, Field Work, tourism businesses, surveys
				Evidence of documentation of species living in the destination and awareness campaigns towards native species conservation exists and is done at the destination level.	I-R-S	0.8		DMOS, Local environmental authorities, Protected areas management, national and local legislation
				Measures to avoid exotic and invasive species for ornamental purposes are implemented at a destination level.	R-D	0.4		National and local legislation
D5. b.c.d	Energy consumption targets are publicised and promoted. Programme to increase energy efficiency. Investment in renewable energy and percent of total provision/consumption. Support and incentives for energy monitoring and reduction by enterprises.	Consumption of resources and water management	6.50	Tourism businesses and the destination management office have policies and strategies for water conservation.	D-P	1		Field Work, DMOs, Tourism businesses management
				Systems and strategies for renewable energy and energy saving are in place at a destination and business level.	S-R	1		DMOS, local government
				More than half of the hotels and tourism businesses have a specialist or team of specialists for water management in their facilities	R-D-P	1		Field Work, DMOs, Tourism businesses management, field work
				More than half of the hotels and restaurants offer plant-based and local options for their menus.	R	0.7		Hotels & Businesses - Field Work
				Smart systems for efficient lighting are used in more than half of the tourism businesses of the destination.	R	0.5		Local authorities and tourism businesses and DMOS
D6. a.b.c.d	Provision of guidance and support for monitoring and reduction of water usage by enterprises. Program to regularly assess water risk. Setting, publication and enforcement of water stewardship goals, where water risk has been assessed as high. Monitoring and control of sources and volume of water used for tourism purposes and its effect on local communities and ecosystems. Promotion and checking of adherence to goals by tourism enterprises.			Tourism businesses use only environmentally friendly cleaning products.	R	0.6		Local authorities
				There are pre-treatment water systems existing in large resorts of the destination.	S-R	0.6		Field Work
				Water treatment facilities are available for all tourism businesses in the destination.	R-D-P	0.7		National legislation and Destination Management Office
				Only native plants are used for ornamental purposes at a destination and business level.	R	0.4		Hotels & Businesses - Field Work
D8, D9, D10, D12.	The destination has guidelines and regulations to minimize light and noise pollution, waste, water contamination, and gas emissions. The destination has targets to reduce greenhouse pollution, waste, and gas emissions, and implements and reports on mitigation policies and actions. Enterprises are encouraged to measure, monitor, reduce or minimise, publicly report and mitigate greenhouse gas emissions, waste and pollution from all aspects of their operation .	Pollution and waste management	3.5	Government and Destination Management Offices work with private stakeholders to develop and enforce a trustworthy system of incentives and penalties related to pollution in the tourism industry at a destination level.	D-P	1		Hotels & Businesses - Field Work - Destination Management Office
				The approach of prevent, reduce, and recycle approach is pursued at a destination level.	R	0.7		Hotels & Businesses - Field Work - Destination Management Office - Local Authorities
				Hotels and tourism businesses in the destination have waste management specialists as part of their management team.	R-D-P	0.7		Hotels & Businesses - Field Work - Destination Management Offices-Local Authorities
				The waste management specialists are in close contact with destination management offices and management of protected areas in the destination.	I-S-P	0.6		Hotels & Businesses - Field Work- Destination Management Office
				Firewood, the use of plastic, littering, and improper disposal of waste are prohibited in destinations.	S	0.5		National and local authorities
			20.86					

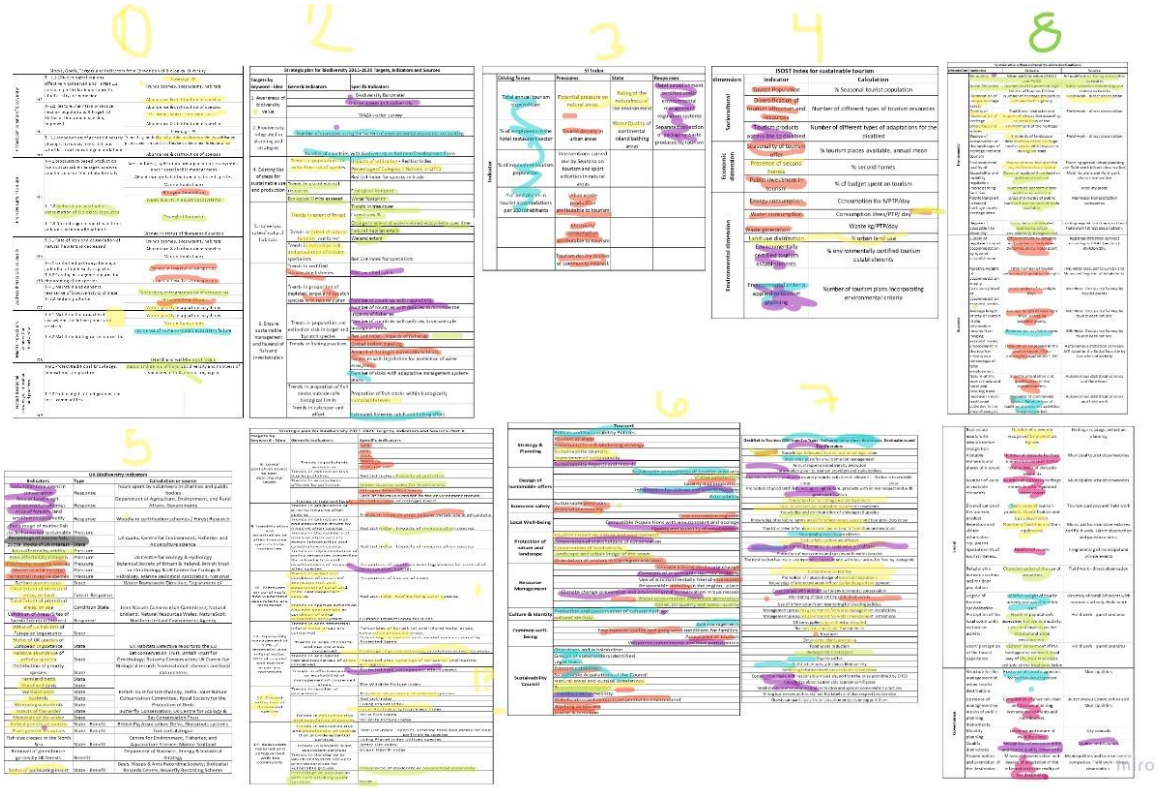
Own elaboration, columns A & B with information from (Global Sustainable Tourism Council, 2019)

9.0 Limitations of the research

Developing a preliminary index for biodiversity conservation in tourism destinations was the goal of this thesis. After a detailed analysis of eight indicator systems for biodiversity and tourism sustainability, and extensive literature review, the result is an index with five main criteria and an overall maximum score of 20.85. Destinations can measure their level of biodiversity conservation by answering yes or no to the indicators proposed. The limitations of this research consist in distinct factors: the number of experts that effectively answered the survey: 12 out of 20, and out of those 12, not all of them answered the survey completely. A wider survey with more population of experts can throw more relevant findings. The selection of the experts can also be a limitation of this research since their expertise is in tourism and its sustainability, for instance some indicators system considers “species and control of invasive species” as one of the most important criteria to look into, however, according to the consulted experts these criteria would be less important than “Mass Tourism” or “Consumption of resources and water management”, for example. Further research or development of a index could consider a survey of multidisciplinary experts and from different areas, also another research path could be the development of the total 22 criteria originally derived.

10. Appendixes

10.1 Appendix 1: Miró Overview



10.2 Appendix 2: Indicators classified by DPSIR framework – Excel. 6 Tables

10.2.1 Driver

Driver Indicators

Original table	Indicator	Key concept
6	Accessibility	Accessibility
7	Construction made with responsible materials, no from the ones prohibited by CITES	Construction
1	Incidence of human-induced ecosystem failure	Ecosystem
7	Education and formation on sustainability is offered	(Education)
2	Number of countries using the system of environmental economic accounting	Environmental economic accounting
2	Number of stocks with adaptative management system plans	Fishing
2	Estimated fisheries catch and fishing effort	Fishing
7	Information given to tourism providers and stakeholders	Information
7	Gathering information of species in the installations	Information & reporting
6	Legal status of the sustainability council	Legal Status
2	Number of countries with biodiversity in National Development Plans	Policies
6	Politics and Sustainability Policies	Policies
6	Protection and conservation of cultural heritage	Policies
7	Knowledge & respect for environmental legislation	Policies
6	Risk Management	Risk Management
6	Groups of stakeholders identified	Stakeholders

Own compilation with information from (Convention on Biological Diversity, 2006), (Convention on Biological Diversity, 2011); (Convention on Biological Diversity, 2016) (Fernández & Rivero, 2009) (Anna Torres-Delgado & Francesc López Palomeque, 2018) (Department for Environment Food & Rural Affairs, 2021)*(TourCert)*(Ecotrans e.V, 2015) (Gema Florido Trujillo et al., 2018)

10.2.2 Pressure

Pressure Indicators		
Original table	**Indicator**	**Key concept**
5	Area affected by acidity	Acidity
2	Climate actions on climate change	Actions
2	Trends in certified sustainable fisheries	Certification
3	Electricity consumption attributable to tourism	Consumption
4	Energy consumption	Consumption
4	Water consumption	Consumption
6	Water consumption	Consumption
6	Resources consumption	Consumption
6	Economic cycle of regions	Economic
6	Quality and quantity employment	Economic
6	Employment quality and good working conditions for families	Economic
6	Economic stability	Economic
6	Working conditions	Economic
3	Potential pressure on natural areas	Ecosystem
2	Impacts of fisheries	Fisheries
2	Global bottom trawling	Fisheries
2	Amount of fishing in vulnerable habitats	Fisheries
6	Acceptance of tourism	Locals
2	Mercury	Mercury
1	Nitrogen Deposition	Nitrogen
2	NOX	Nitrogen
2	Global surplus of nitrogen trend	Nitrogen
5	Area affected by nitrogen	Nitrogen
6	Quality and innovation	Offer
6	Sustainable providers	Offer
2	Pesticide use	Pesticide
2	Pops	POPS
2	Regulations for recovery plan	Regulations
2	Policies to minimize fisheries impacts	Regulations
2	Legislation for protection of water ecosystem	Regulations
6	Tourism Strategy	Regulations
6	Communication & Marketing	Regulations
6	Demand seasonality	Seasonality
2	SOC	Pollution
6	Justice & Inclusion	Social

