



Sustainability challenges of Hungarian lakeside destinations – Lake Balaton and Lake Velence

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Abstract

Lakeside settlements are among the tourist destinations most exposed to climate change and anthropogenic pressure. In landlocked Hungary, Lake Balaton and Lake Velence are key destinations, and in the summer of 2026 both saw a marked decline in visitor traffic. This paper examines how climate change, anthropogenic pressure and economic factors jointly affect the sustainability of the two destinations, and outlines regulatory directions for adapting their tourism. The study draws on recent scientific literature, statistics, the results of an earlier visitor survey and expert statements reported in the press. The findings show that rising water temperatures, more frequent heatwaves and droughts, falling water levels and deteriorating ecological status directly threaten the natural basis of bathing-based tourism, with Lake Velence being the most vulnerable. These effects are compounded by the overdevelopment of the shoreline and the degrading quality of reed beds. Demand is further weakened by economic factors such as the strong forint (HUF) and the growing attractiveness of foreign destinations. A fall of around 20% in hospitality turnover on the southern shore of Lake Balaton and in attendance at the main beach in Siófok, together with a 5.2% decrease in foreign guests at Lake Balaton, illustrates the problem. The paper concludes that preserving the tourist appeal of Hungarian lakes requires sustainable lake management, with special emphasis on the protection of shoreline habitats and restrictions on construction. Furthermore, the tourism offer should be diversified and regulations should facilitate the sustainable development of lakeside tourist destinations.

Keywords

climate change, lake tourism, sustainable tourism, Lake Balaton, Lake Velence

1. Introduction

Tourism is one of the economic sectors that respond most sensitively to changes in the natural environment. Tourist destinations built on natural and recreational resources – landscapes, bodies of water, forests and mountain areas – are particularly vulnerable to climatic change and anthropogenic pressure. The relationship is two-way: while climate change threatens destinations, tourism itself contributes to environmental degradation through emissions, land use and resource consumption (Mann et al., 2025).

This has been felt in Hungary as well: in the summer of 2026, visitor numbers at Lake Balaton and Lake Velence, both traditionally major attractions, fell considerably. The strengthening of the Hungarian currency also contributed to this, as a result of which Hungarian tourists visited the Croatian coast in greater numbers instead. Given that increasingly frequent drought summers and heatwaves that count as extreme under Carpathian Basin conditions must be reckoned with in the near future, solutions must be found to the problems of tourist destinations that rely on bodies of water.

In this article I address this complex set of problems and outline proposals for transforming tourism in the regions concerned. In line with the concept of cognitive sustainability, which emphasises the role of knowledge, awareness and

cognitive capabilities in shaping sustainable processes (Zöldy et al., 2022), the article also considers how stakeholders perceive and respond to these changes.

2. Data and methods

The study is a qualitative, exploratory case study of two Hungarian lakeside destinations, Lake Balaton and Lake Velence. The two lakes were selected because they are the country's most important bathing lakes and, as shallow lakes, both are highly sensitive to climate change, while differing in size, tourist appeal and the severity of the problems they currently face. This makes it possible to compare a destination under acute pressure (Lake Velence, 11 km long) with one where similar processes are at an earlier stage (Lake Balaton, 77 km long) (Figure 1). The analysis focuses on the 2026 summer season, placed in the context of longer-term trends.

