UNIVERSITÀ
DEGLI STUDI
FIRENZE

PHD IN

SUSTAINABLE MANAGEMENT OF AGRICULTURAL, FORESTRY AND FOOD RESOURCES

CYCLE XXXV

Quali-quantitative models for the analysis of Cultural Ecosystem Services: Investigation on the recreational functions of the agro-forestry territory

Academic Discipline (SSD) AGR/01

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Years 2019/2022

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Acknowledgments

The Doctorate has been for me an important and demanding course of study, but also an indispensable and precious experience of life. At the end of this journey, I would like to thank everyone who has been close to me with their time and support, making me never feel alone.

To my supervisor, Professor Claudio Fagarazzi, for giving me the opportunity to connect with the research community and for guiding me along this path.

To Professor Enrico Marone, for his constant availability and interest in my research work.

To Dr. Alessandro Paletto and Dr. Dijana Vuletić, who allowed me to live other realities of research and wonderful places.

To all my family, especially Sandro, Umberto and Maria Vittoria, who have always supported and encouraged me to achieve all my goals.

To Irene, Ilaria and India, whose presence in these challenging years has never been lacking.

To my colleagues, Francesca, Giovanna and Sara, who enriched this adventure with friendship and sharing.

Extended abstract

Cultural ecosystem services (CESs) are a particular type of intangible benefits that derive from ecosystems and contribute to human well-being. Due to their intangibility, the evaluation of CESs is particularly challenging. Therefore, this is a topic that can be further explored in the current literature. On the one hand, there is no real market for these services to easily estimate their monetary value; on the other hand, their intangible effects make investigations very complex. The research project comes from the idea of developing a support model for the public administration, in order to provide a useful tool to highlight the potential and resources provided by the territory. The purpose of this thesis is to explore different methods for the assessment of CESs: quantitative models for an economic estimation; and qualitative models for the study of contents related to the use of CESs. Within the category of CESs, the tourist-recreational function for outdoor activities was selected as the object of study, with particular reference to the agro-forestry area. This function has been declined according to two specific thematic strands in the field of outdoor recreational activities: the recreational hunting function; the visit to the protected areas.

For the first research line, the territory of the province of Siena in Tuscany (Italy) was chosen as the study area. The choice to develop part of the investigation in Tuscany is firstly due to the fact that in this region hunting is very relevant as a recreational activity. Secondly, the regional administration is promoting both: a sustainable hunting model to help manage the high load of ungulates that has negatively impacted on agricultural and forestry productions; and a slow tourism policy to reduce the tourist flow to the big cities, creating new job opportunities in the rural area thanks to the enhancement of CESs. In this perspective, the Tuscan territory will be transformed into a tourist product, where the evaluation of CESs can represent a useful tool for combining territorial

development and protection. The model for the economic assessment of the recreational hunting function was developed in the following steps. Initially, a series of meetings were held with local and national sector associations and regional administration offices responsible for the management of hunting activity. Sector associations and regional offices collaborated to: develop a questionnaire to determine hunting habits; and disclose the survey through their social channels. The investigation was addressed to all hunters resident in Tuscany, who during the 2018-2019 hunting season had hunted in the province of Siena. In the next step, based on the data collected, the hunters' consumer surplus was estimated using the travel cost method. In addition, a detailed analysis of the annual expenditures for hunting activities was performed. The findings show that hunting has now become an elitist and almost exclusively recreational activity, and that it is no longer seen as an income supplement for rural communities. Moreover, by economic estimation of the recreational hunting function, the financial importance of this type of CES can be easily communicated to non-experts. Indeed, it has been found that the annual recreational hunting value for the entire territory of Tuscany is approximately between a minimum of EUR 68 million and a maximum of EUR 170 million. This value far exceeds that of the current Tuscan forest production, which is around EUR 25 million each years. In conclusion, knowledge of the economic value of CESs provides an essential foundation for planning effective management and development policies for the local territory.

As regards the second research line, i.e. visit to protected areas, the Plitvice Lakes National Park (Croatia) was chosen as the study area. The Plitvice Lakes National Park is one of the most important naturalistic areas for international flows in Central Europe. At the same time, it is attracting increasing interest from the local population. The aim of the research project was to develop a flexible methodology for the analysis

of the demanding management of protected areas, taking into account the perspective of visitors. The main reason for this complexity lies in the trade-off that exists between conserving natural ecosystems and promoting tourist visits for economic reasons. Methodologically, a complex system of several tools was implemented. First of all, TripAdvisor reviews on "Plitvice Lakes National Park" were scraped. Second, a sentiment analysis was performed, assigning each review a score. After that, a rapid automatic keyword extraction (i.e. a particular type of natural language processing procedure) was applied to extrapolate the main keywords from the reviews. Based on former results, the analysis of definitely positive and decidedly negative reviews made it possible to identify strengths and weaknesses of the tourist destination studied on the basis of visitors' opinion. In parallel, the multidimensional scaling method and cluster analysis were used to explore potential combinations or groups of words that share similar schemes of appearance. In this way, it was possible to derive the main elements perceived by the reviewers that should be considered for an effective and rational management of the protected areas. Based on previous results, it is clear that visitors are especially sensitive to management aspects. For this reason, an online questionnaire was designed to determine how visitors perceive certain topics related to the theme of the visit system. In the survey, visitors were invited to indicate their level of priority on a variety of management issues. Subsequently, the results achieved were compared to the priorities assigned by the managers in the current Plitvice Lakes National Park Management Plan 2019-2028. The findings of the study proved that visitors to nature-based destinations are interested in discussing and contributing to the management of these places, and not only to appreciate the natural landscapes and beauties. Consequently, it seemed appropriate to involve visitors as protected area stakeholders to obtain their views on management issues. Briefly, social media data analysis combined with online questionnaires for

visitors proved to be a comprehensive survey method. This methodology has made it possible to collect useful and practical information for those involved in the management and planning of protected natural areas.

In conclusion, this thesis sought to explore a variety of quantitative and qualitative methods for assessing recreational functions within the CES category. Actually, a combination of qualitative and quantitative analysis would lead to building a more accurate framework for CESs. Furthermore, relying on different sources of investigation, a solid foundation of knowledge can simplify and improve the efficiency of natural heritage management, taking human activities into account as well. For this reason, it is essential that those who manage the natural resources linked to CESs invest in preliminary studies, in order to make effective investment and planning efforts.

Keywords: cultural ecosystem services; nature-based tourism; recreation; agro-forestry territory; economic evaluations; travel-cost method; hunting activity; qualitative methods; content analysis; protected area management

List of papers

This thesis is based on the following three papers:

1. Fagarazzi, C., Sergiacomi, C.*, Stefanini, F. M., & Marone, E. (2021). *A Model for the Economic Evaluation of Cultural Ecosystem Services: The Recreational Hunting Function in the Agroforestry Territories of Tuscany (Italy)*. Sustainability, 13(20), 11229. DOI: https://doi.org/10.3390/su132011229.

2. Sergiacomi, C.*, Vuletić, D., Paletto, A., Barbierato, E. & Fagarazzi, C. (2022). *Exploring National Park Visitors' Judgements from Social Media: The Case Study of Plitvice Lakes National Park.* Forests, 13(5):717. DOI: https://doi.org/10.3390/f13050717.

3. Sergiacomi, C.*, Vuletić, D., Paletto, A., & Fagarazzi, C. (2022). *Exploring tourist preferences on the visitor management system: the case study of Plitvice Lakes National Park*. SEEFOR 13(2): 67-77. DOI: https://doi.org/10.15177/seefor.22-06 .

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List of abbreviations

Abbreviation	Definition
CICES	Common International Classification of Ecosystem Services
CESs	Cultural Ecosystem Services
CS	Consumer Surplus
CV	Contingent Valuation
DCE	Discrete Choice Experiments
ESs	Ecosystem Services
GLM	Generalised linear models
HPM	Hedonic Price Method
IBA	Important Bird Area
ITCM	Individual Travel Cost Method
MA	Millennium Ecosystem Assessment
MDS	Multidimensional Scaling Method
MEE	Ministry of the Environment and Energy
NLP	Natural Language Processing
NP	National Park
PA	Protected Area
PLNP	Plitvice Lakes National Park
PLNPPI	Plitvice Lakes National Park Public Institution
RAKE	Rapid Automatic Keyword Extraction
SA	Sentiment analysis
SAC	Special Area of Conservation
TCM	Travel Cost Method
TF–DF	Term Frequency–Document Frequency graph
TEEB	The Economics of Ecosystems and Biodiversity
THAs	Territorial Hunting Areas
UGCs	User-Generated Contents
UNESCO	United Nations Educational, Scientific and Cultural Organization
WTP	Willingness To Pay

I. INTRODUCTION

1. Presentation of the research

The purpose of the present thesis is to develop a support model for public administration, in order to provide a useful tool to highlight the potential and resources of the territory. To achieve this goal, a variety of methods for the assessment of Cultural Ecosystem Services (CESs) have been explored: quantitative models for an economic estimate; and qualitative models for the study of the contents related to the use of CESs. Indeed, it has been verified that a combination of qualitative and quantitative analysis could provide a more accurate framework for the exploration of CESs. Similar knowledge could improve the efficiency of management of natural heritage and human activities. For this reason, natural resource managers should invest in preliminary studies, in order to make effective investment and planning efforts.

2. Introduction to Cultural Ecosystem Services

Research on Ecosystem Services (ESs) has become a significant field of study over the past decades (Fisher et al., 2009). The prerequisite for the existence of a service is the presence of an end-user who can benefit from the advantages generated by the service itself (Colavitti et al., 2020). These benefits exist only in relation to the needs of the final beneficiaries. Besides, it is widely acknowledged that goods and services generated by ESs are closely connected with both physical and mental human well-being (Lupp et al., 2016; Riechers et al., 2016). According to the main international reports, ESs can be classified into three main categories: provisioning ecosystem services (e.g. food and fresh water); regulating ecosystem services (e.g. climate regulation and flood prevention); and cultural ecosystem services (e.g. recreation and education) (MA, 2005). In particular, CESs are defined as all the non-material benefits which derive from the ecosystems and which people can enjoy (MEA, 2005). Also, CESs can be divided into two classes (Haines-Young and

Potschin, 2018): biotic services derive from the environmental features that enable a recreational activity (e.g. nature walks); abiotic services are characterised by landscape elements which have cultural or religious value for people. From an economic point of view, CESs are defined as the ESs that generate user experiences (TEEB - The Economics of Ecosystems and Biodiversity, 2008). Although different definitions are used in the literature, it is generally assumed that CESs are an interrelated function between people and the environment (Nepal et al., 2018; Pascual et al., 2010).

Specifically, the content of the thesis concerns the tourist-recreational function for outdoor activities, with particular reference to the agro-forestry context. This function has been declined in two specific research lines related to the field of outdoor recreation: the recreational hunting function; the visit to protected areas.

3. Assessment methods for Cultural Ecosystem Services

The most difficult challenge in studying CESs is their assessment (Matsiori et al., 2012). Especially, it is considered particularly demanding to convert the real value of CESs into economic terms (Daniel et al., 2012; Pachoud et al., 2020; Plieninger et al., 2013). This is mainly due to the fact that CESs are a category of non-market, non-material and non-monetary services which are not traded on the market (Fish et al., 2016). Moreover, it is widely recognised that the economic value generated by recreational services, which belonging to CESs, is extremely relevant (Bernetti et al., 2019; Lupp et al., 2016; Müller et al., 2019; Riccioli et al., 2020, 2019). For this reason, it is essential to develop tools for their quantification. On the other hand, quantitative methods make it difficult to deepen specific issues related to CESs from a user perspective (Lee et al., 2020).

In the literature, studies applying qualitative research methods to CESs are still rare (Ostoić et al., 2020). These

types of investigations are applied to explore how people perceive and use CESs. Therefore, qualitative analysis consent to assess the environmental and social conditions of CESs from the point of view of many stakeholders (Busch et al., 2011). Perception studies can often give a more accurate picture of an underdeveloped research area than purely quantitative and monetary studies (Riechers et al., 2016).

Mixed models, which include both quantitative and qualitative tools, provide a more accurate foundation of knowledge to be used as a solid base for natural resource management.

3.1. Quantitative methods

Generally, the literature provides many references for the study of the economic evaluation of CESs. For what concern the evaluation of recreational activities the most frequently used methods are: Contingent Valuation (CV); Hedonic Price Method (HPM); Discrete Choice Experiments (DCE); and Travel Cost Method (TCM). CV is a stated preference method, usually employed to estimate economic values for all kinds of ESs (Chaudhry and Tewari, 2006). This approach involves interviewing people directly through questionnaires or face-to-face interviews. It allows to estimate: how much people would be willing to pay to secure a benefit as a result of a modification in the supply of a non-market environmental good or service; or how much people would be willing to accept as compensation for a loss of benefits due to a decrease in the provision of the good or service (Gios et al., 2006; Matsiori et al., 2012). Also HPM is frequently used to estimate the values of non-market environmental goods or services. It analyses the price of related attributes or characteristics that are placed in a real market (e.g. the price of houses for the value of a landscape, or the cost of licenses for the value of the hunting activity) (Lundhede et al., 2015; Rhyne et al., 2009). Otherwise, an ecosystem service or good is described in a DCE according to its principal features (van

Zanten et al., 2016). By combining various attributes in different way, hypothetical alternatives of goods or services are created. Among these alternatives, respondents choose the one they prefer most (Demartini et al., 2018). DCEs have recently been successfully applied by combining tourism and environmental economics, in order to analyse recreational activities (Capitello et al., 2013). For this thesis, TCM was adopted as an evaluation method. This is the most widely applied method in the literature for the assessment of CESs in general (Chapagain and Poudyal, 2020; Knoche and Lupi, 2012, 2007; Nepal et al., 2018; Parsons, 2003; Pascual et al., 2010). In particular, it results very effective to estimate recreational activities where long trips are required for the enjoyment of entertainment. First, it assumes that the recreational value of a site reflects the costs of visiting the site itself (Turner et al., 1994). A second assumption is that with the increase of the costs supported, the frequency of the visits to the site decreases (Parsons, 2003; Riera et al., 2012). Among the different types of TCM, the Individual Travel Cost Method (ITCM) was adopted, which examines the relationship between the number of trips made by a person to enjoy a particular type of leisure activity and the personal expenses incurred in reaching that site (Torres-Ortega et al., 2018). In general, TCM can refer to a wide range of cost variables that affect the frequency to a site (Torres-Ortega et al., 2018). In fact, travel costs alone (i.e., the cost of fuel) cannot fully explain the demand function (Parsons, 2003). In particular, the first research line of this thesis concerns the recreational hunting function analysed for the Province of Siena (Tuscany, Italy) as an area of study. To explore this specific recreational function, a complex structure of cost variables were investigated. Three categories of costs were analysed: fixed costs that hunters have to pay each year to practice hunting; annual variable costs that are not directly linked to hunting trips but to the preparation and planning of hunting activities on an annual basis; and daily variable costs that are directly

related to hunting outings (i.e., cost of fuel, and out-of-home meal expenses).

3.2. Qualitative methods

In recent decades, the natural environment has become an increasingly popular tourist destination, particularly in relation to the realities of Protected Areas (PAs) and National Parks (NPs) (Lundmark and Müller 2010, McCool et al. 2021, Smolćić Jurdana 2009, Wolf et al. 2015). The complexity of nature-based destination management is mainly due to the trade-off between the conservation of natural ecosystems and the promotion of tourist visits for economic reasons (Kaffashi et al., 2015; Mangachena and Pickering, 2021). Hence, the primary objective of tourism managers is to meet the expectations of visitors without compromising the natural environment (Mandić, 2021; Perera et al., 2015). For the modern tourism community, identifying nature-based destinations that provide them with meaningful experiences is essential. For this reason, PAs and NPs turn out to be popular places in virtue of their natural value (Niezgoda and Nowacki, 2020). In addition, according to the European Landscape Convention (Council of Europe., 2000), the assessment and management of the landscape should take into account the public perception of places (Koblet and Purves, 2020). Time- and resource-consuming traditional methods (e.g. in situ questionnaires, in-depth interviews, and focus groups) have long been employed to evaluate visitors' opinions towards nature-based destinations (Hausmann et al., 2020; Koblet and Purves, 2020; Kovacs-Györi et al., 2018; Mangachena and Pickering, 2021; Mirzaalian and Halpenny, 2021; Stoleriu et al., 2019). Meanwhile, technological advances in the tourism sector have drastically changed the way information is produced and made accessible (Alaei et al., 2019). In particular, social media platforms offer a space to freely share experiences and make judgements (Lai and To, 2015; Tenkanen et al., 2017). Internet allows to generate an

massive amount of so-called user-generated contents (UGCs) (Hausmann et al., 2020; Mirzaalian and Halpenny, 2021; Yang and Han, 2020). This enormous quantity of unstructured data necessarily requires the use of automated procedures for the development of data analysis (Alaei et al., 2019; Valdivia et al., 2017; Yang and Han, 2020). Content analysis (CA) is one of the most widely used methodologies in tourism research for the extrapolation of content from UGC texts (Barbierato et al., 2021; Yu et al., 2017; Zhang and Cole, 2016).

The main goal of the second research line of this thesis is to define a flexible methodology for the analysis of the management of PAs considering the point of view of visitors. As for the study area, one of the European PAs most affected by international tourist flows was chosen, the Plitvice Lakes National Park (PLNP) in Croatia. TripAdvisor, the largest travel website in the world (Filieri et al., 2021; Ghahramani et al., 2021; Yu et al., 2017) was chosen as a social media from which visitors' reviews of the PLNP are derived. As regards the methodology, a complex system of different tools was implemented. One of the possible approaches of CA , i.e. Sentiment Analysis (SA), was applied. SA can be used to explore consumer attitudes towards particular products, services, or places (Ghahramani et al., 2021) by classifying visitor reviews into positive, negative, or neutral statements through a numerical score (Alaei et al., 2019; Ghahramani et al., 2021; Valdivia et al., 2017). On the basis of SA scores, a Natural language processing (NLP) procedure was adopted, which is a specific type of SA tool. In particular, the strengths and weaknesses of the PLNP were identified using the Rapid Automatic Keyword Extraction (RAKE) procedure (Rose et al., 2010). In parallel, TripAdvisor visitor reviews for the PLNP were used for a second analysis using the Multidimensional Scaling Method (MDS) and Cluster Analysis. The combined use of these two tools allowed to explore possible combinations or groups of words that share similar appearance patterns in text contents (Borg et al., 2018). Based on previous results, a

structured questionnaire on the current PLNP Management Plan was prepared. This final step of the study was conducted as in the literature the opinions of visitors are usually investigated focusing exclusively on environmental and nature conservation aspects (Abdullah et al., 2018; Arnberger et al., 2012; Belkayali and Kesimoğlu, 2015; Cihar and Stankova, 2006). Conversely, visitors are less involved as stakeholders in investigating management issues. In particular, visitors were asked to assign a priority level to certain groups of actions related to the theme of the visitor management system. In addition, the priority levels stated by the visitors participating in the survey were compared with those established in the current PLNP Management Plan. In this way, a valid tool was provided to support the managers of the PA, allowing them to harmonise the planning strategies of the PLNP with the judgement of its visitors.

4. Content of the thesis

The application of quantitative and qualitative methods to two case studies is further developed in the next chapters. Chapter II contains the published papers on which this thesis is based. In particular, the first paper focuses on the development of a quantitative model for the economic assessment of a specific type of CES: the recreational hunting function. The study hypothesizes that this function is economically significant for the territory under examination. Its value would be an important resource both for the local economy and for the sustainable management of agroforestry areas. This model was implemented in the territory of the Province of Siena, Tuscany (Italy). Instead, the second and third papers deal with the case study of Plitvice Lakes National Park (Croatia). In this survey area a qualitative investigation model was performed. The recreational function of visiting protected areas was analysed, involving visitors as key stakeholders. The research questions concern: which tools it is

deemed appropriate to use for this type of textual data analysis; how to extrapolate the topics of greatest interest and identify strengths and weaknesses from the users' point of view; to what extent the vision of the users corresponds to that of the protected area managers. The thesis ends with Chapter III which contains a series of final reflections on: the main research findings; limitations of research; theoretical and practical implications; possible developments.

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II. PAPERS

A Model for the Economic Evaluation of Cultural Ecosystem Services: The Recreational Hunting Function in the Agroforestry Territories of Tuscany (Italy)

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Abstract

Cultural ecosystem services (CESs) are non-material benefits generated by natural and human ecosystems that substantially contribute to human wellbeing. Estimating the monetary value of CESs is challenging because there is no real market for these services and therefore there is no actual market price. This study seeks to define an economic evaluation method for these services, with special reference to a recreational CES that has so far received little discussion: hunting. We conducted an online survey in the province of Siena (Tuscany, Italy). The Consumer Surplus estimate of hunters was made using the travel-cost method with a detailed analysis of the annual expenditure on hunting activities, and a negative binomial statistical regression. The results reflect the nature of hunting activity and show the dynamics that have occurred over recent decades. In fact, whereas hunting used to be strongly connected to the rural world as it was an income supplement for local communities, nowadays it has turned into an elitist and almost exclusively recreational activity. In any case, knowing the economic value of ecosystem services constitutes an essential background for planning effective land management and development policies in the short and long term.

