CONFERENCE PROCEEDINGS/FULL PAPERS
ISBN: 978-625-90336-3-1/October 2026

"48th RSEP International Conference on Economics, Finance and Business" 1-2 October 2026, University of Washington Rome Center, Rome, Italy

Crisis, Climate, and Tourism: Mitigating the Effects of Natural Disasters on Tourism Infrastructure by Polish Local Government Units (2008–2025)

Zbigniew Nobert Piepiora
Assoc. Prof., Division of Socioeconomic Studies, Institute of Spatial Management, Faculty of Spatial Management and Landscape Architecture, Wrocław University of Environmental and Life Sciences, Wrocław, Poland
E-mail: zbigniew.piepiora@upwr.edu.pl

Justyna Bagińska
PhD, University of Wrocław, Wrocław, Poland
E-mail: justyna.baginska@uwr.edu.pl

Paweł Adam Piepiora
Prof., Department of Sport Didactics, Wroclaw University of Health and Sport Sciences, Wrocław, Poland
E-mail: pawel.piepiora@awf.wroc.pl

DOI: https://doi.org/10.19275/RSEPCONFERENCES402

Abstract

Poland is one of the countries affected by natural disasters which cause damage to tourism facilities. Therefore, the aim of this article is to obtain knowledge about the expenses of Polish Local Government units for mitigating the effects of natural disasters, affecting tourism facilities. The method of data analysis from the EM-DAT and BDL GUS databases was used. The time frame of the analysis included the period of 2008-2025, and the spatial scope covered the territory of Poland. It was shown that in the budget sections of provinces, concerning tourism facilities, expenses for mitigating the effects of natural disasters were incurred only in the Dolnośląkie province in 2024. The only county that spent funds on mitigating the effects of natural disasters in tourism facilities in 2025 (as shown in the budget sections) was Lidzbark county in Warmińsko-mazurskie province. In turn, in municipalities and cities with county status, expenditures on disaster recovery in relation to tourism facilities was incurred in the Dolnośląskie, Lubuskie, Małopolskie, Opolskie, Podkarpackie, Pomorskie, Śląskie, and Zachodniopomorskie provinces. The highest expenditures for disaster relief were recorded in 2013 and 2025. It was found that adequate financing of disaster relief will translate into better infrastructure of tourism facilities.

Keywords: disaster recovery funding, local government finance, Poland, tourism economics
Jel codes: H12, Q01, Z32

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1. Introduction

Over the first quarter of the 21st century, more than 10,000 natural disasters were recorded worldwide, with floods and storms accounting for over two-thirds of these events. These disasters resulted in nearly 2 million fatalities, affected approximately 5 billion people, and caused cumulative economic losses exceeding USD 5 trillion. In Europe alone, over 1,300 natural disasters were registered over the past 25 years – predominantly floods, storms, and extreme temperatures. These European events claimed approximately 330,000 lives, affected around 20 million individuals, and generated aggregate financial damage exceeding USD 400 billion. In Poland, between 2001 and 2025, more than 50 natural disasters were recorded, similarly dominated by storms, extreme temperatures, and floods. These events accounted for over 5,000 fatalities, affected nearly 0.2 million people, and incurred total economic losses close to USD 7 billion (EM-DAT, 2026), damaging, among other assets, infrastructure dedicated to tourism (Piepiora et al., 2023).

In Poland, data on public expenditure for post-disaster recovery have been systematically collected since 2008 by the Local Data Bank of Statistics Poland (GUS) under the *Public Finance* category. These data are structured across specific administrative expenditure groups: province (voivodeship) budgets, powiat (county) budgets, and municipal (*gmina*) budgets, including cities with powiat status. Within each of these categories, there is a dedicated subgroup titled "Expenditure incurred under chapters *78 – post-disaster recovery in selected budget divisions"*, which is further broken down according to budgetary classification divisions. Notably, expenditure on tourism is explicitly isolated under Division 630 (*Tourism*), whereas Division 926 (*Physical Culture*) excludes tourism activities in accordance with the national Sports Act (Local Data Bank, 2026).