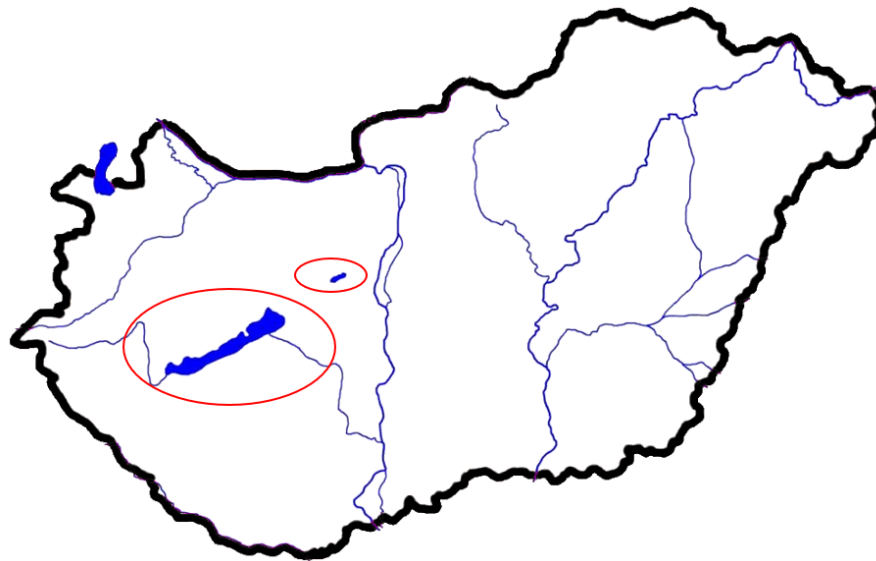


Figure 1. Lake Balaton (left) and Lake Velence (right) (Edited by the author)

The research is based on secondary data from four types of source. (1) Peer-reviewed scientific literature, complemented by a popular-science summary of long-term water temperature measurements by researchers of the Balaton Limnological Research Institute (Tóth and Li, 2025); (2) The results of an earlier questionnaire survey of visitor preferences at Lake Velence (Wirth, 2017), used to assess how dependent the destination is on bathing. (3) Official statistics by the Hungarian Central Statistical Office (KSH, 2026). (4) Articles published in the Hungarian national economic and tourism press between July and September 2026, which report data and statements from key stakeholders. These sources are complemented by the author's own field observations, made on the shoreline of Lake Velence at Velence in April 2026 and at Lake Balaton in September 2026.

The material was analysed through qualitative content analysis. The information was grouped into three dimensions: (a) climatic and hydrological changes, (b) anthropogenic and ecological pressures, and (c) economic factors affecting tourism demand. Wherever possible, figures reported in the press were cross-checked against official statistics, and discrepancies between sources are discussed explicitly. On this basis, the study identifies the main risks to lakeside tourism and formulates regulatory directions for its adaptation.

The study has several limitations. Press sources are not peer reviewed and partly reflect the interests of the stakeholders quoted; the official statistics cover a single month; the field observations were not systematic; and no primary data were collected. The relative contribution of climatic and economic factors to the decline in tourism therefore cannot be quantified here, which remains a task for further research.

3. Results and discussion

In recent decades, clearly perceptible trends have been observed in many parts of Europe, including Hungary, in changing temperature conditions, in the uneven distribution of precipitation, and in the increasing frequency of extreme weather



events. At the same time, tourist traffic is growing, and the recreational pressure on protected natural areas is intensifying. As a consequence, tourism infrastructure is expanding – not infrequently in ecologically vulnerable areas (Robak, 2026).

According to regional climate models, significant changes in climatic conditions are expected in Hungary: an increase in the number of heatwave days, on which the daily mean temperature exceeds 25 °C, is anticipated, as is a higher frequency of heavy rainfall (Sági and Buzási, 2024).

In landlocked countries, including Hungary, lakes are major tourist attractions. It is therefore a very serious problem that they are particularly sensitive to the extreme drought caused by climate change. Water levels are declining in about half of the world's lakes. In addition, lake ecosystems are severely affected by oxygen depletion resulting from heatwaves, which can lead to fish kills and algal blooms. These processes, in turn, also affect the use of lakes for tourism (Woolway et al., 2025).

Climate change manifests itself primarily through the transformation of hydrological conditions, the rise in surface water temperatures, the increasing frequency of extreme precipitation events, and the shortening of recreational seasons. Anthropogenic pressure, by contrast, is reflected in the recreational overloading of natural sites, the pollution of water resources, and the uncontrolled development of tourism infrastructure (Robak, 2026).