Keywords: cultural ecosystem services; economic assessment; travel-cost method; recreation; hunting; agroforestry territory; negative binomial regression

1. Introduction

Nowadays, ecosystem services (ESs) are an increasingly studied field, and this topic is becoming more and more well-known and widespread even among the non-scientific community. Generally speaking, the condition of existence of a service requires the presence of an end user who can enjoy the benefit generated by the service; this benefit exists only in relation to the needs of the final beneficiaries [1]. There are numerous studies evaluating the connection between physical and mental human well-being and the goods or services generated by ESs [2]. The main international reports analysing the effects of ESs include the Millennium Ecosystem Assessment (MA)[3], the Common International Classification of Ecosystem Services (CICES) [4], and The Economics of Ecosystems and Biodiversity (TEEB) [5]. According to a classification shared by these reports, ESs can be classified into three categories: provisioning ecosystem services, such as food and fresh water; regulating ecosystem services, which affect, for example, climate, floods and diseases; and cultural ecosystem services which include recreation and spiritual values [3,6].

Regarding cultural ecosystem services (CES), there are several definitions in the literature. The MA identifies ten types of CESs including the spiritual, religious and recreational ones, i.e., all non-material benefits, which derive from the ecosystem and which people can enjoy [3]. Instead, the CICES approach distinguishes two macro-categories of CES: biotic and abiotic. In the first case they derive from the characteristics of the setting or location of the environment that enables a recreational activity (e.g., nature walks) and determines their qualitative characteristics. On the other

hand, in the second case abiotic services are characterised by the physical elements of the landscape that represent for people a cultural, religious or traditional emblem [4]. A predominantly economic interpretation is given by the TEEB, whereby CESs are defined as the ESs that generate so-called experiences for the users, such as cultural heritage, aesthetic values, recreation and tourism [5]. Other authors have further differentiated these services [7]. For example, following a more economic approach based on Costanza and Daly's studies, Natural Capital is defined as the stock of natural resources, including recreational services, which they can draw on to ensure a flow of goods and services for future generations [6,8]. Additionally, CESs have also been defined as all spaces in the environment and all cultural practices that generate benefits for people [9]. Even though different names have been used to define CESs [10], most authors agree that they are an interdependent function between people and environment [11,12].

In all studies, the most difficult challenge related to the definition of CESs is certainly represented by their quantification, especially in monetary terms. This is in fact a category of non-market, non-material and non-monetary services which are not traded on the market [9]. For this reason, some authors believe that for the research community it is still difficult to translate the value of CESs into economic terms [13–15]. On the other hand, numerous studies have shown that the economic value generated by the category of recreational services is extremely relevant [16–19] and can sometimes exceed the value of agricultural and forestry production [2,7]. In particular in Italy, it is recognised that CESs are widespread in forests and cultivated land [20].

The purpose of this study is to contribute to fill these research gaps by defining an economic evaluation method capable of estimating a particular category of CESs, which is one of the main recreational activities in the Tuscan and national rural territory: hunting. Specifically, this activity was

investigated in order to estimate its recreational use value, which differs from the consumptive (e.g., sale of game meat) [21] and non-consumptive use value of wildlife (e.g., birdwatching) analysed in other studies [22]. In general, the literature offers numerous references for studying the economic valuation of CESs. In particular, the analysis of the hunting function is evaluated through different methods of monetary estimation depending on the objective to be pursued. For example, to estimate the Willingness To Pay (WTP) of hunters for hunting recreational services [23–26], Contingent Valuation (CV) is the most widely used strategy. CV has also been adopted in case studies related to the area examined by this research (Tuscany) [27,28]. Alternatively, the Hedonic Price Method (HPM) is used to identify those factors that primarily influence the cost of market activity the most [29–31]. In addition, the literature presents several case studies that use the method of Discrete Choice Experiments (DCE) to identify the preferences of hunters in the practice of hunting [32,33] or consumers in the purchase of products derived from hunting (i.e., game meat) [34,35]. Instead, the economic evaluation methodology used in the present research was the travel-cost method (TCM). First of all, it is the most widely used method in the literature for the assessment of CESs in general [11,12,36–41]. Moreover, there are many studies in the literature that use TCM to estimate the value of recreational activities such as hunting [37–40,42], in which travel, even of considerable length, is necessary to enjoy an activity practiced exclusively in rural areas far from urban contexts. In fact, because of this, the costs incurred for travel represent a significant factor within the total expenditure incurred annually by hunters that is worth investigating.

The research was carried out by means of a survey on the territory of the province of Siena (Tuscany region, central Italy) through the dissemination of online questionnaires. Through this survey, it was possible to analyse the hunting

habits of recreational users in agroforestry areas. In the following paragraphs, the research is described in its main components. The Materials and methods section defines the study area and the research objectives and provides details about the economic evaluation method applied (TCM) and the econometric model used to carry out the statistical regression of collected data (Negative Binomial Model). Then, the contents and sections of the survey conducted through online questionnaires are described. In the following Results and discussion chapter, an annotated overview of the results obtained is given. Finally, the Conclusions analyse the strengths and weaknesses, and summarise some reflections on possible applications of the method and on the strategies derived from the first results aimed at improving land management.

2. Materials and methods

2.1. Study area and research objectives

The Tuscany region is in central Italy. Around 1,160,000 ha (over 50% of the region's area) of its surface is covered by forests [43]. Over 90% of the territory is classified as rural [44], and the Utilised Agricultural Area covers over 750,000 ha [45]. In particular, the study area covers the province of Siena, located in the central-eastern part of the region (Figure 1). This is a territory developed over an area of over 3800 km2, including 35 municipalities. With its population of 272,638 inhabitants, Siena is the most rural province in all of Tuscany. In fact, in relation to the territory, the province records the lowest density of the whole region, with around 72 inhabitants per km2. The degree of urbanisation is also medium-low: in fact, 39.5% of the inhabitants live in only three municipalities with a population exceeding 20,000 inhabitants [46]. The province registers an old-age index that is not too different from the regional average (i.e., 214.8 and 211.4, respectively). As far as the level of education is

concerned, there is a rather homogenous distribution on the regional territory, with the exception of the provinces where the Tuscan universities are located (Siena, Pisa and Florence). In fact, the percentage of persons with tertiary and higher-education qualifications in the province of Siena (16.5%) is much higher than the regional average (14.5%) and the national average (14.3%) [47]. The employment rate for men (57.4%) and women (44.2%) does not differ greatly from the regional average (56.4% and 42.0%, respectively) [47]. With regards to the economic profile, the Province of Siena is characterised not only by the historically leading sector of agriculture but also by other productive activities such as trade, construction, manufacturing and the food service and hospitality sector. In fact, alongside traditional accommodation facilities, a rich offer of agritourism has also recently been added [48]. In recent years, tourist flows have maintained an increasing trend until the beginning of January 2020, when a turnaround caused by the COVID-19 pandemic was recorded. In 2019, over 2 million arrivals and over 5 million tourist presences were recorded [49]. The agricultural area represents approximately 22% of the regional area (about 170,000 ha) [45]. The territory is home to one of the largest provincial forest areas in Tuscany. In fact, after Grosseto (17%), Florence and Arezzo (16%), the forest area in the Province of Siena covers about 168,000 ha, accounting for 15% of Tuscany's forests [43]. The main crops are vines and olive trees [50], while the wooded area consists mainly of broadleaf forests, in particular, oak, holm oak and turkey oak [43]. From a hunting point of view the territory is divided into two Territorial Hunting Areas (Ambiti Territoriali di Caccia) (Established at national level by Law No. 157 of 11 February 1992 and at regional level by Regional Law No. 3 of 12 January 1994), which represent the elementary units for hunting and wildlife management (Figure 1). In the hunting season of 2017–2018, the province counted over 16,000 hunters registered in the two Territorial Hunting Areas (THAs)

[51]. Ungulate game hunting, migratory game hunting and sedentary game hunting (i.e., hares, pheasants and partridges), typical of the entire national territory, are practised in these places. It was decided to focus the investigation on a purely agroforestry area to fill a gap in sectorial research, namely the fact that "the literature on the valuation of cultural ecosystem services is disproportionately located in urban areas" [11] with particular reference to the themes of urban parks [2,10,52,53]. This may be due to the fact that CESs in urban areas are characterised by a form of more direct experience and a more immediate visibility than those experienced in recreational practices in agroforestry contexts [11]. In fact, there are few studies on forest and rural areas [54,55].

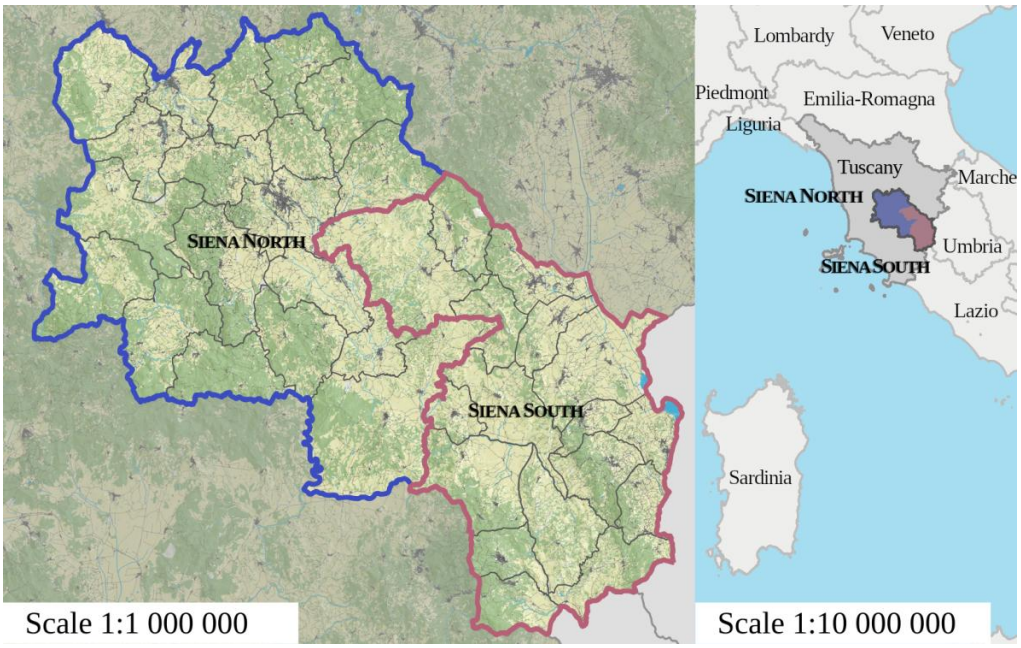

Figure 1. Overview of the study area: Province of Siena (Tuscany, Italy).

The recreational hunting function mainly concerns local residents, while few come from non-regional areas, and of these the vast majority who hunt in Tuscany (93%) come from six regions, i.e., Latium, Liguria, Lombardy, Emilia

Romagna, Veneto and Umbria in descending order of importance [51]. For instance, less than 10% of the sample analysed in this study stated that they go hunting in regions other than the one of residence on an average of 9 hunting days per year. Reviewing the relevant literature, it was decided to focus research on the recreational hunting function, because, although it represents a high economic and social value for the territory, it has limited interest in the European scientific literature compared to the other types of CESs examined in numerous studies [16–18,56,57]. It is likely that this limited interest is influenced by the conflict raised by assessing as a positive externality an activity related to the killing of wildlife. On the other hand, many studies highlight the usefulness of hunting planning in order to improve local ecosystem balances in agroforestry settings. In fact, the progressive reduction of hunting activity in recent decades in Tuscany has led to a considerable increase in the population of ungulates, resulting in serious damage to crops and renewal of coniferous and deciduous forests [58]. For this reason, the evaluation was developed in an area where hunting activity is practised in both forest and agricultural environments.

2.2. The Travel-cost method

The methodology adopted is the travel-cost method, one of the most widely used methodologies for estimating the recreational value of this type of CES [37]. The recreational use value is a very important parameter to structure short- and long-term land management and to development policies that assess not only the values of market products (e.g., timber and agricultural products), but also the values of non-market services (e.g., landscape and recreation) generated by territories.

The monetary value of recreational activities like hunting is not easy to determine, as there is no real market for these services and consequently there is no market price. In economics, to estimate the benefits generated by non-market

goods or services, different evaluation methods are used, which can be divided into stated or revealed preference methods [37,42,59]. Revealed preference methods relate the enjoyment of non-market environmental goods or services to the costs incurred for the purchase of market goods that are indispensable to benefit from the good or service under analysis [42]. Among them, the travel-cost method (TCM), originally proposed by Hotelling [60], is based on the assumption that the recreational value of a site reflects the costs paid to visit the site itself, or of the economic sacrifice made by the user to enjoy that service [61]. A second assumption on which the TCM is based is that as the costs incurred increase, the frequency of visits to the site decreases [36,62]. The TCM was chosen for this study, as it is the most widely used method in the literature for the economic evaluation of recreational activities in natural and rural settings [11,36,37,39]. Moreover, this method has the advantages of keeping survey costs very low and ensuring easy processing of results [37].

Among the different types of TCMs proposed in the literature, in the present study it was decided to adopt the individual travel-cost method (ITCM) which investigates the relationship between the number of trips made by a person to enjoy a particular type of leisure activity and the personal expenses incurred in reaching that site [59]. It is not the intention here to examine in detail the ITCM, already extensively described in numerous studies such as those by Torres-Ortega et al. [59] or by Parsons [36].

What emerges from sector studies is that the TCM can refer to a wide range of cost variables that influence the frequency and willingness to visit a site [59]. This is because in cases such as the hunting activity, travel costs alone (i.e., fuel cost) cannot fully explain the demand function [36]. For this reason, the present study has developed a model that was as comprehensive as possible regarding the costs actually incurred by hunters for recreational hunting. In particular, in

the model developed, three main types of costs have been identified: (1) fixed costs; (2) annual variable costs; and (3) daily variable costs. The first typology concerns the fixed costs that hunters have to pay every year in order to practice hunting. This category includes the costs related to fees and licences [37] (e.g., firearms licence for hunting, registration to THAs). On the other hand, the second type is represented by costs not directly linked to hunting trips but to the preparation and planning of hunting activities on an annual basis. This category includes, for example, the costs for the construction of fixed hunting posts, dog training, the maintenance of weapons and purchase of ammunition. These first two types of expenditure are not linked to each individual hunting trip, but in general to the activities carried out in the course of an entire hunting season (i.e., over the course of a year). For this reason, these costs were attributed to the different locations visited by the individual hunter, in proportion to the annual number of hunting days carried out at that location. Finally, the last type includes only the direct costs related to hunting outings (e.g., cost of petrol used to reach the site, out-of-home meal expenses).

Table 1 summarises all fixed and variable cost items, aggregated by category.

Table 1. Cost categories used in the economic evaluation model.

Fixed costs	Annual variable costs	Daily variable costs
Hunting license (sum of): -national fee: EUR 173.16 -regional fee: EUR 23.00 -medical certificate: EUR 76.00 -tax stamps[1]: EUR 48.00 -insurance[2]: EUR 114.00 Registration to THA: - of residence[3]: EUR 100.00 -other within the Region: 50.00 EUR/each - other outside the Region: 150.00 EUR/each	Hunting mobility [4]: EUR 15.00 Maintenance of a fixed post [5] Feeding of live decoys for fixed posts [5] Feeding of hunting dogs [5] Hunting dog training [5] Hunting clothing [5] Munition purchase and weapon maintenance [5] Hunter training courses [5] Shooting practice [5] Creation of hunting trophies[5]	Out-of-home meals[5]: -breakfast -lunch Travel[6] -small car: 0.25 EUR/km -medium car: 0.34 EUR/km -four-wheel drive: 0.49 EUR/km

[1] Validity: five years. [2] Data provided by Federcaccia Toscana: mode of the maximum number of insured persons for the year 2021. [3] Compulsory registration. [4] For five hunting days in a regional THA different from those in which you are registered [5] Costs defined on the basis of questionnaire responses. [6] Proportional mileage costs [63].

2.3. Econometric model

The Thus, the ITCM is based on the inverse relationship linking the number of visits to the hunting site with the travel cost and a number of independent variables characterising the socio-economic profile and affecting the choices of individual hunters interviewed (e.g., age, level of household income, educational qualification). The dependent variable (i.e., number of visits to the hunting site) takes non-negative integer values; therefore linear models for normal response

variables are not suited to this analysis [11,59,64]. Generalised linear models (GLM), in particular Poisson and negative binomial regression models, take into account both discreteness of count data and the left bound of the sample space in zero. A comprehensive account of GLM for count data is provided by Agresti [65]. Recreational visit models [11], as in this case study for the days spent at hunting sites, have response variable counts whose totals are not fixed in advance. Therefore, the reference model for the distribution of the response variable is the Poisson model [66,67], in which the mean and variance of the response variable coincide. Where the mean and variance of count distribution do not coincide, it is necessary to use the negative binomial model, which has an additional parameter (Theta) to specifically model overdispersion [11,37,64,67,68]. Then, we assume that E(V|X), the expected number of trips to different hunting sites, is an exponential function of independent variables, such that:

$$ln(E(V|X)) = X' \times \beta \quad (1)$$

where X' is the row vector of explanatory variables affecting the expected number of trips and β is the column vector of the coefficients of these variables. The natural logarithm is the so-called link function relating the expected value and the linear predictor. In particular, after estimating the β coefficients of variables by maximum likelihood, the generic Equation (1) can be rewritten using the following demand function for hunting experience:

$$E\,[V_i|\,X] = exp\begin{pmatrix}\beta_0 + \beta_{TC}TCOST_i + \beta_{OC}OCOST_i + \\ +\beta_M MOUNT_i + \beta_A AGE_i + \\ +\beta_{ED}EDU_i + \beta_I INC_i + \beta_{EX}EXP_i\end{pmatrix} \quad (2)$$

Where:

$E[V_i|X]$ = expected number of hunting days spent by each i^{th} hunter;

$TCOST_i$ = travel cost borne by each i^{th} hunter;

$OCOST_i$ = costs in addition to the travel costs incurred for hunting activities (i.e., fixed and annual costs) by the i^{th} hunter;

$MOUNT_i$ = variable identifying whether the residence of the i^{th} hunter is located in a mountainous municipality;

AGE_i = age group of the i^{th} hunter;

EDU_i = the highest educational qualification obtained by the i^{th} hunter;

INC_i = range of annual family income received by the i^{th} hunter;

EXP_i = experience of the i^{th} hunter in terms of hunting years.

Once the β coefficients of these variables have been estimated, it is possible to calculate the Consumer Surplus (CS), which corresponds to the difference between the maximum amount that a hunter would be willing to pay for a day's hunting and the cost actually incurred [68]. Thus, the CS per trip per hunter can be calculated using the following equation [11,38,59,67] which takes into account that the relationship with the dependent variable is exponential [64]:

$$CS = -\frac{1}{\beta_{TC}} \quad 3)$$

Once the value of the CS per trip per hunter is estimated, you can calculate the annual recreational-use value of hunting for the whole population of hunters in the study area (Province of Siena) (Equation 4). To calculate this value, the number of hunters who chose one of the two THAs of the Province of Siena as their residence THA or additional THA during the 2017–2018 hunting season was used as the reference population. For the THA of Siena North, 10,626 hunters were registered, while for the THA of Siena South 5429 were registered. These values have been updated in proportion to the current regional population of Tuscan hunters (68,751) to 8694 and 4442, respectively, for the THA of Siena North and that of Siena South [51].

Thanks to the total number of hunters registered to each THA and to the estimated average annual value of hunting

outings recorded for the sample analysed (i.e., 22 for Siena North and 24 for Siena South), the following equation (5) [11] was applied to calculate the aggregate value of the CS for the Province of Siena:

$$ARUVH = \sum_{N=1}^{2} (-\frac{1}{\beta_{TC} THA^N} \times N°_{hunters}\, THA^N \times avgN°_{hunting\ \ days}\, THA^N) \quad (4)$$

Where:

$ARUVH$ = annual recreational use value of hunting;

$\beta_{TC} THA^N$ = coefficient of the TCOST variable for the Nth THA;

$N°_{hunters} THA^N$ = total annual number of hunters registered to the Nth THA ;

$avgN°_{hunting\ days} THA^N$ = average annual number of hunting days recorded for the Nth THA.

The results section discusses the results of the adopted model.

2.4. Data collection

The survey involved the use of a structured online questionnaire via the Google Form application (https://www.google.it/intl/it/forms/about/). This choice was mainly dictated by the impossibility of undertaking face-to-face interviews due to the COVID-19 epidemic (SARS-CoV-2) starting between December 2019 and January 2020. However, this problem stimulated the use of information technologies, allowing to also check the degree of responsiveness to online surveys by the population of hunters, traditionally characterised by older people who are not particularly inclined to use computer devices [69]. Therefore, the absence of paper questionnaires may have led to some sampling bias because some older hunters have a limited or no IT background. Nevertheless, thanks to the cooperation of the local hunting associations who supported the less-experienced in the compilation of the online questionnaire, it was possible to achieve a very good degree of responsiveness and important benefits from the online survey, such as cost-effectiveness

and speed of data collection [69]. Despite this problem, the use of the online survey is well established in the literature for estimating the value of ESs, and in particular, of CESs [13,54,70]. So, this study, despite some distortions linked to the prevalent sampling of more technologically advanced subjects, has led to good, albeit conditional, results.

