

*Research Paper***The use of a Geographic Information System to increase Outdoor Tourism***Submitted in 25, July 2022**Accepted in 05, September 2022**Evaluated by a double-blind review system*

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**ABSTRACT**

**Purpose:** Outdoor tourism is a growing segment that still requires data for planning and management. Aimed to present the potential of the Geographic Information System (GIS) to improve outdoor tourism in the North of Portugal. To achieve this purpose, a case study was conducted on developing a Web-GIS in Northern Portugal.

**Methodology:** Four steps were followed to develop the GIS tool with information about outdoor tourism in the North of Portugal. In the first step, municipalities in the North of Portugal sent information about outdoor activities. In the second step, the data were georeferenced and associated. In the last step, a Web-GIS was developed.

**Findings:** The development of tools is an important source of support for tourism. This study identified that a tool such as the GIS could support a destination's decision-making

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and promotional processes, besides providing detailed information to the tourist and facilitating travel planning.

**Practical implications:** GIS provides effective planning of outdoor tourism, once this tool allows an effective search of the tourist offer and, from the tourist's perspective, relevant suggestions of visits according to their location are presented, facilitating their experience in the region.

**Originality:** Several studies relate to GIS and tourism, but there is still a gap in specific studies on outdoor activities. So, this study presents the importance of GIS to improve outdoor tourism in the North region of Portugal. Understanding this importance is essential in planning and managing tourism, helping further policymaking and marketing strategies.

**Keywords:** GIS, tourism management, tourism planning, outdoor tourism, North of Portugal.

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## 1. Introduction

Outdoor tourism has increased considerably (Silva et al., 2021) in the last few years, especially during the pandemic period, when people are looking for outdoor activities. Places in nature, protected areas, urban parks, and rural areas are the locals where these activities often happen (Derek et al., 2019) and the features of outdoor tourism align with the principles of sustainability and environmental recognition (Valizadeh & Khorani, 2020). Demand for outdoor activities encourages innovation, once practitioners of outdoor activities seek health and have shown a growing interest in different activities and have adopted new behaviours, creating an opportunity for organisations to innovate (Tsaour et al., 2020).

The practice of this tourism segment requires detailed information about the activities and planning also requires this data to be performed in a sustainable direction. This information can be categorised as supply inventories, localisation maps, impacts monitoring, and others. In this sense, different studies have attempted to understand how technology can support this process of information and data collection for tourism, and also how this technology can benefit tourists in their travel planning process (e.g., Dorcic et al., 2019; Kim & Law, 2015).

Previous studies (e.g., Bunruamkaew & Murayama, 2012; Chhetri & Arrowsmith, 2008; Divanshu et al., 2021; McHaffie et al., 2019) have already shown that an effective tool for this is the Geographic Information System (GIS).

A GIS is a system that allows integration into a platform georeferenced information, including spatial data, that can describe the attributes and locations under analysis (Ahmad et al., 2010). The functionalities of a GIS support the decision-making process once the information is represented and visualised in an uncomplicated way to be interpreted (Albuquerque et al., 2018).

It is important to emphasise the existence of a gap regarding specific studies that relate the importance of the GIS tool with outdoor tourism and the practice of these activities. Studies relating GIS to natural areas are commonly found (e.g., Chhetri & Arrowsmith, 2008; Ghafourian & Sadeghzadeh, 2021; Ghorbanzadeh et al., 2019), and these studies corroborate the importance of GIS in the decision-making process for tourism planning and promotion of destinations and how this tool may benefit different stakeholders involved in tourism activity.

So, in this context, this study aimed to discuss a Geographical Information System as a tool to improve outdoor tourism. A case study in the Northern region of Portugal was used for this analysis. Based on the GIS data, it is possible to provide the information on the internet, which is called Web-GIS, and this will be the tool presented in this study.

Notably, the characteristics of the region under study are propitious for the practice of outdoor tourism. The territory covers an area where it is possible to carry out aerial (e.g. paragliding), aquatic (e.g. surfing, kayaking, rafting) and terrestrial (hiking, mountaineering, cycling) activities, attracting demand for these different activities all year round.

So, to achieve the objectives, this paper is organised into five sections. After the introduction, the concepts of GIS and Outdoor tourism are presented in the section titled Theoretical Framework. The methodology (Section 3) described the study area, the data collected, and the way of analysis. Section 4 was dedicated to presenting the findings of the study. Finally, Section 5 was committed to presenting some conclusions and recommendations.