1	Trends in invasive alien species	Species
2	Invasive alien species eradications	Species
5	Freshwater invasive species	Species
5	Marine coastal invasive	Species
5	Terrestrial invasive species	Species
1	Marine trophic index	Trophic level
3	Tourist density	Tourism density
3	Tourism density in sites of community interest	Tourism density
6	Orientation of visitors in the region and town	Tourists
4	Tourist population	Tourism density
6	Use of environmentally friendly transport	Transport
4	Public investment in tourism	Tourism investment
4	Diversification of tourism attraction and resources	Tourism Offer
4	Tourism products to disabled are available	Tourism Offer
6	Responsible mobility in the region	Transport
3	Urban waste production attributable to tourism	Waste
4	Waste generation	Waste
6	Waste generation	Waste
7	Management pressures for waste management installations	Waste
7	Management pressures for water management installations	Water

Own compilation with information from (Convention on Biological Diversity, 2006), (Convention on Biological Diversity, 2011); (Convention on Biological Diversity, 2016) (Fernández & Rivero, 2009) (Anna Torres-Delgado & Francesc López Palomeque, 2018) (Department for Environment Food & Rural Affairs, 2021)*(TourCert)*(Ecotrans e.V, 2015) (Gema Florido Trujillo et al., 2018)

10.2.3 State

Original table	Indicator	Key concept
7	Knowledge about sustainable tourism certificates	Certifications
2	Trends in extent of forest	Ecosystem
2	Trends in tree cover	Ecosystem
2	Forest area %	Ecosystem
2	Trends in extent of natural habitats	Ecosystem
2	Wetland extent	Ecosystem
2	Extinction risk and population of habitat	Ecosystem
2	Extent and condition of coral reef	Ecosystem
2	Risk and population of vulnerable ecosystems	Ecosystem
3	Rating of the naturalness of environment	Ecosystem
5	Status of UK habitats	Ecosystem
6	Tourism impact on nature and environment	Ecosystem
6	Conservation of biodiversity	Ecosystem
6	Natural Areas outside installations	Ecosystem
7	Knowledge of sensible nature areas	Ecosystem
7	Protection of ecosystems and species with extinction risk	Ecosystem
1	Trends of genetic diversity	not included
7	Promotion of natural design of external installations	Installations
7	Ornamental plants are native	Installations
7	Office supplies are certified or recycled	Installations
7	No plastic is used	Pollution
7	Biodegradable detergent is used	Pollution
7	No souvenirs are made from animals	Installations
7	Construction made with responsible materials	Installations
4	Land use distribution	Land use
7	Local businesses protect ecosystems	Locals
7	No animal spectacles are offered	Offer
7	Eco touristic options are offered	Offer
1	Coverage PA	Protected Areas
2	Inland water areas are conserved	Protected Areas
2	Marine and Costal areas protected by Protected Areas	Protected Areas
2	Protected area of terrestrial and marine ecoregions	Protected Areas
2	Coverage of Protected Areas in relation to marines areas	Protected Areas
5	Total Extent of Protected Areas, on land	Protected Areas
5	Total Extent of Protected Areas, on sea	Protected Areas
1	Abundance and distribution of species	Species

1	Change in status of threatened species	Species
1	Marine Trophic Index	Species
2	Trends in population and extinction risk of species	Species
4	Presence of second homes	Second homes
2	Extinction risk and population of coral reef and species	Species
2	Proportion of fish stocks within biologically sustainable levels	Species
2	Trends un abundance of selected species	Species
2	Extinction Risk and population of species	Species
2	Extinction risk of species that provide essential services	Species
5	Status of UK species	Species
5	Relative abundance of priority species	Species
5	Distribution of species	Species
5	Farmland birds	Species
5	Woodland Birds	Species
5	Seabirds	Species
5	Wintering waterbirds	Species
5	Insects of the wider	Species
5	Mammals of the wider	Species
5	Animal genetic resources	Species
5	Plant genetic resources	Species
5	Status of pollinating insects	Species
7	Knowledge and communication of endangered species	Species
6	Sustainability councils	Sustainability
6	Importance of sustainability	Sustainability
1	Water Quality	Water
3	Water Quality of continental inland bathing areas	Water Quality
5	Surface water status	Water Quality

Own compilation with information from (Convention on Biological Diversity, 2006), (Convention on Biological Diversity, 2011); (Convention on Biological Diversity, 2016) (Fernández & Rivero, 2009) (Anna Torres-Delgado & Francesc López Palomeque, 2018) (Department for Environment Food & Rural Affairs, 2021)*(TourCert)*(Ecotrans e.V, 2015) (Gema Florido Trujillo et al., 2018)

10.2.4 Impact

Impact Indicators

Original table	Indicator	Key concept
1	Connectivity or fragmentation of ecosystems	Ecosystems
2	Change in extent of water-related ecosystems over time	Ecosystems
1	Ecological footprint	footprint
2	Ecological footprint	Footprint
6	Noise, air quality and water quality	Living quality
1	Health and well-being of locals	Locals
1	Status and trends of linguistic diversity and number of speakers in indigenous languages	Locals
2	Prevalence of food insecurity	Locals
6	Cultural Identity	Locals
6	Residents satisfaction	Locals
2	Impacts of pollution	Pollution
5	Area affected by acidity and nitrogen	Pollution
2	Impacts of invasive alien species	Species
6	Landscape and urban image of the town	Tourism Offer
6	Visitor satisfaction	Tourists satisfaction
6	Visitor satisfaction	Tourists satisfaction
2	Water footprint	Water
2	Population with safe drinking water services	Water Access
1	Water quality in aquatic ecosystems	Water quality
2	Water Quality Index for Biodiversity	Water quality

Own compilation with information from (Convention on Biological Diversity, 2006), (Convention on Biological Diversity, 2011); (Convention on Biological Diversity, 2016) (Fernández & Rivero, 2009) (Anna Torres-Delgado & Francesc López Palomeque, 2018) (Department for Environment Food & Rural Affairs, 2021)*(TourCert)*(Ecotrans e.V, 2015) (Gema Florido Trujillo et al., 2018)

10.2.5 Response

Response Indicators

Original table	Indicator	Key concept
4	Tourism products are accessible to disabled	Accessibility
6	Compatible Acquisitions with environment and ecology	Acquisitions
5	Condition of areas / sites of special scientific interest	Areas status
2	MSC certified catch	Certified
3	Hotel establishment certified under environmental management regulation systems	Certified
4	Environmentally certified tourism establishments	Certified
4	Area of forestry land certified as sustainably	Certified
7	Promotion of good catch fish, ecological agriculture, products with animal respect and with green certification	Certified
3	Separated collection of packaging waste produced by tourism	Waste
6	Cooperation of stakeholders of conservation	Cooperation
4	Fish stocks caught sustainably	Fishing
6	Information for visitors and sensibilization	Information
7	Influences tourism providers to do and promote activities in allowed areas	Information
2	Online interest in biodiversity	Interest
4	Area of land agri-environmental schemes	Land use
7	Stablished goals for environmental management	Management
6	Concepts of responsible touristic mobility	Mobility
6	Friendly-useful mobility	Mobility
2	Number of countries with regulations	Policies
2	Number of countries with policies to minimize the impacts of fisheries	Policies
2	Number of countries with policies to secure safe biological limits	Policies
2	Proportion of countries with legislation for control of invasive alien species	Policies
7	Use of information from monitoring for creating policies	Policies
7	Establishment of environmental protection and species conservation practices	(Practices)
6	Climate change prevention and environmental conservation in business	(Prevention)
7	Promotion for not selling protected products	(Promotion)
2	Protected area management effectiveness	Protected Areas
7	Local businesses are motivated to protect ecosystems	(Protection)
6	Sustainability Reports and records	Reports
7	Hiring businesses with sustainability labels that respect biodiversity	Sustainability
4	Environmental criteria applied to tourism planning	(Tourism)

7	The destination has made a compromise to cooperate with local actors for freeing transgenic	Transgenic
4	Volunteer time spent in conservation	Volunteering
6	Volunteer commitment and local participation	Volunteering
7	Corporate volunteering	Volunteering
7	Guests can participate in conservation projects or support them	Volunteering

Own compilation with information from (Convention on Biological Diversity, 2006), (Convention on Biological Diversity, 2011); (Convention on Biological Diversity, 2016) (Fernández & Rivero, 2009) (Anna Torres-Delgado & Francesc López Palomeque, 2018) (Department for Environment Food & Rural Affairs, 2021)*(TourCert)*(Ecotrans e.V, 2015) (Gema Florido Trujillo et al., 2018)

10.2.6 Cultural urban destinations classified.

Sustainable urban cultural tourism destinations		
Indicator	**Key topic**	**DPSIR role**
Air quality	Air Quality	Pressure
Noise Pollution	Pollution	Pressure
Illumination of unique heritage assets	Heritage Illumination	State
Quality of illumination of heritage properties and spaces	Heritage Illumination	State
Degree of conservation of the landscape of heritage interest tourism	Ecosystem degradation	State
Environmental quality of tourism projects	Ecosystem	Driver
Accessibility and mobility regulation	Mobility	Pressure
Public parking facilities	Mobility	Driver
Public transport in tourist heritage tourist heritage sites	Mobility	Pressure
Degree of adaptation to disability	Mobility	State
Supply of regulated tourist accommodation by type of establishment	Tourism intensity	Pressure
Relative weight of accommodation supply	Tourism density	Pressure
Occupancy level of accommodation establishments.	Tourism intensity	Driver
Average length of stay of visitors in the destination	Tourism intensity	Driver
Income from lodging establishments	Tourism importance	Driver
Employment in the tourism activity as a percentage of total employment	Employment	Driver
Nature of the tourist trade and hotel and catering trade.	Economic environment	Driver
Increase in non-traditional activities in the area of analysis	Economic environment	Driver
Real estate assets with administrative recognition	Cultural environment	Driver
Visitable elements and places of interest	Cultural environment	Pressure
Number of users in visitable elements	Tourism intensity	State
Diversification of the tourism product	Tourism Offer	State
Reception and visitor information equipment.	Tourism Offer	Driver
Special events of tourist interest.	Tourism Offer	State
Relationship between visitors and resident population	Locals	Pressure
Degree of tourism specialization	Tourism importance	Pressure
Perception of the local community on tourism activity.	Locals	Driver
Users' perception of the tourist experience.	Tourist Satisfaction	Driver
Structure for the management of urban-tourist destinations	Tourism importance	Driver