In order to achieve high effectiveness and interpretability of the questionnaire, focus groups were organised with experts and representatives of local hunting associations to whom preliminary questionnaires were submitted. As confirmed by several studies, this made it possible to structure effective and comprehensive questionnaires [13,53,71], examining further organisational and management aspects of hunting practices sometimes unknown to research teams. To ensure general validity of the results, respondents were asked to refer to their hunting behaviour and habits before the start of the COVID-19 pandemic. This has been done in order to estimate the economic value of the annual recreational use value of hunting in agroforestry land under ordinary conditions.

In order to facilitate the filling-in of the questionnaire, mainly closed-ended questions were used in which it was possible to select one or more of the answers listed. This is because scientific evidence shows that this type of question allows a higher number of answers to be collected compared to open-ended questions [72]. Moreover, a survey with response alternatives facilitates statistical processing of final results [73]. Through the questionnaire it was possible to collect both quantitative information (e.g.travel costs or costs of maintaining dogs) and qualitative information (e.g., age, education or hunting experience). The questionnaire is divided into five main sections. (1) The first section concerns the profiling of respondents (e.g., age, address of residence, years of hunting experience). (2) The second part concerns the general characteristics of hunting activity, such as the frequency with which this activity is usually conducted or the

priority use of game (i.e., private use or sale). (3) In the third section, the questionnaire investigates the main costs of hunting (Table 1). (4) In the fourth section, the questionnaire includes a series of questions aimed at identifying at a municipal level the location of the hunting days spent by individual hunters during the hunting season. In addition, for each site, hunters were asked to indicate the annual frequency with which they visited those places. In this way it was possible to reconstruct the routes taken annually by each hunter from the place of residence to the different hunting grounds. Therefore, knowing the total distances travelled, the type of vehicle used (i.e., small car, medium car or four-wheel drive) and the average number of people with whom the hunter shares the hunting experience, it was possible to calculate the average annual travel cost of each hunter. (5) In the fifth and last section, the questionnaire aims to frame the socio-economic profile of respondents (e.g., family income bracket, educational qualification) as well as leave space for a short open-ended comment on the services offered by associations and local authorities responsible for land and hunting management. Before administering the questionnaire to the entire population of hunters in Tuscany, between December 2020 and January 2021, a pilot test was carried out on 41 subjects in collaboration with some local hunters' associations. The results of the pilot test allowed for the validation of the questionnaire, checking the correctness of its contents and the comprehensibility of the questions [74]. Disclosure of the final questionnaires to the entire population of hunters in Tuscany was achieved through the dissemination of links on the social channels of local hunting associations and local bodies involved in research (Facebook, Instagram, websites), as well as through some online hunting magazines and hunters' WhatsApp groups. A total of 296 questionnaires were completed, of which 66 are not counted because they related to hunters who hunt outside the survey area and 14 were incomplete. Therefore, the sample analysed is

represented by 216 questionnaires completed in the period between February and May.

3. Results and discussion

3.1. Visitor's characteristics

The sample analysed (216 questionnaires) consisted almost entirely of men (99%) while only 1% are women. For this reason, given the low representation, the only three women present were eliminated to make the sample more homogeneous. Regarding age, more than 80% of the respondents were over 40 years old, and of these more than 55% were between 55 and 69 years old. In terms of educational qualifications, 73% obtained a secondary education diploma, whereas less than 22% completed graduate or postgraduate studies. With respect to residence, it emerged that almost 20% of the respondents live in a mountainous municipality. Regarding the economic profile, over 89% reported having an annual family income of less than EUR 70,000, and of these, 45% declare that they have an income less than EUR 35,000 per year. Examining the level of experience in hunting practice, more than 76% of the sample stated that they had been hunting for more than 20 years, while inexperienced hunters (with less than 10 years of experience in hunting activities) represented only 6% of the sample.

In addition to the variables used for structuring the regression model (Table 2 and Table 3), the questionnaire also collected qualitative data that provide descriptive information on hunters' habits.

Table 2. Descriptive statistics of quantitative variables.

Variable	Definition	Mean	SD	Min	Max
V_i	Frequency of trips: hunting days.	24.27	16.72	1.0	80.0
TCOST	Travel Cost: average value of expenses incurred to reach hunting sites.	23.43	19.25	1.6	120.2
OCOST	Other Costs: average value of fixed and variable costs incurred for hunting activities, except travel costs	89.8	74.9	12.0	565.0

Table 3. Descriptive statistics of qualitative variables.

Variable	Definition	Mode	Comulative relative frequenciey			
			1	2	3	4
MOUNT	Variable for the location of residence in a: non-mountainous municipality (1); mountainous municipality (2).	1	0.80	1	-	-
AGE	Age group: (1) < 39; (2) 40–54; (3) 55–69; (4) > 70	3	0.19	0.49	0.93	1
EDU	Educational qualification: (1) primary school; (2) high school or professional training; (3) bachelor's degree; (4) master's degree or postgraduate education	2	0.04	0.77	0.86	1
INC	Annual family income: (1) < 35 k EUR /y; (2) 35 k-70 k EUR /y; (3) > 70 k EUR /y.	2	0.40	0.89	1	-
EXP	Years of hunting experience: (1) < 10; (2) 10–19; (3) > 20.	3	0.06	0.24	1	-

For example, the survey shows that more than 69% of people practice hunting exclusively on weekends or holidays and less than 1% hunt for commercial purposes and not for self-consumption. This information suggests that the subjects surveyed practice hunting mainly for recreational purposes, thus attributing an economic value to the CESs generated by

agroforestry areas. Moreover, 57% of hunters stated that their main type of hunting was hunting of migratory land game (e.g., thrust, woodcock, quail and woodpigeon), whereas 26% are mainly engaged in the hunting of sedentary game (i.e., hares, pheasants and partridges), and only 17% in hunting ungulates. Regarding hunting in private areas, which in Italy are known as Aziende Faunistico-Venatorie (Hunting and Wildlife Farms) and Aziende Agri-Turistico-Venatorie (Agricultural Tourism Hunting Farms), only 23% of subjects declared to be engaged in hunting activities inside these places. Finally, special attention was paid to annual ancillary costs related to hunting activity, i.e., the training of dogs, the maintenance of fixed posts and equipment costs (e.g., expenditure on the maintenance of arms and ammunition and clothing expenses) (Table 4).

Table 4. Descriptive statistics of the quantitative variables Other Costs.

Variable	Definition	Mean	SD	Min	Max
Annual variable costs	Maintenance of fixed post	286.4	510.1	0	2500
	Live decoys for fixed post	201.9	403.1	0	2500
	Feeding hunting dogs	597.4	620.1	0	2500
	Hunting-dog training	145.0	305.5	0	2500
	Hunting clothing	256.7	155.3	25	550
	Weapons and ammunition	293.5	216.2	0	650
	Training courses for hunters	22.8	55.5	0	250
	Shooting practice	106.1	151.3	0	550
	Creation of hunting trophies	30.5	80.3	0	550
Variable costs per day	Breakfast	58.0	48.9	0	216
	Lunch	235.5	342.1	0	2040

An examination of these types of costs shows that the main costs incurred by hunters are related to the feeding of hunting dogs (597.4 EUR/year on average) followed by weapons maintenance (average 293.5 EUR/year). Significant values are also recorded in the expenses for the maintenance

of the fixed post (286.4 EUR/year). Instead, few invest in training courses or in the creation of hunting trophies. In terms of daily costs, 73% of hunters eat breakfast away from home, incurring a total average annual cost of EUR 58.0, while 47% eat lunch outside of the home, in bars (25%) or restaurants (21%), with a total average annual expenditure of EUR 235.5.

3.2. Regression results and consumer surplus

The analysis of statistical regression models was conducted separately for each THA into which the Province of Siena is divided (i.e., Siena North and Siena South). This is in order to respect the greatest possible uniformity (morphological and ecological) within each area.

Examination of the results shows that the ratio of the variance to the mean is always greater than 1, both in the case of the sample of Siena North (10.9) and in the case of the sample from Siena South (14.9). This indicates the presence of overdispersion in the collected data and the need to prioritise the application of a negative binomial model rather than a Poisson model. In the present study, the regression model uses annual average travel costs (TCOST) as the main independent variable, while the other covariates are: average annual other costs (OCOST) (see Table 4); residence in a mountainous municipality (MOUNT); hunter's age class (AGE); hunter’s educational qualification (EDU); hunter’s annual family income (INC); and hunter's years of hunting experience (EXP). While the two variables related to cost (i.e., TCOST and OCOST) are quantitative, all the others are qualitative variables, divided into different levels described in Table 3.

As shown in Table 5, in both THAs, the coefficient of the variable TCOST is negative and highly significant confirming the assumption underlying the TCM that as the cost increases, the frequency of visits decreases. Furthermore, the results show that hunters living in mountainous areas hunt more

frequently than those living in urban areas. There appears to be an inverse relationship between hunting frequency and cultural level. This confirms the findings in the literature that for recreational activities such as hunting and fishing, the demand for outdoor recreation tends to decrease as the cultural level increases. This phenomenon seems to be due to the increased knowledge users have about the recreational alternatives available [75]. Finally, age and income, in both THAs, do not seem to significantly influence the number of annual hunting days.

Table 5. Negative binomial model results for the hunting function.

	Siena North		**Siena South**	
Variables	**Coefficient**	**Std. error**	**Coefficient**	**Std. error**
Constant	2.963428 ****	0.315391	4.205264****	0.450059
TCOST	− 0.015264****	0.003443	−0.018382****	0.003673
OCOST	−0.003197****	0.000851	−0.004033****	0.001152
MOUNT2	0.295714*	0.168105	0.334854**	0.170441
AGE2	0.157951	0.199863	0.147443	0.351690
AGE3	0.049773	0.219873	0.238808	0.393124
AGE4	0.224158	0.289024	0.251554	0.484127
EDU2	0.080830	0.235871	-	-
EDU3	−0.529322*	0.299176	−0.599908*	0.339581
EDU4	−0.017702	0.273889	−0.769761***	0.282309
INC2	−0.144034	0.113451	−0.135866	0.172504
INC3	−0.011443	0.192834	0.369691	0.317498
EXP2	0.953155****	0.252867	−0.444670	0.418889
EXP3	0.583280**	0.258152	−0.421933	0.415886
No of observation	174		52	
Theta	2.590		4.57	
2*Log-Likelihood	−1305.545		−372.057	
CS per visit per capita	EUR 46 ÷ 119		EUR 39 ÷ 91	

To estimate the range of the CS per visit per hunter with 95% probability, the lower and upper bounds of the confidence interval of the βTC coefficient were calculated according to Equation (3) [37,59]. For the THA of Siena North, the lower limit (2.5%) of the βTC coefficient equals −0.022, while the upper limit (97.5%) equals −0.008. Consequently, the CS per visit per hunter per year is between EUR 45 and EUR 119. In the case of the THA of Siena South, the confidence interval of the βTC coefficient is between −0.026 and −0.011, and the corresponding CS per visit per hunter per year (with 95% probability) is between EUR 39 and EUR 91. Therefore, applying Equation (5), the estimated annual recreational use value of hunting for the Province of Siena is between a minimum of EUR 12,956,040 and a maximum of EUR 32,462,220. Therefore, the annual recreational use value of hunting per hunter estimated for the study area is between EUR 986 and EUR 2471. These values are well above those identified in 2013 for the whole of Tuscany by the study of Marinelli and Marone [28] (i.e., 521 EUR/year) which estimated a total value of EUR 58,235,147 for the 89,142 hunters enrolled at the time. In fact, using the data estimated in this study for the Province of Siena, it is possible to calculate an approximate value for the entire Tuscany Region ranging from a minimum of EUR 67,809,128 to a maximum of EUR 169,900,281 for the current 68,751 registered hunters. In fact, even if on the one hand the number of hunters in Tuscany has halved over the last twenty years, the cost of hunting has risen so much as to cancel out the effect of this reduction. This phenomenon has transformed this activity, which was once strongly linked to the rural community that also practised it as a means of supplementing income, into an elitist and almost exclusively recreational activity.

4. Conclusions

This study analyses the value of the recreational hunting function in the Province of Siena using TCM. This is a function belonging to the CESs that, although representing a high economic and social value for the territory, is little-studied in comparison to other types of CESs (e.g., nature tourism) [16–18,56,57]. Therefore, the study represents a useful upgrade in the literature of the sector, both for the Italian national context where the recreational activity of hunting is strongly practiced, and also for the European context where the growing importance of the ESs provided by farms is recognised through the progressive importance of the European economic policy of Rural Development [76]. Moreover, the flexibility of the TCM methodology adopted, guarantees an easy replication both in other territorial contexts and for other scales, such as at the regional or national level [59]. In addition, the data collection carried out exclusively with online questionnaires had the undeniable advantage of being able to develop the study during the current pandemic condition, even if, with respect to the type of CES analysed (i.e., hunting function), it did not guarantee a uniform sampling with respect to the population of hunters. This is because a large proportion of users are pensioners or rural dwellers, who have a reduced computer culture compared to young people and city dwellers [69]. Furthermore, it was not possible to define a spatialisation of the data because the sample collected, although significant for the purposes of the study, did not allow for adequate representativeness at the municipal scale. In fact, the limited number of records attributable to each municipality in which hunting is practised does not allow a demand curve to be constructed for each municipality observed. Therefore, a larger sample would have made it possible to carry out geostatistical analysis and territorial downscaling approaches with at least municipal detail [77]. A further aspect, which was

not voluntarily examined, was travel-time cost, which is an important cost component in recreational experiences involving travel over relatively long distances [37,38,41].

Despite the imperfections identified, however, the results obtained represent a valid reference in the economic analysis of the recreational-use value of hunting in the areas analysed. In addition, the use of TCM has made it possible to estimate the value of a rural area in monetary terms, allowing simple and clear communication not only to the scientific public but also to political referents and civil society, regarding the importance of this type of service for the territory [59]. Knowledge of the real value of an area in terms of all of its potential should be the starting point for an effective management and enhancement policy. Indeed, the need to incorporate CESs into political strategies and decision-making processes is now widely recognised. However, since a standardised approach to quantifying these services has not yet been defined [63], research similar to that of the present study can contribute greatly to the definition of models capable of applying sustainable approaches in different contexts with a view to optimising available resources and enhancing the territory.

Acknowledgments

The authors wish to thank the associations of Federcaccia Italia and Federcaccia Toscana for their collaboration in drafting and disseminating the online questionnaire, and the Tuscany Region for providing data useful for further investigating the evolutionary dynamics of the hunter population in the study area.

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Exploring national park visitors' judgements from social media: the case study of Plitvice Lakes National Park

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Abstract

This study aims to conduct a survey of visitor reviews of the Plitvice Lakes National Park in Croatia to detect strengths and weaknesses of the park. In total, 15,673 reviews written in the period between 2007 and 2021 were scraped from the social media platform TripAdvisor. The research applies a comprehensive combination of multidimensional scaling, sentiment analysis, and natural language processing approaches to a sample area of international naturalistic interest. Analyzing the opinions of visitors, the authors identify: the main topics of interest related to the management of the park; and the strengths and weaknesses on the basis of definitely positive and decidedly negative reviews, respectively. The tested methodology is easily applicable for the analysis of different naturalistic contexts and protected areas, even in different countries, thanks to the use of translated reviews. The results obtained show that visitors to protected natural areas are not only interested in naturalistic and landscape aspects but also in issues such as accessibility and management of routes and visits.

Keywords: forest recreation; protected area management;

text mining; natural language processing; sentiment analysis; multidimensional scaling method; web scraping; customer satisfaction; TripAdvisor reviews

1. Introduction

In the last decades, technological advances applied to the tourism sector have radically changed the way information is produced and consulted [1]. Tourists can access an increasing number of sources of knowledge and have many channels available to share their opinions on experiences and places. When the experiences are shared online, they help to define a concrete image of tourist destinations and to shape the decisions of future visitors [2,3]. In particular, social media platforms offer a space to freely share experiences and make judgements [4,5] through the so-called user-generated contents (UGC) [6–8]. For this reason, these platforms are becoming increasingly important both in the planning of destinations and in the definition of management priorities for places of tourist interest [9–12]. Social media can be considered as a rich source of news within which users create, circulate, and consult such information to mutually update each other on products, services, personages, and other objects of interest [13]. They are interactive platforms where individuals or larger communities share UGCs and include, among others, blogs, forums, or social networks [14]. Some social media are of general interest (e.g., Facebook or Twitter), while others are focused on more specific topics (e.g., professional networking on LinkedIn); some of them deal with media sharing (e.g., YouTube or Flickr), while others allow you to provide reviews on products and services (e.g., Google My Business or TripAdvisor).

In this study, TripAdvisor was chosen among the many available social media, because it is the largest travel website in the world, operating in 45 countries around the world [11]. It has more than 400 million visitors visiting every month [15]

and more than 450 million reviews and opinions which concern more than seven million accommodations, restaurants, and attractions [16]. Besides, TripAdvisor is available in 28 languages [17]. TripAdvisor reviews are a source of information characterised by several positive aspects, including being free and easily accessible and covering a considerable number of years [3]. In addition to reviews, users can also publish other information, such as the country of provenance and the purpose of the trip. Therefore, user reviews on TripAdvisor combine textual comments (i.e., reviews) with concise ratings (i.e., bubbles). Although recent studies have shown that textual comments receive a lower priority than synthetic evaluations [18], it should be highlighted that users may have different priorities [19] that cannot be fully explained in choosing between one and five bubbles. Therefore, it becomes essential to develop tools which allow more information to be extrapolated from the textual component of the reviews.

The massive amounts of unstructured data that are continuously generated on the Internet necessarily require the use of automated procedures for this kind of data analysis [1,7,12]. Social media analytics is receiving increasing attention from companies in many sectors, because they try to analyse the large amount of data collected through different methods [6,20,21]. Content analysis (CA) is one of the available techniques for extrapolating and analyzing the text contents which is widely used in the tourism research field [11]. Sentiment analysis (SA) approach is part of the CA field, and it is a valid option to process this type of data automatically. SA uses computational linguistics and natural language processing (NLP) to analyse the text and identify the polarity of the judgements contained within it [1,8,16]. Another technique for analyzing unstructured textual data is that of multidimensional scaling (MDS), the main purpose of which is that of a better graphical visualization of the data in order to facilitate the understanding of the text structure [22].

In the international literature, the applications of MDS in tourism studies are numerous [23,24]. MDS is usually associated with cluster analysis, a particular application of which is text clustering [6].

Today, it is essential for the tourist community to identify destinations that provide them with meaningful experiences in natural contexts. In this way, protected forest areas and forested landscapes turn out to be popular destinations thanks to the multitude of natural values that take place within them [25]. In Croatia, this type of destination is well represented by national parks, which correspond to the second-highest level in the scale of protected areas (Law on Nature Protection, OG 88/13, 15/18, 14/19, 127/19). One of the most famous and visited national parks in Croatia is Plitvice Lakes National Park (PLNP). The choice of this well-known park was guided: on one side, by the need to validate a new methodology with a case study for which a great deal of information was already available on the activities and management problems with which to compare the final results; on the other side, by the fact that that social media data prove to be a better proxy of tourist visits in reference to the most popular parks [5].

To the best of our knowledge, no previous studies have focused on visitors' experiences for PLNP. The present study tried to fill this gap in the literature by conducting an in-depth analysis of TripAdvisor tourists' reviews on PLNP, by applying a comprehensive method of text mining and natural language processing techniques.

In particular, this study aims to answer the following research questions.

RQ1. How to collect and investigate textual data by social media platform to investigate the preferences of users of protected areas?

RQ2. How to extrapolate and analyse the management issues of greatest interest to visitors who choose protected areas as their destination?

RQ3. How to identify the strengths and weaknesses of the management of protected areas from the point of view of visitors?

The management of protected forest areas as a potential tourist destination is particularly demanding. This complexity is due to the trade-off between the conservation of natural ecosystems and the promotion of tourist visits for economic reasons [26,27]. Therefore, it is particularly useful to define a flexible methodology for the analysis of the management of protected areas that considers the point of view of visitors. In the present study, the answers to the research questions will allow PLNP managers to monitor the satisfaction of local and international users and plan activities aimed at improving the quality of visits to the park.

The remainder of the paper is organised into the following five sections. Foremost, section two provides a literature review on the analysis of nature-based tourism using MDS and NLP tools. After that, the methodology used is illustrated in section three. Section four shows the results, while section five discusses the findings. Finally, section six analyses the limitations of the study and provides suggestions for useful application and future research directions.

2. Literature review

2.1. Nature-based tourism

Nowadays, it is widely recognised that some segments of the tourism sector can be considered a "clean industry" and part of the Green Economy [28]. In particular, nature-based tourism is a growing key sector of this industry [26,29,30] which seeks to respond to a growing consumer demand for a return to nature [3,25]. This need is well explained by the fact that nature is capable of generating human well-being from a physical and psychological point of view. [20,25,31–34]. Moreover, natural areas are a place of refuge for biodiversity, in addition to providing restorative surroundings for people

[26,31]. The establishment of protected areas created to conserve biodiversity and aesthetic value of landscapes is one of the main pillars of nature-based tourism [29,30]. Thus, protected areas and nature-based tourism represent fundamental access for people to cultural ecosystem services [25,35,36]. Particularly, national parks are characterised by a high level of biodiversity protection among protected areas and, at the same time, provide tourism opportunities [5,26,27,37]. Thus, national parks play a very important role also in the tourism sector. For this reason, it is essential to analyse the factors that attract visitors and make visits to protected areas pleasant. Both internal components (e.g., expectations for places and activities) and external components related to tourism management (e.g., accessibility, means of transportations, etc.) strongly influence visitors' perception of the natural landscape [3]. Consequently, the management of nature-based tourism services must take into account the diversified opinions that visitors have towards nature in general and recreational activities in particular [38]. Therefore, it has become fundamental to evaluate how people perceive their recreational experiences in this type of protected area [8].

