

Article

Tourism Industry's Vulnerability upon Risk of Flooding: The Aquis Querquennis Complex

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Abstract: Thermal baths are the main touristic attraction of Ourense (Galicia, Spain). Therefore, protecting and potentializing the resources related to this type of tourism is essential for the province. Most of these resources are located by the banks or nearby rivers, which makes them particularly susceptible to flooding, a very common phenomenon throughout the province. In this context, vulnerability analysis, and particularly flooding damage evaluation, are of utmost importance to this area. Considering this scenario, the present study consists of a preliminary analysis of a historical-heritage tourism resource's vulnerability to flooding. To this end, the study examines the visitation patterns to the Aquis Querquennis complex (Bande, Ourense, Spain), which is located by the banks of the As Conchas reservoir, and the water levels of said reservoir. The complex is a touristic resource with great historical value. Apart from the thermal baths, it encompasses a military campsite and a hostel. The Roman complex attracts a constant tourist flow, which has a positive socioeconomic impact to the area. The analysis showed that there is a correlation between the number of visits and flooding patterns. Increased levels of water are a hinderance for those willing to access the attraction. Consequently, there is a negative relationship between water level and number of visitors.

Keywords: Aquis Querquennis; flooding; tourism; thermal baths; Roman complex

1. Introduction

The present investigation consists of a preliminary analysis of a historical-heritage tourism resource's vulnerability to flooding. The resource analyzed is the roman archaeological complex Aquis Querquennis, a relevant tourist attraction that has been recognized as a cultural interest resource (CIT). Located in the district of Baños, in the municipality of Bande (Ourense, Spain), the complex consists of three main parts: An ancient military campsite, a travelers' hostel, and thermal baths (see Figure 1). In 1948, Fenosa, a hydroelectrical energy company flooded the Limia Valley to build the "As Conchas" reservoir (in Ourense), after which the hot springs and the ancient Roman baths fell into disuse. In 1975, after Professor Rodríguez Colmenero found the Roman campsite, excavations and recovery tasks began. In 2018, the thermal baths were restored and improved, which led to a significant increase in the number of visitors.



Figure 1. (a) Aerial view of whole complex; (b) the military campsite. Source: Aquis Querquennis Foundation.

The hot springs are a unique and valuable endogenous resource of Ourense, as well as one of the great inland tourism attractions of Galicia. Thermal tourism is a significantly valuable resource due to a set of characteristics. It is less subject to seasonality (when compared to sun and sea tourism, for instance), complements other tourism products, and appeals to various socioeconomic segments [1]. In addition to the mineral-medicinal properties of the water, thermal tourists value the environmental quality of the surroundings, as well as the infrastructure. In this regard, the Aquis Querquennis complex has the added potential of being a historical/heritage site.

The complex is currently in a flood risk zone. For this reason, it often becomes inaccessible to tourists and visitors, as the water level rises. This problem happens with a certain frequency, especially during winter. The consolidation of cultural attractions must be accompanied by mechanisms to generate economic resources from the visits [2]. Flooding events are an external factor that causes a hindrance to these mechanisms. Therefore, they must be considered in the management plans for the attraction. In this vein, the present study consists of a preliminary analysis of a historical-heritage tourism resource's vulnerability to flooding. To this end, the study examines the visitation patterns to the Aquis Querquennis complex, which is located by the banks of the As Conchas reservoir, and the water levels of said reservoir, which when high, flood the attraction.

This paper comprises a theoretical review on tourism's vulnerability to flooding, which is a common phenomenon in the region. The review also encompasses the importance of thermal baths as a tourism resource, as they represent a key element for the attraction's appeal. The next section describes the object of study, the Aquis Querquennis complex. Next, the methodological steps carried out throughout the study are described, followed by the main results regarding the relationship between tourist demand and water levels. Finally, the research's conclusions are addressed, along with implications for the site's tourism territorial management and suggestions for future investigations.

2. Literature Review

2.1. Tourism's Vulnerability to Risk of Flooding

A significant proportion of the global tourism industry is highly vulnerable to environmental risks. In recent years, such industry has been severely affected by natural disasters and the subsequent crises they cause [3]. Moreover, any study on the relationship between water and tourism must consider the effects of climatic variability [4]. As many studies conclude [5], these episodes generally cause significant damages to the affected places' physical environments and socio-economic activities, as well as to inhabitants' health. In this context, weather is one of the components that affect the relationship between tourism and development [6]. The consequences of such a relationship include tourism's vulnerability to water level risings and flooding events.

Flood damage evaluations are important for carrying out vulnerability analyses. Such an evaluation is quite a complex task, as it must consider many heterogeneous elements that might affect vulnerability. Those include, for instance, weather variability and socio-economic factors, which can either intensify or mitigate damages [7].