The decline is also reflected in the figures: for example, the turnover of hospitality businesses on the southern shore of Lake Balaton fell by around 20 per cent this year compared with 2025 (Turizmus.com, 2026). This is somewhat contradicted by data published by the Hungarian Central Statistical Office (KSH) in September 2026, according to which the number of domestic guests arriving at tourist accommodation around Lake Balaton rose by 1.8% (KSH, 2026). It is also true, however, that the number of foreign guests arriving at tourist accommodation was 3.0% lower in Budapest and 5.2% lower at Lake Balaton (KSH, 2026). Among the most important source countries, considerably fewer visitors came to Lake Balaton in 2026 than a year earlier from Slovakia, Germany and the Czech Republic (Pénzcentrum, 2026). At national level, the KSH data – also reported by Infostart (2026b) – show that the number of guests decreased by 0.4 per cent, while the number of guest nights increased by 0.3 per cent compared with the previous year (KSH, 2026).

However, the tourist appeal of Lake Balaton and Lake Velence has declined not only because of the direct problems arising from climate change; the growing purchasing power of the Hungarian currency, the forint (HUF), has also played a part. In the summer of 2026, for example, owing to the strong Hungarian currency, far more Hungarians visited the Croatian coast than in any previous year (Járdi, 2026).

According to Péter Makkos, head of the South Balaton group of the Association of Retail and Hospitality Entrepreneurs (KISOSZ), it must be accepted that “water and sunshine cannot be sold at the price of gold”, referring to the cost of a holiday for a family, including parking fees, beach admission and charges for toilets. Because of falling turnover, high costs and labour shortages, many lakeside hospitality businesses have fallen into crisis; some have given up, while others now open only at weekends (Turizmus.com, 2026). Beyond the economic difficulties, a greater long-term problem may be the local deterioration of water quality caused by climate change (Figure 2), or even the disappearance of the very body of water that constitutes the tourist attraction (Figures 3–6).

Furthermore, because of extremely high summer temperatures, bathing habits are also changing radically. According to Makkos, many people now only go bathing in the afternoon in the heat, so there should be a switch to Mediterranean opening hours: closing in the afternoon and opening in the evening and at night (Turizmus.com, 2026). Such shifts in timing are one of the typical ways in which tourists adapt to climate change, alongside changing their destination or their activities (Gössling and Scott, 2026).



Figure 2. Lake Velence turned chartreuse in 2026, probably due to an algal bloom, as seen from space (*Copernicus / Sentinel-2 photos in Varga, 2026*)

At Lake Velence, the signs of drying-up due to warming were especially apparent: empty beaches and stretches of shoreline, closed snack bars, as if on a late-autumn Sunday – with one enormous difference: the thermometer showed more than 35 degrees in the shade, and in places the water had retreated several tens of metres from the shore, although even where it had not, there were few bathers in the water (Turizmus.com, 2026). My personal experience in this regard is that in April 2026 the water surface on the Velence stretch of the lakeshore already visibly began several metres away from the shore. The lake had already reached record low water levels in 2021–2022, and a climate risk assessment of Lake Velence identifies beach, bathing and angling tourism as the activities most vulnerable to climate change (Boromisza and Harea, 2023). By September 2026, water levels had remained consistently 40 cm below the previous record low of 2022, as shown by official records (Figure 3).