Existence of management by means of public planning instruments.	Tourism Planning	Driver
Mobility planning	Mobility	Pressure
Quality distinctions	Certified	State
Dissemination and promotion of the destination	Promotion	State

Own compilation with information from (Convention on Biological Diversity, 2006), (Convention on Biological Diversity, 2011); (Convention on Biological Diversity, 2016) (Fernández & Rivero, 2009) (Anna Torres-Delgado & Francesc López Palomeque, 2018) (Department for Environment Food & Rural Affairs, 2021)*(TourCert)*(Ecotrans e.V, 2015) (Gema Florido Trujillo et al., 2018)

10.3 Appendix 3: Key concepts comparison. Excel

Key concepts comparison				
State	**Pressure**	**Impact**	**Driving**	**Response**
Certifications	Acidity	Air Quality - Locals	Accesibility	Accesibility
Cultural environment	Actions	Ecosystems	Cultural environment	Protected Areas
Ecosystem	Certification	Ecosystems	Economic environment	Certified
Ecosystem	Consumption	footprint	Ecosystem	Certified
Ecosystem	Consumption	Footprint	Education	Certified
Ecosystem	Consumption	Living quality	Fishing	Certified
Ecosystem	Consumption	Locals	Fishing	Certified
Ecosystem	Consumption	Locals	Information	Certified
Ecosystem	Consumption	Locals	Information & reporting	Consumption
Ecosystem	Consumption	Locals	Instalations - Construction	Cooperation
Ecosystem	Economic cycle	Locals	Policies	Fishing
Ecosystem	Economic environment	Locals	Policies	Information
Ecosystem	Economic stability	Locals	Policies	Information
Ecosystem	Ecosystem	Noise Pollution	Policies	Interest
Ecosystem	Employment	Pollution	Policies - Legal status	Land use
Ecosystem	Employment	Pollution	Stakeholders	Mobility
Ecosystem	Employment	Species	Sustainability Council	Mobility
Ecosystem	Employment	Tourism Offer	Sustainable management -	Mobility
Ecosystem	Fisheries	Tourist Satisfaction	Sustainable management -	Mobility
Ecosystem degrad	Fisheries	Tourists satisfaction	Sustainable management -F	Mobility
Genetic diversity	Fisheries	Tourists satisfaction	Tourism expenditure	Mobility
Heritage Illumina	Locals	Water	Tourism density	Policies
Heritage Illumina	Mercury	Water Access	Tourism employment	Policies
Instalations	Mobility	Water quality	Tourism importance	Policies
Instalations	Nitrogen	Water quality	Tourism importance	Policies
Instalations	Nitrogen		Tourism importance	Policies
Instalations	Nitrogen		Tourism intensity	Practices
Instalations	Nitrogen			Prevention
Instalations	Offer			Promotion
Instalations	Offer			Protected Areas
Land use	Pesticide			Protection
Offer	POPS			Reports
Offer	Promotion			sustainable management
Protected Areas	Regulations			Sustainable Management
Protected Areas	Regulations			Sustainable Management
Protected Areas	Regulations			Tourism Plannin
Protected Areas	Regulations			Transgenic
Protected Areas	Regulations			Volunteering
Protected Areas	Seasonality			Volunteering
Protected Areas	SOC			Volunteering
Second homes	Social justice			Volunteering
Species	Species			Waste
Species	Species			
Species	Species			
Species	Species			
Species	Species			
Species	Thropic level			
Species	Tourism density			
Species	Tourism density			
Species	Tourism density			
Species	Tourism density			
Species	Tourism intensity			
Species	Tourism intensity			
Species	Tourism intensity			
Species	Tourism investment			
Species	Tourism Offer			
Species	Tourism Offer			
Species	Tourism Offer			
Species	Tourism Planning			
Species	Tourists orientation			
Species	Transport			
Species	Waste			
Species	Waste			
Sustainability cou	Waste			
Sustainability imp	Waste			
Tourism Offer	Waste			
Tourism Offer				
Water				
Water Quality				
Water Quality				

Source: Own elaboration.

10.4 Appendix 4: First clustering of key concepts

Key concepts found - first clustering	
Number	Topic
1	Accesibility
2	Areas status - Protected Areas
3	Certifications
4	Consumption
5	Cooperation
6	Cultural environment
7	Economic environment
8	Ecosystem
9	Education
10	Employment
11	Fisheries
12	Footprint
13	Genetic diversity
14	Heritage Illumination
15	Information & reporting (reports)
16	Instalations - Construction
17	Interest
18	Land use
19	Living quality - Locals
20	Mobility
21	Policies - Legal status
22	Pollution
23	Prevention
24	Promotion
25	Protected Areas
26	Protection
27	Regulations
28	Seasonality
29	Second homes
30	Social justice
31	Species
32	Stakeholders
33	Sustainability council
34	Sustainability importance
35	Sustainable Management
36	Thropic level
37	Tourism expenditure & investment, economic importance
38	Tourism density & intensity
39	Tourism Offer
40	Tourists satisfaction & orientation
41	Transgenic
42	Volunteering – Practices & Actions
43	Waste
44	Water

Source: own elaboration

10.5 Appendix 5: Key topics repetition and criteria definition

Key topics repetition and criteria definition			
Percentages	**Times**	**Topic – criteria definition**	**Remainder of indicators per topic**
11.7391304	27	Species & Invasive Species	22
8.69565217	20	Tourism Intensity + density + seasonality	20
9.56521739	22	Ecosystem	12
6.52173913	15	Economic importance of tourism	15
7.82608696	18	Pollution -	10
6.52173913	15	Tourism Offer + Accessibility	12
3.91304348	9	Transport – Mobility	9
4.34782609	10	Locals	9
4.34782609	10	Consumption of resources + Foot Print	4
4.34782609	10	Certifications – Certified	2
3.91304348	9	Policies	8
3.91304348	9	Protected Areas	7
3.91304348	9	Sustainable management	7
3.47826087	8	Water Quality and Management	6
3.47826087	8	Waste	4
3.47826087	8	Fishing	1
3.04347826	7	Installations	5
1.73913043	4	Reports & Information	4
0.43478261	4	Volunteering	4
1.73913043	4	Tourist satisfaction	3
1.73913043	3	Sustainable council	1

Source: Own elaboration

10.6 Appendix 6: Survey template.

Indicators for biodiversity conservation in tourism destinations

Introduction

Dear Expert,

Thank you for taking the time to open this survey. *I am Dulce Fabiola Vega Posada, M.Sc. Student researching indicators for biodiversity conservation in tourism destinations. The aim of this survey is to gather your expert opinion on the importance of the biodiversity conservation indicators proposed after an analysis of eight different biodiversity and tourism schemes.*

I realize how precious your time is. *That is why I made sure this survey will not take more than 10 minutes of your time.*

Your data is confidential and will not be shared with third parties. I am happy to share the results of this research upon your request.

1. My analyses revealed the following 5 key subject areas for biodiversity conservation in tourist destinations. In your expert opinion, please rank the subject areas according to their importance for monitoring biodiversity conservation at a destination level. Please fill in the box in front of the subject area with 1 (most important) to 5 (least important).

□ Regulation of Invasive species and native species conservation

□ Prevention and regulation of mass tourism

□ Ecosystem and Protected Areas protection

□ Resource and water management

□ Pollution and waste management

Indicators for biodiversity conservation in tourism destinations

In the following five pages I present the key subject areas with their criteria for biodiversity conservation stemming from the analyses of the 8 biodiversity schemes. You are asked again to rank each criterion according to its importance.

2. Subject area: Invasive species regulation and species conservation

Fill in the box in front of the criterion with 1 (most important) to 5(least important).

□ Evidence of documentation of species living in the destination and awareness campaigns towards native species conservation exists at the destination level.

□ The prohibition of hunting, trapping, and fishing of endangered species for the purposes of leisure, tourism, and souvenir making is enforced at a destination level.

□ Measures to avoid exotic and invasive species for ornamental purposes are implemented at a destination level.

□ Tourism businesses and tourists are aware of the protected areas, biodiversity hotpots, endemic species, endangered species and species threatened with extinction of the destination.

□ Conservation measures and efforts for protected areas, biodiversity hotpots, endemic species, endangered species and species threatened with extinction exist at the destination level and are well-documented.

3. Subject area: Mass tourism avoidance and regulation

Fill in the box in front of the criterion with 1 (most important) to 3(least important).

□ Tourism and environmental carrying capacity are measured and respected at the destination level.

□ At the destination level, there are a variety of ecotourism products and opportunities to promote them.

□ Tourism development and activities are regulated according to seasonality, availability of infrastructure and carrying capacity.

4. Subject area: Ecosystem and Protected Areas

Fill in the box in front of the criterion with 1 (most important) to 4(least important).

□ Incentives and legislation for restoration of landscape and mitigation of ecosystem fragmentation exist at a destination level.

□ Tourism businesses are aware of the natural areas, sensitive ecosystems and how ecosystems change over time.

□ Nature is seen and valued as an asset or important feature of the destination by the tourism stakeholders of the destination.

□ There is a code of conduct and conservation efforts for protected areas that is monitored, regulated and communicated at a destination level.

5. Subject area: Consumption of resources and water management

Fill in the box in front of the criterion with 1 (most important) to 9(least important).

□ Hotels and tourism businesses have a specialist or team of specialists for water management in their facilities.

□ Systems and strategies for renewable energy use and energy savingare in place at a destination and business level.

□ Hotels and restaurants offer plant-based and local options for their menus.

□ Smart systems for efficient lighting are used in the tourism businesses of the destination.

□ Tourism businesses use environmentally friendly cleaning products.

□ Tourism businesses and the destination management office have policies and strategies for water conservation.

□ Only native plants are used for ornamental purposes at a destination and business level.

□ There are pre-treatment water systems t in large resorts of the destination.

□ Water treatment facilities are available for all tourism businesses in de destination.

6. Subject area: Pollution and waste management

Fill in the box in front of the criterion with 1 (most important) to 5(least important).

□ Hotels and tourism businesses in the destination have waste management specialists as part of their management team.

□ The waste management specialists are in close contact with destination management offices and management of protected areas in the destination.

□ Government and Destination Management Offices work with private stakeholders to develop and enforce trustworthy system of incentives and penalties related to pollution in the tourism industry at a destination level.

□ Firewood, the use of plastic, littering and improper disposal of waste are prohibited in destinations.