Flood impacts to the tourism industry include the decline of visitors' numbers and consequent business losses, damage to facilities and local infrastructure, and substantial rebuilding costs [8–11]. The damage caused by floods to tourism are classified as either direct or indirect. Direct damage includes the interruption of business activities due to the direct physical impacts of the flooding on facilities [12]. Indirect damage is caused by floods, but not at the same time or in the same place where the disaster occurs. Flood damages to the tourism industry are also classified into tangible or intangible. Tangible damage includes both direct and indirect damage that can be evaluated in monetary terms without any significant difficulty. Despite the efforts of planners, there are practical difficulties and a certain confusion in the classification of damage as direct or indirect, as well as tangible or intangible [13].

Indirect costs are difficult to quantify and may have effects over months or even years. In the short term, floods cause indirect, economic damage through the decrease of consumption and, consequently, of income due to the interruption of business activities. Floods may also cause indirect impacts in the long term, namely through changes in tourist behavior and destination choice [14,15], communication and promotion channels, the local community, local jobs, and public budgets. In this context, in order to effectively evaluate the damage caused by floods, a dynamic adjustment must be carried out. However, such a process is normally not included in the existing damage evaluation models [16]. In this vein, some studies attempt to measure indirect costs by analyzing data from public aid and insurance companies. Nevertheless, such data are of limited use, as these do not include the most significant part of indirect effects. Moreover, many companies do not have business interruption insurance [16].

The damage evaluation is carried out homogeneously in terms of the elements of each class and considering the different types of damage: Direct and indirect; tangible and intangible. Adopting this classification, Merz et al. [12] proposes the following list of elements at risk in the tourism industry:

- Direct, tangible: Damage to accommodation establishments, restaurants, bars, and facilities; destruction of infrastructure such as paths, roads, and railroads; business interruption inside the flooded area; evacuation and rescue measures; clean-up costs.
- Direct, intangible: Damage to cultural heritage; negative effects on ecosystems.
- Indirect, tangible: Disruption of public services outside the flooded area; business losses to companies outside the flooded area, e.g., cancellation of tour operators and suppliers of flooded camping and hotels.
- Indirect, intangible: Media coverage; negative perception; business closure due to lack of resilience.

Besides the nature of the affected elements, other factors influence damages caused by a flood. For instance, in the case of tourism, the time of the year (high season or low season) and duration of the flood are particularly relevant for the evaluation of its impacts [17]. The damage functions relate the damage (to each element at risk) to its main influencing factors and to the flood characteristics (see Table 1). Damage influencing factors can be classified as impact parameters and resistance parameters [18]. Impact parameters reflect the specific characteristics of a flood event to the object of study and depend on the type and the magnitude of the flood. Resistance parameters represent the capacity of an element to resist the impact of a flood. They depend on the characteristics of the element at risk and their likeliness to flood [19]. Considering that the various influencing factors are not independent from each other, a multivariate analysis is necessary [16].

Table 1. Damage influencing factors considered in river flood damage assessments for tourism.

Impact Parameters	Description
Duration of inundation	Direct and indirect damage to the tourism industry in the affected area are directly proportional to the duration of the flood.
Inundation depth	The likeliness of damage to assets and property is directly proportional to the inundation depth.
Frequency of inundation	The frequency of flood events may have negative effects on destination image. On the other hand, the destination improves its capacity to face future floods, as flood experience may also be considered a resistance parameter.
Timing	The time of the year in which a flood event happens influences the magnitude of the damage. Floods during the high season and vacation time affect a higher number of tourists and cause greater business loss.
Resistance Parameters	Description
Use and type of building	State/level of preparation. For example, a flood in a recreation area with a pool presents lower damage potential than one at a restaurant.
Precaution/Mitigation measures	Measures that may significantly mitigate the damage caused by the flood, such as construction of dikes and transportation of elements at risk to higher altitude areas.
Early warnings	With enough warning time, the mitigation measures may be particularly effective, as the water levels are still low.

Source: Adapted and extended from Merz et al. [16].

In sum, floods' impacts on the tourism industry include decrease in tourist arrivals, business losses, damage to facilities and infrastructure, and recovery costs [8–10]. Considering this scenario, the present work follows Merz et al.'s [16] indications. In this context, a preliminary analysis of tourism vulnerability is carried out by cross analyzing data regarding the number of visitors and water levels. The study adopts a micro scale approach; that is, it focuses the analysis on an individual resource, namely the Aquis Querquennis archaeological complex. Such an approach facilitates the obtention of precise data, and consequently, the results' adaptation to different scenarios in terms of type of inundation, flooded elements, previous experiences, and warning time [12].

2.2. Thermalism as a Tourist Attraction and Floods in Thermal Establishments

Thermal culture has existed for over 2000 years in ancient Greek, Roman, and Arab societies, where thermal waters were used exclusively for healing purposes, namely for treating respiratory, gastric, and other types of diseases or conditions. The culture has survived to current days and started becoming significantly more popular by the transition from the 19th to the 20th century [20], largely due to the diversification of thermal practices. Within the last century, people started using thermal waters not only for healing purposes, but also for stress relieving, aesthetics, and leisure purposes, which reflects the characteristics of current society [20].

