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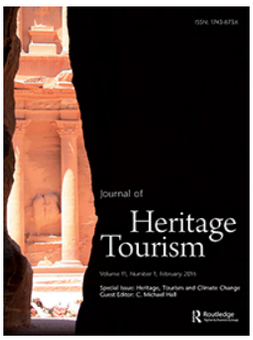

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RESEARCH NOTE

Built heritage and flash floods: hiking trails and tourism on Madeira Island

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High-magnitude, low-frequency rain events (heavy rains) have increased on the island of Madeira in recent years. The levadas, a built heritage of water canals, and one of the biggest tourist attractions on the island due to their role as hiking trails, have been repeatedly damaged as a result of heavy rains causing problems that affect stakeholders, regional governments and local communities. Using ethnographic methods this study analyses the relations between tourism, actors and climate change and especially the vulnerability of tourism spaces (hiking trails) as a result of increased risk and (in)security.

Keywords: heritage; tourism; flash floods; Madeira Island

Introduction

Increases in the impacts of catastrophic events and natural disasters have become indicative of the potential direct and indirect impacts of climate change on the tourism industry (Hall, 2010a; Jopp, De Lacy, & Mair, 2010; Moore, 2010; Zeppel, 2012). Tourism is susceptible to climate change because of the "reliance on the environment in many destinations for their attractiveness" (Hall & Higham, 2005, p. 9). However, the relationship between climate change and tourism is bidirectional, since tourist activity is impacted by, and is a main contributor to, climate change (Hall, 2008; Scott, Hall, & Gössling, 2012). Climate change may have important consequences for tourism activity (Gössling, Scott, & Hall, 2013). It can produce direct or indirect impacts on tourist destinations, affecting not only ecosystems and local populations but also social and economic systems thereby producing new geographies of tourism (Coles & Hall, 2006; Hall, 2010b; Kaján & Saarinen, 2013). If tourism systems are affected by climate change, this will be visible both in demand and supply (Hall & Higham, 2005; Scott et al., 2012). The climatés impact on tourism can therefore be either physical, physiological and/or psychological (de Freitas, 2003).

This paper focuses on natural high-magnitude low-frequency storm events (heavy rains) that affect not only the tourism industry and local communities but also the built heritage (Cassar, 2005; Hassler, 2006) in Madeira, namely the *levadas*, water canals that have been transformed into the biggest touristic attraction on the island as hiking trails. They have been repeatedly damaged due to heavy rains in recent years causing major problems

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that affect stakeholders, regional government and local communities. Based on ethnographic research the paper focuses on the relations between tourism, actors, climate change and infrastructures. Sources are anonymised throughout where appropriate.

Climate change, flash floods and tourism in Madeira

Madeira Island, along with Porto Santo the Desertas and Selvagens Islands, form the Madeira Archipelago, a Portuguese autonomous region located 900 km from mainland Portugal, 600 km from the Moroccan coast and 450 km north of the Canary Islands. Madeira Island (population over 260,000), is a mountainous island of 740.7 km². Due to its volcanic origin, its orography is characterised by deep valleys, steeped slopes, scarps and with a central mountain range 1200 m above sea level. It has a Mediterranean type climate moderated by the Atlantic Ocean.

The island's economy is based on the tertiary sector, and is dominated by public administration and tourism. In 2013, 917,493 tourists stayed in one of the 159 hotels in the region with the tourism sector accounting for 10% of GDP. Around two-thirds of the island is part of the Madeira Natural Park. The diversity of natural values and their preservation are indicated in several existing protected areas, including the Laurel Forest, which was inscribed as World Heritage in 1999 by UNESCO. Madeira with its natural and cultural attributes offers many tourism opportunities (Oliveira & Pereira, 2008; Fernandes, 2015). These factors contribute to the fact that this insular destination has been one of the traditional destinations for Northern Europeans since the nineteenth century, being especially popular among the British, German and Scandinavian markets (Table 1).

Research on the effects of climate change suggests that for the next 100 years in Europe, more flash floods are likely to occur in Southern Europe (IPCC, 2014a, 2014b; Kovats et al., 2014). These situations, included in extreme weather events, might affect destination attractions and infrastructure (Buckley, 2012; Scott et al., 2012). Rain-induced natural hazards in Madeira Island include flash floods, landslides and debris flows (Rodrigues & Ayala-Carcelo, 2003). Flash flooding in Madeira can be the most dangerous natural hazard; one flash flood in the Island in 2010 (Fragoso et al., 2012) caused around €1080 million in damage (Sauter et al., 2013). This phenomenon is known localally as *aluvião* (Quintal, 1999), and refers to flash floods affecting watercourses whose discharges and energy increase dramatically after intense rainfall episodes, dragging mud, blocks and debris, generating a strong and destructive current (Ribeiro, 1985).