□ The approach of prevent, reduce, and recycle approach is pursued at a destination level.

7. According to your expertise, is there a missing criteria for each of the following subject areas? If no, please type N/A. If Yes, please specify:

For regulation of invasive species and native species conservation:

For prevention and regulation of mass tourism:

For ecosystem and Protected Areas protection:

For resoruces and water management protection:

For pollution and waste management:

Thank you so much for your time!

8. If you would like to receive the results of this research, please type here your email.

10.7 Appendix 7: Process for weighting indicators.

Criteria	Value of relevance (weighted average)	Highest achievable index for the subject area	Indicators	DPSIR	Weight of the indicator	Yes (Type value on the left)	No = blank or type 0
Prevention and Regulation of Mass Tourism	5.42 -> 1	3.5	Tourism and environmental carrying capacity are measured and respected at the destination level.	Response - Driver - Pressure	3.1-> 1	1	
			Development of Tourism and its activities are regulated according to seasonality challenges of the destination, tourism carrying capacities and available infrastructure of the destination.	Impact - Driver - Pressure	2.7 -> 1	1	
			The destination regulates visitor intensity affluence in order to avoid or diminish mass tourism.	Response - Pressure	2.7 -> 1	1	
			At the destination level, there are a variety of ecotourism products and opportunities to promote them.	State - Response	1.5 -> .5	0.5	
Ecosystem and Protected Areas	5.42 -> 1	4	Government and Destination Management Offices work with private stakeholders to develop and enforce a trustworthy system of incentives and penalties related to pollution in the tourism industry at a destination level.	State - Pressure	2.6 -> 1		
			Tourism businesses are aware of the natural areas, sensitive ecosystems and how ecosystems change over time.	State - Driver	2.7 -> 1		
			Nature is seen and valued as an asset or important feature of the destination by the tourism stakeholders of the destination.	Impact - State	2.2 -> 1		
			There is a code of conduct and conservation efforts for protected areas that is monitored, regulated and communicated at a destination level.	Response - Impact	2.5 -> 1		
Species and Invasive Species	4.17 -> .8	4.2*0.8 = **3,36**	Conservation measures and efforts for protected areas, biodiversity hotpots, endemic species, endangered species and species threatened with extinction exist at the destination level and are well-documented.	Response - Driver - Pressure	3.7 -> 1		
			The prohibition of hunting, trapping, and fishing of endangered species for the purposes of leisure, tourism, and souvenir making is enforced at a destination level.	Response - Driver - Pressure	3.5 -> 1		
			Tourism businesses and tourists are aware of the protected areas, biodiversity hotpots, endemic species, endangered species and species threatened with extinction of the destination.	Impact - State	3.4 -> 1		
			Evidence of documentation of species living in the destination and awareness campaigns towards native species conservation exists and is done at the destination level.	Impact - Response - State	2.86 -> .8		
			Measures to avoid exotic and invasive species for ornamental purposes are implemented at a destination level.	Response - Driver	2.1 ->.4		
Consumption of resources and water management	5.25 -> 1	6.50	Tourism businesses and the destination management office have policies and strategies for water conservation.	Driver - Pressure	6.9 -> 1		
			Systems and strategies for renewable energy and energy saving are in place at a destination and business level.	State-Response	6.8 -> 1		
			More than half of the hotels and tourism businesses have a specialist or team of specialists for water management in their facilities	Response - Driver - Pressure	6.2 -> 1		
			More than half of the hotels and restaurants offer plant-based and local options for their menus.	Response	5.1 ->.70		
			Smart systems for efficient lighting are used in more than half of the tourism businesses of the destination.	Response	3.5 -> .5		
			Tourism businesses use only environmentally friendly cleaning products.	Response	4.4 ->.6		
			There are pre-treatment water systems existing in large resorts of the destination.	State - Response	4.3 -> .6		
			Water treatment facilities are available for all tourism businesses in the destination.	Response - Driver	5 ->.70		
			Only native plants are used for ornamental purposes at a destination and business level.	Response	2.8 -> .4		
Pollution and waste management	4.75 -> 1	3.5	Government and Destination Management Offices work with private stakeholders to develop and enforce a trustworthy system of incentives and penalties related to pollution in the tourism industry at a destination level.	Driver - Pressure	4.11 -> 1		
			The approach of prevent, reduce, and recycle approach is pursued at a destination level.	Response	3.11 -> .7		
			Hotels and tourism businesses in the destination have waste management specialists as part of their management team.	Response - Driver - Pressure	2.89 -> .7		
			The waste management specialists are in close contact with destination management offices and management of protected areas in the destination.	Impact - State - Pressure	2.56 -> .6		
			Firewood, the use of plastic, littering, and improper disposal of waste are prohibited in destinations.	State	2.33 -> .5		
		20.86					

Source: own elaboration

References

Achintha, M. (Ed.). (2016). *Sustainability of glass in construction*. Sustainability of Construction materials. https://doi.org/10.1016/b978-0-08-100370-1.00005-6

Aguiló, E., Palmer, T., & Rosselló, J. (2012). Road Transport for Tourism: Evaluating Policy Measures from Consumer Profiles. *Tourism Economics*, *18*(2), 281–293. https://doi.org/10.5367/te.2012.0120

Ai, J., Yang, L., Liu, Y [Yanfen], Yu, K., & Liu, J. *Dynamic Landscape Fragmentation and the Driving Forces on Haitan Island, China* (No. 1). https://doi.org/10.3390/land11010136

Allemand, D., & Osborn, D. (2019). Ocean acidification impacts on coral reefs: From sciences to solutions. *Regional Studies in Marine Science*, *28*, 100558. https://doi.org/10.1016/j.rsma.2019.100558

Alquezar, R. D., & Macedo, R. H. (2019). Airport noise and wildlife conservation: What are we missing? *Perspectives in Ecology and Conservation*, *17*(4), 163–171. https://doi.org/10.1016/j.pecon.2019.08.003

Amundsen, V. S., & Osmundsen, T. C. (2020a). Becoming certified, becoming sustainable? Improvements from aquaculture certification schemes as experienced by those certified. *Marine Policy*, *119*, 104097. https://doi.org/10.1016/j.marpol.2020.104097

Amundsen, V. S., & Osmundsen, T. C. (2020b). Becoming certified, becoming sustainable? Improvements from aquaculture certification schemes as experienced by those certified. *Marine Policy*, *119*, 104097. https://doi.org/10.1016/j.marpol.2020.104097

Andam, K. S., Ferraro, P. J [Paul J.], Pfaff, A., Sanchez-Azofeifa, G. A., & Robalino, J. A. (2008). Measuring the effectiveness of protected area networks in reducing deforestation. *Proceedings of the National Academy of Sciences of the United States of America*, *105*(42), 16089–16094. https://doi.org/10.1073/pnas.0800437105

Anderson, L. G., Rocliffe, S., Haddaway, N. R., & Dunn, A. M. (2015). The Role of Tourism and Recreation in the Spread of Non-Native Species: A Systematic Review and Meta-Analysis. *PloS One*, *10*(10), e0140833. https://doi.org/10.1371/journal.pone.0140833

Anna Lind Björnsdóttir. (2018). *Nature Based Tourism Trends: An Analysis of Drivers, Challenges and Opportunities: Norwegian University of Life Sciences.* Faculty of Environmental Sciences and Natural Resource Management. https://nmbu.brage.unit.no/nmbu-xmlui/bitstream/handle/11250/2570242/Trends%20in%20nature%20based%20tourism.pdf?isAllowed=y&sequence=1

Anna Torres-Delgado, & Francesc López Palomeque (2018). The ISOST Index: A tool for studying sustainable tourism. Advance online publication. https://doi.org/10.1016/j.jdmm.2017.05.005 (Journal of Destination Marketing & Management).

Arjen Hoekstra, Ashok Chapagain, Maite Aldaya, & Mesfin Mekonnen. (2009). *Water Footprint Manual: State of the Art*. https://waterfootprint.org/media/downloads/WaterFootprintManual2009.pdf

Arjen Hoekstra, Ashok Chapagain, Maite Aldaya, & Mesfin Mekonnen. (2011). *The Water Footprint Assessment Manual: Setting the Global Standard*. https://waterfootprint.org/media/downloads/TheWaterFootprintAssessmentManual_2.pdf

Arriagada, R. A., Ferraro, P. J [P. J.], Sills, E. O., Pattanayak, S. K., & Cordero-Sancho, S. (2012). Do Payments for Environmental Services Affect Forest Cover? A Farm-Level Evaluation from Costa Rica. *Land Economics*, *88*(2), 382–399. https://doi.org/10.3368/le.88.2.382

Aryblia, M., Quintal, L., Ribeiro, M., Sifakis, N., Tournaki, S., & Tsoutsos, T. (2022). Climate Change Mitigation Through Smart Environmental Monitoring of the Urban Ecosystem in Insular Touristic Cities: Experience from Rethymno and Madeira, 129–147. https://doi.org/10.1007/978-3-030-73715-3_8

Asif Khan, Sughra Bibi, Ardito Lorenzo, Jiazing Lyu, & Zaheer Udden Babar (2020). Tourism and Development in Developing Economies: A Policy Implication Perspective. Advance online publication. https://doi.org/10.3390/su12041618 (Sustainability).

Avishek Khanal, Mohammad Mafizur Rahman, Rasheda Khanam, & Eswaran Velayutham (2021). Are Tourism and Energy Consumption Linked? Evidence from Australia, *13.* https://doi.org/10.3340/su131910800 (Sustainability).

Baker, D. M., Rodríguez-Martínez, R. E., & Fogel, M. L. (2013). Tourism's nitrogen footprint on a Mesoamerican coral reef. *Coral Reefs*, *32*(3), 691–699. https://doi.org/10.1007/s00338-013-1040-2

Balmford, A., Beresford, J., Green, J., Naidoo, R., Walpole, M., & Manica, A. (2009). A global perspective on trends in nature-based tourism. *PLoS Biology*, *7*(6), e1000144. https://doi.org/10.1371/journal.pbio.1000144

Baum, T., Cheung, C., Kong, H., Kralj, A., Mooney, S., Nguyễn Thị Thanh, H., Ramachandran, S., Dropulić Ružić, M., & Siow, M. (2016). Sustainability and the Tourism and Hospitality Workforce: A Thematic Analysis. *Sustainability*, *8*(8), 809. https://doi.org/10.3390/su8080809

Bennacer, R., Abahri, K., & Belarbi, R. (Eds.). (2016). *Intrinsic properties controlling the sustainability of construction*. Sustainability of Construction materials. https://doi.org/10.1016/b978-0-08-100370-1.00003-2

Bhakti Chougule (2011). Environmental Carrying Capacity and Ecotourism development, *4*(1), 45–54 (International Journal of Economic Issues).