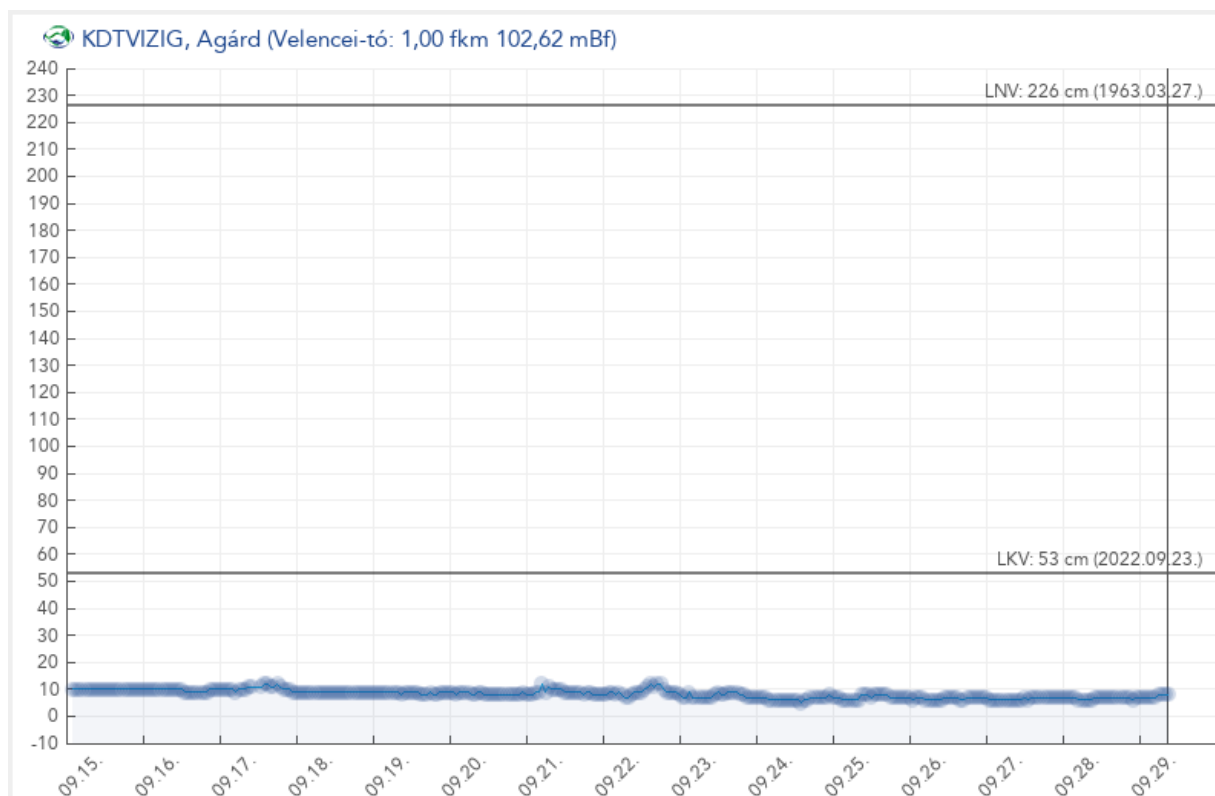


Figure 3. Water levels at Agárd, Lake Velence, in September 2026 (*Vízúgy, n.d.*)

Because of drought summers, fewer foreign and domestic guests are expected to come to Lake Balaton or Lake Velence. As Hungarian summers grow ever hotter, northern destinations such as Scandinavia are gaining in value, which also puts Hungary in a difficult position in terms of tourism (Infostart, 2026a). This is consistent with international findings that tourists are becoming increasingly flexible in their choice of destination and season, and that in the near term rising climate-related costs are likely to be the main factor shaping changes in demand (Gössling and Scott, 2026). These adaptive decisions are essentially cognitive processes: visitors increasingly rely on digital information when deciding whether, when and where to travel, which illustrates how digital tools extend human cognition in sustainability-related choices (Zöldy et al., 2022). Such information may include weather forecasts, satellite images and real-time water-level data, such as those documenting the changes at Lake Velence in this study (Figures 2 and 3).

In the case of Lake Velence, too, the greatest problem would be if the body of water that constitutes its main attraction became unsuitable for bathing or disappeared altogether (Figure 4). This is clearly supported by the research of Wirth (2017). According to his survey, the primary preference of the majority of respondents (84.41%) remained beach-going and bathing. The secondary preference, however, was not wellness (14.3%), water sports or health tourism (16.2%), but cycling (41%). Events and hiking each appealed to almost 28% of respondents, whereas visiting wineries (13.63%), fishing (12.3%), horse riding (2.6%) and other activities (5.2%) were less popular. The position of Lake Velence among Hungary's lakes as a tourist destination is faithfully reflected in the fact that 58% of respondents preferred Lake Balaton, to which the much smaller and less attractive Lake Velence (18% of mentions) cannot be a real competitor. The situation is further complicated by the fact that natural processes at the lake tend towards its lower, pre-regulation water level, whereas tourism and other economic activities depend on an artificially maintained high water level, which creates a fundamental conflict between ecological and economic interests (Boromisza and Harea, 2023).