Given that expenditure on physical culture – comprising sport, physical education, and physical rehabilitation (excluding recreation) pursuant to the Sports Act – falls under Division 926 (Act, 2026), it was examined in a separate study (Piepiora et al., 2026). Consequently, the present article focuses on the analysis of public expenditure incurred for post-disaster recovery between 2008 and 2025 specifically within Division 630 (*Tourism*). Here, tourism is conceptualised in line with UN Tourism (2025) as: *"a social, cultural, and economic phenomenon which entails the movement of people to countries or places outside their usual environment for personal or business/professional purposes. These people are called visitors (which may be either tourists or excursionists; residents or non-residents) and tourism has to do with their activities, some of which involve tourism expenditure."* Accordingly, the main objective of this paper is to evaluate local government units' (LGUs) budgetary expenditure allocated to post-disaster recovery within the tourism sector in Poland.

2. Literature Review

Disasters are defined as sudden, high-impact events causing significant human suffering, economic losses, and long-term socio-spatial transformations (Alexander, 1993; Abbott, 2009; Piepiora, 2012). Existing scholarship on mitigating the impacts of natural hazards on tourism infrastructure spans diverse geographical scales and sectoral contexts. At the macroeconomic level, structural damage to transport and tourism assets can severely destabilise national economies, particularly in vulnerable island states. For instance, Marto et al. (2018), evaluating the aftermath of Cyclone Pam in Vanuatu, demonstrated that post-disaster infrastructure recovery imposes critical debt sustainability challenges when tourism and agricultural losses wipe out substantial shares of GDP. Despite tourism's vital economic role, post-disaster recovery efforts in the sector are frequently marginalized by non-governmental organisations (NGOs), which tend to prioritise traditional livelihoods such as agriculture or fisheries (Robinson & Jarvie, 2008).

Beyond macroeconomic impacts, post-disaster recovery is constrained by institutional, political, and social dynamics. Spatial and political-economic inequities often emerge during recovery processes, as documented by Sovacool et al. (2018) across various global disasters, highlighting the need to safeguard vulnerable populations from systemic marginalisation. Effective recovery, therefore, increasingly relies on participatory, subnational governance frameworks. As Dunning (2020) demonstrated in coastal Texas following Hurricane Harvey, multi-stakeholder engagement and simulation exercises enhance adaptive capacity and policy implementation within coastal hazard management.

From a fiscal perspective, natural hazards exert profound pressures on public finances by inflating short-term expenditures while depressing tax revenues (Deryugina, 2022). To counteract these disruptions, innovative economic models have been proposed; for example, Udeorah et al. (2026) explored ecotourism financing as a strategic tool to generate economic value from environments affected by land degradation in Nigeria. In Poland, Piepiora et al. (2026) evaluated local government units' (LGUs) fiscal responses to disaster damage between 2008 and 2024 using EM-DAT and Polish Local Data Bank (BDL) records, identifying distinct spatial-temporal spending patterns. However, their analysis focused on Section 926 (*Physical Culture*), which excludes tourism. Consequently, local government financing for post-disaster recovery specifically targeted at the tourism sector in Poland remains an unaddressed research gap that the present study seeks to fill.

3. Data & Methodology

The methodological design of this study was structured into seven distinct analytical stages.

First, a comprehensive literature review was conducted across the Scopus and Google Scholar databases (Google Scholar, 2026; Scopus, 2026) to establish the theoretical and empirical context. The search query incorporated exact-match and multi-term keyword combinations, including: *"Financing the Removal of the Effects of Natural Disasters in Tourism Facilities by Local Government Units in Poland"*, *"Financing the Removal of the Effects of Natural Disasters in Physical Culture Facilities by Local Government Units in Poland"*, *"Financing the Removal of the Effects of Natural Disasters in Tourism Facilities"*, *"Financing the Removal of the Effects of Natural Disasters in Physical Culture Facilities"*, *"Financing the Removal of the Effects of Natural Disasters in Tourism Infrastructure"*, and *"Financing the Removal of the Effects of Natural Disasters in Physical Culture Infrastructure"*.