2.2. Content analysis

Content analysis (CA) is a research tool to be adopted in order to identify some particular words or more general concepts within qualitative textual data [2,39] or to extrapolate homogeneous units of meaning from a complex text. Traditionally, CA involved human subjective interpretation by researchers, which has now been replaced by automated procedures and sophisticated software [4]. One of the possible approaches of CA is sentiment analysis (SA), which is also an important component of text mining. Text mining is an interdisciplinary field which draws on information retrieval, data mining, machine learning, statistics, and computational linguistics [40]. Valid overviews on SA were

produced by Ma et al. and Alaei et al., to which reference should be made for further information [1,9]. In these contributions, the authors reconstruct the main historical stages that characterised the evolution of the SA and outline its most recent features and applications. Nonetheless, it can be synthetically said that the main purpose of SA is to distinguish between positive, negative, or neutral opinions [1,12,16]. Natural language processing (NLP) is one of the available tools for SA, but its application on UGC from social media in landscape design, and planning research is still in a preliminary stage [21,42]. In the text analysis, MDS is a particularly valid automated computer algorithm. MDS is a data visualization technique based on the proximity of words and their spatial representation [23,24]. Another type of machine learning algorithm usually associated with MDS is that of cluster analysis, which is usually applied to transform unstructured word sets into structured clusters [21].

Social media analytics—in particular, SA—has been applied to social media in numerous tourism-related research fields [6,39]. The most investigated fields are food and wine tourism [19,39,42,43], hospitality [9,11,44,45], areas of interest or events in cities [4,16,46–48], and natural spaces with special regard to urban parks [20,21,31–33,49]. Conversely, national parks and nature reserves [3,6,8,25,27] are a field still not much investigated [8].

2.3. Nature-based tourism and content analysis

According to the European Landscape Convention [50], landscape assessment processes should take into consideration public perception of places [41]. To evaluate visitors' perception towards natural destinations, traditional methods, such as in situ questionnaires, in-depth interviews, and focus groups, have long been employed. These techniques are usually time- and resource-consuming, in addition to not allowing the collection of results on a large scale or comparisons over time [3,6,8,27,32,41]. On the other hand,

the development of modern tools for web analysis allows us to overcome all of these shortcomings. In the recent literature, numerous research contributions have used CA methods to analyse nature-based tourism destinations, but there are still few contributions that investigate the usability of the various social media platforms in relation to visits to protected areas [3].

Stoleriu et al. explores 226 online TripAdvisor reviews on Danube Delta through an automated CA in order to identify and quantify the main dimensions of visitors' experiences and memories [3]. Their results showed that managerial aspects linked to visit organisation (e.g., trip itinerary and visit duration) were more prominent themes in the tourists' reviews compared to the site characteristics. One of the main limitations of the study in relation to the use of TripAdvisor reviews is the lack of demographic and socioeconomic information of visitors. For this reason, it would be necessary to integrate this type of analysis with surveys that make it possible to evaluate the preferences of visitors based on their characteristics.

Two other recent studies [8,27] conducted SA in some national parks of South Africa. Hausmann et al. used SA and NLP techniques to analyse the content of image captions in 33,213 English posts published on Instagram relating to four national parks in South Africa [8]. The authors identified the main emotional components and the keywords formed by both a single word and a pair of adjacent words that recurred most in the posts. The results showed that the polarity of sentiment about national parks expressed by visitors on social media is generally positive, with a minor expression of negative feelings. This is significant to highlight the social role that national parks assume, favouring the development of positive interactions with nature and, therefore, well-being in visitors. Those authors found that visitors tend to idealise certain places or features of national parks and give them symbolic meaning. This meaning is what makes visiting experiences

worth sharing and promoting. Among the problems identified by those authors in using this method, there are: on the one hand, the potential lack of representation of the sample of visitors who publish reviews; on the other hand, the use of an unconventional language (e.g., abbreviations, slang, emojis, etc.) which can make the use of automatic computational systems less effective. In almost the same area, Mangachena and Pickering conducted an analysis of 10,292 English tweets on Twitter about seven South African national parks [27]. Even in this case, they mostly found positive feelings and opinions related to the nature-based experience. Those authors identified a particular interest from visitors regarding specific events, such as commemorations related to the history of the park or discoveries of naturalistic interest. Furthermore, according to previous studies [8], some authors recognised that the use of concise texts, shortened words, and special characters (e.g., hashtags and emoticons), typical of social networks such as Instagram and Twitter, may also complicate text analysis of tourists' reviews [20].

Recently, Niezgoda and Nowacki investigated visitors' opinions towards one of the most visited protected areas in Poland, Tatra National Park [25]. Those authors elaborated a composite methodology made by text mining, NLP, and coding opinion procedures to process the data obtained from 624 English reviews published on TripAdvisor. The authors were interested in identifying the main reasons that led visitors to live experiences in the nature park and whether these were mainly related to the themes of ecological awareness and nature protection. The results of their study showed that the most active forms of entertainment (e.g., hiking, taking photos, mountain climbing) are the main motivation for visiting places in the open air. Those authors also highlight that in order to conduct this type of analysis it is necessary to assume that the reviews contain the elements considered most important by visitors, but it would be advisable to deepen the themes identified with more detailed surveys.

One of the latest applications of CA to national parks is that of Mirzaalian and Halpenny. In their study on Jasper National Park, they analysed 17,224 English reviews on TripAdvisor [6]. In addition, that study analysed destination loyalty statements using a keyword clustering approach. Among the main categories of visitor favorite destinations can be found waterfalls and lakes. Those authors acknowledge that one of the biggest limitations of this study is that the analysis did not concern some meaningful management aspects (e.g., transportation or outdoor activities).

3. Materials and methods

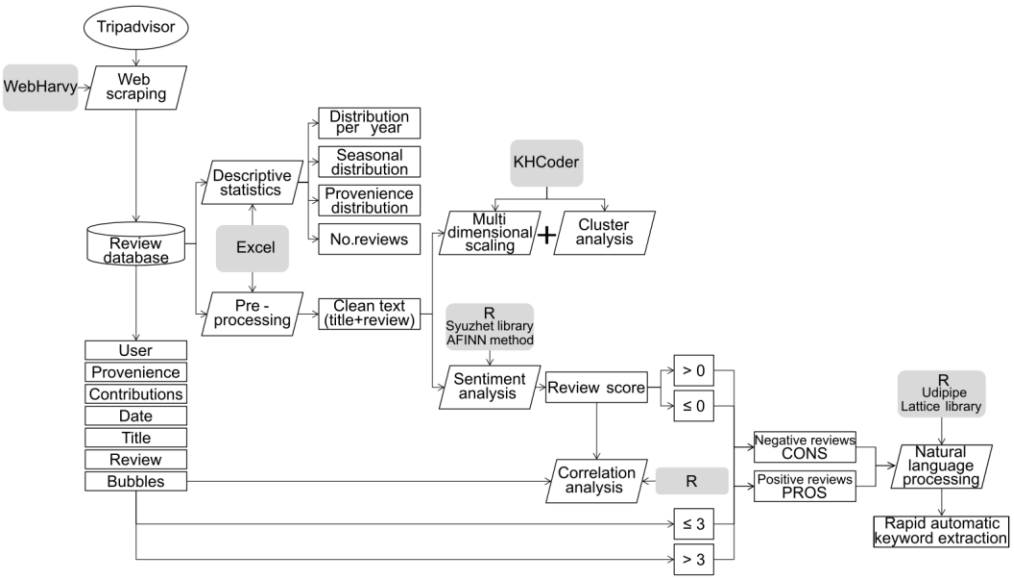

Figure 1. Flowchart of the research procedure.

The combination of several tools has made it possible to obtain different types of results that can be useful to the managers of the study area. On the one hand, the strengths and weaknesses of the PLNP from the visitor's point of view stemmed from the NLP technique (i.e., rapid automatic keyword extraction) based on SA scores. On the other hand, the MDS and cluster analysis were carried out to identify the

topics most dealt with in the reviews released by PLNP visitors on TripAdvisor.

The different steps of the method used are summarised and described in a procedure flowchart (Figure 1).

3.1. Study area

Plitvice Lakes National Park (PLNP) is one of the most famous and visited national parks in Croatia. PLNP is located in the mountainous central part of the nation and is part of the Dinaric karst area. PLNP is the oldest protected area (designated 8 April 1949) and the biggest national park (29,685.15 ha) in Croatia. The park mainly consists of forest areas, which represent about 81% of the total territory, with a complex system of lakes connected with waterfalls. The PLNP is well known for the rich biodiversity of its 296 square kilometers of forests. It is managed by the Plitvice Lakes National Park Public Institution (PLNPPI), founded by the Republic of Croatia and placed under the jurisdiction of the Ministry of the Environment and Energy (MEE). In addition, Plitvice is the only Croatian national park that is on the UNESCO World Heritage list (1979) as natural heritage and is entirely identified as a Natura 2000 site. Despite the large area of the park, only a small part of it represents the point of major tourist interest [37]. It is a lake system which includes 16 main lakes characteristic for their waterfalls, to which are added several other smaller lakes [52]. The park's finances derive entirely from the entrance tickets and hospitality services, including four hotels (380 accommodation units and 820 beds), two camping sites (2850 parking spaces for campers), seven restaurants, and eight other small park facilities (just under 3000 seats) [53]. The income of these activities is used for management and investments within the park area [37].

PLNP is one of the most visited natural sites in Central Europe and in the Mediterranean region [54]. The park's official statistics report a significant growth in the number of

visitors per year, from 850,000 registered in 2007 to about 1.75 million in 2018. More than 80% of visitors visit the park in the period from May to September. The months of the greatest peak are July and August, when approximately 335,000 and 385,000 visitors were registered in 2017, with daily averages of about 10,800 and 12,400 visitors and reaching the maximum with over 16,000 visitors in a single day (August 2017). Consequently, the Park is often congested, causing both considerable discontent in the opinion of some visitors but above all putting safety procedures at risk and causing negative ecological impacts for the natural systems of the park [54].

3.2. Data collection

Reviews relating to "Plitvice Lakes National Park" were scraped between October and November 2021 from the dedicated website on TripAdvisor (https://www.Tripadvisor.com/Attraction_Review-g303827-d554038-Reviews-Plitvice_Lakes_National_Park-Plitvice_Lakes_National_Park_Central_Croatia.html accessed on 26/11/2021).

WebHarvy software was used to scrape the reviews and obtain the following information:

- User data: name, origin, number of contributions (review number);
- Review data: date (month and year), travel purpose, number of bubbles (i.e., summary judgement), title and text of the review (i.e., extended judgement).

The software utilised is a visual web scraper that uses no script or code to scrape data. The program allows you to access the URL address of interest and to select the items that you want to collect. Thanks to the potential of the tool used, it was possible to carry out the immediate translation of the reviews and their respective titles by referring to the Google Translate plug-in. In this way, all of the reviews of all available

languages were translated into English and used for subsequent analysis.

The study did not collect other types of socio-demographic information such as the age, occupation, and educational level of visitors. This is due to the fact that TripAdvisor profiles do not contain this kind of data [3]. The only personal information that TripAdvisor users commonly share is their country of origin. These data could be useful for analyzing the origin of visitor flows to the PLNP.

3.3. Multidimensional scaling method and cluster analysis

MDS and cluster analysis allow us to explore possible combinations or groups of words that share similar appearance patterns [22]. In particular, text clustering is a textual data mining method which converts the original sentences in a term-document-matrix using different feature extraction techniques [6,54]. In this way, it is possible to deduce the main elements perceived by the users (e.g., reviewers), which should be taken into consideration for an effective and rational management of the protected areas. The ease of analysis application and result interpretation are among the main advantages of the MDS [23,24]. The elaborations were carried out using KH Coder 3 software [25,39,54,55]. The KH Coder software combines two fundamental approaches of computer-based text analysis: the correlational approach, which consists in automatically extracting words from a text and analyzing them statistically; and the dictionary-based approach, which establishes coding rules for the different elements that form the text (e.g., sentences or groups of words) [55]. In order to identify the clusters of words, the Ward's minimum variance method or Ward's hierarchical clustering method was applied, as previously carried out by Barbierato et al. [39]. The Ward's method is a procedure that initially generates in clusters containing single objects. These clusters are gradually

aggregated in such a way as to create clusters with the highest number of objects possible, but ensuring that the variance within each cluster is minimised [56]. The Ward's method was applied within the so-called Sammon space, which allows one to maintain a certain distance between words, preventing them from being excessively crowded and overlapping, giving more readable results [57]. Furthermore, among the options to define the distance, the cosine similarity coefficient was chosen, which is considered an efficient option in the presence of long documents (e.g., reviews) which contain, as in our case study, numerous words with an important frequency in each document [57]. A frequency threshold of 1,500 terms was adopted on the basis of the term frequency–document frequency graph (i.e., TF–DF) (Figure 2a.) in order to include exclusively the most representative terms that appear in several reviews. Based on the agglomeration graph (Figure 2b.), it was chosen to generate seven clusters of 60 words each. For further information on the method, refer to the KH Coder software manual [57].

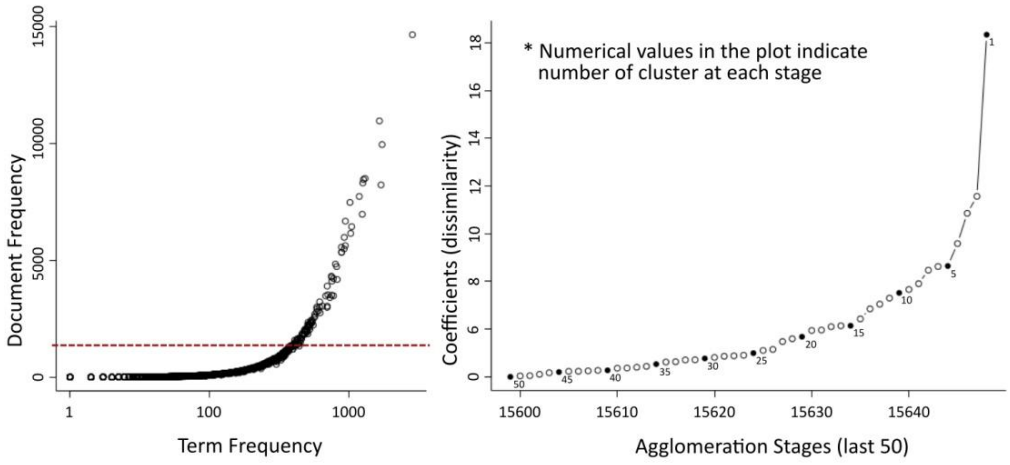

Figure 2. MDS model parameters for Plitvice Lakes National Park: TF–DF (a) and agglomeration graph (b).

3.4. Sentiment analysis

Sentiment analysis (SA) research is driven by the importance of understanding consumer judgement [9]. In particular, SA can be used to understand consumer attitudes towards particular products, services, or places [16]. SA determines the positive or negative polarity of each relevant word in the text. Moreover, SA calculates a score based on a predefined lexicon contained within a library [39]. It should be specified that this score is not set on a reference scale between a predetermined minimum and maximum. The sentiment score varies both in reference to the text length and to the specific words contained therein. The only fixed references are the scores assigned to the individual words within the lexicon to be adopted. In the present study, the "syuzhet" library of R software was chosen, as it was applied in previous research that analysed reviews on TripAdvisor [12,27,39]. The AFINN lexicon [58] was applied at the "syuzhet" library. Negative words and slang are commonly used in reviews on social networks (e.g., TripAdvisor). The AFINN lexicon is considered a valid option for evaluating this type of comment [59]. Furthermore, SA is widely applied to the analysis of quality perception through TripAdvisor reviews for heritage sites and natural parks [46] and urban green areas [16]. For a more in-depth analysis of the procedure used by the software, please refer to Barbierato et al. [39].

3.5. Natural language processing

Natural language processing (NLP) is a technology that combines computer science and linguistics in order to interpret written texts [39]. In this study, the strengths and weaknesses of the PLNP were identified using a NLP procedure. The rapid automatic keyword extraction (RAKE) procedure is a method for extrapolating multi-word keywords from documents [60]. Candidate keywords are obtained by partitioning text through stop words (e.g., and, the, of, etc.)

and phrase delimiters (e.g., ; and ,) and assigning a score to each candidate multiple keyword. Only double-word keyword candidates are searched in this study. Each of the two words that constitute the candidate keyword obtains a score that is given by the ratio between the number of times each single word co-occurs with the other word of the candidate keyword and the total frequency with which it appears by itself. The final RAKE score for the entire candidate keyword is the sum of the scores of each of the two words that form the candidate keyword [61]. The procedure was carried out through the "udpipe" library [61] of R software [62], considering only adjectives and nouns. Furthermore, only the first 20 keywords as a sequence of two adjacent words—defined as bi-grams—are considered, and a frequency threshold of 6 was adopted. In addition, the "lemma" option was chosen instead of "token". Through the lemmatization process, it is possible to group the different forms in which a word can be presented (e.g., singular and plural) in a single common voice. In this way, the various forms of the same reference word are counted as a single lemma, assuming a greater weight.

The analysis of definitely positive (bubbles > 3 and sentiment score > 0) and decidedly negative (bubbles ≤ 3 and sentiment score ≤ 0) reviews allowed us to identify strengths and weaknesses of the PLNP based on the visitor's judgement.

4. Results

4.1. Data collection and sample description

Overall, 15,673 online reviews were automatically retrieved from the online review website TripAdvisor. The downloaded reviews date back to the period between 2007 and 2021.

Figure 3 shows the trend in the number of reviews registered on TripAdvisor for PLNP. This trend is considered to be related to the interest of visitors. The graph shows an

important growth until 2015, followed by a slight decrease until 2019. In 2020, there is a significant drop (–88% compared to the previous year) due to the international and national restrictions on travel as a consequence of the COVID-19 pandemic.

The monthly and seasonal distribution of reviews (Figure 4) is consistent with the dynamics of visitor flows that have been analysed in the current PLNP management plan [52]. The graph shows that in the summer—with special regard to August—the maximum peak is recorded. Instead, an intermediate influx of visitors is recorded on average in spring and autumn, even if the month of September still seems to be influenced by the importance of the summer flow. Winter is the season of least interest for visitors, as confirmed by the low number of revisions.

As regards the origin of PLNP visitors, Figure 5 shows that most of the visitors come from European countries. In particular, the largest flows are recorded from Italy, the United Kingdom, and France.

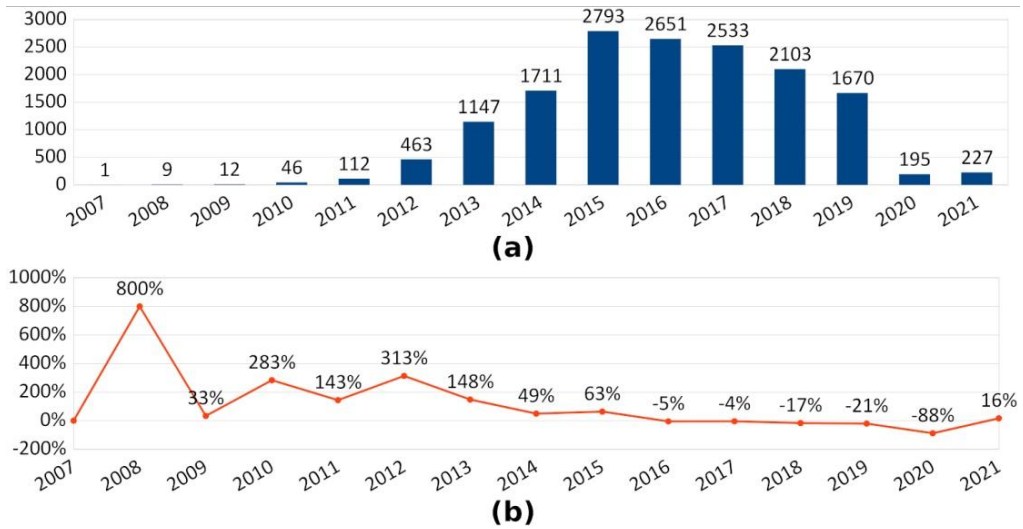

Figure 3. Frequency of reviews per year (a) and annual percentage growth rate of reviews (b).