Such scenarios led to a shift in the business models of thermal establishments, as well as in the profile of thermal consumers. In this context, spas have adapted their offerings to the requests and needs of this new consumer, aiming to cater to the following motivations [21]:

- Enhancing one's current state of health;
- Resting and relaxing;
- Being in touch with nature;
- Pursuing aesthetics and beauty.

The thermal consumer is no longer limited to seniors in search of therapeutic solutions for diseases. It now also includes people of all ages in search of rest and leisure [20]. Currently, there are two main groups of thermal consumption: Therapeutic and touristic. The therapeutic use is motivated by the

healing properties of warm water, which makes it an alternative treatment for several diseases and conditions. The touristic use is motivated by wellbeing and leisure elements, such as staying in a hotel and enjoying the facilities [21].

From the beginning of the 21st century, thermalism has been experiencing a peak in Spain. Already in 2005, a study by Ipsos-Eco Consulting pointed out that 19% of the Spanish population had gone to a spa or thermal center. This percentage is significantly higher in Bilbao (27%) and San Sebastián (29%) [22]. Thermalism has been present in Spain since remote times, and made significant contributions to medicine, historical heritage, and the tourism industry in the country. Additionally, the previously mentioned interest in health and wellbeing in modern society has diversified the demand for thermal establishments. This led to a myriad of new products and services, such as thalassotherapy, as well as packages that include accommodation and spa, and the combination of thermal services with other segments, such as cultural tourism, family trips, and corporate or business events.

In the specific case of Galicia, expectations regarding this sector are high, since, due to the richness of its thermal potential, Galicia is a national leader. According to a study on thermal tourism in Spain [23], Galicia is the main thermal tourism destination in the country, followed by Catalonia. More specifically, Galicia accounts for 19.29% of the national thermal tourism offer, while Catalonia is responsible for 16.6%. Moreover, Galicia counts with 300 catalogued springs and 21 spas, which together generate over 1400 direct jobs.

These numbers support the argument that having thermal resources is a great opportunity for a territory, especially because very few destinations worldwide offer springs with waters that have beneficial properties to the human body [24]. If well managed, such resources can lead to tourism development, job creation, and social improvements brought about by investments in facilities and conditioning of the thermal zones. The Health Route, in Michoacán-México [25], as well as Nuquí, Aguascalientes, and Machetá, in Colombia [26], are well-documented examples of how thermal resources can be used to boost local development through tourism.

Thermal tourism presents yet another great advantage, as it is not significantly affected by seasonality, and therefore can attract tourists during any time of the year [27]. This brings about many benefits to inland destinations, where these resources are normally located, such as in Galicia.

Normally, thermal tourism facilities are in the proximity of rivers, hence they are directly affected by water flow variations, particularly rises and floods. Between 1970 and 2013, flooding was the most frequent type of natural disaster in Latin America and the Caribbean [28]. The most recent example is the case of Río Hondo (Argentina), located on top of a 12 km hot spring and known as Latin America's main thermal center. The attraction is defined in Argentina's tourism website (welcomeargentina.com) as "a great thermal spa" that offers a new concept of tourism, as it combines health, pleasure, and recreation. The thermal activity is complemented by a tourist offer that includes excursions, hiking, fishing, nautical activities, horseback riding, and rural tourism, which are offered by a total of 25 hotels. The destination was visited by over 1 million tourists in 2014, which generated an economic impact of 100 million dollars [29]. Despite the significant economic benefits generated by the touristic exploitation of this area, in 2017, authorities had to open the floodgates of the Río Hondo reservoir, which could not contain any more water [29]. Therefore, in April of that year, the city was flooded due to the rise in the river's water level. In the city itself, 400 families were evacuated. In the thermal village, 78 km away, the fairground, the campsite, and the southern access were flooded [30]. Floods are common in summer, as rains are cyclic in this area. Aware of thermal tourism's economic importance, authorities built a dam, which has, however, already lost much of its retention capacity. The phenomenon happens periodically. Similar events took place in 1981, 1984, 2000, and 2007. On these occasions, however, the Río Hondo reservoir acted as a regulator [31].

A similar case occurred in Daymán's hot springs (Uruguay). Located 10 km away from the city of Salto, and almost 490 km from Montevideo, Daymán is the most visited thermal center in the region. The complex was created in 1957, and currently includes a lot of hotels and bungalows, as well as private and public swimming pools [32]. In July 2017, there were several floods around Salto due to

the rise in the Dayman River. The floods extended to Dayman hot springs; therefore, the facilities had to be closed for two days [33].

Another case happened in Peru, in April 2015, when the Municipality of Mayobamba had to suspend the activities of the San Mateo Thermal Baths (San Martín region). On this occasion, an overflow of two streams had caused a 30-meter crack on the reservoir's retaining walls, leading to water jets and hot pools [34].

As illustrated by the addressed examples, many thermal zones are susceptible to flooding, which is also true of the case analyzed in this study.