Börner, J., Baylis, K., Corbera, E., Ezzine-de-Blas, D., Honey-Rosés, J., Persson, U. M., & Wunder, S. (2017). The Effectiveness of Payments for Environmental Services. *World Development*, *96*, 359–374. https://doi.org/10.1016/j.worlddev.2017.03.020

Broadbent, E. N., Zambrano, A. M. A., Dirzo, R., Durham, W. H., Driscoll, L., Gallagher, P., Salters, R., Schultz, J., Colmenares, A., & Randolph, S. G. (2012). The effect of land use change and ecotourism on biodiversity: a case study of Manuel Antonio, Costa Rica, from 1985 to 2008. *Landscape Ecology*, *27*(5), 731–744. https://doi.org/10.1007/s10980-012-9722-7

Brühl, C. A., & Zaller, J. G. (2019). Biodiversity Decline as a Consequence of an Inappropriate Environmental Risk Assessment of Pesticides. *Frontiers in Environmental Science*, *7*, Article 177. https://doi.org/10.3389/fenvs.2019.00177

Burghardt, K. T., Tallamy, D. W., & Gregory Shriver, W. (2009). Impact of native plants on bird and butterfly biodiversity in suburban landscapes. *Conservation Biology : The Journal of the Society for Conservation Biology*, *23*(1), 219–224. https://doi.org/10.1111/j.1523-1739.2008.01076.x

Business and Biodiversity Offsets Programme. (2012). *Standard on biodiversity offsets: Washington, DC, USA.*

Carić, H., & Mackelworth, P. (2014). Cruise tourism environmental impacts – The perspective from the Adriatic Sea. *Ocean & Coastal Management*, *102*, 350–363. https://doi.org/10.1016/j.ocecoaman.2014.09.008

Catibog-Sinha, C. (Ed.). (2011). *Sustainable forest management: heritage tourism, biodiversity, and upland communities in the Philippines* (Vol. 6). https://doi.org/10.1080/1743873x.2011.620113

Cazcarro, I., Hoekstra, A. Y., & Sánchez Chóliz, J. (2014). The water footprint of tourism in Spain. *Tourism Management*, *40*, 90–101. https://doi.org/10.1016/j.tourman.2013.05.010

Challéat, S., Barré, K., Laforge, A., Lapostolle, D., Franchomme, M., Sirami, C., Le Viol, I., Milian, J., & Kerbiriou, C. (2021). Grasping darkness: the dark ecological network as a social-ecological framework to limit the impacts of light pollution on biodiversity. *Ecology and Society*, *26*(1). https://doi.org/10.5751/ES-12156-260115

Churchill, S. A., Pan, L., & Paramati, S. R. (2022). Air Pollution and Tourism: Evidence from G20 Countries. *Journal of Travel Research*, *61*(2), 223–234. https://doi.org/10.1177/0047287520977724

Claudio Mantero. (2022). *Sustainable, Smart and Safe Mobility at the Core of Sustainable Tourism in Six European Islands*. Sustainable Mobility for Island Destinations. https://link.springer.com/chapter/10.1007/978-3-030-73715-3_1 https://doi.org/10.1007/978-3-030-73715-3_1

Colin Hunter, & Jon Shaw. The ecological footprint as a key indicator of sustainability, *28*, 46–57. https://doi.org/10.1016/j.tourman.2005.07.016 (Tourism Management).

Convention on Biological Diversity. (2006). *DECISION ADOPTED BY THE CONFERENCE OF THE PARTIES TO THE CONVENTION ON BIOLOGICAL DIVERSITY AT ITS EIGHTH MEETING*. https://www.cbd.int/doc/decisions/cop-08/cop-08-dec-15-en.pdf

Convention on Biological Diversity. (2011). *Indicator framework for the Strategic Plan for Biodiversity 2011-2020 and the Aichi Biodiversity Targets*. https://www.cbd.int/kb/record/recommendation/12968?RecordType=recommendation

Convention on Biological Diversity. (2016). *GENERIC AND SPECIFIC INDICATORS FOR ASSESSING PROGRESS IN THE ATTAINMENT OF THE AICHI BIODIVERSITY TARGETS, INCLUDING AN ASSESSMENT OF THEIR MAIN CHARACTERISTICS*. https://www.cbd.int/doc/decisions/cop-13/cop-13-dec-28-en.pdf

Coria, J., & Calfucura, E. (2012). Ecotourism and the development of indigenous communities: The good, the bad, and the ugly. *Ecological Economics*, *73*, 47–55. https://doi.org/10.1016/j.ecolecon.2011.10.024

Costas Christ, Oliver Hillel, Seleni Matus, & Jamie Sweeting (Eds.). (2003). *Tourism and Biodiversity: Mapping Tourism's Global Footprint*. Conservation International.

Cramer, W., Egea, E., Fischer, J., Lux, A., Salles, J.-M., Settele, J., & Tichit, M. (2017). Biodiversity and food security: from trade-offs to synergies. *Regional Environmental Change*, *17*(5), 1257–1259. https://doi.org/10.1007/s10113-017-1147-z

Dangi, T., & Jamal, T. (2016). An Integrated Approach to "Sustainable Community-Based Tourism". *Sustainability*, *8*(5), 475. https://doi.org/10.3390/su8050475

David Matarrita-Cascante (2010). Tourism Development in Costa Rica: History and Trends: Texas A&M University, *8* (E-Review of Tourism Research).

Degarege, G. A. (2019). *Tourism, Livelihood Diversification and food security in Ethiopia*, New zealand. http://hdl.handle.net/10523/9193

Degarege, G. A., & Lovelock, B. (2021). Addressing zero-hunger through tourism? Food security outcomes from two tourism destinations in rural Ethiopia. *Tourism Management Perspectives*, *39*, 100842. https://doi.org/10.1016/j.tmp.2021.100842

Deniz Sari, Nesimi Ozkurt, Samet Feyyaz Hamamci, Mustafa Ece, Nazli Yalcindag, Ali Akdag, & Nese Yugruk Akdag (2014). Assessment of noise pollution sourced from entertainment places in Antalya, Turkey. https://www.acoustics.asn.au/conference_proceedings/INTERNOISE2014/papers/p141.pdf

Department for Environment Food & Rural Affairs. (2021). *UK biodiversity indicators 2021 Revised.*

Dilys Roe (2019). Biodiversity loss- more than an environmental agency, *3*(7). https://doi.org/10.1016/S2542-5196(19)30113-5 (The Lancet Planetary Health).

Ecotrans e.V. (2015). *Lista de autochequeo de biodiversidad: Destinos turísticos, alojamientos turísticos, operadores turísticos*. Germany. Global Nature Fund. https://destinet.eu/topics/natural-cultural-heritage/biodiversity/germany/self-checks

Edith Smeets, & Rob Weterings. (1999). *Environmental Indicators: typology and overview*. The Netherlands. TNO Centre for Strategy, Technology and Policy. https://www.eea.europa.eu/publications/TEC25

Eleni Farmaki, Maria Aryblia, Stavroula Tournaki, & Theocharis Tsoutsos. (2022). *Assesing Sustainable Urban Mobility Policies in the Mediterranean Tourism Destinations Through Multi-Criteria Decision-Making Process.* https://link.springer.com/chapter/10.1007/978-3-030-73715-3_2 https://doi.org/10.1007/978-3-030-73715-3_2

Enilov, M., & Wang, Y. (2021). Tourism and economic growth: Multi-country evidence from mixed-frequency Granger causality tests. *Tourism Economics*, 135481662199015. https://doi.org/10.1177/1354816621990155

Fan, W [Wenjie], Li, Y., Upreti, B. R., Liu, Y [Yong], Li, H., Fan, W [Wei], & Lim, E. T. K. (2021). Big Data for Big Insights: Quantifying the Adverse Effect of Air Pollution on the

Tourism Industry in China. *Journal of Travel Research*, 004728752110472. https://doi.org/10.1177/00472875211047272

Farrell, B., & Twining-Ward, L. (2005). Seven Steps Towards Sustainability: Tourism in the Context of New Knowledge. *Journal of Sustainable Tourism*, *13*(2), 109–122. https://doi.org/10.1080/09669580508668481

Fen Wei. (2012). *Compendium of Best Practices in Sustainable Tourism: Prepared for: United Nations Department of Economic and Social Affairs*. https://sustainabledevelopment.un.org/content/documents/3322Compendium%20of%20Best%20Practices%20in%20Sustainable%20Tourism%20-%20Fen%20Wei%2001032014.pdf

Fernández, J. I. P., & Rivero, M. S. (2009). Measuring Tourism Sustainability: Proposal for a Composite Index. *Tourism Economics*, *15*(2), 277–296. https://doi.org/10.5367/000000009788254377

Ferretti, V., & Comino, E. (2015). An integrated framework to assess complex cultural and natural heritage systems with Multi-Attribute Value Theory. *Journal of Cultural Heritage*, *16*(5), 688–697. https://doi.org/10.1016/j.culher.2015.01.007

Fitzgerald, L., & Wikoff, D. S. Persistent Organic Pollutants, 820–825. https://doi.org/10.1016/B978-0-12-386454-3.00211-6

Food and Agriculture Organization of the United Nations. (2021). *Ecosystem Services & Biodiversity (ESB)*. https://www.fao.org/ecosystem-services-biodiversity/background/cultural-services/en/

Franz Hölker, Christian Wolter, Elizabeth K. Perkin, & Klement Tockner (2010). Light pollution as a biodiversity threat, *25*(12). https://doi.org/10.1016/j.tree.2010.09.007 (Trends in Ecology and Evolution).