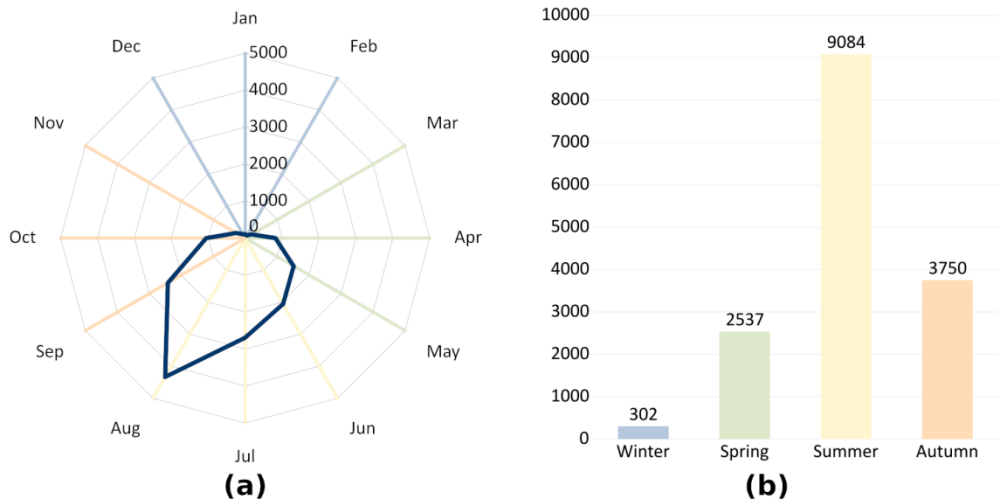

Figure 4. Monthly (a) and seasonal (b) distribution of reviews (average value for the period 2007–2021).

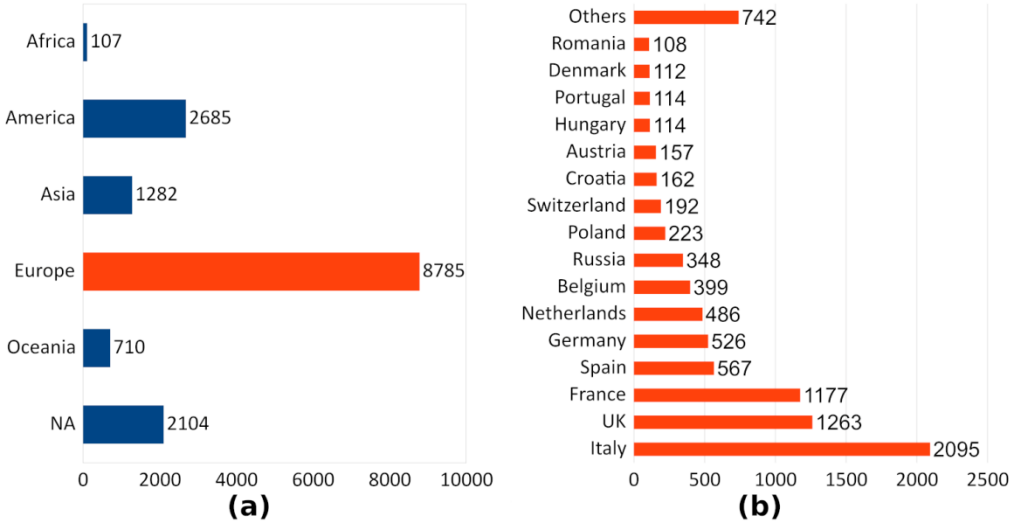

Figure 5. Provenance of the reviewers by continents (a) and from exclusively EU countries (b) (reference period 2007–2021).

4.2. Multidimensional scaling method and cluster analysis

The diagram derived from the MDS method shows

seven clusters of words differentiated by color [54]. The results are in Figure 6. Cluster 1 (i.e., turquoise bubbles) concerns the principal elements that characterised PLNP landscape (i.e., "park", "lake", "waterfall") which are commonly associated with positive judgements ("beautiful"). Cluster 2 (i.e., yellow bubbles) is related to the theme of accessibility, including: the possible means of transport to access and/or visit the park (i.e., "boat", "bus", "train", "car"); the organization into "route(s)" divided by length in terms of "hour(s)"; and the real entrance to the park, which concerns different activities, such as "parking" and the purchase of the "ticket". Cluster 3 (i.e., violet bubbles) is a hybrid set of aspects that characterise the park, emphasizing the beauty of the site on the one hand, using terms such as "nice" and "good", and the disadvantages related to overcrowding in the summer months of the high season, expressed by adjectives such as "many", "long", and "lot". Clusters 4 (i.e., red bubbles) and 6 (i.e., orange bubbles) contain the main favorable appreciations thus synthesizable: "great", "worth", "wonderful", "natural" connected to "nature", "beauty", and "experience" for Cluster 4; "stunning", "amazing", "clear", and "different" (in the positive sense of "different" landscapes and sceneries) relating in general to the "Croatia(n)" "national" park of "Plitvice" for Cluster 6. All of the positive adjectives of the Clusters 4 and 6 are also related to the nearest central terms of the Cluster 1. Cluster 5 (i.e., blue bubbles) contains the most negative elements, referring to the main problems related to the PLNP management: the presence of "crowd" and "queue(s)" in many different "point(s)", "path(s)", and "way(s)" of the area. Finally, Cluster 7 (green bubbles) represents a small deepening of the nearby Cluster 2 themes, recovering the theme of the fruition through the use of words such as "walk", "trip", and "tour". In this cluster, some information about the division in the "upper" and "lower" districts of the park are included.

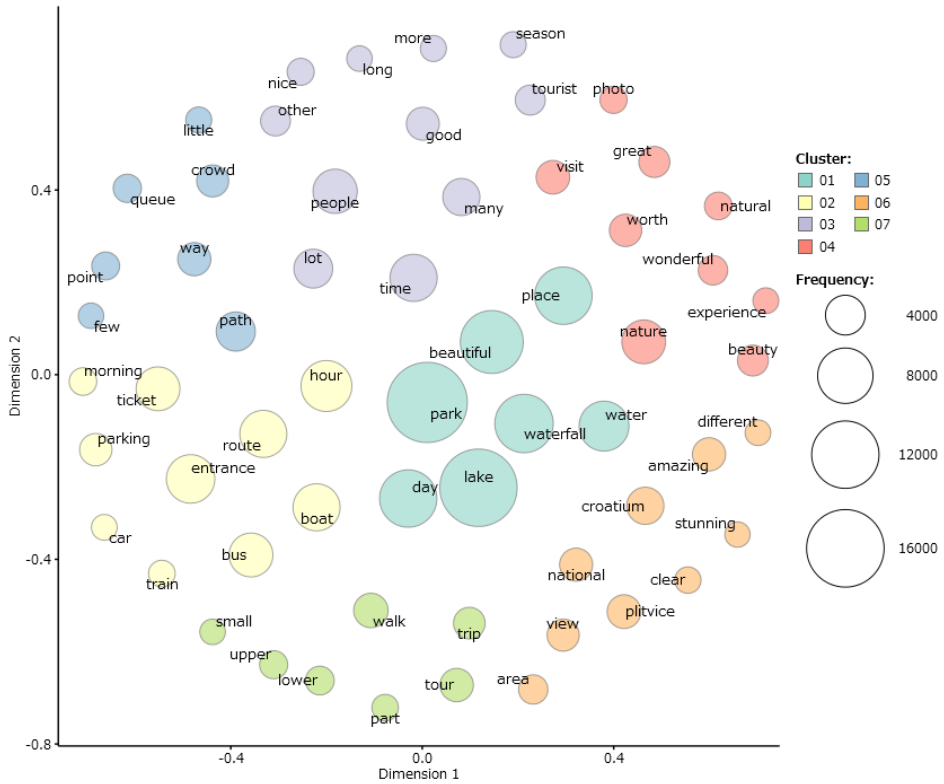

Figure 6. Multidimensional scaling method and cluster analysis results for Plitvice Lakes National Park.

These results make it possible to identify the issues (i.e., the seven clusters) related to the PLNP management that are of greatest interest to visitors. The issues thus identified would be useful if applied to guide a participatory planning of the park in which samples of visitors were also involved.

4.3. Sentiment analysis

The results of the SA are shown in Table 1. The reviews for PLNP are basically positive (mean value of 9.16) and the dispersion is relatively symmetrical (1st Qu.=5; 3rd Qu.=13). In fact, the mean value is shifted upwards, as the group of reviews designated with five bubbles represents over 78% of the total reviews (15,673). The SA results show

that mean and median values tend to increase with the increment in the number of bubbles (i.e., short judgement).

Table 1. Sentiment analysis scores for Plitvice Lakes National Park.

Bubbles	N reviews	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
●○○○○	210	−27	−3	0	0.40	4	23
●●○○○	228	−19	−1	3	3.04	7	36
●●●○○	641	−14	2	6	5.96	10	27
●●●●○	2317	−15	4	8	8.10	11	40
●●●●●	12,277	−16	6	9	9.79	13	72
Total	15,673	−27	5	9	9.16	13	72

The non-normal distribution of the SA scores was visually verified through normal quantile plots, histograms, and box plots for each group related to the five review ratings (i.e., bubbles) (see Appendix A: Figure A 1, Figure A 2, Figure A 3). Furthermore, the Shapiro–Wilks test was performed for the groups of Bubbles 1, 2, 3, and 4 (in R, the Shapiro–Wilks test cannot be performed on sets of more than 5000 units). The p-value of all four groups ($min<2.2\times10-16$; max=0.002) showed that the data do not follow a normal distribution. For this reason, the non-parametric Kruskal–Wallis test was applied to verify the correspondence between the SA scores and the bubbles assigned by the reviewers themselves.

The results confirmed the hypothesis of a statistically significant difference between the groups of bubbles in relation to the dependent variable of SA scores ($K=848.91$; p-value$<2.2\times10-16$; $\alpha=0.05$). In addition, a pairwise comparison using the non-parametric Mann–Whitney U test was conducted to highlight where the statistically significant differences between groups of bubbles are [34]. Although the differences within each pair of groups are statistically significant (Table 2), according to Barbierato et al. [39] the complete database was divided only into two sub-databases in order to simplify the data analysis: one definitely positive

(bubbles > 3 and sentiment score > 0) and one decidedly negative (bubbles ≤ 3 and sentiment score ≤ 0), which were used separately in NLP analysis.

Table 2. Mann–Whitney U test (α=0.05) results for Plitvice Lakes National Park.

Pair of groups of bubbles	W	p-value
●○○○○ ●●○○○	17,998	6.934×10−6
●○○○○ ●●●○○	33,963	< 2.2×10−16
●○○○○ ●●●●○	86,522	< 2.2×10−16
●○○○○ ●●●●●	348,787	< 2.2×10−16
●●○○○ ●●●○○	52,868	5.059×10−10
●●○○○ ●●●●○	141,873	< 2.2×10−16
●●○○○ ●●●●●	584,911	< 2.2×10−16
●●●○○ ●●●●○	589,860	1.306×10−15
●●●○○ ●●●●●	2,551,728	< 2.2×10−16
●●●●○ ●●●●●	11,975,881	< 2.2×10−16

4.4. Natural Language Processing: the RAKE analysis

The RAKE analysis was applied to the two sub-databases obtained dividing positive from negative reviews considering the SA scores. The double-word keywords most frequently encountered in TripAdvisor reviews for PLNP were identified by the RAKE analysis (Figure 7). The most cited characteristics can be identified both in the definitely positive reviews, to be interpreted as the main strengths, and in the decidedly negative reviews, to be read as the most critical weaknesses. Definitely positive RAKE analysis results (Figure 7a.)—deriving from the sub-database containing the reviews with bubbles > 3 and sentiment score > 0—show that the natural heritage and landscape elements are the most appreciated aspects of the PLNP. In particular, the "UNESCO" designation is considered as an extremely positive characteristic, as highlighted by three keywords: "UNESCO heritage", "UNESCO site", and "UNESCO list". The negative results—deriving from

the sub-database containing the reviews with bubbles ≤ 3 and sentiment score ≤ 0—show that the main weaknesses are represented by the phenomenon of crowding ("many people"), because the presence of a "mass tourism" during the "high season" is the cause of complex management problems, such as "traffic jam" and "endless queue" (Figure 7b.). In addition to "long (waiting) time", there are also complaints about the organization of "parking lot" and the "high price" of the entrance ticket.

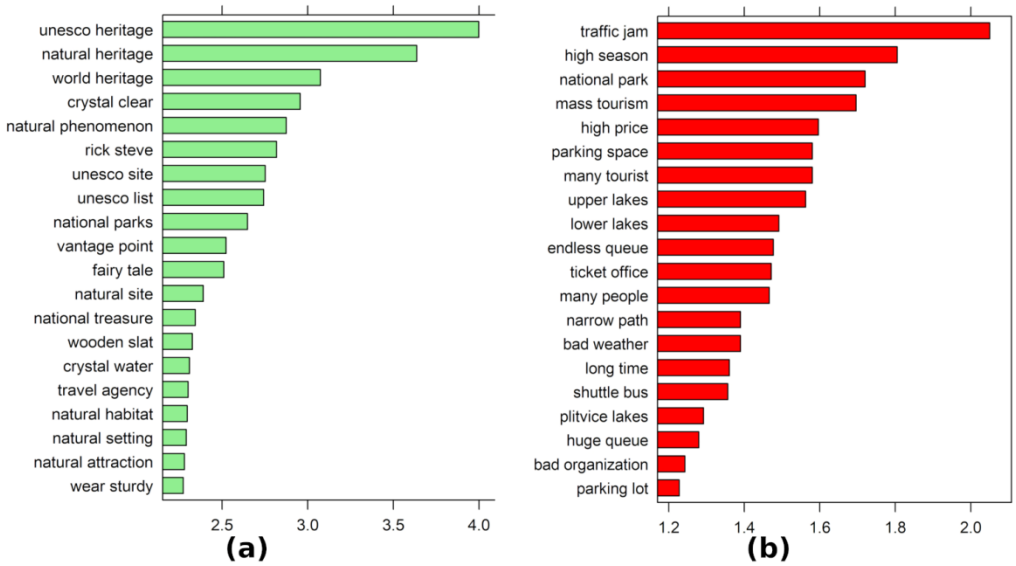

Figure 7. RAKE analysis for positive (a) and negative (b) reviews for Plitvice Lakes National Park.

5. Discussion

5.1. Answers to research questions

The importance of the PLNP at national and international levels is now recognised (Figure 3 and Figure 5). The descriptive statistics highlighted the recurring seasonal trend of visits (Figure 4). This trend has made it essential to implement strategies to redistribute tourist pressure acting on the protected area in a more balanced way.

Regarding the first research question (RQ1), the research

has shown that efficient tools exist as an alternative to manual coding (e.g., the software WebHarvy) to collect extensive data relating to lengthy textual reviews (e.g., TripAdvisor online platform). Moreover, the combination of CA with MDS method and cluster analysis turned out to be exhaustive to analyse visitors' preferences and perception for areas of naturalistic interest. First of all, these techniques make it possible to identify the most important symbols and attributes that characterise national parks in accordance with the visitors' opinions. The SA results (Table 1) confirm that national parks and, in general, nature-based experiences arouse positive sentiments in visitors, as already found in other studies [6,8].

MDS methods and cluster analysis are valid instruments to investigate the principal management issues from visitors' point of view (RQ2). The seven clusters identified by this study can help guide a participatory discussion on the issues that visitors consider most important for the reality of PLNP. As stated by Hausmann et al., visitors to national parks tend to idealise some particular places in their destinations, assigning them meanings that make those places worth visiting [8]. In fact, some of the naturalistic and landscape aspects of the PLNP (Cluster 1, 4, and 6, Figure 6) assume a symbolic meaning that almost exclusively attracts the interest of visitors. The most recurring element is the complex aquatic ecosystem of lakes and waterfalls. Also Mirzaalian and Halpenny have identified this type of water elements as one of the main categories of destinations preferred by visitors and a recurring element in the reviews of naturalistic sites [6]. On the one hand, the water system represents the most important naturalistic attraction of the PLNP, but it is also the place where visitors flock the most, representing the fulcrum of tourist organizational problems. In this way, interest in high landscape and environmental or historical values of other areas of the park is excluded a priori. The most evident example is that of the large forest area which is not mentioned at all in any clusters. Other relevant aspects

identified are those of accessibility and management of paths and visitors (Clusters 2, 5, and 7, Figure 6). The results obtained show that visitors are aware of and interested in discussing and expressing opinions on organizational issues related to the fruition of places, as already found by Stoleriu et al. [3]. In particular, words like "route" (Cluster 2), "experience" (Cluster 4), "path" (Cluster 5), and "walk" (Cluster 7) emphasise the attention of visitors towards active experiences (e.g., hiking or nature photography). Other studies have also identified these activities as being of great interest in the outdoor visits [25]. In addition, the organizational capacity and the entertainment activities promoted by a tourist destination is an indispensable experiential factor for all those who do not have naturalness as their primary interest [25]. In any case, the most relevant management aspect identified is the management of visitor flows and the problem of overcrowding (Cluster 3 and 5, Figure 6), which was also found by the RAKE analysis.

About the third research question (RQ3), NLP techniques proved to be fundamental to highlight strengths and weaknesses that characterise the image of PLNP. These techniques are of greater interest to identify the negative aspects to be solved and improved rather than the positive aspects to maintain and enhance. The problem of overcrowding is already widely recognised by the Plitvice Lakes National Park Management Plan 2019–2028 [50], which talks about the dissatisfaction of visitors (e.g., due to numerous encounters on the trails or impossibility of taking good photos of pristine landscapes) and the countless organizational problems (e.g., the overcoming of the physical capability of means of transport such as buses and boats or the inability to find parking) detected in the high season [53]. Visitor congestion caused by the crowds of visitors and the consequent recreational conflicts are recurring themes also in other studies focused on the use of protected areas of international interest [21,25,63]. Only a small part of the

PLNP's surface represents the main focal point [37], with the "upper lake(s)" and "lower lake(s)" zones (see Figure 6 and Figure 7), where the majority of visits are concentrated [51]. This means that an organizational and promotional effort could be conducted to make the other parts of the park more attractive with activities and guided tours. In fact, the organization of specific events, preferably connected to naturalistic aspects, are of particular interest and attract a large number of visitors as found by Mangachena and Pickering [27].

The automated text analysis processes on social media can provide park managers useful information relating to environment and organizational perception of visitors [27] with a view to collaborative and participatory planning.

5.2. Theoretical implications

This study makes significant theoretical contributions in the management of areas of naturalistic interest. Firstly, the research demonstrates the flexibility and effectiveness in using an automated approach to obtain information from a large amount of content generated by visitors. From a methodological point of view, the web scraper software applied, WebHarvy, proved to be a valid alternative to manual coding tools. One of the most important innovations of this study is the use of reviews in different languages. In fact, the automatic translation procedure made it possible to use a large number of reviews compared to previous studies that only used reviews written in English [6,8,11,16,25,27,33,39]. Secondly, this study answers a series of research questions regarding the users' judgement on the management of areas of naturalistic interest. In fact, it was possible to identify the topics most cited in visitor reviews, give an order of importance to their discussion, and summarise those that are considered the most important strengths and weaknesses. The study made it possible to extend the use of text mining and NLP techniques already widely applied in other research topics

related to tourism in general [9,19,39,45,46] but less explored [8] in nature-based tourism [6,25,27].

Finally, the use of this innovative technique for a well-known study area of international interest (i.e., Plitvice Lakes National Park) allowed to validate the effectiveness of the tool, finding results in accordance with previous knowledge. This step will permit extending the use of the method to other less investigated areas of naturalistic interest, being able to contribute substantially to the identification of key management factors.

5.3. Practical implications

The results show that social media analysis can be very validly applied to the nature-based tourism field [8]. In particular, these techniques can help decision makers and managers to interpret the online image of national parks constructed by visitors [3,8]. CA—with special regard to SA—effectively identifies negative trends in online reviews, making the tourism operators of national parks capable of being proactive and developing targeted strategies [9]. On the one hand, the method adopted makes it possible to monitor the perception of visitors' recreational experiences in order to plan attractive and well-organised tourist activities. On the other hand, the need to create protected areas and implement conservation and enhancement strategies within them would be supported by similar results [8,53]. In fact, the results of this study demonstrate the high interest and involvement that visitors have towards these very popular tourist destinations. Furthermore, starting from the results obtained, social media could be used by tourism actors (e.g., park managers, tour operators, etc.) to communicate their strategies and marketing proposals to consumers [6]. In particular, for the PLNP both the topics of greatest interest treated by visitors in their reviews and the less contemplated elements are identified, thanks to the use of the methodology adopted. Particularly, the forest ecosystem is not taken into

consideration by the visitor reviews, while it would represent the largest percentage of the park area. In line with what has been identified in the current Management Plan [52], it becomes essential to enrich the program of visits with activities that encourage the exploration of all areas of the park. For example, experiences of great interest [25], such as group excursions or guided naturalistic visits, could generate greater appreciation for the complexity of the park's natural systems other than the aquatic ones already widely known. Given the importance attached by visitors to events and special occasions, a further solution to improve the management of the PLNP could be to organise theme-days, highly appreciated by visitors to national parks [27], in order to attract tourists even in less crowded periods, for example, during the winter season, and, therefore, reduce the pressure of the summer season. The PLNP managers could monitor the effectiveness in the proposal of the new visiting programs and events by repeating in the future an analysis of the TripAdvisor reviews with the method adopted in this study in order to search for the presence or absence of the "forests" theme among the interests of visitors.

Thus, in general, from a managerial point of view, these findings can help PLNP managers to better understand visitors' preferences. Furthermore, in this way, managers can more consciously decide which aspects to devote more attention to and how to best redistribute investments to ensure visitor satisfaction.