2.3. The Aquis Querquennis Complex

The Aquis Querquennis complex is located in Bande (Ourense, Galicia, Spain) on the banks of River Limia (Figure 2). Historical records point out that the complex was built during Vespasiano's reign (69–79 Before Cristo) [35]. After that, the place was occupied by a roman cavalry and infantry unit until around half of the following century. The first archaeological excavations at the site were carried out in the 1920s. In 1975, authorities authorized new studies focusing on the northwest area [36].



Figure 2. Thermal area. Source: Aquis Querquennis Foundation.

The complex includes three main zones: (I) The military campsite, known as “A Cidá”, “A Cibdade” or “La Ciudad”, which has a classic design (rectangular shape and two orthogonal main routes, covering an area of 3 hectares) and is considered one of the most important in the Iberian Peninsula; (II) the pilgrims' hostel; and (III) the hot springs (Figure 3).

Currently, there is also an interpretation center (Aquaes Querquenna–Vía Nova) just a few meters from the baths, which welcomes visitors and provides information about the complex. There is also the Quarquenia Museum, in the district of A Baixa Limia, which depicts the oldest period of the place's history—from Prehistory to Middle Age [37].

It is believed that the presence of thermal waters was the main reason for the establishment of human settlements in this site, as the ancient romans were already aware of the benefits offered by mineral medicinal water [38]. The water in the Aquis Querquenna is considered hyperthermal (over 45 °C), as its average temperature is 48 °C. Like the ancient Romans, residents and visitors alike enjoy the benefits of these waters, which, due to its properties, is indicated for treating rheumatism and for general skin care [38]. In 2018, the number of bathers increased significantly due to structural improvements carried out in the thermal baths area, known as “O Baño” (Figure 4). The complex currently attracts even foreign visitors, mainly from Portugal, whereas before the reforms, only residents attended [39].

Archaeological research in the area started in 1921, when a group of intellectuals were interested in the roman campsite, which led to the first excavations. In 1935, the complex started receiving visits from the Comisión Provincial de Monumentos Históricos y Artísticos de Ourense (Ourense's Provincial Commission for Historical and Artistic Monuments). The interest in the place's history, however, was paralyzed during the civil war. During Franco's regime, a reservoir (As Conchas) was built in the area, which caused flooding of a significant portion of the Limia River's banks. Consequently, in 1948,

the town of Baños de Bande, as well as the “A Cibdade” field and other sites of historical interest, such as the Pontepedriña bridge (considered historical-artistic monument), were totally submerged.



Figure 3. “O Baño” hot baths. Source: Turismo de Galicia (2015) [40].

In 1975, Rodríguez Colmenero, Herves Raigoso and Ferrer Sierra initiated the excavations. They discovered a Roman fort from the high imperial era, as well as a significant civil structure. Currently, the Aquis Querquennae-Via Nova Foundation focuses on developing, conserving, and promoting these archaeological remains. Such tasks have the added difficulty of facing periodic floods that affect the site. The water level of the reservoir varies according to the rainy season. Figure 4a shows the complex in a moment when the reservoir’s water level is low, whereas Figure 4b shows the moment when the water starts to cover the roman campsite area.



Figure 4. (a) Roman fort in 2006; (b) Roman fort in 2014. Source: romanarmy.eu (2016) [41].

3. Objective and Methodology

The present study consists of a preliminary analysis of a historical-heritage tourism resource’s vulnerability to flooding. To this end, the study examines the visitation patterns to the Aquis Querquenna complex, which is located by the banks of the As Conchas reservoir, and the water levels of said reservoir. As a secondary objective, the study aims to describe the profile of tourists and visitors who attend this type of tourist attraction, as well as tourism’s impact in the destinations (namely in the residents and the complementary tourist offer). To achieve these goals, records from 2008 to the present were retrieved from the Aquae Querquenna-Vía Nova Interpretation Centre, located near

the complex. Since 2017, the center has collected information on visitor's sociodemographic profiles, including gender, age, country or region of origin, and source of information through which they learned about the complex. The data regarding the relative level of water were retrieved from the Hydrographical Confederation, which keeps a daily record since 2011.

In-depth interviews have also been conducted with experts and technicians in the area.

The collected data on tourist demand and water levels were subjected to Pearson correlation analysis, in order to verify whether there is a statistically significant correlation between these two variables.

4. Results

Since October 2011, the Hydrographical Confederation keeps record of the water level in the As Conchas reservoir. The historical data show that the highest flow variations took place in 2013, 2014, 2016, and 2018, when the difference between the minimum and maximum values exceeded 10 meters (see Table 2).

Table 2. Historical maximum flow variations in the As Conchas reservoir.

Year	Max. Variation
2011	2.42
2012	7.26
2013	10.38
2014	10.83
2015	8.02
2016	11.00
2017	6.65
2018	11.06
2019	5.21

The accessibility to the different areas of the complex depend on the water level. In this context, there are water level thresholds that allow for the accessibility of specific resources. For example, the campsite area can be assessed when the water level is below 544.7 m. The thermal zone, in turn, is fully usable only when the water is no higher than 542.4 m (Figure 5). To obtain such control points, the water level has been measured exactly when each area was flooded.