Fred Dyke. (2008). *Conservation Biology: Biodiversity: Concept, Measurement, and Challenge.* https://doi.org/10.1007/978-1-4020-6891-1_4

Ganzevoort, W., van den Born, R. J. G., Halffman, W., & Turnhout, S. (2017). Sharing biodiversity data: citizen scientists' concerns and motivations. *Biodiversity and Conservation*, *26*(12), 2821–2837. https://doi.org/10.1007/s10531-017-1391-z

Geiger, F., Bengtsson, J., Berendse, F., Weisser, W. W., Emmerson, M., Morales, M. B., Ceryngier, P., Liira, J., Tscharntke, T., Winqvist, C., Eggers, S., Bommarco, R., Pärt, T., Bretagnolle, V., Plantegenest, M., Clement, L. W., Dennis, C., Palmer, C., Oñate, J. J., . . . Inchausti, P. (2010). Persistent negative effects of pesticides on biodiversity and biological control potential on European farmland. *Basic and Applied Ecology*, *11*(2), 97–105. https://doi.org/10.1016/j.baae.2009.12.001

Geldmann, J., Manica, A., Burgess, N. D., Coad, L., & Balmford, A. (2019). A global-level assessment of the effectiveness of protected areas at resisting anthropogenic pressures. *Proceedings of the National Academy of Sciences of the United States of America*, *116*(46), 23209–23215. https://doi.org/10.1073/pnas.1908221116

Gema Florido Trujillo, Rafael Garzón García, & Ma Luisa Ramírez López (2018). En torno al concepto de sostenibilidad y su compleja aplicación al turismo. El caso del turismo urbano cultural(4-1), 269–302. https://www.researchgate.net/publication/331471091_EN_TORNO_AL_CONCEPTO_DE_SOSTENIBILIDAD_Y_SU_COMPLEJA_APLICACION_AL_TURISMO_EL_CASO_DEL_

TURISMO_URBANO_CULTURAL/citations (International Journal of Scientific Management and Tourism).

A. George Assaf (2011). Benchmarking the Asia Pacific tourism industry: A Bayesian combination of DEA and stochastic frontier. Advance online publication. https://doi.org/10.1016/j.tourman.2011.11.021

Gini, S., & Ambrosino, G. (2022). Innovation, Digital Solutions and MaaS Concept in Touristic Insular and Rural Destinations: The Case of the Shared Mobility Agency in Elba, 39–66. https://doi.org/10.1007/978-3-030-73715-3_3

Global Sustainable Tourism Council (2019). GSTC Destination Criteria: Version 2.0. with Performance indicators and SDGs.

González-Marín, R. M., Moreno-Casasola, P., Castro-Luna, A. A., & Castillo, A. (2017). Regaining the traditional use of wildlife in wetlands on the coastal plain of Veracruz, Mexico: ensuring food security in the face of global climate change. *Regional Environmental Change*, *17*(5), 1343–1354. https://doi.org/10.1007/s10113-016-0955-x

Gössling, S [Stefan] (2015). New performance indicators for water management in tourism. *Tourism Management*, *46*, 233–244. https://doi.org/10.1016/j.tourman.2014.06.018

Gössling, S [Stefan], Peeters, P [Paul], Hall, C. M., Ceron, J.-P., Dubois, G., La Lehmann, V., & Scott, D. (2012). Tourism and water use: Supply, demand, and security. An international review. *Tourism Management*, *33*(1), 1–15. https://doi.org/10.1016/j.tourman.2011.03.015

Guillet, F., & Semal, L. (2018). Policy flaws of biodiversity offsetting as a conservation strategy. *Biological Conservation*, *221*, 86–90. https://doi.org/10.1016/j.biocon.2018.03.001

Gulbrandsen, L. H. (2005). The Effectiveness of Non-State Governance Schemes: A Comparative Study of Forest Certification in Norway and Sweden. *International Environmental Agreements: Politics, Law and Economics*, *5*(2), 125–149. https://doi.org/10.1007/s10784-004-1010-9

Hakim, L. (2017). Managing biodiversity for a competitive ecotourism industry in tropical developing countries: New opportunities in biological fields, 30008. https://doi.org/10.1063/1.5012708

Hall, C. M. (2010a). Tourism and biodiversity: more significant than climate change? *Journal of Heritage Tourism*, *5*(4), 253–266. https://doi.org/10.1080/1743873X.2010.517843

Hall, C. M. (2010b). Tourism and biodiversity: more significant than climate change? *Journal of Heritage Tourism*, *5*(4), 253–266. https://doi.org/10.1080/1743873X.2010.517843

Haubrock, P. J., Bernery, C., Cuthbert, R. N., Liu, C., Kourantidou, M., Leroy, B., Turbelin, A. J., Kramer, A. M., Verbrugge, L. N. H., Diagne, C., Courchamp, F., & Gozlan, R. E. (2022). Knowledge gaps in economic costs of invasive alien fish worldwide. *The Science of the Total Environment*, *803*, 149875. https://doi.org/10.1016/j.scitotenv.2021.149875

Haubrock, P. J., Turbelin, A. J., Cuthbert, R. N., Novoa, A., Taylor, N. G., Angulo, E., Ballesteros-Mejia, L., Bodey, T. W., Capinha, C., Diagne, C., Essl, F., Golivets, M., Kirichenko, N., Kourantidou, M., Leroy, B., Renault, D., Verbrugge, L., & Courchamp, F. (2021). Economic costs of invasive alien species across Europe. *NeoBiota*, *67*, 153–190. https://doi.org/10.3897/neobiota.67.58196

He, L., Zha, J., & Loo, H. A. (2020). How to improve tourism energy efficiency to achieve sustainable tourism: evidence from China. *Current Issues in Tourism*, *23*(1), 1–16. https://doi.org/10.1080/13683500.2018.1564737

Hernández-Calzada, M. A., Pérez-Hernández, C. C., & Ferreiro-Seoane, F. J. (2019). Diversification in Tourism-Related Activities and Social Sustainability in the State of Hidalgo, Mexico. *Sustainability*, *11*(22), 6429. https://doi.org/10.3390/su11226429

Hölker, F., Bolliger, J., Davies, T. W., Giavi, S., Jechow, A., Kalinkat, G., Longcore, T., Spoelstra, K., Tidau, S., Visser, M. E., & Knop, E. (2021). 11 Pressing Research Questions on How Light Pollution Affects Biodiversity. *Frontiers in Ecology and Evolution*, *9*, Article 767177. https://doi.org/10.3389/fevo.2021.767177

Hotel Energy Solutions (2011). Factors and Initiatives Affecting Energy Efficiency use in the Hotel Industry: Hotel Energy Solutions project publications. Advance online publication. https://doi.org/10.18111/9789284415021

Hubert G. Scarlett (2021). Tourism recovery and the economic impact: A panel assesment. Advance online publication. https://doi.org/10.1016/j.resglo.2021.100044 (Research in Globalization).

IUCN. (2008). *What is a protected area? About*. https://www.iucn.org/theme/protected-areas/about

IUCN and World Commission on Protected Areas. (2017). *IUCN Green List of Protected and Conserved Areas: Standard, Version 1.1*. Gland, Switzerland. https://iucn.my.salesforce.com/sfc/p/#24000000e5iR/a/1o0000005kM6/tFf7d8BgjDRxUKyujmm7DdgrfPz77RzGkQizYNb_dmA

János Csapó (2013). Energy Efficiency in Tourism- Towards a More sustainable Travel Industry, *1*, 44–57 (Geographical Locality Studies).

Jayaraj, R., Megha, P., & Sreedev, P. (2016). Organochlorine pesticides, their toxic effects on living organisms and their fate in the environment. *Interdisciplinary Toxicology*, *9*(3-4), 90–100. https://doi.org/10.1515/intox-2016-0012

Josef Zelenka, & Jaroslav Kacetl (2014). The concept of carrying capacity in tourism, *XVI*(36). https://www.researchgate.net/publication/275657335_The_Concept_of_Carrying_Capacity_in_Tourism (Economic Interferences).

Jozef M Pacyna, Kyrre Sundseth, Elisabeth G. Pacyna, John Munthe, Mohammed Belhaj, Stefan Asröm, Damian Panasiuk, & Anna Glodek. (2009). *Socio-economic costs of continuing the status-quo of mercury pollution*. http://norden.diva-portal.org/smash/get/diva2:701754/FULLTEXT01.pdf

Juan Gabriel Brida, Silvia London, & Mara Rojas (2014). El turismo como fuente de crecimiento económico: impacto de las preferencias intertemporales de los agentes. Advance online publication. https://doi.org/10.1016/S0185-1667(15)30003-5

Karel Mayrand, & Marc Paquin (2004). Payments for Environmental Services: A Survey and Assessment of Current Schemes: Unisféra International Centre (For the Commission for Environmental Cooperation of North America).

Katircioglu, S. T. (2014). International tourism, energy consumption, and environmental pollution: The case of Turkey. *Renewable and Sustainable Energy Reviews*, *36*, 180–187. https://doi.org/10.1016/j.rser.2014.04.058

KC, B. (2021). Complexity in balancing conservation and tourism in protected areas: Contemporary issues and beyond. *Tourism and Hospitality Research*, 146735842110158. https://doi.org/10.1177/14673584211015807

Kılıç, M., Uyar, A., Kuzey, C., & Karaman, A. S. (2021). Drivers and consequences of sustainability committee existence? Evidence from the hospitality and tourism industry. *International Journal of Hospitality Management*, *92*, 102753. https://doi.org/10.1016/j.ijhm.2020.102753

Kim, Y. J., Lee, D. K., & Kim, C. K. (2020). Spatial tradeoff between biodiversity and nature-based tourism: Considering mobile phone-driven visitation pattern. *Global Ecology and Conservation*, *21*, e00899. https://doi.org/10.1016/j.gecco.2019.e00899

Kira de Groot. (2011). *Payments for environmental services (PES) from tourism: A realistic incentive to improve local livelihoods and sustain forest landscapes in Viet Nam's northern highlansd?* Wageningen University. https://edepot.wur.nl/177106

Lambert, P. (Ed.). (2016). *Sustainability of metals and alloys in construction.* https://doi.org/10.1016/b978-0-08-100370-1.00006-8

Leah Hagreen, & Leslie Kulperger. (2004). *Mercury in the Great Lakes Basin: Background Paper Final Report: Prepared for the commission for environmental cooperation*. Toronto, Canada. http://www.cec.org/files/documents/publications/2098-mercury-in-great-lakes-basin-final-report-en.pdf

Lim, H., Ngarambe, J., Kim, J., & Kim, G. (2018). The Reality of Light Pollution: A Field Survey for the Determination of Lighting Environmental Management Zones in South Korea. *Sustainability*, *10*(2), 374. https://doi.org/10.3390/su10020374

Liu, H., Jiang, Y., Zhu, H., Chen, Y., Lyu, W., Luo, W., & Yao, W. (2021). Analysis of water resource management in tourism in China using a coupling degree model. *Water Policy*, *23*(3), 765–782. https://doi.org/10.2166/wp.2021.155

Liu, Y [Yanfang], Zhang, L., Wei, X., & Xie, P. (2016). Integrating the spatial proximity effect into the assessment of changes in ecosystem services for biodiversity conservation. *Ecological Indicators*, *70*, 382–392. https://doi.org/10.1016/j.ecolind.2016.06.019

M. R. Dileep. Tourism and Waste Management: Areview of Implementation of Zero Waste: Kerala Institute of Tourim and Travel Studies, India. Advance online publication. https://doi.org/10.1080/10941660701823314

Maas, S., & Attard, M. (2022). Shared Mobility Services in Malta: User Needs and Perceptions, 87–100. https://doi.org/10.1007/978-3-030-73715-3_5

Magali A. Delmas, & Vanessa Cuerel Burbano (2011). The Drivers of Greenwashing, *54*(1), 64–87. https://doi.org/10.1525/cmr.2011.54.1.64 (California Management Review).