"Levadas" and tourism in Madeira Island

Levadas are human-made irrigation canals with parallel monitoring pathways. They are used simultaneously by tourists, recreationists and peasants in Madeira Island. Since the

Table 1. Madeira Island main tourism indicators.

Tourism indicators	2013	2012	2013/2012
Total beds available	27,862	27,732	0.5%
Total guests	917,493	841,963	9.0%
Bed occupancy rate	59.3%	54.4%	+4.9 pp
Revenue per available room	34.83€	31.42€	10.9%

Source: Regional Directorate of Statistics of Madeira (DREM).

1940s they have come to cover almost the entire area of the island, and have become a regional cultural symbol, a space of consumption and cultural attraction for tourists who go to gaze at natural and cultural heritage. The majority of these canals are located in the Natural Park of Madeira (PNM), which also includes the Laurel Forest World Heritage site.

Blending the past and the present: heritage in use and irrigation

The construction of the levadas on Madeira Island dates back to the fifteenth century when the first settlers established themselves in the southern part of the island. Their primary function was the conduction of water for irrigated lands (Fernandes, 2010). Led by the development of the hydraulic plans of the island in the twentieth century, the state intervened forming a plan to build a network of canals that could conduct water from the northern slopes to the southern drylands, increasing the amount of irrigated area and combining energy production with the need for irrigation.

Although used primarily for irrigation, this built heritage started to be used by travellers to reach the northern coast of the island or to visit the Laurel Forest. The first reference to the levadas used for recreation and tourism purposes appeared in nineteenth- and twentieth-century travel guides (Brown, 1890, 1927; Power, 1935) and in travel literature of the time (Biddle, 1900; Brassey, 1885; Harcourt, 1851; Jones, 1909; White, 1851). In fact, these access points have always been available to various social actors, since in some cases they were the only roads leading to the more remote interior of the island.

Alongside their primary water supply functions, the levadas have become subject to new uses. They were converted into heritage/tourist attractions (Timothy & Boyd, 2003), and for that reason, these built landscape elements reflect their multiple and heterogeneous users (walkers, sightseers, hikers, farmers). In 2000, a Decreto Legislativo Regional n7-B/2000/M was created, pointing out some walking routes around the levadas for tourist enjoyment in the context of recreation and leisure. In addition, there was an increase in regional promotional initiatives surrounding this product, such as the investment in one project of redeveloping several trails to improve mobility. These initiatives were financed by the European Regional Development Fund (ERDF) and the Madeira Regional Development Association (ADRAM). The exponential growth of activities around the levadas has also been marketed by local tourism companies and groups and associations, as well as the development of the Madeira Islands Walking Festival promoted by Madeira's Bureau of Tourism.

In 2010, Despacho conjunto da SRTT e da SRARN –JORAM II série, n°157, 20.8.2010 revised the list of recommended walking routes, decreasing the initial list to 28. The reasons given by the Regional Directorate of Forests were:

> a careful selection of the routes targeted for intervention was needed based on the following criteria: Regional Representation (taking into account the demand), Quality of routes (ensuring thematical diversity), Safety walks (excluding routes where the danger involved cannot be overcome by upgrading measures), Cooperation with other entities. In this way, we guarantee a set of very interesting and amazing natural scenery, where you can choose a landscape exclusively mountain, forest, by the sea or mixed, thus stimulating the development of hiking tourism and consequently the rise and decentralization of tourist facilities in every county in the Region. (M.F., 13.10.2009)

Vulnerability, the tourism system and hiking trails

Since 2008, many of the walking routes have been closed for various reasons. According to the Regional Directorate of Forests and Nature Conservation, the closure of walking routes

is due to landslides, primarily because of stone falls and the entrainment of the trail surface where the surface sediment becomes fluid, caused by an excess of water, which then damages the trail floor. This may be influenced by climate change since changes in weather "will impact on the most exposed routes, that without maintenance, will degrade and put users at risk" (AZ). In 2010, for example, Madeira's walking routes were closed 19 times (see Table 2). This detail is related to one of the biggest flash floods registered in the island, mentioned above. Curiously the more frequently closed walking routes are those with higher flows of walkers (Fernandes, 2013), and which register a greater carrying capacity.

The closure of several walking routes (see Table 3) may affect the daily routines of local tourism companies that depend of these resources for some of their commercial guiding activities. If one of the routes on which popular walking tours are sold is closed, operators

Table 2. Frequency of closure.

Year	Number times walking routes have been closed
2008	3
2009	4
2010	19
2011	2
2012	6
2013	7
2014	6
Total	42

Source: Regional Directorate of Forests and Nature Conservation (2014).

Table 3. Closure of walking routes in Madeira Island (2008–2014).