Figure 5. Accessibility thresholds for the Aquis Querquennis complex's resources (control points for the hot baths and the campsite).

The historical data on the reservoir's level (Table 3) show that the minimum and maximum values follow a regular periodical cycle. The lowest levels take place near the end of the year (between November and January), whereas the highest levels happen at the end of spring (May and June). There are, indeed,

some exceptions, such as in 2012 and 2013, when the maximum values were registered in March and February, respectively, and the thermal zone remained totally accessible during the end of the year (September, October, November, December, and even January). Indeed, on several occasions, it was accessible even during the beginning of the year (in 2015 until April, and in 2017 and 2018 until March). The least favorable conditions for thermal activities take place in May and July, which are precisely when tourist demand in general is higher. The campsite, in turn, is best visited at the end of the year. Moreover, it can still be visited during August, as the water level threshold for its flooding is higher than that of the thermal baths.

Table 3. Minimum and maximum values of water level in As Conchas Reservoir.

Year	Minimum	Date	Maximum	Date
2011 *	537.62	10/10	540.04	12/04
2012	536.99	10/31	544.25	06/26
2013	537.32	10/23	547.70	03/29
2014	536.93	12/19	547.76	02/26
2015	537.63	01/14	545.65	06/20
2016	537.48	11/29	548.48	05/13
2017	536.89	12/07	543.54	05/24
2018	537.30	11/07	548.36	06/13
2019 **	540.95	01/05	546.16	04/12

* Data from October. ** Data until April.

Regarding the number of visits, data from the Interpretation Centre (Aquae Querquenna-Vía Nova), which keeps daily record of visitations since 2008 (Table 4), show that 2017 was the year with the most visits to date. A total of 7059 people visited the complex that year, whereas the annual average for the 2008–2018 period is 4718. This figure represents approximately 1.5% of the visits of the Ourense province.

Table 4. Annual number of visitors (2008–2018).

Year	No. Visitors Aquis Querquennis	No. Visitors Ourense	No. Visitors Galicia
2008	4557	616,535	7,790,366
2009	4866	560,041	7,444,456
2010	5595	550,677	8,174,138
2011	4305	296,194	3,354,067
2012	3405	271,399	3,216,346
2013	3023	267,089	3,374,160
2014	3870	262,772	3,647,751
2015	4981	289,277	4,086,189
2016	4592	312,542	4,326,401
2017	7509	317,019	4,495,651
2018	5199	341,840	4,206,677
Maximum	7509	616,535	8,174,138
Minimum	3023	262,772	3,216,346
Average	4718	371,399	4,919,638

The records also show that, during the last decade, August has consistently been the month with the highest number of visits. On seven occasions, over 1000 people visited the complex, and in 2010 and 2017, it received over 1400 visitors. As shown in Figure 6, in the last four years, the peaks in visitation take place in August, followed by July and the end of the year (September, October, or November). Such a trend has been noticed during the entire decade.

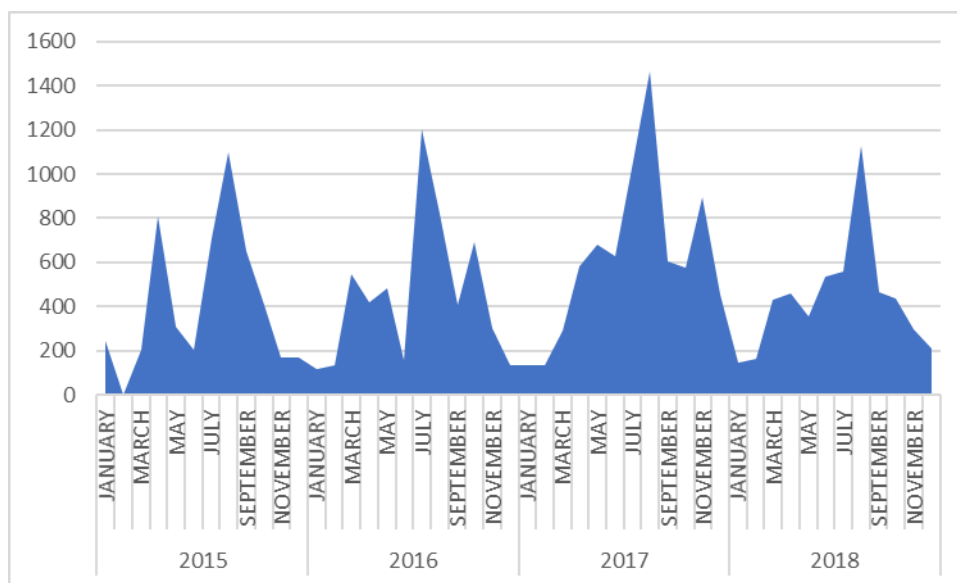


Figure 6. Visits to 2015 from 2018.