Second, empirical data regarding the occurrence and impacts of natural hazards in Poland, set against European and global trends for the period 2001–2025, were retrieved from the International Disaster Database (EM-DAT, 2026).

Third, socio-economic and budgetary data spanning 2008–2025 were extracted from the Local Data Bank (BDL) of Statistics Poland (Local Data Bank, 2026) across four administrative tiers: national, province (voivodeship), county (*powiat*), and municipal (*gmina*). The collected variables encompassed:

- Population size;
- Municipal and regional public expenditure incurred under chapters ***78 (*post-disaster recovery*) explicitly within Division 630 (*Tourism*).

Fourth, quantitative data processing was executed using spreadsheet software. To account for inflation and reflect the real purchasing power of money over time, historical expenditure figures recorded in Polish Zloty (PLN) at current prices for 2008–2025 were deflated using the Consumer Price Index (CPI) annual averages (Statistics Poland, 2026). Furthermore, absolute chain increments were converted into relative fixed-base growth rates (Piepiora, 2019), adopting 2025 as the baseline reference year ($t_0 = 2025$) (Table 1).

Table 1. Annual consumer price index in Poland in the 2008-2025 period*.

Year	Annual consumer price index (I)	I/100	The value of the product of indicators
2008	104.2	1.042	1.809395219
2009	103.5	1.035	1.736463742
2010	102.6	1.026	1.677742746
2011	104.3	1.043	1.635226847
2012	103.7	1.037	1.567810976
2013	100.9	1.009	1.511871722
2014	100.0	1.000	1.498386246
2015	99.1	0.991	1.498386246
2016	99.4	0.994	1.511994193
2017	102.0	1.020	1.521120919
2018	101.6	1.016	1.491295018
2019	102.3	1.023	1.467810058

2020	103.4	1.034	1.43480944
2021	105.1	1.051	1.38763002
2022	114.4	1.144	1.320294976
2023	111.4	1.114	1.154104
2024	103.6	1.036	1.036
2025	100.0	1.000	1

*Assumption: 2025 is the base year.

Source: (Piepiora, 2019; Statistics, 2026).

In the fifth step, figures originally expressed in Polish Zloty (PLN) were converted into United States Dollars (USD) applying the official exchange rate of the National Bank of Poland (NBP) as of 31 December 2025 (PLN 3.6016 = USD 1.00) (National Bank of Poland, 2026). Sixth, spatial and temporal trends were visualised using thematic charts and a choropleth map (Pieniążek et al., 2014). The choropleth map was generated in QGIS 3.44.1 using the Natural Breaks (Jenks) classification method (QGIS, 2026; Head, 2026). Finally, in the seventh step, synthesis and conclusions were formulated based on a comprehensive spatio-temporal analysis.

4. Results

Between 2008 and 2025, expenditure for post-disaster recovery within the tourism section was recorded only in the Dolnośląskie province budget, specifically in 2024 (USD 47,433.47). A similar pattern was observed at the county level, where funds were allocated exclusively in Lidzbark county (Warmińsko-mazurskie province) in 2025 (USD 13,882.72).