Recommended walking routes	No. of times closed
PR 1 Vereda do Areeiro	5
PR 1.1Vereda da Ilha	1
PR 1.2 Vereda do Pico Ruivo	1
PR 1.3 Vereda da Encumeada	2
PR 2 Vereda do Urzal	1
PR 3 Vereda do Burro	1
PR 3.1 Caminho Real do Monte	1
PR 4 Levada do Barreiro	1
PR 7 Levada do Moinho	2
PR 9 Levada do Caldeirão Verde	5
PR 10 Levada do Furado	4
PR 11 Vereda dos Balcões	2
PR 12 Caminho Real da Encumeada	3
PR 14 Levada dos Cedros	3
PR 16 Levada Fajã do Rodrigues	1
PR 17 Caminho do Pináculo e Folhadal	2
PR 18 Levada do Rei	5
PR 20 Vereda do Jardim do Mar	1
PR 3 Vereda do Calhau (Porto Santo) (permanently)	1
Total	42

Source: Regional Directorate of Forests and Nature Conservation (2014).

have to find an alternative, thereby creating additional security and promotional work. Although, arguably, in some cases this could be a positive situation since these companies might then sell other walking routes that are less crowded (Fernandes, 2013).

Such potential changes in the supply of tourism products will be negative for some tourist companies in that they may result in fewer customers owing to a situation for which they have no direct responsibility. The following statement is indicative:

> I know there are customers who want to make certain pathways that, when they contact us to book, if the route is closed and no date for opening, does not come. More importantly (and Regional Directorate of Forests and Nature Conservation has this sensitivity by our insistence) is to have a team (or agreements with municipalities) with material from "rapid response" (cuts cables and cable balconies, chainsaws to remove trees and related equipment required to do so safely), thus allowing rapid resumption of deeper pathways for further intervention. (AZ)

Thus, if a tourist goes to Madeira to walk a specific route and it is closed, this could affect the island's image and potentially prejudice some businesses and the island's tourism system in the medium term since other destinations that sell a similar product, such as the Canary Islands (Fernandes, 2013), might remain more viable.

Safety, risk and security are issues of increasing significance in tourism since they are part of the attractiveness and stability of destinations (Hall, 2010a, 2015; Kaján & Saarinen, 2013). People who travel become aware of this, as stated by one hotelier:

> those seeking the mountain walks, know the risks associated with it and in practice some changes in tours, or even the closure of sections of the levadas, results from a risk analysis that is to be welcomed and that transmits security to anyone visiting us. (AJT)

although their effects on destination image tend to be underestimated (Lemelin, Dawson, Stewart, Maher, & Lueck, 2010; Machado, 2011; Ritchie, 2009).

Safety and risk issues are very important since they may affect the purchase of future travels, although risk is a common issue in the case of walking tourism (Timothy & Boyd, 2015). As stated by a traveller on Tripadvisor:

> After the recent landslip damage to the Island in early 2010 a number of the Levada walks on the island are still closed. For those that aren't, nearly all of them have some sort of damage to them, which may vary from the route being blocked by a fallen tree, to a Bridge or the actual Path being totally destroyed. We took in around 10 Levada walks recently towards the end of March, all of which were damaged to some extent. After talking to many other walkers on the Island they all had the same experiance on other walks, so the damage is quite extensive, and not just confined to the area in and around Funchal. Most of the obstacles can be overcome, assuming that you are reasonably fit, and don't mind a bit of scrambling around on your hands and knees, but there are a few where the damage is too bad and you cannot pass. Unfortunately, there is not really any way of knowing what to expect, as the condition of each Levada walk is not advertised anywhere, so you only generally find out by word of mouth, or your own experience. (In: http://www.tripadvisor.com.ph/ShowUserReviews-g189167-d547127-r89228696-Madeira_Explorers-Funchal_Madeira_Madeira_Islands.html, 20.01.2015)

To cope with existing and potential vulnerabilities (Ritchie, 2009), several strategies are needed in the regional tourism system, since this product is one of the most demanded by tourists who visit the island (Fernandes, 2013). One informant indicated that

> due to Madeira coastline climate change mainly affects the increase of danger or disappearance of some walking routes by the sea, by the increasingly frequent landslides. To remedy this problem, the entities – public and private – with intervention in the tourism sector should

work together to build safer alternatives in the interior of the island, or prepare to intervene with more frequent maintenance of pathways, especially the most problematic. (MO)

Conclusion

This paper discussed the relations between tourism in Madeira Island, the levadas and climate change, more specifically, the vulnerabilities of a built heritage tourism product. Repeated damage to the levadas has caused some problems in the regional tourism system. The trails along the canals often suffer damage as a result of storms that are only expected to get worse as a result of climate change, and it affects the activities of tourists and the local tourism companies that guide them. The regional government is responsible for maintaining these spaces. However, it costs millions of euros annually, and sometimes there is not enough funding to support the work. As yet there is also no strategy to cope with climate change in the region, meaning that this traditional destination has much work ahead to deal with managing the vulnerabilities of these tourism spaces and adapting to the impacts of climate change.

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