The data from the Interpretation Centre also include sociodemographic information about visitors. Regarding place of origin, 62% of visitors come from within Galicia, whereas 23.6% are from other parts of Spain and 14.2% from other countries. More specifically, 21% of visitors come from the Province of Ourense, where the complex is located, whereas 18% come from A Coruña, and another 18% from Pontevedra (two neighboring provinces). Regarding visitors from other parts of Spain, 13.5% of the total visitors come from Madrid (13.5%). Regarding international visitors, Portugal accounts for 10.1% of the total, which is expected, as the attraction is in a bordering zone (Figure 7).

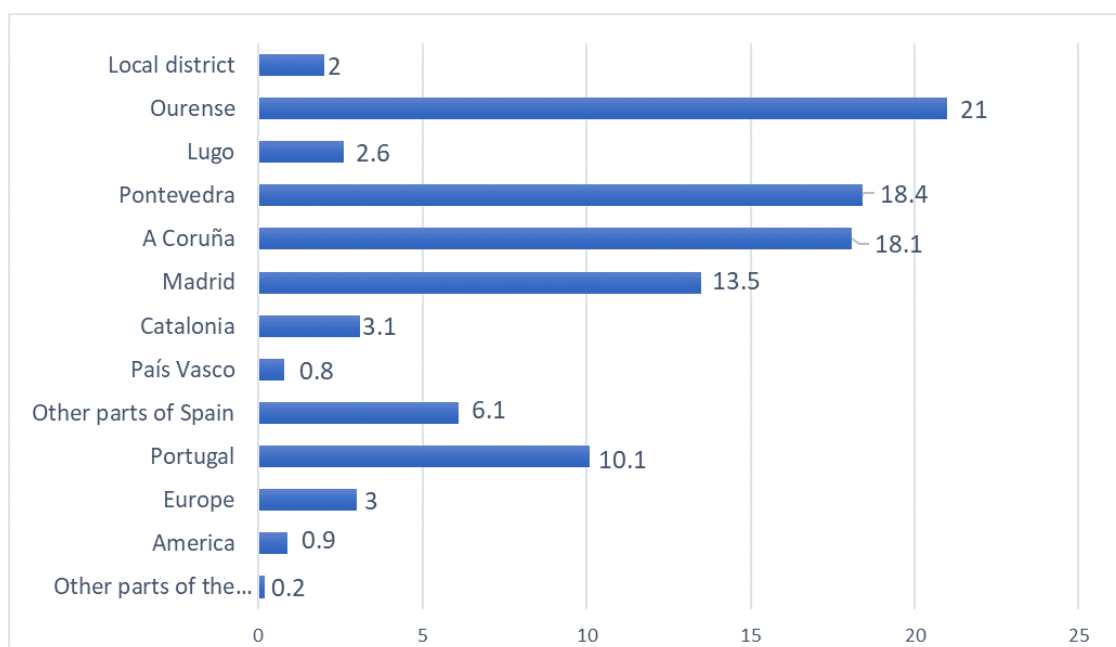


Figure 7. Place of precedence of visitors (%).

The data on gender show a very balanced demand, as men and women account for exactly 50% each. The most frequent age group is that of adults, between 30 and 65 years old (50%), followed by seniors (over 65 years old), which represent 22% of visitors. The remaining 28% is close to equally

distributed between the below 12 and the 12–30 groups. The high number of visitors below 12 years old is largely explained by school group visits.

Regarding the information source through which visitors learned about the complex, word of mouth and internet are by far the most utilized (Figure 8).

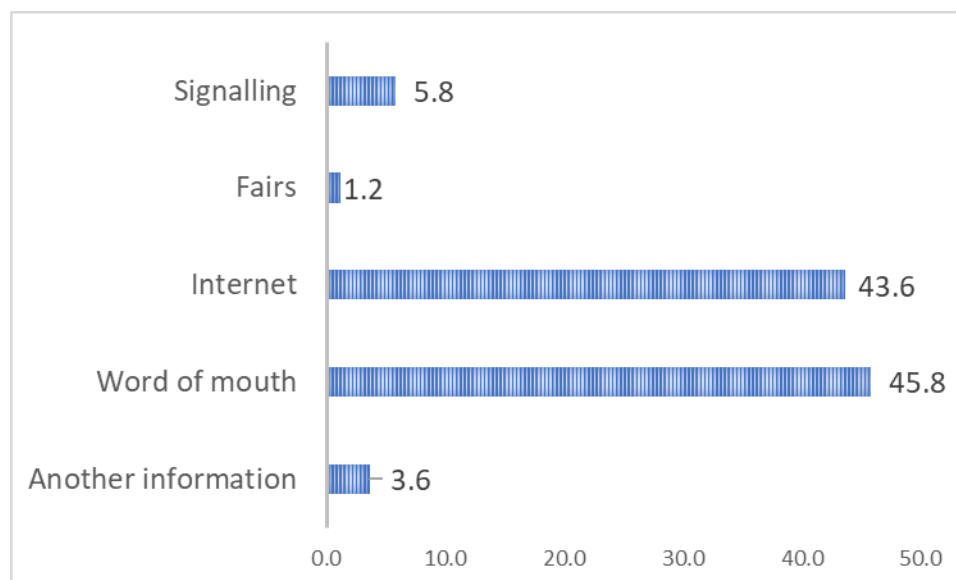


Figure 8. Information source (%).