5.4. Limitations and future research

Through the use of social media, it is possible to involve visitors in a first level of participation for protected natural resource management, that of information gathering. In fact, it is extremely complex to include visitors in the subsequent steps of the process, first of all, because it would be necessary to involve very large samples to be representative for the entire population and, secondly, because it is difficult to find

simple and adequate channels to contact and interview so many people. Conversely, one of the most relevant advantages is due to the opportunity to carry out investigations on very large samples at extremely low costs. It is also true that other social media (e.g., Instagram and Twitter) allow analysis on a larger scale [8,27], even if they reported some difficulties in processing much shorter texts with a definitely lower amount of information [27].

In the present study, in order to obtain a consistent sample (15,673 online reviews) it was decided to use TripAdvisor reviews on the PLNP issued over a long period (2007–2021). Future research could investigate shorter periods of time to analyse the evolutionary dynamics of the park as well as the effectiveness of the different management strategies used over the years. Furthermore, it must be said that the analysis was restricted to a single Croatian National Park, even if it is the best known (i.e., PLNP). A further study could be, for example, that of a broader analysis of the overall network of national parks that would make it possible to systematizs the monitoring and management of protected areas based on a shared investigation effort. It should also be noted that the study presents some biases related to the habits of people in the use of social media. In fact, it has been demonstrated that social media are mostly used among younger people [8,32], which highlights the fact that the analysed sample is not representative of some categories of people (i.e., children and elderly). The absence of socio-demographic information from TripAdvisor users does not allow for more extensive surveys on the characteristics of the sample [3], while it would be advisable to analyse the preferences of visitors based on their personal characteristics through subsequent in-depth surveys. In fact, it has not been forgotten that the combination of current and traditional survey methods certainly allows the carrying out of very extensive investigations but also allows one to deepen some aspects of the issue in detail [3]. Likewise, it is assumed that

all reviews analysed come from honest opinions of visitors. However, this assumption may not be true, as fake reviews are not uncommon, and it is likely that some of them were included in the sample used in this as well as other sector studies [19]. Since that of natural areas, and in particular of national parks, is a topic not yet particularly deepened in the CA field [3], it could be useful to develop a recreational dictionary specific for national parks that can improve the accuracy of the analysis of the text thanks to the reference to specific terms for the description of the perception of natural environments [8]. Finally, future research could exploit the information available relating to the country of provenance in order to investigate the different preferences expressed by visitors from diverse geographic clusters [27], which have not been investigated in this study.

Despite the above-mentioned limitations, it is believed that the research conducted can be a reliable and useful starting point in the context of tourism analysis to deepen the opinions of the users of the areas of naturalistic interest and extrapolate from their reviews important information for better planning of management activities.

6. Conclusions

The present study investigated the strengths and weaknesses of the PLNP through a large sample of visitor reviews. The results demonstrated the flexibility and effectiveness of applying the developed method to unstructured textual data of online reviews. The present study contributes to fill a research gap in visitor perception analysis for natural areas. The management of the forest area of the PLNP is complex, as it must combine the conservation of natural ecosystems and the tourist destination promotion. In other words, the management must consider the trade-off between the tourism-recreation function and other ecosystem services. The combined use of different and complementary

techniques allowed us to develop two research branches in parallel. In the first, the sentiment analysis scores were used to implement a natural language processing technique (i.e., RAKE analysis) from which the strengths and weaknesses of the PLNP have been extrapolated from the visitors' point of view. In the second, the multidimensional scaling method and cluster analysis were used to identify the key topics covered in visitors' reviews. In accordance with the latter result, it might be appropriate to involve visitors in a more in-depth investigation so as to collect visitors' opinions on the priorities defined by the park managers. Despite the limitations encountered, the social media data analysis turns out to be an exhaustive investigation method capable of providing useful information. On the one hand, theoretical advantages can be achieved, contributing in the field of research to the definition of increasingly in-depth and efficient survey tools, and, on the other hand, it is possible to obtain practical information to be provided to the figures who deal with the management and planning related to protected natural areas.

Appendix A

The non-normal distribution of the sentiment analysis scores was visually verified in the following graphs.

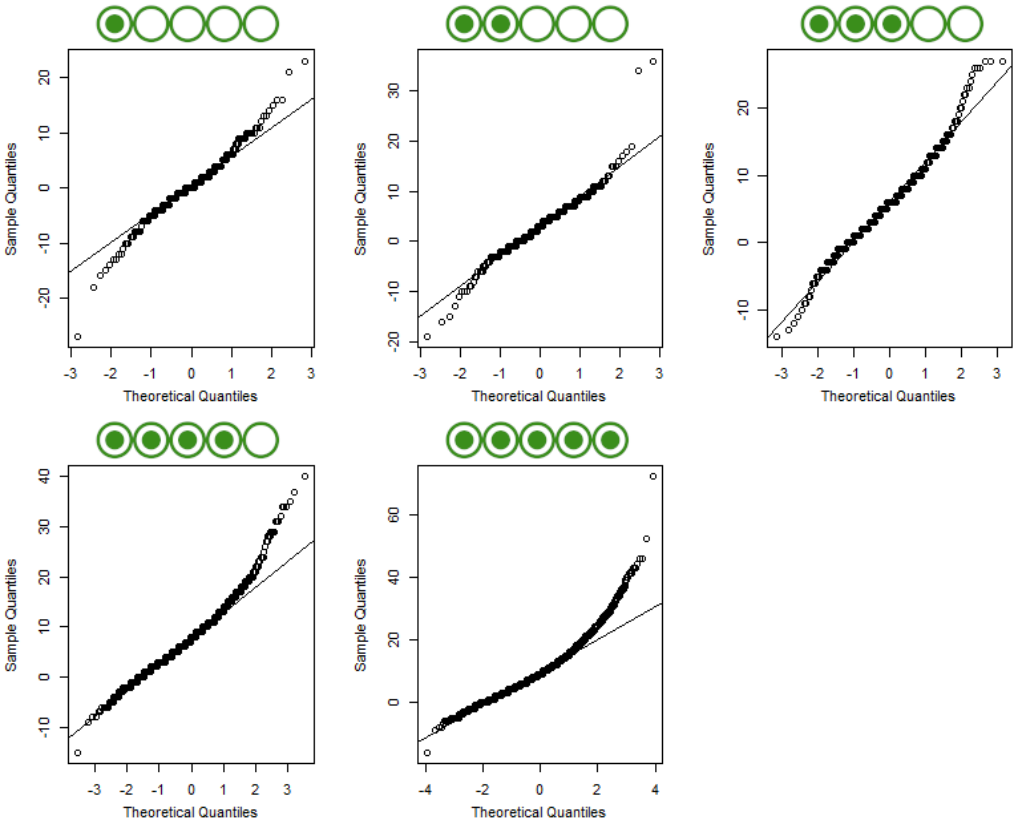

Figure A 1. Quantile-quantile plots of the variable "score" for the five groups of bubbles.

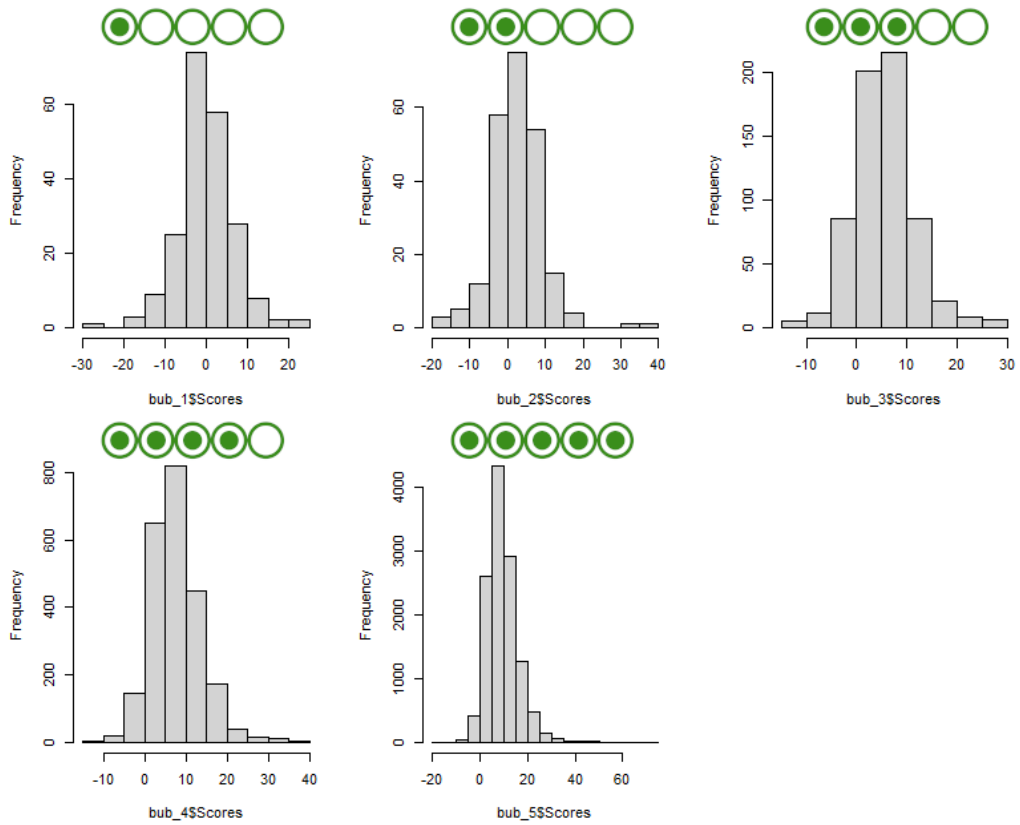

Figure A 2. Histograms of the variable "score" for the five groups of bubbles.

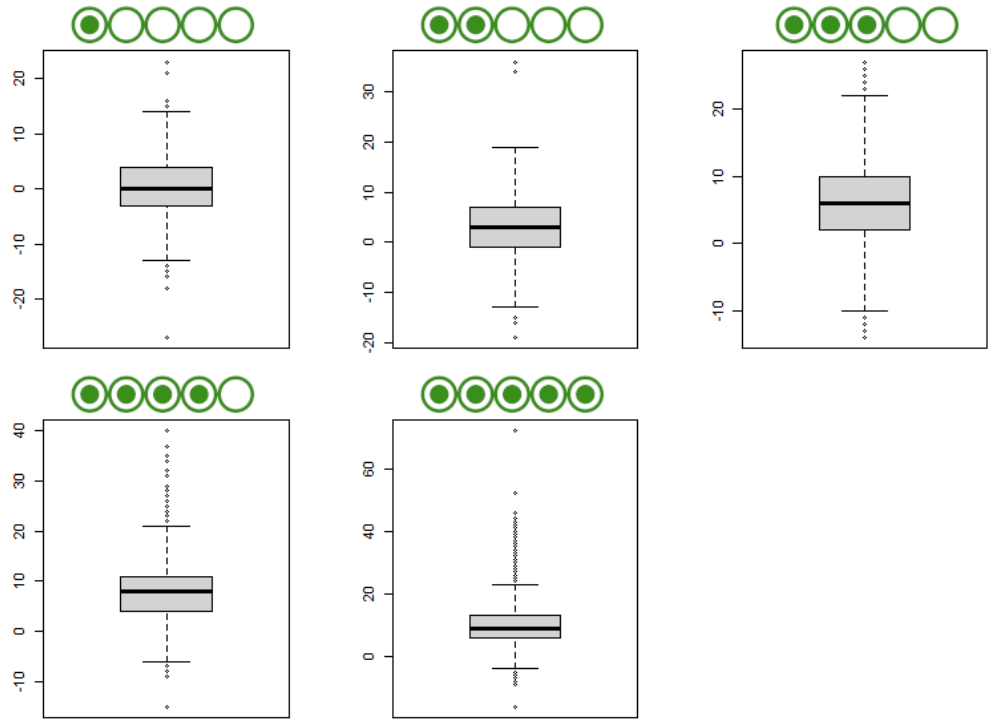

Figure A 3. Box plots of the variable "score" for the five groups of bubbles.

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Exploring tourist preferences on the visitor management system: the participatory case study of Plitvice Lakes National Park

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Abstract

This study aims to develop an online survey on the tourist perception of the visitor management system of the Plitvice Lakes National Park in Croatia. As tourists are particularly sensitive to organisational issues related to the Park management, a bottom-up approach based on visitors' opinions has been applied. First of all, a brief chronology has been reconstructed that retraces the most significant stages of the Park. Subsequently, an online questionnaire was structured on the basis of the current Park Management Plan with a focus on the macro-topics concerning the visitor management system. The survey was distributed using the Google Form application. A total of 214 questionnaires were collected in the period between May and July 2022. The sample was statistically analysed to detect the main habits of the Park users. The Mann-Whitney-Wilcox U test and the Kruskal-Wallis test were applied to identify the differences in the priorities attributed by visitors to the various management actions. Among the main findings of the research, the authors identified that national visitors (i.e. Croatian) place a higher priority on the implementation of services and infrastructure

than tourists from other countries. In addition, those who have visited the Park on multiple occasions have higher safety expectations than those who have only visited the Park once. This category of visitors also considers it more important to take into account the opinions of visitors. Furthermore, with regard to retail and souvenir shops, tourists are generally inclined to set a lower priority for intervention than that attributed to other management aspects. The results of this study can be of great value to Park managers, who should consider visitors as key stakeholders in the decision-making process that is the foundation for managing this important natural resource.

Keywords: visitor perception; tourist satisfaction; natural resources management; park management; nature-based tourism; national parks; protected areas

1. Introduction

In post-modern society, the sustainable tourism sector is one of the key activities to be developed while preserving natural resources for future generations (Sandell 2016). Firstly, tourism is an economic activity and therefore can have an environmental impact (Smolćić Jurdana, 2009). This is a key factor that managers need to take into consideration in planning and managing nature-based destinations. In general, a tourist destination is primarily a complex system which incorporates tourist attractions, structures and accommodation facilities (Radisic and Basan 2007). In fact, there is a strong connection between the provision of infrastructure and services and the tourist development of a given area (Mandić et al., 2018). In this context, the main objective of tourism managers is to satisfy visitors' demands without compromising the integrity of the sites (Mandić, 2021; Perera et al., 2015).

Over the past decades, the natural environment has become an increasingly popular tourist destination, especially as regards protected areas (PAs), in general, and national parks (NPs), in particular (Lundmark and Müller 2010, McCool et al. 2021, Smolćić Jurdana 2009, Wolf et al. 2015). According to the Flash Eurobarometer 499 "Attitudes of Europeans towards tourism" Report (European Commission, 2021), in 2020, the natural environment was identified as the main driver - on a par with the cost factor - in the choice of tourist destination for 43% of European travellers. Furthermore, the current scale of tourist flows to nature-based destinations requires an additional effort by managers to minimise the negative impacts of tourism on natural ecosystems (Smolćić Jurdana, 2009). These impacts are often related to managing tourism infrastructure and services (McCool et al., 2021), which require special attention. In particular, the management of the PAs is characterised by a trade-off between the objectives of nature conservation and tourism promotion (Mandić, 2021).

Taking those considerations into account, the present study focuses on the tourist management system in one of the European PAs most affected by international tourist flows, the Plitvice Lakes National Park (PLNP) in Croatia. A bottom-up approach was applied in this study, which was based on the opinions of visitors, who are seen as the main judges of the quality of the tourist destination (Radisic and Basan 2007). The most relevant management problems for PLNP visitors were identified based on the findings of a previous study (Sergiacomi et al., 2022). In that study, the authors found that visitors are particularly sensitive to both organisational issues related to overcrowding, and to the planning of visits to the PLNP, in order to enjoy the best of its natural beauties. The research questions of this study, are as follows:

RQ1. What are the management issues related to the visitation system identified as a priority by PLNP tourists?

RQ2. How does the visitor's perspective coincide with the vision outlined by managers in the current PLNP Management Plan?

In the literature, few recent studies have been conducted on issues strictly related to the management of nature-based destinations directly involving visitors of PAs (Abdullah et al., 2018; Arnberger et al., 2012; Belkayali and Kesimoğlu, 2015; Cihar and Stankova, 2006). Thus, this research aims to fill this gap by exploring the views and preferences of visitors on some key aspects of PLNP management.

The remainder of the paper is organised into the following sections. The second section provides a literature review of nature-based tourism, in particular the participatory management of these types of tourist destinations. The methodology used is illustrated in the third section. After that, the main findings are presented in the fourth section, while the fifth section discusses the results. Finally, the sixth and final section analyses the limits of the study and provides useful applications and future research.

2. State of art

2.1. Nature-based tourism

In the literature, there are many different and sometimes conflicting definitions of nature-based tourism. Since nature can assume different meanings for different types of tourists (Lundmark and Müller, 2010; Sandell, 2016), nature-based tourism is a very wide category. It includes both general visits to pleasant natural landscapes, and many specific activities that can be enjoyed in nature (e.g. sports; outdoor education; nature conservation). In particular, PAs and nature reserve areas (especially NPs) represent the predominant setting for nature-based tourism activities (Kaffashi et al. 2015, Perera et al. 2015, Sandell 2016, Smolćić Jurdana 2009, Vurnek et al. 2018).

In recent years, demand for nature-based destinations has increased significantly. In fact, trends have shown that this specific segment continues to grow much faster than the development of the tourism sector in general (Kaffashi et al., 2015; Lundmark and Müller, 2010; Smolćić Jurdana, 2009). This is mostly due to the modern urgency of returning to nature (Niezgoda and Nowacki, 2020; Stoleriu et al., 2019). At present, it is widely recognised that this need stems from nature's ability to generate human well-being, both physically and mentally (Niezgoda and Nowacki, 2020; Plunz et al., 2019; Roberts et al., 2018; Wolf et al., 2015). As such, this growth requires increased managerial responsibilities and skills on the part of NP administrators, to meet tourists' leisure needs and to ensure the efficient conservation of natural resources (Mandić, 2021; Perera et al., 2015).

Moreover, visitor perception of nature-based destinations is strongly influenced by external components. These components are related to tourism management (Stoleriu et al., 2019), such as: good accessibility; proposal of differentiated activities; availability of transport means; security of visits. Therefore, in NPs the development and maintenance of tourism infrastructure is extremely important, both economically and for the conservation of natural ecosystems (Mandić, 2021; Mandić et al., 2018). Particularly, in countries where the economy is strongly dependent on tourism, management aspects relating to tourist destinations are of fundamental importance. This is the case in the Republic of Croatia, where PAs are selected as one of the main reasons for visiting the country (Lončarić et al., 2021; Vukadin et al., 2013).

Thus, in a similar landscape becomes more and more important to provide an exhaustive picture of nature-based tourism. It also becomes important to cover the demand-side and deepen how people perceive their recreational experiences in nature-based destinations (Lundmark and Müller, 2010).

2.2. Participatory management of nature-based tourist destinations

The importance of stakeholder involvement in nature-based destination planning and management is generally recognised (Mandić, 2019; Pezdevšek Malovrh et al., 2019). In the international literature, many different methods are used to gather stakeholder input (Paletto et al., 2017), including focus groups, interviews and questionnaires. Particular attention is paid to the forest recreation sector. Some explored the aesthetic preferences of users for different types of forest management (Paletto et al., 2018), while others looked at visitor uses and urban forest conditions (Kičić et al. 2020, Krajter Ostoić et al. 2017). Specifically, these latest studies have increased over the course of the spread of the SARS-CoV-2 pandemic (Marin et al., 2021).

Other categories of stakeholders have been extensively involved in surveys on natural sites management, such as: managers (Moreno et al., 2014; Pietilä, 2019), staff (Mandić, 2021; McCool et al., 2021), or the local population (Héritier, 2010; Jones et al., 2015). Conversely, visitors are rarely involved in management surveys. Only a few studies have recently engaged NP users to express their views on purely management aspects. In their research, Cihar and Stankova (2006) interviewed visitors to the Podyji/Thaya River Basin National Park (Czech Republic) and other stakeholder groups (i.e. local residents and representatives of local governments) to obtain their opinions on the management of the nature conservation. However, those authors themselves recognised that tourists have a fairly low knowledge of environmental dynamics and problems. Therefore, they are not the best class of stakeholders to be involved in this aspect of management. In another study conducted in the Gesaeuse National Park (Austria), visitors were the subject of a survey aimed at studying the relationship between tourist affinities with NPs and their attitude towards the management of visits with respect to nature conservation (Arnberger et al. 2012).

Thereafter, Belkayali and Kesimoğlu (2015) for the Kure Mountains National Park (Turkey) and Abdullah et al. (2018) for the Penang National Park (Malaysia) also engaged visitors and other categories of stakeholders. The goal has always been to analyse the opinion of tourists on the relationship between the management of tourism in parks and environmental issues.

Actually, visitor feedback proved effective in developing good management practices for nature-based destinations. Indeed, they represent the main subjects who perceive the results of a good or poor management of the places. Therefore, comments from visitors may provide important suggestions for improving visitor satisfaction (Kaffashi et al. 2015, Marin et al. 2021). In fact, to take into account the dual purpose of nature conservation and recreation, the tourist point of view is of great importance (Perera et al., 2015).