## **2. Theoretical Framework**

The studies on Outdoor Tourism have been in evidence in recent years, mainly due to the increase in the search for this tourism segment. Outdoor Tourism is a segment of tourism where different activities are practised in natural and rural areas and cities (Silva et al., 2021). These activities can involve natural, cultural and human resources (Hao et al., 2016), and outdoor tourists can choose hard or soft activities (Tsaour et al., 2013, 2020; UNWTO, 2014) that can be practised in land-based, air-based or water-based locations (Derek et al., 2019). Some of the most practised outdoor activities are trekking, hiking/walking, surfing, paragliding, cycling, and others.

Many studies have been conducted to present the relevance of this tourism segment for destinations. Some authors demonstrate that outdoor tourism can mitigate the problems of tourism seasonality since the activities can be practised throughout the year (Saló et al., 2020) and can assist in the recovery of natural resources (Koenig-Lewis & Bischoff, 2005).

In recent years, there has been a remarkable increase in the demand for this tourism segment (Silva et al., 2021). What motivates the practice of outdoor activities can be nature, looking for places to relax, escaping routine, relaxation, culture and others (Pomfret & Bramwell, 2016; Sand & Gross, 2019). In general, the authors (e.g., Tsaour et al., 2020) point out that the practice of outdoor activities is related to an escape from daily life and often as a way of getting away from the stressful life of large cities.

As the demand for this tourism segment grows, planners and developers must have technological tools to manage and plan the activities. The technology can also be helpful for tourists, as they can easily access all the information (Castañeda et al., 2019). Different technological tools are offered, including the Geographical Information System.

A GIS integrates information into a platform that enables the analysis, update, and visualisation of spatial and non-spatial data (Albuquerque et al., 2018; Chhetri & Arrowsmith, 2008). The data is georeferenced, describing the attributes in graphics or maps, so the information is presented more visually, easily understood, accessible, and useable (Chhetri & Arrowsmith, 2008).

Several studies have analysed the use of the GIS in tourism. These studies may be focused either on the importance of this tool in destination marketing or on its use to measure and control tourism supply.

Chhetri and Arrowsmith (2008) developed a model representing a recreational opportunity potential in natural areas in western Victoria, Australia, from the information provided in the GIS. Based on the definition of the location of the attractions, a better spatial distribution of tourists was suggested based on the planning of marketing strategies for such action.

To evaluate the land use and planning of sustainable ecotourism in Thailand, Bunruamkaew and Murayama (2012) used a GIS and presented the results. According to the authors, the maps generated will allow the planning of activities in a way that ecotourism is practised in a sustainable form in the region.

Aiming to attract more tourists to Osogbo, Olukole (2014) developed cartographic representations of the cultural resources using GIS. The reason for this development was the need to provide the town with more information about these attractions. In this way, all the data concerning the cultural attractions was provided in a structured, organised, and friendly format.

Albuquerque et al. (2018) presented a study about using GIS for tourism marketing, specifically in Aveiro (Portugal). They pointed out the importance of the GIS platform for the decision process. In addition, they emphasised the use of this tool by the different stakeholders involved with tourism in the municipality under study.

The use of GIS to map tourism in natural areas has been studied by Ghorbanzadeh et al. (2019) in East Azerbaijan. The result presented in this paper was a nature-based potential map of the region, identifying the features of the tourist attractions and mapping the location of the main attractions.

Specifically on planning, Ghafourian & Sadeghzadeh (2021) analysed the use of GIS in coastal tourism on the Shirud Coast, Iran. The authors highlighted two important points regarding GIS. Through the integrated information network, this tool can assist in

developing sustainable tourism and corroborates the importance of GIS in the decision-making processes.

Divanshu et al. (2021) investigated the use of GIS to understand the behaviour of tourists in different destinations. Moreover, the authors explored travellers' spatial and social characteristics, concluding with the importance of this data for destination planning.

The common feature identified among all the studies presented above is the importance of GIS in planning, decision-making processes and in delimiting marketing strategies and can be used by different stakeholders involved with tourism. The number of studies analysing GIS applications in natural environments also draws attention. This is also the reality of the region under analysis in this study proposed in the present study.