On what concerns the relationship between the number of visits and water levels in the reservoir, the Pearson correlation test shows a correlation value of 0.03, with a significance level of 122 (above 0.05). Such results do not represent enough evidence of a clear correlation between the two variables. However, when considering the total visits per month, and the monthly average of water levels, the correlation value is -0.3 , and the significance level is 0.04 (below 0.05). Therefore, there is a clear negative correlation with an acceptable significance level, which is sufficient evidence of significant correlation.

Figure 9 shows the historical evolution of the total number of visits to the complex and the average water level in the reservoir for each month, which is distributed in four sections. The lowest value is for the lowest section (536.89 to 533.79 meters above sea level) and level 4 for the highest section (545.58 to 548.48 meters above sea level). The largest difference of the water levels was divided into four categories, and the scale was matched to that of the visits. The data show that the months with the highest number of visits indeed corresponds to those with the lowest levels of water in the reservoir, that is segment 1 or segment 2, which allow visits to both the thermal area and the campsite.

Regarding the qualitative component, interviews with local tourism experts showed that the Aquis Querquennis complex, including the thermal zone and the interpretation center (from which guide tours to the roman campsite depart), is one of the main local attractions. Moreover, the campsite is crossed by the Via Nova, a 318 km long ancient Roman road from the Flavia dynasty, which connected Bracara Augusta (Braga, Portugal) to Asturica Augusta (Astorga). The zone (Municipality of Brande) also features a significant religious heritage (churches, crosses, and chapels), including the Church of Saint Peter, the Visigoth Church of Saint Comba, the Corvelle Cross, the Vilea Cross, and the Chapel of Martiñán or Chapel of Buxán. Another local strength is its natural space, since part of the municipality integrates the Natural Park of Baixa Limia-Serra do Xurrés, which includes trekking and mountain biking routes, as well as lookout points, such as Xurrés, in the village of Xordos. The destination also offers a significant immaterial heritage, including the Entroido (carnival), in which participants wear a typical mask, the “troteiro”. There is also the fish party, at the end of May or beginning of June, and the party of Saint Roque, the town’s patron saint. The municipality also hosts the fair of endogenous resources, during summer. Finally, the region has a museum of icons, in a restored old house in Santa

Comba. The museum features Byzantine icons and classic paintings on tables and ceramics. Regarding accommodations and restaurants, there is a municipal hostel, a rural tourism property (Casa Mariña), several cafes, and three to four simple restaurants. Regarding residents' perception on tourism, they do not consider that the current tourist influx is big enough to impact their daily lives. A significant part of visitors to the thermal zone comes from the surroundings. Therefore, the attraction is seen as beneficial to residents, which consequently tend to have positive attitudes on tourism.

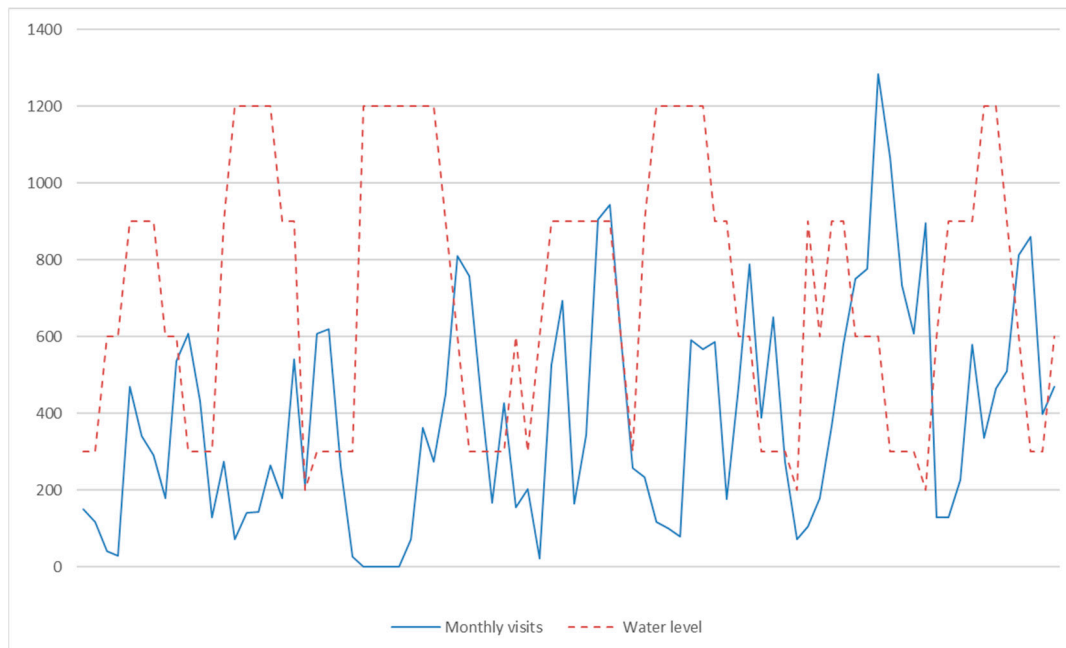


Figure 9. Monthly visits–water level comparison (2011–2018).