Figure 4. Water has disappeared from parts of Lake Velence, 3 July 2026 (Photo: Zoltán Adrián, in Csóti, 2026)

Lake Balaton faces similar difficulties, although the problem is not yet as severe as in the case of Lake Velence. Because of climate change, the expected increase in the frequency of low water levels, the spread of invasive species, new forms of algal growth and increasing tourist pressure, the future state of Lake Balaton is difficult to predict. For the sake of sustainable lake use, natural habitats must be preserved, external loading reduced and adaptation to the changing climate achieved, while Lake Balaton continues to fulfil its ecological, recreational and economic role. The management of Lake Balaton is therefore the art of balancing the preservation of good ecological status with human use, which requires continuous dialogue and science-based water and land management (Erős and Vasas, 2026). Considering conditions in Hungary, this approach should be applied generally to all Hungarian lakes.



Figure 5. The shoreline of Lake Balaton has retreated by approximately 20 metres. Balatonalmádi, September 2026 (Author's photo)

Since Lake Balaton is not only a tourist destination but also a significant water resource and an important habitat, the lake should be managed in an integrated way, as a hydrological and ecological unit. However, in recent decades, and especially over the past 16 years, the preservation of Lake Balaton as an ecological unit has not been a priority.

According to Gábor Vasas, Director General of the Balaton Limnological Research Institute, Hungary's large shallow lakes (Lake Balaton, Lake Fertő, Lake Velence and Lake Tisza) are especially sensitive to the challenges posed by the weather, that is, by climate change. The summer of 2026 brought these problems into particularly sharp focus. The average water temperature of Lake Balaton, for example, has risen significantly over the past fifty years. The number of days with water temperatures above 25 °C has increased dramatically, exceeding 70 in 2026. Long-term measurements show that the warming of the lake has accelerated sharply in the last two to three decades: since 2000 its water has warmed by about 0.07 °C per year, making it about 1.7 °C warmer than at the turn of the millennium, while lake heatwaves have become more frequent and longer (Tóth and Li, 2025).

Warming also favours heat-tolerant aquatic plants with spiny leaves that are unpleasant for bathers, the spread of invasive species such as *Vallisneria spiralis*, which already occupied about 40 km of shoreline in the western basins by 2024, and a higher risk of algal blooms – all of which directly reduce the lake's appeal for bathing (Tóth and Li, 2025). Moreover, the first heatwave of 2026 and the so-called heat dome caused the water to warm to around 30 °C down to a depth of 3–4 metres. A significant problem is that most of Lake Balaton's biota lives in the littoral zone. This zone could be very rich in wildlife if it were left alone. The lack of extensive reed beds, however, is a serious problem, not only for wildlife but also for water clarity. As the lakeshore is already overdeveloped, wildlife is increasingly being displaced from its natural habitats (Világgazdaság, 2026b).



Figure 6. Alarming low water levels at Lake Balaton on 27 August 2026 (Photo: Márton Mohos, in Csóti, 2026)

Despite legal regulation, insufficient attention is paid to the ecological system of Lake Balaton. Construction along the shores often takes place at the expense of natural habitats. The shoreline at Balatonfüred, for example, has been almost entirely built up. The most important element in maintaining water clarity and the ecological balance of the lake is the preservation of the shoreline reed and bulrush communities. According to surveys of the extent of reed beds at Lake Balaton, the reed area is not shrinking; quite the contrary: between 2008 and the most recent survey in 2020, the area of reed beds outside the lakebed nearly doubled, while their total area within the lakebed has remained around 1,200 hectares, changing very little. This does not, however, represent a clear improvement: despite all the positive signs, the quality of the reed beds continues to deteriorate. Furthermore, the construction of numerous blocks of flats and holiday estates is harmful not only because it destroys natural assets; sooner or later, those who like to visit Lake Balaton may also lose the familiar and much-loved scenery, which is one of the main tourist attractions of Lake Balaton and its surroundings (Kun, 2022).