### 3. Methodology

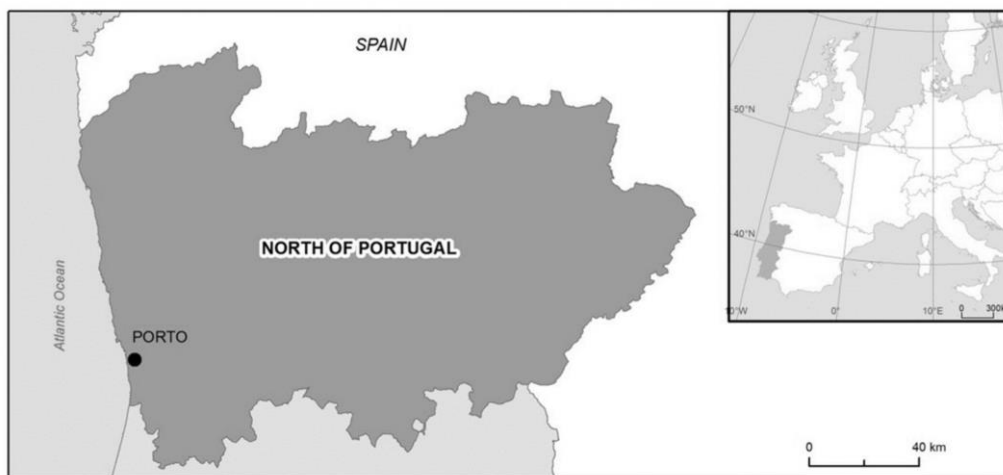
#### 3.1. Study Area

Northern Portugal (Fig. 1) is the region with the third largest area of the country (21,285.86 km<sup>2</sup>) and consists of eight micro-regions known as NUTS III. These micro-regions present the diversity and uniqueness of natural resources, from the sea to the mountains. Five Protected Areas are in the North (Peneda-Gerês National Park; Northern Coast Natural Park; Montesinho Natural Park; Douro International Natural Park; Alvão Natural Park). It is worth noting that the only National Park in the country is located in this area (Peneda Gerês).

Another aspect being mentioned is the number of river basins in the North Region, such as the Douro, Minho, Cávado and Ave basins, among others.

The areas available for an adventure, nature-based, and outdoor tourism have characteristics and infrastructures that support the practice of hard and soft activities such as surfing, BTT, hiking, cycling, canoeing, trekking, hiking, mountaineering, and others. These features set this region as a strategy for tourism in Portugal, which presented nature-based tourism as a priority segment in the Tourism Strategic Plan (Turismo de Portugal, 2017).

**Fig. 1. Geographical Context**



Source: Silva et al. (2021)

### 3.2. Collected Data and GIS Development

Four steps were followed to develop the tool (GIS) with information about outdoor tourism in the North of Portugal (Fig. 2.).

**Fig. 2. Development of Web-GIS**



Firstly, a questionnaire was sent to all the town councils that compose the eight sub-regions of the North Region. This instrument was composed of questions that allowed us to obtain detailed information about the activities offered by each city in the North Region. The information collected and subsequently used for the GIS development was presented in Table 1.

**Table 1. Collected information for the development of GIS**

|                                  |                                    |  |
|----------------------------------|------------------------------------|--|
| • Activity                       | • Location (with coordinates)      | • Difficulty Level                         |
| • Protected Area (yes or no)     | • Accessibility                    | • Type of path                             |
| • Infrastructures/equipment      | • Signposting/Guidance             | • Type of footpath                         |
| • Information/Communication      | • Associated Interpretation Centre | • Promoting body/company                   |
| • Safety                         | • Universal Accessibility          | • Entities/companies developing activities |
| • Ideal period to enjoy the site | • Main values to observe           | • Level of experience of the practitioner  |
| • Dangers                        | • Distance                         | • Duration                                 |

The second step was the georeferencing of the data collected with the municipalities. Georeferencing is to position the activities geographically using a coordinate system

(McHaffie et al., 2019). The data set was associated with generating the Web-SIG (step 3), named TURNOUT Web-SIG.

On this website are available 337 layers and ten maps that will be presented in the next section. The last step was to map each one of the activities, an important action to understand the distribution of the activities throughout the region. Finally, the GIS was developed aiming:

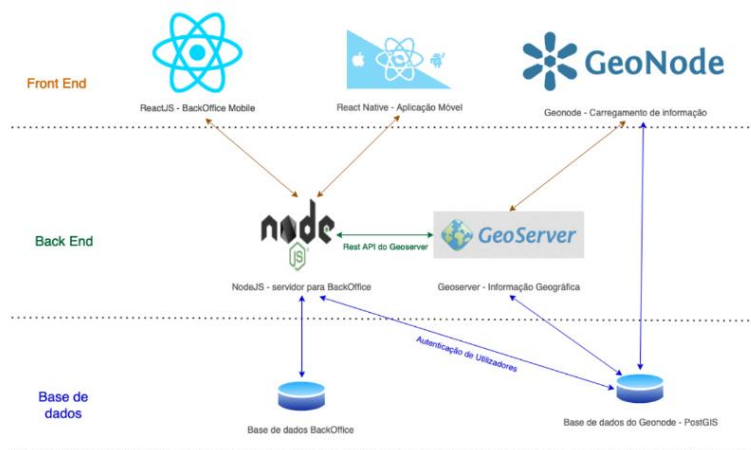
- To provide a georeferenced database to include all the information considered relevant on existing data, collected, and resulting from the application of the models.
- To make a geographic information system available on the Web, with access control, for loading and consulting the information collected in the project, issuing statistics, and carrying out simple data analysis operations.

#### 4. Findings

On the development aspect, the TURNOUT Web-GIS is built of three layers: front-end, back-end and Database. The front-end uses ReactJs and Geonode technologies that allow the user to access via desktop. The back end consists of a service in Node JS that stores and processes all the information related to the BackOffice and the GeoServer service that is responsible for managing data related to geographic information and documents (Fig. 3).

Concerning geographic information, the coordinate system to be adopted for all spatial data of the platform is EPSG:3763 (ETRS89/ PT-TM06), corresponding to the reference system used for mainland Portugal. The Web-GIS is available in Portuguese.

**Fig. 3. Web-GIS System**



Based on the information collected, a geographic information system/geo visualiser was developed on the Web with viewing, sharing and data management functions, which allows simple viewing and analysis of the data on the Web-GIS platform and the provision of geo web services for communicating with other institutional, thematic, or territorial Web-GIS information systems.

In Web-GIS are inserted general data, including the official administrative cartography of Portugal, the boundaries of Protected Areas and Natural Network and base maps. Data inserted that allow the analysis of the outdoor activity in the Norte Region of Portugal are the resources and infrastructure associated with outdoor activities, the demand for outdoor activities, the cartography of zoning and natural suitability for outdoor activities at a regional scale and the units of tourism and delimitation of units of tourism vocation for outdoor activities.

To complement it, this Web-SIG can view the seasonal characterisation of the variables of demand and tourism supply associated with outdoor activities and validate the information with data.

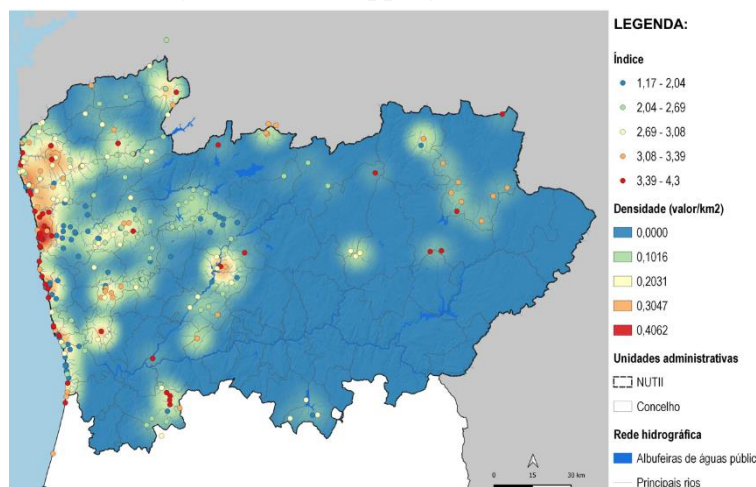
It is relevant to mention that, from the point of view of the spatial distribution of information to be considered, three geographical levels have been identified for the data: regional, municipal, and localised (point, line, or polygon). The last data levels will always be associated with a given region (Northern Portugal).

Through the collected data, the Web-GIS developed is composed of 337 layers, which represent one or more geographical points about a particular outdoor activity and ten maps, which were also available on Web-GIS. The activities inserted in the GIS were those most cited by municipal managers and those identified as the most practised in the region in surveys with companies that offer the practice of Outdoor Tourism. The main activities inserted in GIS were rafting, canyoning, canoeing, trails, wildlife watching, fishing, ecotourism, surfing, mountain biking and climbing.

Based on the information available in the GIS, the ten most practised activities were distributed in global mapping, enabling us to understand the spatial distribution of the supply of activities in the North Region (Fig. 4).