In addition, the scarcity of visitor satisfaction data makes it a field of investigation to explore further (Mandić, 2021). A new hypothesis is to transform the current system of monitoring and managing visitors in the PAs into a "third generation" model (Mandić, 2021). From this point of view, visitors will become an opportunity, actively contributing in defining management strategies. Moreover, the use of management strategies that derive from the users themselves, can help them to become aware of the values and limitations of PAs, educating visitors and minimising their potential negative impacts (Kaffashi et al., 2015). Therefore, involving visitors as co-protagonists in the management of nature-based destinations represents a stimulating challenge for the world of research and administration.

3. Materials and methods

3.1. Study area

The Plitvice Lakes National Park (PLNP) - one of Central Europe's most visited natural sites (McCool et al. 2021) - is

located in the mountain hinterland of the Republic of Croatia, in the counties of Ličko-senjska and Karlovačka. The PLNP is part of the Dinaric karst area and is the largest national park in the country with nearly 30,000 hectares of forests, lakes and caves. The aquatic area of the PLNP represents about 1% of the total surface and is the most important attraction for visitors (Mandić, 2021; Vurnek et al., 2018). The remaining 99% of the surface consists mostly of forests and grasslands. Within the boundaries of the PLNP, there are 20 settlements that do not exceed the level of several hundred inhabitants (based on the 2011 Census). Local farms produce cheese, jam, and honey, which are incorporated as traditional products in the PLNP sales system. The surrounding area includes small farms and accommodation facilities.

The PLNP is administered by a Director General and a large staff, who are under the supervision of the Plitvice Lakes National Park Public Institution (PLNPPI). The PLNPPI was established by the Republic of Croatia and falls under the authority of the Ministry of the Environment and Energy (MEE). The PLNP has to comply with two current regulation forms. One is the Physical Planning Act (Official Gazette 153/13), which defines what can be built within the area. The other is the Nature Protection Act (Official Gazette 88/13, 15/18, 14/19, 127/19), which requires the PLNP to prepare and adopt a management plan as a key policy governance document.

Furthermore, the PLNP is the oldest PA in Croatia and has covered many important milestones in the over 70 years of its existence (Figure 1). In fact, shortly after the end of World War II, the Yugoslav government named it NP (8 April, 1949). Initially, the PLNP had no real management system, but it was simply served by trails that led tourists to major waterfalls and lakes, and to the canyon area. It was only in the early 1950s that the first accommodations were constructed, including hotels, restaurants and campsites. In 1979, the PLNP was granted UNESCO World Heritage Site, thanks to the

universally recognised value of the exceptional tufa formation process taking place there. An major wound was left by the Croatian Homeland War (1990–1995), during which many structures were destroyed or extensively damaged, and many mines were scattered in the PLNP area. Since 1995, the PLNP staff has been recovered, user fees have been set and a first administrative program has been implemented. In 1997, the PLNP area expanded to the current surface of 29,630 hectares. Until the 2000s, the PLNP received significant but steady flows of visitors. For this reason, the General Management Plan developed in 2007 focused mainly on the multiple natural ecosystems of the PLNP, while little attention was given to the system of visits. In particular, the 2007 Plan paid more attention to the preservation and enhancement of the territory's cultural and historical values, crafts and local traditions. Some limited changes have also been proposed in the trail network and internal transportation (e.g. the conversion of panoramic buses from diesel engines to electric motors). Nevertheless, few interventions were actually carried out in response to increased visitor flows. As regards the importance of the PLNP for the biodiversity conservation, this was underlined in 2013 when the PLNP was declared Important Bird Area (IBA) and Special Area of Conservation (SAC) within the Natura 2000 network. The Nature Protection Act requires the renewal of NP management plans every ten years. As a result, a new planning process was launched in 2016, with the primary goal of addressing the pressing issue of visit management. Between 2015 and 2018, several workshops and training seminars were organised for PLNP staff by external experts in the management of visits (McCool et al. 2021).

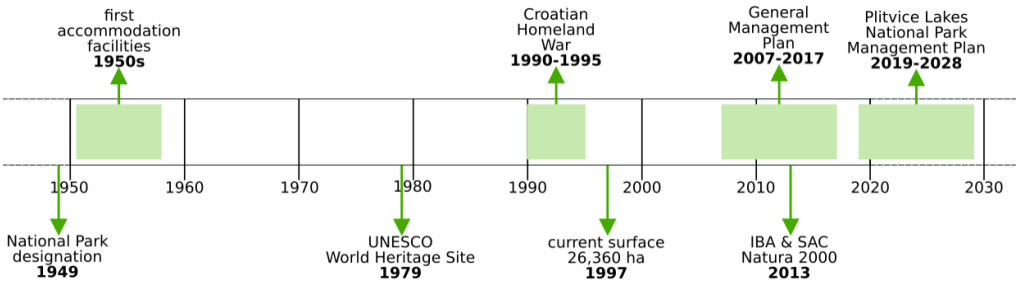

Figure 1. Main stages in the history of Plitvice Lakes National Park.

The current Plitvice Lakes National Park Management Plan 2019-2028 (2019), which set out to address these challenges, came into force in 2019 (Figure 2). After an introduction to the PLNP area, the Plan organises the chapter dedicated to management into five main themes: Conservation of natural values (theme A); Conservation of cultural heritage (theme B); Visitor management (theme C); Support to sustainable development of the local community (theme D); Capacity development and management of Public Institution (theme E). Each theme is further divided into a number of specific objectives, which are in turn organised into macro-topics containing several actions (see for example: theme C - Visitor management, Figure 3).

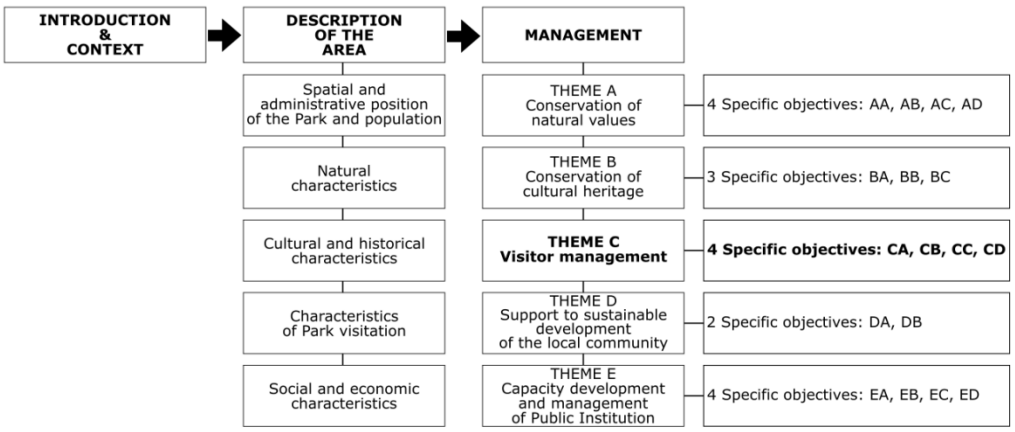

Figure 2. Plitvice Lakes National Park Management Plan

2019-2028 map.

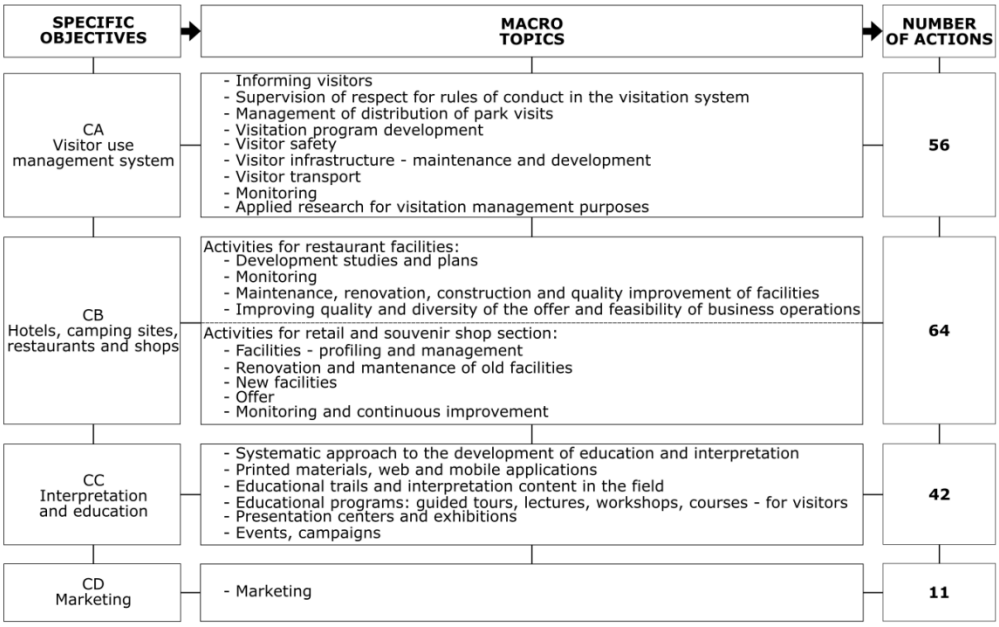

Figure 3. Specific Objectives of Theme C. Visitor management (Plitvice Lakes National Park Management Plan 2019-2028).

3.2. Questionnaire survey and sampling method.

This study is based on a demand-driven survey of nature-based tourism management in the PLNP. First, two interviews with PLNP managers were undertaken. This preliminary stage proved to be useful both for deepening the process of drafting the current Management Plan, and for identifying the steps within which visitors have already been involved as stakeholders. Given the recent adoption of the Plan, visitor opinion has not yet been deeply taken into account, in particular as regards the evaluation of the PLNP management. For this reason, an online questionnaire was structured according to the current Management Plan. Visitors of the PLNP were chosen as the privileged interlocutors of this survey. In particular, user inputs are recognised as an effective support to improve management practices (Marin et

al. 2021). In fact, unlike visitors, other stakeholders - e.g. park managers and administrators; staff members; public institutions; and local people - have already participated in extensive interviews and focus groups (Mandić, 2021; McCool et al., 2021). The questionnaire was designed to identify visitors' perceptions of certain topics related to the visitor system theme, which are considered fundamental to the management of the PLNP. The topics were taken from both the Plan and interviews with PLNP managers.

According to a previous study (Sergiacomi et al., 2022), visitors are very interested and often express opinions about management aspects, which can impact making their experience memorable, either positively or negatively. For this reason, only the action groups included in the macro-topics concerning the Visitor management (i.e. theme C) in the current Management Plan were considered (Figure 3). From the original set of 25 macro-topics, three of them were not included in the survey, because they were considered out of the interest and the perception of the visitors (i.e. *Applied research for visitation management purposes* and *Improving quality and diversity of the offer and feasibility of business operations*) or because they partially overlap with another topic (i.e. *Development studies and plans* with *Maintenance, renovation, construction and quality improvement of facilities*) (see Figure 3). The questionnaire opens with a short presentation of the research project. The first section contains some questions concerning memories related to the last visit to the PLNP and its relative date (month and year). In the following five sections, visitors were asked to assign a priority level to each macro-topic group of actions related to theme C. In the current Management Plan, priorities for individual actions were assigned on a scale ranging of one to three. Within each macro-topic analysed - which contains multiple actions (see Figure 3) - the mean priority level assigned by PLNP managers was calculated. However, in the questionnaire a 9-point Likert scale (from 1 = low priority to 9 = high

priority) was used to allow visitors to express their priority levels. Subsequently, the 9-point scale was transformed into a 3-point scale to facilitate the comparison between the priority scores obtained through the questionnaire and the average scores obtained for each macro-topic within the current Management Plan. In this way, in both cases, values close to the second decimal place were obtained, which make them easy to comparable. These sections were intended to compare the mean priority values assigned to the different action groups. This has been done in order to interpret: the behaviour of the different types of visitors, and the discrepancies in the evaluations given by users and managers. Lastly, a final section was dedicated to collecting information on the profile of respondents (e.g. age; gender; highest level of education; country of origin). A final place was given to free comments and suggestions.

The questionnaire was drawn up via the Google Form application and translated into six languages (i.e. English, Deutsch, French, Italian, Spanish and Croatian), in connection with national and international visitors from the countries for which the most important tourist flows come from (Plitvice Lakes National Park Management Plan 2019-2028, 2019). Prior to disclosure, a pre-test was conducted with a sample of seven visitors - who were also experts of the forestry sector - to ask them for suggestions to improve the clarity of the survey. The questionnaire was distributed by the main social media platforms of the PLNP, and then by e-mail via the PLNP newsletter.

4. Results

4.1. Description of sample characteristics

At the end of the data collection period (May-July 2022), 214 questionnaires were collected. Since the study refers to the current Management Plan, 25 of the questionnaires originally collected were rejected as they referred to visits

conducted prior to the implementation of the Plan in 2019.

Table 1 presents respondents' socioeconomic characteristics. Most of the sample is in the 30-50 age group. For what concern the gender, the majority of interviewees were female. In terms of origin, Croatian visitors represent the greater part of the group examined .

Table 1. Individual variables: socioeconomic aspects.

Variables	Numbers	% Total
Age class		
< 30	37	19.6
30 - 50	102	54.0
> 50	50	26.4
Gender		
male	64	33.9
female	118	62.4
do not wish to respond	7	3.7
Origin		
National (Croatia)	102	54.0
International	87	46.0

Regarding the key features of the visits to the PLNP (Table 2), over half were conducted in 2021. Following the natural trend of tourism flows, the majority of the sample reported having visited the PLNP between March and August. Visitors who went to the PLNP only once represented the highest percentage of tourists in the sample. As concerns the number of companions, more than half of respondents declared they were accompanied by a few persons (i.e. between 2 and 5 companions).

Table 2. Individual variables: visit habits.

Variables	Numbers	% Total
Number of visits		
1 visit	70	37.0
2 visits	27	14.3
3 visits	19	10.1
4 visits	11	5.8
5 visits	3	1.6
More than 5 visits	59	31.2
Number of companions		
Individuals or couples	58	30.7
Families (2-5 companions)	110	58.2
Groups (> 5 companions)	21	11.1
Year of the last visit		
2019	15	7.9
2020	12	6.3
2021	98	51.9
2022	64	33.9
Month of the last visit		
Dec-Feb	11	5.9
Mar-Apr	69	36.7
Jun-Aug	61	32.4
Sep-Nov	47	25.0

As a first question, the respondents were asked to indicate which elements of the PLNP surprised them the most, both positively and negatively, in the last visit. As shown in Figure 4a, the natural landscape represents the most appreciated characteristic of the PLNP, followed by a much lower percentage of preferences for staff organisation. Instead, the main weaknesses (Figure 4b) are considered to be food services and the cost of the visit which is deemed too high. For the management of public transport and parking lots, both were assessed positively by a reduced number of visitors and negatively by a slightly higher percentage. Finally, the natural landscape is not listed as a negative; therefore, it is believed that it is a generally shared strength of the PLNP.

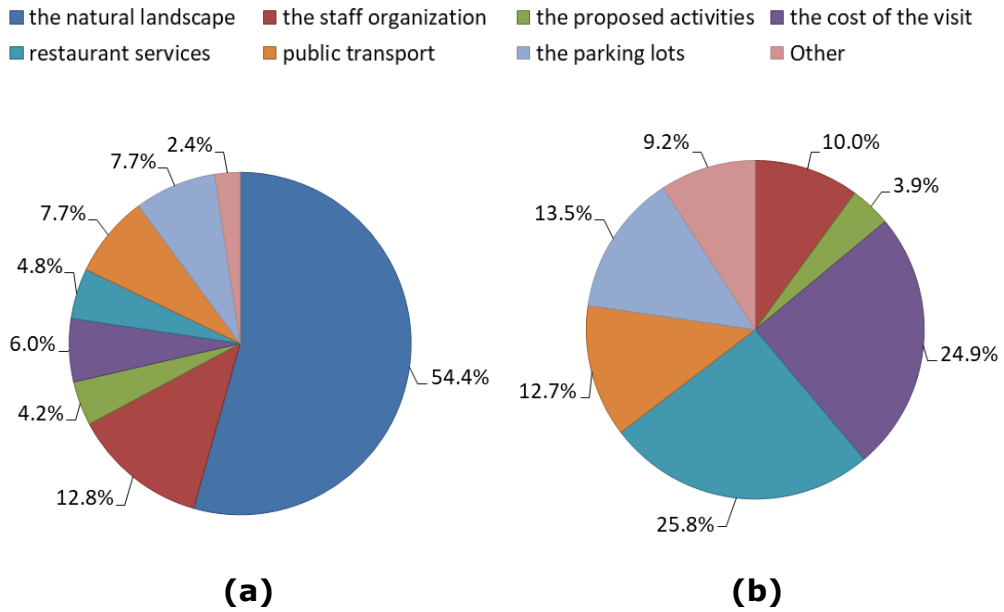

Figure 4. Plitvice Lakes National Park elements that surprised more positively **(a)** and negatively **(b)**.

4.2. Actions related to the visitor management system

The following sections of the questionnaire were devoted to the collection of visitor opinions. In particular, it analyses the level of priority deemed necessary for various macro-topics of actions within four different issues related to the management of visits (Table 3). The results show that visitors tend to assign slightly higher priority levels for each macro-topic studied under the theme "Visitor use management system" (mean value: +0.28). The only exception is the need to install new signage to improve the safety of the paths (A.5), for which tourists roughly agree with the priority assigned within the current Management Plan. In particular, there are three macro-topics for which visitors recognise a half-point higher priority than that assigned by the managers: (A.1) actions aimed at increasing tourist information; (A.8) the monitoring of tourist satisfaction with regard to the system of visits and the infrastructure of the PLNP; (A.4) the definition of new visiting programs, useful for redistributing

the presence of visitors even outside the crowded lakes area. Conversely, as regards the management of "Restaurant facilities" (B.a.1, and B.a.2), visitors recognise a lower priority than that envisaged in the Plan. For what concern the section on "Retail and souvenir shops", visitors expressed on all the macro-topics a priority of half a point more than that established in the Management Plan. In particular, the renovation of old structures and shops (B.b.2) recorded the higher difference, in positive terms, than that established by the managers. But, it should also be said that this is the theme where, on average, the lowest priorities were assigned by tourists in relation to the other issues analysed in the questionnaire. With regard to the "Interpretation and education" segment, visitors on average agree with the priority assigned in the current Management Plan. The only exception concerns the macro-topic relating to the construction of a new visitor centre (C.5), for which they assigned a lower priority than that established by the managers.

Table 3. Comparison between priority scores assigned by visitors and those defined by the Plitvice Lakes National Park Management Plan 2019-2028 for the macro-topics of the theme C "Visitor management".

	Macro-topics	Visitors' score	Plan's score
	Visitor use management system		
A.1	INFORM VISITORS through the website, apps, social networks, etc. on: park rules; maximum daily number of visitors; presence of alternative tours in non-congested areas.	2.48	1.67
A.2	ENHANCE SURVEILLANCE: increasing the number of rangers to check the rules and report illegal acts.	2.49	2.00
A.3	AVOID OVERCROWDING by introducing new technologies and pricing policies.	2.18	1.67
A.4	OFFER NEW VISIT PROGRAMS for alternative areas to the Lakes area.	2.40	1.64
A.5	INCREASE the signage to ensure SAFE use of the itineraries.	2.16	2.20

A.6	MAINTAIN and ADAPT the different INFRASTRUCTURES, such as: bus stops, boat docks, parking areas and toilets.	2.24	1.84
A.7	INCREASE the capacity of the TOURIST MEANS OF TRANSPORT used during the visits.	2.07	1.67
A.8	Prepare a PERMANENT MONITORING SYSTEM on the visitors' satisfaction degree on: infrastructures and visits management system.	2.05	1.25
	Restaurant facilities		
B.a.1	IMPROVEMENT of the RESTAURANT STRUCTURES according to ecological standards.	2.25	2.86
B.a.2	Prepare a PERMANENT MONITORING SYSTEM on the visitors' satisfaction degree on restaurant facilities.	2.11	3.00
	Retail and souvenir shops		
B.b.1	EXPAND the range of PRODUCTS in souvenir shops to suit all visitor preferences.	1.77	1.00
B.b.2	RENOVATE the old STRUCTURES according to styles that are modern and well integrated with the landscape.	2.12	1.00
B.b.3	REALISE NEW STORES of souvenirs and local products and NEW EXHIBITION AREAS.	1.75	1.00
B.b.4	EXPAND THE OFFER of: local products; souvenirs; equipment for outdoor visits.	2.03	1.43
B.b.5	Prepare a PERMANENT MONITORING SYSTEM on the visitors' satisfaction degree on the offer of local products and souvenirs.	1.87	1.00
	Interpretation and education		
C.1	DEVELOP new programs for EDUCATIONAL VISITS and content adapted to people with disabilities.	2.53	2.67
C.2	Prepare: MONOGRAPHS on the park for both adults and children; MANUALS for tourist guides; WEB PLATFORM and MOBILE APPLICATIONS.	2.45	2.38
C.3	Create NEW EDUCATIONAL TOURS with informative signs.	2.45	2.30
C.4	Program GUIDED TOURS, LESSONS, WORKSHOPS, COURSES on: ecosystems and landscapes; cultural heritage, history and tradition; nature photography; recognition of plants and animals.	2.40	2.50
C.5	Design and build a new VISITOR CENTRE for shows and exhibitions.	2.01	2.75
C.6	Organise cultural and promotional EVENTS on the park's heritage.	2.15	2.29

For what concerned the characteristics and habits of visitors, a statistical analysis was performed using R software, in order to identify which are the variables that most influence the opinion of tourists. First of all, a Shapiro-Wilks test (α=0.05) was conducted to verify whether the data for the 21 macro-topics were normally distributed or not. The Shapiro-Wilks test showed a non-normal distribution for all 21 macro-topics; therefore, non-parametric tests were used to identify statistically significant differences between the variables. The Mann-Whitney-Wilcox U test (α=0.05) was performed for the dichotomous variables (i.e. gender; country of origin; and number of visits, by dividing the sample into two classes: those that visited the PLNP once, and those that returned there more than once). For the variables where there were more than two independent groups (i.e. age; number of companions) the Kruskal-Wallis test (α=0.05) was performed. The results showed that for only two variables (i.e. Origin and Number of visits) there is a significant difference within the groups for most of the macro-topics analysed (Table 4). This means that the diverse visitor characteristics associated with these two variables tend to influence the opinions of the visitors themselves.