Apart from the ecological factors already mentioned, economic problems are also a significant driver of the decline in tourism. In 2026, attendance at paid beaches in Siófok fell markedly. For example, almost one in five visitors disappeared from the Nagystrand (Main Beach) in Siófok, as people are now economising even on beach admission at Lake Balaton. Róbert Lengyel, Mayor of Siófok, reported that visitor numbers at the Siófok Nagystrand had fallen by around 20 per cent, while a decline of about 10 per cent had been measured at the paid beach in Sóstó. As a result, the beaches operated by Balaton-Parti Kft. may have lost approximately HUF 70 million in ticket revenue (Világgazdaság, 2026a).

For Lake Balaton and its region to survive both as a natural ecological unit and as a tourist attraction, sustainable lake management, settlement development and tourism development must be established. Since the main objective of sustainable tourism development is to strike a balance between meeting tourism demand and preserving the region's ecological assets (Gyurkó and Csegődi, 2024), the current comprador-type land use is entirely unsustainable. International experience shows, however, that although knowledge about the effects of climate change on tourism is available, its translation into action at destination level is often hindered by imprecise concepts, misaligned levels of governance and competing stakeholder priorities (Hübner and Ioannides, 2026). From the perspective of cognitive sustainability, this knowledge-to-action gap is itself a cognitive challenge: sustainable lake use depends not only on regulation but also on how local stakeholders, decision-



makers and visitors perceive, interpret and act upon the available knowledge about environmental change (Zöldy et al., 2022).

What regulatory instruments could facilitate sustainable lake management?

- Environmental regulations: these can limit pollution, protect local wildlife and regulate the use of natural resources.
- Spatial development regulations: these can steer the development of tourism infrastructure, protect the landscape and restrict building density.
- Tourism regulations: these can encourage sustainable tourism practices, limit mass tourism and promote the development of the local economy.

4. Conclusion

In this study I have examined the relationship between climate change, anthropogenic pressure and tourism through the example of Hungarian lakeside tourist destinations, primarily Lake Balaton and Lake Velence. The relevance of the research lies in the fact that the heatwaves, periods of drought, extreme precipitation events and rising water temperatures that are becoming increasingly frequent as a result of climate change directly threaten the natural foundations of recreational tourism based on bodies of water. These processes are further intensified by the development of shoreline areas, habitat fragmentation, the growing burden of tourism infrastructure and anthropogenic impacts on water quality.

In the case of Lake Balaton, and Lake Velence in particular, the state of the water body fundamentally determines the tourist appeal of the destination. Falling water levels, warming water, deteriorating ecological status and the transformation of shoreline habitats therefore represent not only an environmental risk but also a significant economic and tourism risk. At the same time, tourism demand is not influenced by environmental change alone: the economic environment, prices and the growing attractiveness of foreign destinations are also significant factors.

In order to preserve the tourist appeal of wetland areas, sustainable lake management, the preservation of natural shoreline habitats and reed beds, the restriction of construction, and the adaptation of tourism infrastructure to climate change are of paramount importance. In addition, the tourism offer needs to be diversified so that destinations depend less exclusively on bathing and the summer season. Sustainable development requires coordinated environmental, spatial development and tourism policy regulation that simultaneously ensures the preservation of natural resources, the viability of the local economy and the long-term adaptive capacity of tourism. Strengthening the cognitive dimension of sustainability – environmental awareness, access to reliable information and the capacity of local communities and visitors to learn and adapt – is therefore an essential condition for the long-term resilience of lakeside destinations. As the study relies on secondary data and a single tourist season, further research based on primary visitor surveys and longer time series is needed to quantify the relative weight of climatic and economic factors in the decline of lakeside tourism.

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