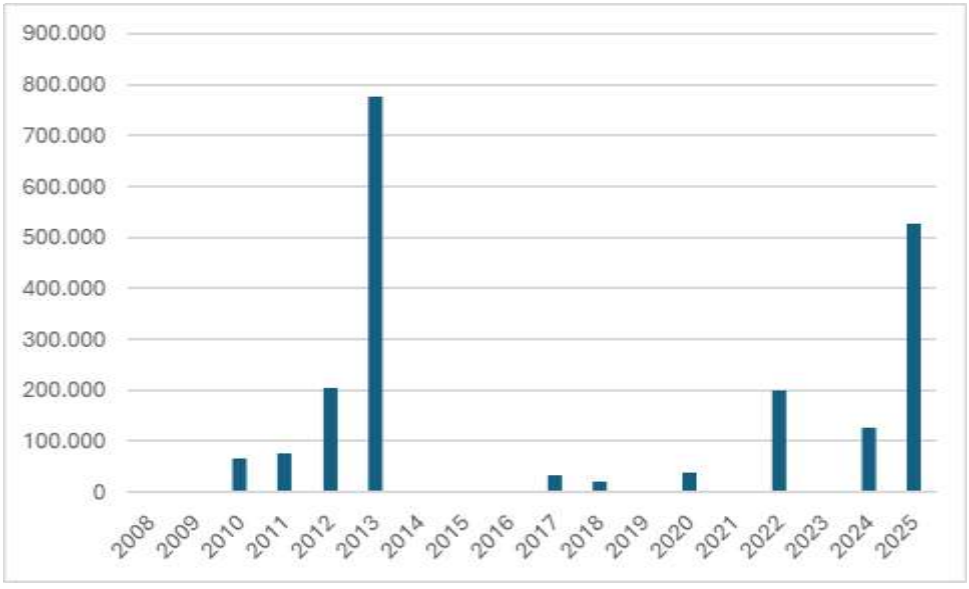

Figure 1. Expenditures of municipal and county-level city budgets incurred in chapters ***78 – Mitigating the effects of natural disasters in section 630 – Tourism in Poland in 2008–2025 in US dollars in 2025.

Source: study based on (Local, 2026; Statistics, 2026; National, 2026).

Public expenditure for post-disaster recovery within the tourism sector across municipalities and cities with county status exhibited a notable increase between 2010 and 2013, peaking at slightly over USD 700,000 in 2013. A second expenditure spike occurred in 2025 (Figure 1).

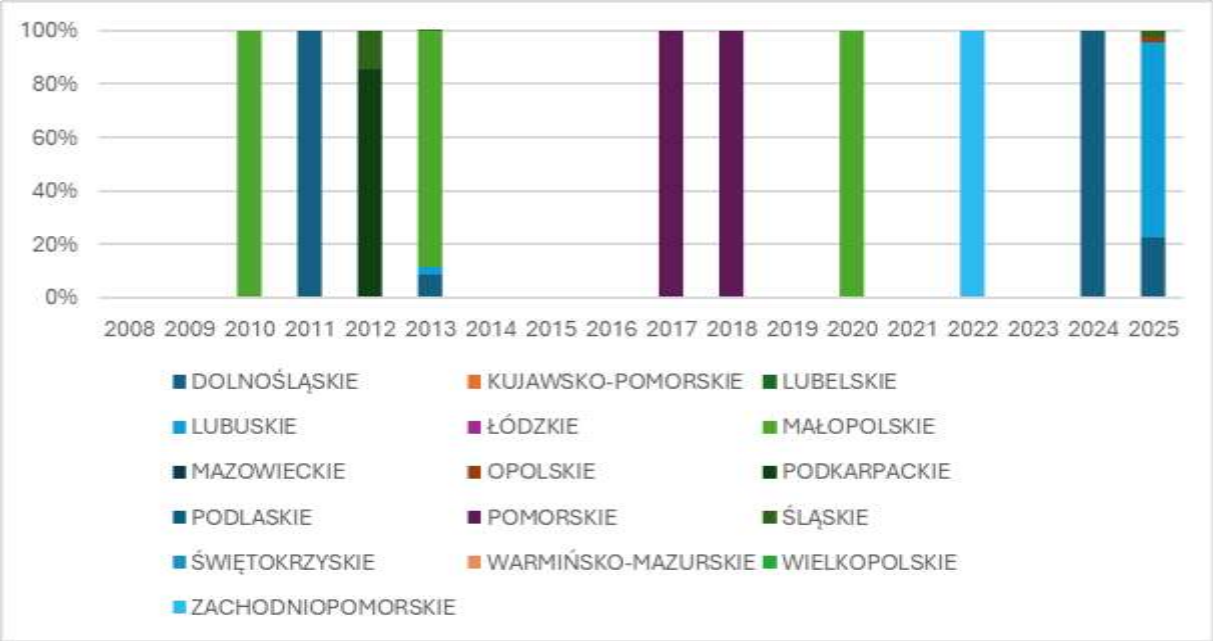

Figure 2: Expenditure of municipal and county-level city budgets incurred in chapters ***78 – Removal of the effects of natural disasters in section 630 – Tourism – share of individual provinces in total expenditure in Poland in 2008–2025 (%).