Table 4. Statistically significant results of Mann-Whitney-Wilcox U test for variables: Origin and Number of visits.

Macro-topics	Origin	N of visits
	p-value	p-value
A.2	<0.01	<0.001
A.4	0.04764	-
A.5	<0.01	-
A.7	0.02130	0.04579
A.8	<0.001	<0.01
B.a.1	<0.001	<0.01
B.a.2	<0.001	<0.001
B.b.1	<0.001	<0.001

B.b.2	<0.001	0.01508
B.b.3	<0.001	<0.01
B.b.4	<0.001	<0.001
B.b.5	<0.001	<0.001
C.1	<0.01	-
C.4	<0.01	0.03153
C.5	0.00137	0.04712
C.6	<0.001	<0.001

As regards the Origin variable (Table 5), Croatian visitors on average assigned higher priority to all the macro-topics than foreign tourists. In particular, the macro-topics with a higher priority difference of one point are the following: the monitoring of visitors' satisfaction with the management system (A.8) and the restaurant facilities (B.a.2); the renovation and expansion of restaurant facilities (B.a.1) and retail and souvenir shops (B.b.1÷B.b.5); the preparation of a new visitor centre (C.5); the organisation of events (C.6).

Table 5. Mean and standard deviation of the priority for the macro-topics with statistically significant difference between national visitors and foreign visitors. (Δ Mean - the difference between the average values of national visitors and the average values of foreign visitors).

Macro-topics	National visitors	Foreign visitors	Δ Mean
	Mean±SD	Mean±SD	
A.2	6.92±2.19	6.10±2.16	0.82
A.4	7.16±2.07	6.64±2.11	0.51
A.5	6.86±2.17	6.02±2.07	0.84
A.7	6.58±2.35	5.78±2.46	0.80
A.8	6.87±1.98	5.29±2.29	1.58
B.a.1	7.36±1.88	6.07±2.13	1.29
B.a.2	7.25±1.91	5.28±2.27	1.98
B.b.1	6.13±2.33	4.38±2.45	1.75
B.b.2	6.99±2.36	5.63±2.37	1.36
B.b.3	5.91±2.45	4.48±2.65	1.43

B.b.4	6.87±2.44	5.19±2.33	1.69
B.b.5	6.66±2.28	4.40±2.37	2.26
C.1	7.88±1.68	7.26±1.74	0.63
C.4	7.52±1.81	6.81±2.07	0.71
C.5	6.53±2.52	5.45±2.40	1.08
C.6	7.07±2.23	5.76±2.52	1.31

Regarding the Number of visits (Table 6), those who chose to return to the PLNP have expressed on average a higher priority for all macro-topics than tourists who have visited the PLNP only once. In particular, the macro-topics that reported a higher priority difference at one point are the following: increasing surveillance (A.2); monitoring visitor satisfaction (A.8, and B.a.2); the implementation of retail and souvenir shops (B.b.1, B.b.3, B.b.4, and B.b.5); the organisation of events (C.6).

Table 6. Mean and standard deviation of the priority for the macro-topics with statistically significant difference between visitors who went to the PLNP only once and visitors who returned more than once to the PLNP (Δ Mean - the difference between the average values of national visitors and the average values of foreign visitors).

Macro-topics	National visitors	Foreign visitors	Δ Mean
	Mean±SD	Mean±SD	
A.2	6.95±2.08	5.86±2.25	1.09
A.7	6.45±2.44	5.79±2.36	0.66
A.8	6.53±2.16	5.49±2.30	1.04
B.a.1	7.11±2.04	6.19±2.08	0.92
B.a.2	6.83±2.12	5.51±2.36	1.32
B.b.1	5.78±2.50	4.54±2.42	1.24
B.b.2	6.66±2.50	5.87±2.32	0.78
B.b.3	5.67±2.60	4.54±2.56	1.13
B.b.4	6.55±2.51	5.33±2.40	1.21
B.b.5	6.24±2.38	4.55±2.56	1.69
C.4	7.44±1.80	6.78±2.15	0.66

C.5	6.28±2.59	5.63±2.36	0.65
C.6	6.87±2.44	5.79±2.33	1.09

5. Discussion

Natural landscapes are widely recognised as important reasons for choosing one tourist destination over another (Lončarić et al. 2021). For this reason, it is considered essential to examine in depth the preferences of tourists (Perera et al., 2015). Some studies have already investigated visitors' opinions on management issues, but with an exclusive focus on environmental and nature conservation aspects (Abdullah et al., 2018; Arnberger et al., 2012; Belkayali and Kesimoğlu, 2015; Cihar and Stankova, 2006). Whereas, the present study goes even further: involving tourists in the evaluation of the adequacy of the actions related to the visitor management system of a NP, and thus giving voice to the opinions of the beneficiaries of such planning.

Besides, it is also important to point out that different types of tourists visit nature-based destinations, following a great variety of motivations, needs and expectations. Indeed, the outcomes of this study have revealed the existence of different types of visitors, also within the PLNP. For example, Croatian visitors gave a higher priority to the implementation of services and infrastructure, compared to tourists from other countries (Table 5). Approximately half of the sample is represented by Croatian visitors who are returned to the PLNP on more than one occasion. Only a small part of the sample consists of foreign vacationers who have visited the PLNP more than once. This means that the expectations that national visitors have by frequenting the PLNP many times are more related to the good maintenance of the services and infrastructure that the PLNP offers.

Another aspect found in the study is that which concerns the retention of visitors. In fact, it has proven that those who have repeatedly returned to the PLNP have higher safety

expectations, and consider it important to taken into account the visitor opinion (i.e. through tourist satisfaction monitoring systems), both as regards the organisation of the visiting system and the improvement of the infrastructure. For this purpose, information panels with QR codes linked to a survey web page may be installed. This would ensure that a high percentage of visitors could easily accessed PLNP information services and express their preferences. These kinds of applications have been developed and refined in recent years, and prior to them it was considered extremely demanding to conduct multilingual surveys (Perera et al. 2015). Thanks to these new technologies, six versions of the questionnaire could be adopted in different languages to reach more international tourists, without creating data processing problems. In addition, the majority of questions were asked in such a way as to receive numerical answers that could easily converge in a single archive.

For those who chose to return to visit the PLNP, having travelled many times towards the same nature-based destination creates a desire to participate in new events or to benefit from a variety of facilities (e.g. the sale of products and restaurant services) that can diversify their experience (Lončarić et al. 2021). These aspects had already been identified among the strategies adopted in previous studies (McCool et al., 2021), in order to increase the duration of visits and the average expenditure of visitors. Higher expectations for infrastructure and services can also be viewed as advantage benefit. Services and facilities are actually a fundamental part of the physical infrastructure of a tourist destination, making a territory more attractive and competitive (Mandić et al., 2018). Furthermore, tourist attractions, events, local food and craft products can provide an excellent opportunity to experience the local culture (Lončarić et al., 2021), sensitising visitors to explore the various aspects that characterise a place. Finally, from an economic and market point of view, the range and quality of

services greatly influence the success of a tourist destination (Radisic and Basan, 2007). However, the results also demonstrated that visitors are generally inclined to set lower priorities for strategies related to retail and souvenir shops than those assigned to other management issues. In any case, they attribute greater importance to this macro-topic than that envisaged in the current Management Plan (Table 3). Therefore, it would be useful for PLNP managers to develop actions related to this theme in slightly shorter timeframes than those foreseen in the current Plan, to meet the expectations of a large number of visitors.

In addition, the Interpretation and education section received the highest priority from tourists(Table 3). Particularly, visitors showed interest in the development of new visit programs and educational materials and activities related to the natural and cultural heritage of the PLNP (see macro-topics C.1, C.2, C.3, and C.4, Table 3). So, in accordance with what has already been established in the current Management Plan, if these aspects were developed with a medium-high priority, it would increase the attractiveness of the PLNP, with tangible economic consequences (Wolf et al. 2015). Furthermore, this would redistribute visitors through a range of interesting alternative activities, which would decongest the most crowded area of the PLNP (i.e. the Lakes area). Finally, these initiatives would enhance visitors' awareness of the values and resources of the site. In this way, they would be more conscious of the environment, and therefore more respectful of the natural landscape and its ecosystems (Perera et al. 2015, Wolf et al. 2015). Among the new activities to be proposed, it would be important to involve local people, who are crucial stakeholders in the sustainable development of a PA (Marković et al. 2013). Private farms and villages can be interesting destinations to appreciate local traditions (McCool et al., 2021).

Regarding the Visitor use management system, tourists confirmed the need to intervene with almost the same level of medium-high priority already established in the current Management Plan. As stated in other studies (Lončarić et al., 2021; Radisic and Basan, 2007), it is fundamental for managers of nature-based destinations to disseminate information on the various natural attractions and services available, using communications materials, web pages and social media. By being informed in advance, visitors would be facilitated in planning their trip, which would increase their satisfaction with the chosen destination. This is also confirmed by the results of this study. In fact, the survey sample gave a slightly higher priority to multiple actions related to this issue compared to the current Management Plan (see macro-topics A.1, A.4, and A.8 Table 3).

As PLNP tourism receipts represent approximately 98% of the total income (Mandić, 2021), it is evident that any kind of action included in the management strategies could not be developed without visitors. Moreover, effective integration in the international tourism market requires specialised managerial skills and the provision of high quality tourism products, which can satisfy a wide range of visitors (Lundmark and Müller, 2010). For this reason, the managers of the PLNP, as a nature-based tourist destination, must necessarily consider the satisfaction of their users.

6. Conclusions

In this study, a new research dimension concerning the investigation of visitors' perceptions of the management of an international nature-based destination - the Croatian Plitvice Lakes National Park - was experienced. This study builds on the findings of a previous research that used a methodology based on big data analysis to identify the topics of greatest interest to PLNP visitors (Sergiacomi et al., 2022). The results of this study may be useful to PLNP managers in formulating

and promoting innovative experiences aimed at improving the aspects that the tourists themselves consider most relevant.

With respect to research questions, the survey identified management issues considered as priorities by PLNP visitors (RQ1). In particular, the actions strictly related to the issues of the "Visitor use management system" and "Interpretation and education" appear of greater interest to tourists. Furthermore, the study also identified the main discrepancies between the priorities expressed by visitors and those assigned by the managers (RQ2). Specifically, visitors gave a much higher priority than the current Management Plan on information and monitoring of tourist preferences. The theme of the renovation of the old souvenir shop structures reported the largest difference in positive terms on behalf of visitors, even if the absolute score they assigned to this topic is not one of the highest in the survey.

Although the online survey was released through the main social channels of the PLNP, this strategy collected only a small sample of respondents (214). Therefore, it would be useful to expand data collection by enabling an on-going monitoring system, for example using information panels with QR codes that are always connected to an online questionnaire on visitor preferences.

Nowadays, to achieve effective economic sustainability, PA managers are increasingly faced with a dual mission. On the one hand, the protection of natural and cultural resources, which makes the sector of interest a unique heritage. On the other hand, satisfying the expectations and needs of those who choose to use and enjoy these goods. To do this, visitors should be regularly included in the stakeholder categories to be involved in the decision-making process of managing the PLNP. In conclusion, all the results of this study are a confirmation of the fact that it is essential to involve tourists to management issues of a nature-based destination. In this way, it will be possible to turn them into visitors actively involved in the conservation of the resource, and attentive

inspectors of the behaviour of the other users.

Acknowledgments

The authors would like to thank Marija Turkalj, Head of Sales and Marketing Department of the Croatian National Park Plitvička jezera for her support in defining and disseminating the survey questionnaire.

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III. CONCLUSIONS

1. Main research findings

The main goal of the present thesis is to develop a support model for the qualitative and quantitative assessment of CESs, particularly in the agro-forestry territory. On the one hand, the tested methodology can be adopted by the managers of natural areas to investigate the potential and resources of the territory assigned to their jurisdiction. On the other hand, the preliminary results of this study can provide a useful knowledge base for the analysed areas.

Regarding the first research line (i.e. the economic evaluation of the recreational hunting function by the ITCM), it has been found that the annual recreational hunting value for Tuscany is approximately between a minimum of EUR 68 million and a maximum of EUR 170 million. It is interesting to note that the economic activation related to this CES far exceeds that of Tuscan forest production, which is about EUR 25 million per year (Marinelli and Marone, 2014). Although it has been proven that hunting represents a high economic and social value for the territory, as the studies in this thesis have also shown, this particular recreational function is little investigated compared to other types of CESs (Bernetti et al., 2019, 2013; Riccioli et al., 2020, 2019; Sottini et al., 2019). Besides to being an economic resource for the territory, hunting, if conducted according to sustainable criteria, makes it possible: to keep the load of species under control (especially ungulates), by limiting the damage caused to agriculture, forest renewal and road safety; to conserve and monitor the biodiversity of agro-forestry systems (ISPRA, 2013).

With regard to the second research line (i.e. the qualitative assessment of the function of visiting PAs through CA tools), the results reveal that there is a generally positive opinion on the PLNP, based on the SA of TripAdvisor reviews. As well, the NPL findings show that the strengths of the PLNP lie primarily in its natural elements and beautiful landscapes,

while its weaknesses mainly concern management problems related to overcrowding in high season. As an additional result of the MDS and cluster analysis, seven clusters of words were extrapolated to identify the PLNP management issues that are of greatest interest to visitors. On the basis of these clusters, PLNP visitors turned out to be particularly sensitive to organisational issues, and not only to the beauty of the landscape. Lastly, through the final online questionnaire, drawn up on the basis of previous findings, it was possible to identify different types of tourists and their wide variety of motivations, needs and expectations. The levels of priority stated by visitors during the survey may allow PLNP managers to align the strategies drafted in the current Management Plan with visitor opinions.

2. Principal limitations of the study

This thesis made use of a set of complementary methodologies to assess both quantitative and qualitative aspects related to CESs. However, the context of the COVID-19 epidemic in which the survey was developed between 2019 and 2022 has led to some limitations to research. First of all, data collection was conducted exclusively with online instruments. This strategy did not guarantee uniform and extensive sampling of the population of recreational user analysed. In particular, for what concerns the hunter population, most of the users are pensioners or inhabitants of rural areas with reduced computer culture (Dolnicar et al., 2009). In fact, it is true that, in general, social media are mainly used among younger people (Hausmann et al., 2020; Kovacs-Györi et al., 2018), which highlights the fact that the analysed sample is not representative of certain categories of people (e.g., the elderly). For both research lines, an enlargement of the samples would allow the effectiveness of the tested tools to be evaluated in more detail. Regarding the assessment of the recreational hunting function, a larger

sample would have made it possible to perform geospatial analysis and territorial downscaling approaches (Moriondo et al., 2011). Furthermore, the variability of the results obtained (between a minimum of EUR 68 million and a maximum of EUR 170 million) is mainly due to the fact that a high precision of 95% probability interval was applied to a relatively small sample. Despite this, the order of magnitude of the result obtained is approximately that obtained by Marinelli and Marone (2014), taking into consideration the effective increase in the willingness to pay of hunters for this type of recreational function. Also for PLNP visitors, the online questionnaire made it possible to collect only a small sample of respondents in relation to the number of visitors registered each year. Therefore, it would be useful to enable an on-going monitoring system, which allows people to easily connect to an online questionnaire on visitor preferences.

Despite the above-mentioned limitations, it is believed that the research conducted can be a useful starting point in the study of the recreational functions derived from CESs, especially as regards the agro-forestry territory.

3. Theoretical and practical implications

The methodology adopted in the present study provides some theoretical contributions in the management of natural areas. First, by using online survey tools it is possible to address challenging research contexts. This is the case of a limited availability of time or resources (Mirzaalian and Halpenny, 2021; Stoleriu et al., 2019), as well as extraordinary situations such as the COVID-19 pandemic that has affected us in recent years. In particular, regarding the use of an automated approach for the assessment of PAs, it has proven to be an efficient procedure for gathering large amounts of data from UGCs. In addition, it has been confirmed that the method adopted for the evaluation of the recreational hunting function (i.e. ITCM) is flexible enough to

be included in an exclusively online questionnaire, and readily reproducible both in manifold territorial contexts and for different survey scales (Torres-Ortega et al., 2018). As regards the involvement of natural area users as the subjects of investigation, it is true that there are numerous contributions involving hunters for economic assessments of the agro-forestry territory (Chapagain and Poudyal, 2020; Knoche and Lupi, 2012; Whitten and Bennett, 2002). On the other hand, as regards PA visitors, specific online protocols have not yet been developed to evaluate their judgement on management issues. Therefore, this thesis seeks to help fill this gap currently present in the literature.

From a practical point of view, the thesis contributes significantly to deepening the knowledge of the territory studied according to specific research topics. Regarding the recreational hunting function analysed in the Tuscan territory, the most economically significant categories of expenditures that hunters have to incur for this activity have been identified. This allows local entrepreneurs to detect the hunting products to be promoted more and those already effectively integrated into the market of this sector. As for the recreational visits to PAs, research findings prove that social media analysis can be applied very effectively to the nature-based tourism field. In particular, these technique may assist managers and decision makers to interpret the online image of PAs constructed by visitors within the Internet (Hausmann et al., 2020; Stoleriu et al., 2019). By interpreting the findings achieved, certain management strategies considered effective for user satisfaction were identified. Managers can leverage these results to plan interventions and promote activities. In this way, the agro-forestry territory could be enhance in the eyes of recreational users in a perspective of economic and environmental sustainability.

4. Future developments and final considerations

Based on the results of this project, some lines can be drawn for future research developments. A first proposal regards the combination of innovative and traditional methods. In particular, in the literature it is widely recognized that the application of content analysis to social media is effective in numerous case studies. For instance, platforms such as that of Tripadvisor are useful for extrapolating user opinions of experiences in a place such as, e.g. a protected natural area (Mirzaalian and Halpenny, 2021; Stoleriu et al., 2019). On the other hand, to investigate the awareness and interest of visitors towards complex and technical-scientific topics (e.g. the protection and conservation of nature), it would be more effective to integrate innovative CA methodologies with traditional techniques, such as focus groups or face-to-face interviews led by experts. Another suggestion for future studies concerns the establishment of permanent monitoring systems, which will enable the value of CESs in a given territory to be regularly updated. These systems should be developed using simple and practical computer instruments. This would provide natural area managers with an effective tool that can be used independently. Finally, the qualitative and quantitative analysis methodologies, which were used separately in the two strands of this research, could be combined in a single survey process to test a comprehensive tool for the assessment of CESs. A possible case study for the agro-forestry area would be that related to hiking along pilgrimage routes. In particular, during the doctorate course, a collaboration was established in a project for the enhancement of the Tuscan paths. The project focuses on planning, promoting and monitoring the so-called Via Romea Sanese. This is a 78 km pilgrimage route that connects Florence to Siena, characterised by numerous historical, cultural, naturalistic, and gastronomic attractions. In the initial stages,

participation in the project involved: carrying out numerous on-site inspections; participating in meetings with the authorities and owners of the land on which the path extends; developing cartographic archives through the use of GIS software; creating promotional maps and infographics to disseminate and install along the way. The subsequent stage of the project will be to define an investigation tool to assess this specific type of CES in relation to the area under consideration. Qualitative and quantitative analysis based on methodologies tested in the studies of this thesis will be implemented on online platforms and aimed at the users of the route.

In conclusion, this thesis provides a set of valid methodologies for the assessment of CESs in the agro-forestry territory. Experimentation with these instruments has made it possible to conduct both quantitative and qualitative analysis. From a quantitative (i.e. economic) perspective, the method adopted allowed to measure the use value of a natural area in monetary terms. This type of estimation facilitates to communicate the value of CESs for a natural area both to the scientific community and to political and civil society. Knowing the total economic value of a territory provides a solid basis for structuring an effective policy for managing and improving resources. On the other hand, from a qualitative point of view, the combined use of automated investigation techniques on big data and online questionnaires allows for a good knowledge of the opinion of recreational users on natural area. Therefore, in order to ensure sustainable economic development of agro-forestry areas, the assessment of CESs should be introduced into the planning of natural areas. In this way, it would be possible to guarantee a compromise between the economic exploitation of the resource (e.g., tourism, production, etc.) and the conservation of the environment and its services. To achieve this goal, visitors should be regularly involved as relevant actors in the decision-making process for the management of the agro-forestry territory and its

resources. Research similar to those contained in this thesis can contribute significantly to the development of tools for the sustainable management of natural resources. The adaptability of these models makes it possible to apply them in different contexts while maintaining constant the objectives of the sustainable use of resources and the enhancement of the territory.

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