The zone includes mainly natural resources, which need to be capitalized on in order to attract a higher number of visitors.

5. Discussion and Conclusions

A vulnerability analysis must consider potential and actual damage caused to the tourism industry. Besides the economic aspects, such evaluation must include a range of heterogeneous dimensions, such as social, cultural, and environmental aspects, which may either intensify or mitigate the damage [16]. The number of visitors should be the first parameter to be considered in such evaluation, as it allows for a direct examination of the damage. It also allows for an objective comparison, either with other periods of time, for the same resource, and with other cases or flooded tourism resources.

The present study includes a brief analysis of the historical and heritage value of the examined resource. In this context, the visitors' influx is examined so that potential seasonality patterns are identified. The analyzed resource has an outstanding potential, but due to human action, it became significantly vulnerable to flooding. The building of an artificial reservoir has endangered the access to the complex, and even hindered the access to other attractions, such as the Pontepedriña bridge (considered a historical-artistic monument). Besides the historical value, the complex is also a thermal zone. Thermal waters are one of the main tourism resources of Galicia and are particularly important for the Ourense Province. Currently, thermal waters have a twofold appeal, including the health and the pleasure components, which diversifies the profile of visitors they attract [20,21]. In the examined case, the contact with nature further adds to such appeal, as the hot springs are nestled in a natural space. The thermal baths are used by both residents and tourists, which are attracted by the natural surroundings and the properties of the water. In this context, the attraction differentiates the region, and must be capitalized on, since very few destinations worldwide feature thermal waters with such

strong benefits to the human body [24]. Moreover, it is a type of tourism that should not be significantly affected by seasonality, since spas can be visited at any time of the year. The only exceptions are the exterior baths, which are typically close to rivers, and are thus affected by the water flows.

In this context, the present study shows that there are cyclical variations in the water levels in the As Conchas reservoir, and that those variations affect the accessibility to the thermal/archaeological complex. More specifically, results show that the accessibility to the complex is best during the last months of the year, when the water levels in the reservoir are the lowest. Moreover, the thermal zone is the part of the complex that is more easily flooded (i.e., the water level threshold for flooding it is the lowest).

The study shows that here is a significant correlation between the level of water and the tourist influx to the complex. The tourist influx is higher precisely in the months when the water level is lowest, and therefore, the complex is most accessible. These results reinforce those obtained by previous studies [8–10], as they show that flood impacts to the tourism industry include the decline of visitors' numbers and consequent business loss, damage to facilities and local infrastructure, and substantial rebuilding costs. Local authorities must recondition the complex after flooding events, making it attractive and accessible to visitors. Corroborating previous studies' contributions [14–16], this implies direct costs, but also indirect ones, since a significant part of the local tourist influx is drawn by this attraction, and tourism impacts other local industries (i.e., commerce, food, accommodations).

Moreover, results show that tourists get information about the current state of the access to the complex before-hand. Therefore, the influx is intensified when the attraction is most accessible. In this context, information diffusion through the internet plays a significant role, although word-of-mouth is the most used information source.

Future studies should advance the comprehension of this (and other) tourism resources' vulnerability, considering other aspects, such as potential damage to the attraction's tourism offerings and associated businesses, impacts to facilities or infrastructures and other types of indirect damage. Such knowledge would be useful for authorities and other decision makers responsible for implementing measures for adapting the resource to future threats and maintaining or promoting its value.

6. Managerial Implications

The present study results demonstrate the impact of the water level in the As Conchas reservoir on the tourist influx in the Aquis Querquennis archaeological and thermal complex. Moreover, the study verifies that the water level follows a cycle, with higher levels in spring and lower ones in the end of the year. In the face of such a scenario, destination managers must ensure that the damage caused by these partial flooding events are minimised, and that the resource is rapidly recovered, not least because it is the destination's main tourism resource. Namely, they need to periodically recondition the complex after each flooding, making it accessible and attractive to visitors again, as well as predict the next flooding in order to control the recondition. They must also use the information conveyed through the interpretation centre to make tourists aware of the periods in which they can visit the thermal baths, by highlighting the offer of visits in the end of the year. Such information must be clearly conveyed in all promotional channels in order to avoid receiving tourists that expect to visit the thermal baths when they are not accessible, as it might lead to frustration and, consequently, negative memories associated with the destination. Moreover, managers of the complementary offer must also be aware of this scenario, and consequently, intensify their offer and create complementary activities/experiences during the last months of the year.

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