From the map analysis, it is possible to identify a large concentration of activities in the coastal region. Although the interior has potential for outdoor activities, there is still little concentration in these areas. These results corroborate the information from the official organ of Tourism Portugal, which presents the coastal region as the one that most attracts tourists.

**Fig. 4. Global mapping of activities**

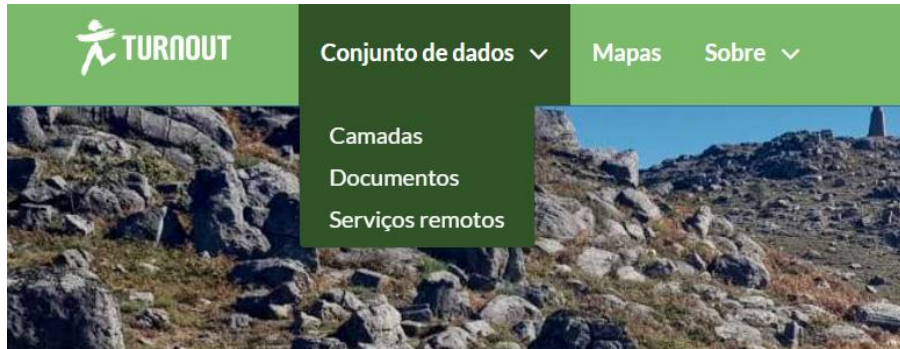


Source: Turnout SIG



On the front end, the user, be it a tourist or an administrator, will have access to a set of information that will allow him to plan outdoor activities in the North Region. In Web-GIS Turnout, 3 main categories of data can be consulted, created, and managed through it. These can be accessed from the "Data Set" menu, where the 3 types of data will be displayed in layers, documents, and remote services (Fig. 5).

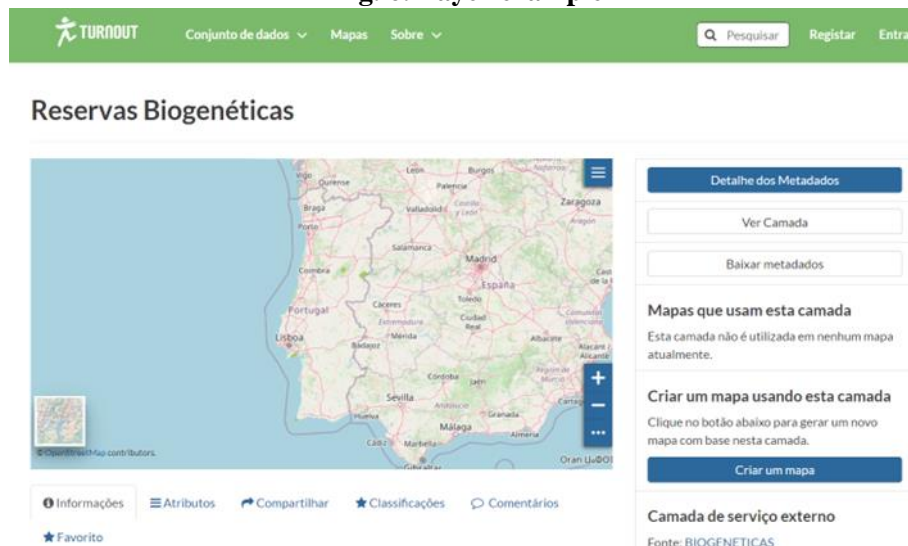
**Fig. 5. Data Set of the Web-GIS Turnout**



Source: <https://turnoutsigs.ipvc.pt/>

By viewing the layers tab, it will be possible to have information regarding the geographical point where a certain activity is offered (Fig. 6). An important point to highlight is that a layer represents a logical separation of the cartographic information according to a theme (Hadzilacos, 1996). In the case of the GIS under analysis, the layers were built according to geographical points about a particular outdoor activity in North Portugal.