Source: study based on (Local, 2026; Statistics, 2026; National, 2026).

Spatial analysis revealed shifting regional dominance over the study period. The Małopolskie province accounted for the largest share of municipal and city-with-county-status expenditures in 2010, 2013, and 2020. Conversely, the Dolnośląskie province dominated in 2011 and 2024, absorbing 100% of the total annual allocations in those years. Other temporarily dominant regions included the Pomorskie province in 2017 and 2018 (also reaching a 100% share), the Podkarpackie province in 2012, the Zachodniopomorskie province in 2022, and the Lubuskie province in 2025. Notably, no post-disaster recovery expenditures in the tourism sector were recorded in 2008–2009, 2014–2015, 2019, 2021, or 2023 (Figure 2).

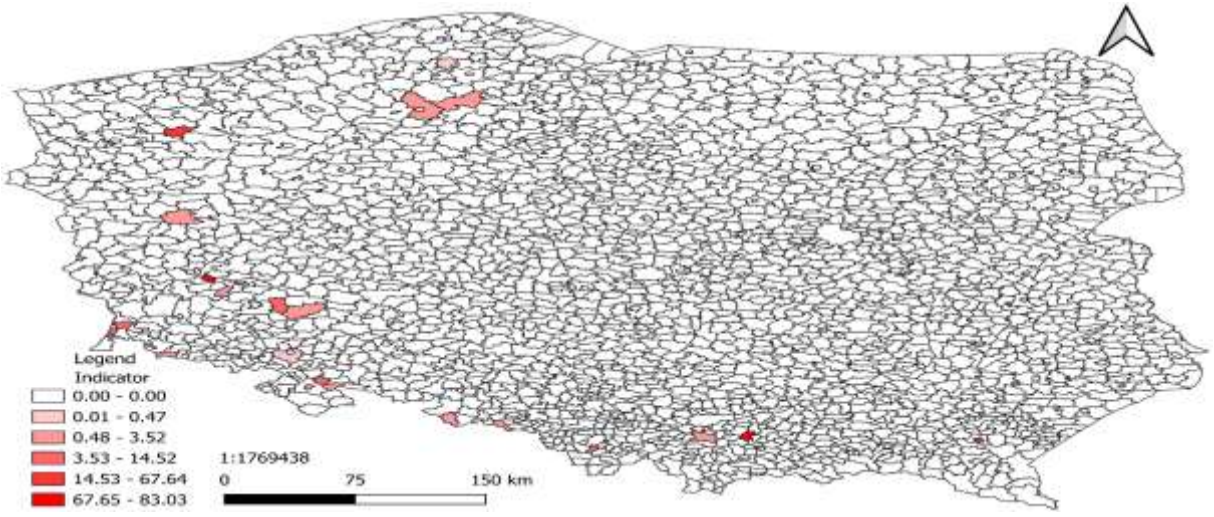

Figure 3. Expenditures of municipal and county-level city budgets incurred in chapters ***78 – mitigating the effects of natural disasters in section 630 – Tourism in Poland in 2008-2025 to the population of individual units in 2025 in US dollars in 2025.

Source: study based on (Local, 2026; Statistics, 2026; National, 2026; QGiS, 2026; Head, 2026).