Marine Stewarship Council. *How MSC Certified fisheries are improving: Our Collective impact*. https://www.msc.org/what-we-are-doing/our-collective-impact/fisheries-improving

Mohamad, N. H. N., Idilfitri, S., & Thani, S. K. S. O. (2013). Biodiversity by Design: The attributes of ornamental plants in urban forest parks. *Procedia - Social and Behavioral Sciences*, *105*, 823–839. https://doi.org/10.1016/j.sbspro.2013.11.085

Moorhouse, T. P., Dahlsjö, C. A. L., Baker, S. E., D'Cruze, N. C., & Macdonald, D. W. (2015a). The Customer Isn't Always Right-Conservation and Animal Welfare Implications of the Increasing Demand for Wildlife Tourism. *PloS One*, *10*(10), e0138939. https://doi.org/10.1371/journal.pone.0138939

Moorhouse, T. P., Dahlsjö, C. A. L., Baker, S. E., D'Cruze, N. C., & Macdonald, D. W. (2015b). The Customer Isn't Always Right-Conservation and Animal Welfare Implications of the Increasing Demand for Wildlife Tourism. *PloS One*, *10*(10), e0138939. https://doi.org/10.1371/journal.pone.0138939

Moorhouse, T. P., D'Cruze, N. C., & Macdonald, D. W. (2017). The effect of priming, nationality and greenwashing on preferences for wildlife tourist attractions. *Global Ecology and Conservation*, *12*, 188–203. https://doi.org/10.1016/j.gecco.2017.11.007

Moravcikova, K., Stefanikova, Ľ., & Rypakova, M. (2015). CSR Reporting as an Important Tool of CSR Communication. *Procedia Economics and Finance*, *26*, 332–338. https://doi.org/10.1016/S2212-5671(15)00861-8

Mori Junior, R., Franks, D. M., & Ali, S. H. (2016). Sustainability certification schemes: evaluating their effectiveness and adaptability. *Corporate Governance*, *16*(3), 579–592. https://doi.org/10.1108/CG-03-2016-0066

Muzafar Shah Habibulla, Badariah Haji Din, & Choo Wei Chong (2016). Tourism and Biodiversity Loss: Implications for Business Sustainability. Advance online publication. https://doi.org/10.1016/S2212-5671(16)00021-6

A. N Candrea, & A. ISPAS. Visitor Management, A tool for sustainable tourism development in protected areas, *2*(51). https://www.researchgate.net/publication/268429784_Visitor_Management_a_Tool_for_Sustainable_Tourism_Development_in_Protected_Areas (Bulletin of the Transilvania University of Brasov).

Naeem, S., Chazdon, R., Duffy, J. E., Prager, C., & Worm, B. (2016). Biodiversity and human well-being: An essential link for sustainable development. *Proceedings. Biological Sciences*, *283*(1844). https://doi.org/10.1098/rspb.2016.2091

Naseem, S. (2021). The Role of Tourism in Economic Growth: Empirical Evidence from Saudi Arabia. *Economies*, *9*(3), 117. https://doi.org/10.3390/economies9030117

Nilon, C. H. (2011). Urban biodiversity and the importance of management and conservation. *Landscape and Ecological Engineering*, *7*(1), 45–52. https://doi.org/10.1007/s11355-010-0146-8

OECD (2019). Biodiversity: Finance and the Economic and Business Case for Action: A report prepared for the G7 Environment Ministers Meeting.

Osipova, E., Emslie-Smith, M., Osti, M., Murai, M., Åberg, U., & Shadie, P. (2020). IUCN World Heritage Outlook 3. Advance online publication. https://doi.org/10.2305/IUCN.CH.2020.16.en

Oviedo-García, M. Á., Vega-Vázquez, M., Castellanos-Verdugo, M., & Orgaz-Agüera, F. (2019). Tourism in protected areas and the impact of servicescape on tourist

satisfaction, key in sustainability. *Journal of Destination Marketing & Management*, *12*, 74–83. https://doi.org/10.1016/j.jdmm.2019.02.005

Pabian, A [Arnold], Pabian, A [Aleksander], & Brzeziński, A. (2020). Young People Collecting Natural Souvenirs: A Perspective of Sustainability and Marketing. *Sustainability*, *12*(2), 514. https://doi.org/10.3390/su12020514

Pearce, D. (2001). *The economic value of forest ecosystems, Ecosystem Health 7.*

Peeters, P [P.], Gössling, S [S.], Klijs, J., Milano, C., Novelli, M., Dijkmans, C., Eijgelaar, E., Hartman, S., & Heslinga, J. (2018). Research for TRAN Committee - Overtourism: impact and possible policy responses: European Parliament, *Brussels* (Policy Department for Structural and Cohesion Policies).

Peiró-Signes, A., Miret-Pastor, L., & Segarra-Oña, M. (2020). Effects of green certification and labelling on the Spanish fisheries industry. *Aquaculture Reports*, *17*, 100396. https://doi.org/10.1016/j.aqrep.2020.100396

Peter Werner, & Rudolg Zahner. (2009). *Biological Diversity and Cities: A Review and Biobliography* (No. 245). Bonn.

Pörtner, H.-O., Scholes, R. J., Agard, J., Archer, E., Arneth, A., Bai, X., Barnes, D., Burrows, M., Chan, L., Cheung, W. L., Diamond, S., Donatti, C., Duarte, C., Eisenhauer, N., Foden, W., Gasalla, M. A., Handa, C., Hickler, T., Hoegh-Guldberg, O., . . . Ngo, H. (2021). Scientific outcome of the IPBES-IPCC co-sponsored workshop on biodiversity and climate change. Advance online publication. https://doi.org/10.5281/zenodo.4659158

Pörtner, H.-O., Scholes, R. J., Agard, J., Archer, E., Bai, X., Barnes, D., Burrows, M., Chan, L., Cheung, W. L., Diamond, S., Donatti, C., Duarte, C., Eisenhauer, N., Foden, W., Gasalla, M. A., Handa, C., Hickler, T., Hoegh-Guldberg, O., Ichii, K., . . . Ngo, H. Ipbes-IPCC co-sponsored workshop report on biodiversity and climate change. Advance online publication. https://doi.org/10.5281/zenodo.4782538

Prosser, R. (2012). *Encyclopedia of Applied Ethics* (2nd ed.). Elsevier. https://doi.org/10.1016/B978-0-12-373932-2.00072-7

Rabindra Nepal, M. Indra al Irsyad, & Sanay Kumar Nepal (2019). Tourist arrivals, energv consumption and pollutant emissions in a developing economy - implications for sustainable tourism, *72*, 145–154. https://doi.org/10.1016/j.tourman.2018.08.025 (Tourism Management).

Ramesh Durbarry (2004). Tourism and Economic Growth: The case of Mauritius. Advance online publication. https://doi.org/10.5367/0000000042430962

Rasool, H., Maqbool, S., & Tarique, M. (2021). The relationship between tourism and economic growth among BRICS countries: a panel cointegration analysis. *Future Business Journal*, *7*(1). https://doi.org/10.1186/s43093-020-00048-3

Rivero Marcelino Sánchez, & Juan Ignacio Pulido Fernández. (2008). *Medida de la sostenibilidad turística: propuesta de un índice sintético.* Centro de Estudios Ramón Areces SA. https://scholar.google.com/scholar?cluster=15897948601027650124&hl=es&as_sdt=0,5#d=gs_cit&u=%2Fscholar%3Fq%3Dinfo%3ATOKrjQXcoNwJ%3Ascholar.google.com%2F%26output%3Dcite%26scirp%3D0%26scfhb%3D1%26hl%3Des

Rumschlag, S. L., Mahon, M. B., Hoverman, J. T., Raffel, T. R., Carrick, H. J., Hudson, P. J., & Rohr, J. R. (2020). Consistent effects of pesticides on community structure and ecosystem function in freshwater systems. *Nature Communications*, *11*(1), 6333. https://doi.org/10.1038/s41467-020-20192-2

Saenz-de-Miera, O., & Rosselló, J. (2012). *The responsibility of tourism in traffic congestion and hyper-congestion: A case study from Mallorca, Spain* (Vol. 33). https://doi.org/10.1016/j.tourman.2011.06.015

Samuels, K. L. (2017). Biodiversity in World Heritage Cultural Landscapes: Possibilities and Problems for Communicating Climate Change and Mobilizing Mitigation. *Culture, Agriculture, Food and Environment*, *39*(2), 116–126. https://doi.org/10.1111/cuag.12094

Savastano, H., Santos, S. F., Fiorelli, J., & Agopyan, V. (Eds.). (2016). *Sustainable use of vegetable fibres and particles in civil construction.* https://doi.org/10.1016/b978-0-08-100370-1.00019-6

Schernewski, G., Schönwald, S., & Kataržytė, M. (2014a). Application and evaluation of an indicator set to measure and promote sustainable development in coastal areas. *Ocean & Coastal Management*, *101*, 2–13. https://doi.org/10.1016/j.ocecoaman.2014.03.028

Schernewski, G., Schönwald, S., & Kataržytė, M. (2014b). Application and evaluation of an indicator set to measure and promote sustainable development in coastal areas. *Ocean & Coastal Management*, *101*, 2–13. https://doi.org/10.1016/j.ocecoaman.2014.03.028