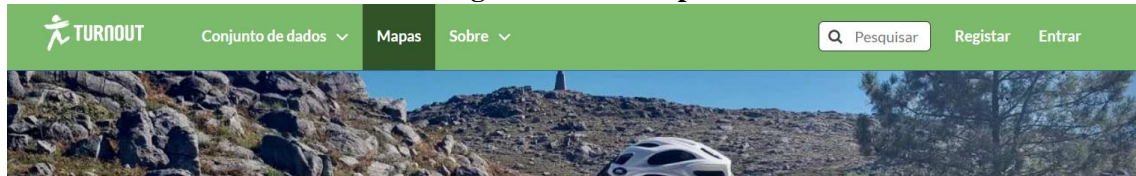
**Fig. 6. Layer example**



Source: <https://turnoutsigs.ipvc.pt/>

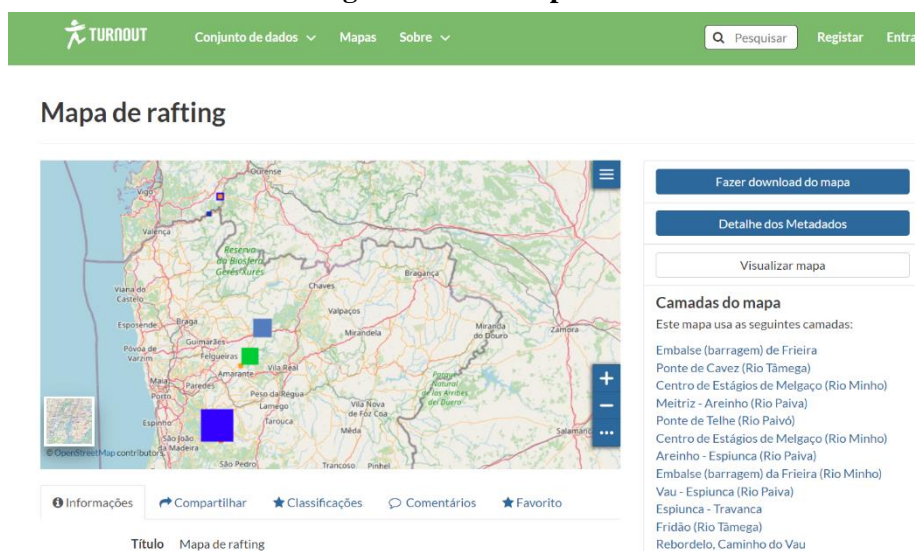
Another category of data is Maps, which can be accessed from the "Maps" menu (Fig. 7). It is worth mentioning that a map may consist of one or more layers. Each map corresponds to one of the ten activities practised in the northern region (Fig. 8).

**Fig. 7. Access to maps**



Source: <https://turnoutsigs.ipvc.pt/>

**Fig. 8. Access to maps**



Source: <https://turnoutsigs.ipvc.pt/>

Based on these results, it is possible to state that the development of this tool provides some important outputs. The first of them is the availability of georeferenced information that will assist in decision-making, both in terms of planning and marketing strategies, through an integrated analysis of existing data.

The second is the availability of information to practitioners of outdoor activities in the North Region of Portugal, which can improve the knowledge about the activities and enhance this segment of tourism in the region.

## 5. Discussion and Conclusion

This paper aimed to discuss a Geographical Information System as a tool to improve outdoor tourism, and to this end, presented the case of implementation of this tool in the North of Portugal. The methods used to implement the GIS and the functionalities of this tool were presented.

Analysing the maps, undoubtedly the activities are concentrated in the coastal area. These findings demonstrate the importance of planning outdoor activities to attract the demand

to the interior of the north region, noting that these areas present infrastructure and resources to attend to the practitioners of different activities.

In addition, it is widely known that more activities are offered in the Northern Region (Ferreira et al., 2021; Martins et al., 2021). Therefore, as one of the study's limitations was not obtaining answers from all the municipalities, the Web-GIS will need to be complemented and constantly updated.

One of the challenges of Web-SIG is the maintenance and updating of data. For this reason, those responsible for the activities must define the form of governance of the tools.

Regarding the importance of GIS for outdoor tourism, it is evident that this tool is useful for tourists to obtain details about the activities offered, as mentioned by (Divanshu et al., 2021). Accessing the Web-GIS, the tourist will have access to information such as the detailed location of the activity (latitude and longitude) and features of the activity.

This investigation corroborates with other studies (e.g., Albuquerque et al., 2018; Chhetri & Arrowsmith, 2008; Ferreira et al., 2021; Ghafourian & Sadeghzadeh, 2021; Ghorbanzadeh et al., 2019; Martins et al., 2021) on the importance of using the information provided by GIS in planning and delimiting marketing strategies in destinations. The implementation of GIS can promote tourism development and the different stakeholders involved with this activity can benefit from its tools. In a practical analysis the GIS can facilitate the effective consultation of the tourism offer, the control of tourism information through the maps. In addition, interactivity facilitates that the tourist obtains information and can better plan their activities in a destination, since relevant visit suggestions according to their position represent the best way to experience the region.

In conclusion, the importance of tools such as GIS for sustainable tourism development in different regions of the world is emphasised all over again.

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