Finally, disaster relief expenditures in the tourism section were verified on a per capita basis relative to the type of local government unit (Figure 3, Table 2). For each category, units with the highest expenditure levels were identified. Consequently, most significant spending per capita was recorded in Łapanów (rural municipality), Bytom Odrzański (urban-rural municipality), Dynów (urban municipality), and Chorzów (city with county status). Table 2. Expenditures of municipal budgets and cities with county status incurred in chapters ***78 - mitigating the effects of natural disasters in section 630 – Tourism in Poland in 2008-2025 to the population of individual units in 2025 in US dollars in 2025 by type of local government unit.

No.	Name	Expenditures (USD 2025/Person)
Urban municipalities		
1	Dynów	29.65
2	Szczyrk	5.79
3	Szklarska Poręba	3.52
4	Kłodzko	1.66
Rural municipalities		
1	Łapanów	83.03
2	Zgorzelec	6.11
3	Radwanice	1.93
4	Branice	1.79
5	Chojnice	1.16
6	Krzyżanowice	1.13
7	Świdnica	0.47
8	Sulęczyno	0.29
Rural-urban municipalities		
1	Bytom Odrzański	76.18
2	Ińsko	67.64
3	Ścinawa	14.52
4	Bardo	10.17
5	Złoty Stok	3.13
6	Wołów	2.83
7	Myślenice	1.5
8	Czersk	1.38
9	Międzyrzecz	1.06
Cities with county status		
1	Chorzów	0.01

Source: study based on (Local Data Bank, 2026; Statistics, 2026; National, 2026).

5. Discussion and Conclusions

A deeper synthesis of the empirical data reveals significant socio-spatial and fiscal asymmetries in post-disaster recovery funding in Poland. The burden of rebuilding tourism infrastructure falls disproportionately on the lowest administrative tier – municipalities – highlighting a highly decentralised risk exposure. This vulnerability is particularly acute in rural and urban-rural municipalities, where the per capita financial strain vastly exceeds that of larger urban centres. Furthermore, the spatial correlation between high-expenditure municipalities and river valleys or mountainous terrain underscores a fundamental spatial planning paradox: tourism infrastructure is inherently concentrated in high-amenity areas that are simultaneously zones of maximum hydrometeorological hazard exposure. The observed temporal lag – typically one to two years between a disaster event and the corresponding fiscal allocation – further exacerbates this vulnerability, prolonging the economic disruption of local tourism markets.

Moreover, the frequent occurrence of zero-expenditure years across division 630 (Tourism) suggests a critical methodological limitation within the public finance classification framework. Given the interdisciplinary nature of the tourism economy, it is highly probable that substantial recovery costs for tourism-related assets – such as access roads, cycling networks, or recreational waterside boulevards – are absorbed by broader budgetary divisions, namely Transport (division 600) or Municipal Economy (division 900). Consequently, the actual financial impact of natural hazards on the tourism sector is likely structurally underestimated. This accounting gap points to an urgent need for cross-sectoral disaster accounting and the establishment of dedicated, centralised contingency funds to support high-risk, low-capacity local governments in implementing 'build back better' strategies.

Based on the spatio-temporal analysis conducted, the following key conclusions emerge. Between 2001 and 2025, natural hazards in Poland were predominantly characterised by storms, extreme temperatures, and floods – closely mirroring broader European hydro-meteorological trends.

The analysis of local government expenditure for post-disaster recovery within the tourism sector demonstrates a direct relationship between the occurrence of extreme weather events and subnational fiscal responses. At the regional tier, expenditure in the Dolnośląskie province was recorded exclusively in 2024, directly responding to the severe flooding triggered by Storm Boris (Genoa Low) in September 2024.

At the county level, Lidzbark county (Warmińsko-mazurskie province) stood out as the sole unit to allocate funds for post-disaster recovery in tourism infrastructure in 2025. Across municipal budgets, including cities with county status, public spending in Division 630 (*Tourism*) exhibited two primary peaks – in 2013 and 2025 – both following major flood events across the Oder and Vistula river basins. Ultimately, targeted and adequate public financing for post-disaster recovery is essential for enhancing the long-term resilience and structural robustness of tourism infrastructure.

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