Schmeller, D. S., Henry, P.-Y., Julliard, R., Gruber, B., Clobert, J., Dziock, F., Lengyel, S., Nowicki, P., Déri, E., Budrys, E., Kull, T., Tali, K., Bauch, B., Settele, J., van Swaay, C., Kobler, A., Babij, V., Papastergiadou, E., & Henle, K. (2009). Advantages of volunteer-based biodiversity monitoring in Europe. *Conservation Biology : The Journal of the Society for Conservation Biology*, *23*(2), 307–316. https://doi.org/10.1111/j.1523-1739.2008.01125.x

Secretariat of the Convention on Biological Diversity. (2000). *Sustaining Life on Earth: Secretariat of the Convention on Biological Diversity*. https://www.cbd.int/doc/publications/cbd-sustain-en.pdf

Sessa, C. (2022). Co-creating Sustainable Urban Mobility Solutions for Guests and Citizens: The Experience in the Elba Island, 67–85. https://doi.org/10.1007/978-3-030-73715-3_4

Shabani, F [Farzin], Ahmadi, M., Kumar, L., Solhjouy-fard, S., Shafapour Tehrany, M., Shabani, F [Fariborz], Kalantar, B., & Esmaeili, A. (2020). Invasive weed species' threats to global biodiversity: Future scenarios of changes in the number of invasive species in a changing climate. *Ecological Indicators*, *116*, 106436. https://doi.org/10.1016/j.ecolind.2020.106436

Shun Zhang, X. L. (2019). The roles of international tourism and renewable energy in environment: new evidence from Asian countries. Advance online publication. https://doi.org/10.1016/j.renene.2019.02.046 (Renewable Energy).

Simmons, B. A., Wilson, K. A., Marcos-Martinez, R., Bryan, B. A., Holland, O., & Law, E. A. (2018). Effectiveness of regulatory policy in curbing deforestation in a biodiversity

hotspot. *Environmental Research Letters*, *13*(12), 124003. https://doi.org/10.1088/1748-9326/aae7f9

Sordello, R., Ratel, O., Flamerie De Lachapelle, F., Leger, C., Dambry, A., & Vanpeene, S. (2020). Evidence of the impact of noise pollution on biodiversity: a systematic map. *Environmental Evidence*, *9*(1). https://doi.org/10.1186/s13750-020-00202-y

Stefan Gössling, Carina Borgström, Oliver Hörstmeier, & Stefan Saggel (2002). Ecological footprint analysis as a tool to assess tourism sustainability, *43*, 199–211 (Ecological Economics).

Steven, R., Castley, J. G., & Buckley, R. (2013). Tourism revenue as a conservation tool for threatened birds in protected areas. *PloS One*, *8*(5), e62598. https://doi.org/10.1371/journal.pone.0062598

Styles D, Schönberger H., & Galvez Martos J. K. (2017). Best Environmental Practice in the Tourism Sector: EUR 27022 EN. Advance online publication. https://doi.org/10.2788/33972

Survey Monkey. *How is average in ranking questions calculated?* https://help.surveymonkey.com/en/create/ranking-question/

Székely, N., & vom Brocke, J. (2017). What can we learn from corporate sustainability reporting? Deriving propositions for research and practice from over 9,500 corporate sustainability reports published between 1999 and 2015 using topic modelling technique. *PloS One*, *12*(4), e0174807. https://doi.org/10.1371/journal.pone.0174807

Theocharis Tsoutsos. (2022). *Sustainable Mobility for Island Destinations*. Springer. Springer. https://doi.org/10.1007/978-3-030-73715-3

Thushari, G. G. N., & Senevirathna, J. D. M. (2020). Plastic pollution in the marine environment. *Heliyon*, *6*(8), e04709. https://doi.org/10.1016/j.heliyon.2020.e04709

Törn, A., Tolvanen, A., Norokorpi, Y., Tervo, R., & Siikamäki, P. (2009). Comparing the impacts of hiking, skiing and horse riding on trail and vegetation in different types of forest. *Journal of Environmental Management*, *90*(3), 1427–1434. https://doi.org/10.1016/j.jenvman.2008.08.014

Torres-Delgado, A., & López Palomeque, F. (2018). The ISOST index: A tool for studying sustainable tourism. *Journal of Destination Marketing & Management*, *8*, 281–289. https://doi.org/10.1016/j.jdmm.2017.05.005

TourCert. *Autovaluación de Sostenibilidad y BioDiversidad en el Destino*.

TourCert. (2021). *FAQ*. https://www.tourcert.org/en/

Toyoshima, J., & Nadaoka, K. (2015). Importance of environmental briefing and buoyancy control on reducing negative impacts of SCUBA diving on coral reefs. *Ocean & Coastal Management*, *116*, 20–26. https://doi.org/10.1016/j.ocecoaman.2015.06.018

UNEP-WCMC. (2016). *The state of Biodiversity in Latin America and the Caribbean: A mid-term review of progress towarsa the Aichi Biodiversity Targets.* https://www.cbd.int/gbo/gbo4/outlook-grulac-en.pdf

UNEP-WCMC. (2018). *United Nations List of Protected Areas. Supplement on protected area management effectiveness.*

United Nations. (2007). *Is the concept of sustainable tourism sustainable: Developing the sustainable tourism benchmarking tool*. https://unctad.org/system/files/official-document/ditctncd20065_en.pdf

United Nations. (2018). *The 2030 Agenda and the Sustainable Development Goals: An opportunity for Latin America and the Caribbean.* Santiago. 978-92-1-122011-7

United Nations Development Group. Theory of Change. https://unsdg.un.org/sites/default/files/UNDG-UNDAF-Companion-Pieces-7-Theory-of-Change.pdf

United Nations World Commission on Environment and Development. (1987). *Our Common Future; Oxford University Press: UNESCO*. https://en.unesco.org/themes/education-sustainable-development/what-is-esd/sd#:~:text=Sustainable%20development%20is%20the%20overarching,to%20meet%20their%20own%20needs.%E2%80%9D

UNWTO. *Glossary of tourism terms.* UNWTO. https://www.unwto.org/glossary-tourism-terms

UNWTO (Ed.). (2011). *Practical Guide for the Development of Biodiversity-based Tourism Products*. World Tourism Organization (UNWTO). https://doi.org/10.18111/9789284413409

UNWTO. (2021). *Sustainable development*. https://www.unwto.org/sustainable-development

Valentina Castellani, Alessandra Fusi, & Serenella Sala. (2017). *Consumer Footprint Basket of Products indicator on Food*. Luxembourg. Publications Office of the European Union. https://doi.org/10.2760/668763

Valentina Castellani, & Serenella Sala (2008). Ecological Footprint: A way to assess the impact of tourists choices at the local scale, *115*, 197–206. https://doi.org/10.2495/ST080201 (WIT Transactions on Ecology and the Environment).

van Hieu, N., Thuy, D. T. T., & Nam, N. H. (2020). Payment For Environmental Service: An Application in Tourism in Vietnam. *SEAS (Sustainable Environment Agricultural Science)*, *4*(1), 77–87. https://doi.org/10.22225/seas.4.1.1691.77-87

Velonaki, A., & Stone, C. (2015). *Carbon Offsetting Schemes - Responsible Tourism Behaviour: Issues & Challenges in the 21st Century.*

Weidenfeld, A. (2018). Tourism Diversification and Its Implications for Smart Specialisation. *Sustainability*, *10*(2), 319. https://doi.org/10.3390/su10020319

Wilde, H. D., Gandhi, K. J. K., & Colson, G. (2015). State of the science and challenges of breeding landscape plants with ecological function. *Horticulture Research*, *2*, 14069. https://doi.org/10.1038/hortres.2014.69

Winter, C. (2020). A review of research into animal ethics in tourism: Launching the annals of tourism research curated collection on animal ethics in tourism. *Annals of Tourism Research*, *84*, 102989. https://doi.org/10.1016/j.annals.2020.102989

Woodard, A. C., & Milner, H. R. (Eds.). (2016). *Sustainability of timber and wood in construction.* https://doi.org/10.1016/b978-0-08-100370-1.00007-x

World Bank Group, & PROFOR. (2016). *Biodiversity Offsets: A user guide.*

World Economic Forum. (2019). *The Travel & Tourism Competitiveness Index Report 2019*. https://www3.weforum.org/docs/WEF_TTCR_2019.pdf

World Tourism Organization (2010). Tourism and Biodiversity – Achieving Common Goals Towards Sustainability. Advance online publication. https://doi.org/10.18111/9789284413713

World Tourism Organization and International Labour Organization. (2014). *Measuring Employment in the Tourism Industries - Guide with Best Practices*. UNWTO. Madrid. https://www.e-unwto.org/doi/pdf/10.18111/9789284416158 https://doi.org/10.18111/9789284416158

World Travel & Tourism Council (2017). Sustainability Reporting in Travel & Tourism: Environmental, Social & Governance Reporting in Travel & Tourism.

Xu, J., Wang, Q., Deng, C., McNeill, V. F., Fankhauser, A., Wang, F., Zheng, X., Shen, J., Huang, K., & Zhuang, G. (2018). Insights into the characteristics and sources of primary and secondary organic carbon: High time resolution observation in urban Shanghai. *Environmental Pollution (Barking, Essex : 1987)*, *233*, 1177–1187. https://doi.org/10.1016/j.envpol.2017.10.003

Yue Gue, & S. Page. (2009). *Transportation and tourism: A symbiotic relationship? In book: The Sage Handbook of Tourism Studies. (pp.371-395). Chapter 21*. Sage Publications (Jamal & M. Robinson). https://www.researchgate.net/publication/285827144_Transportation_and_tourism_A_symbiotic_relationship

Zeng, X. (2018). Influence of Tourism disturbance on carbon, nitrogen, and enzyme activities of the soil in an urban park in China. *Šumarski List*, *142*(9-10), 535. https://doi.org/10.31298/sl.142.9-10.8

Zhao, Y., & Jiao, L. (2019). Resources development and tourism environmental carrying capacity of ecotourism industry in Pingdingshan City, China. *Ecological Processes*, *8*(1). https://doi.org/10.1186/s13717-019-0161-0

Ziegler, R., Balzac-Arroyo, J., Hölsgens, R., Holzgreve, S., Lyon, F., Spangenberg, J. H., & Thapa, P. P. (2022). Social innovation for biodiversity: A literature review and research challenges. *Ecological Economics*, *193*, 107336. https://doi.org/10.1016/j.ecolecon.2021.107336