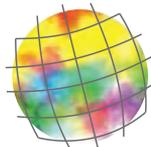


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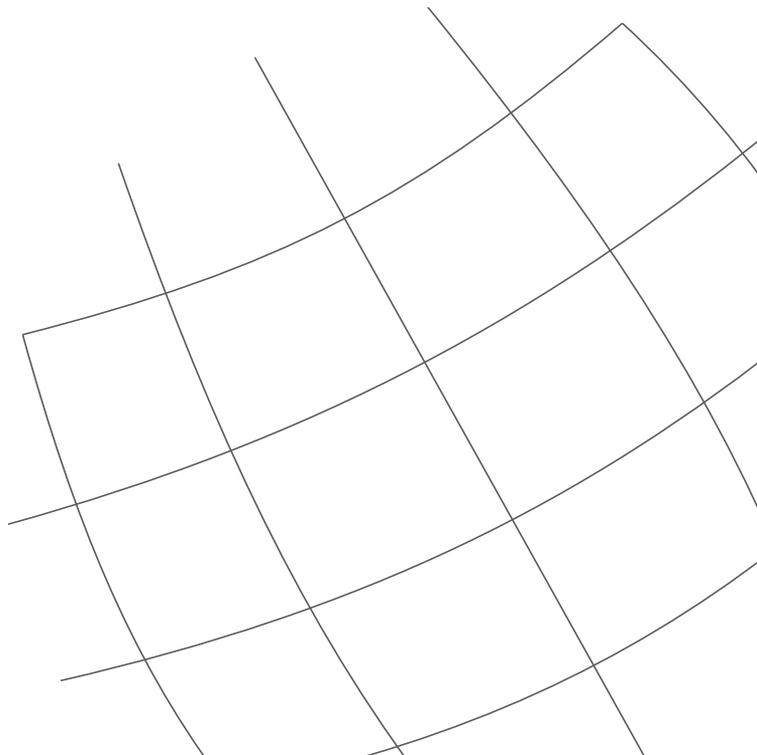
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CONTENT

**RICHMOND, A., WOLFEL, R., FAIRFIELD, CH., GRANNIS, R.,
GRAZAITIS P., 2026.**

Fragile Stability: The Impact of Geopolitical Interests
and Environmental Security on Burkina Faso's Political Landscape.

Folia Geographica, 68(1), 5-36

POLA, A., HULÍKOVÁ TESÁRKOVÁ, K., DZÚROVÁ D., 2026.

East-West and Gender Mortality Gaps in Europe's Elderly Population
During the COVID-19 Period.

Folia Geographica, 68(1), 37-52

LONČAR, J. BAČAN, D., 2026.

Framing Media Imaginaries of Nato's Political Geography in the Western
Balkans. NATO in the Western Balkans.

Folia Geographica, 68(1), 53-81

**ILIEȘ, A., NOJE, C., HASSAN, T. H., ILIEȘ, D. C., WENDT, J. A.,
BERDENOV, Z., SAFAROV, B., DEAC, L. A., FAZIA, C.,
MATLOVICOVA, K., 2026.**

The paradigm shift from sustainable to regenerative tourism:
A case study of heritage wooden church preservation in Romania

Folia Geographica, 68(1), 82-111



FRAGILE STABILITY: THE IMPACT OF GEOPOLITICAL INTERESTS AND ENVIRONMENTAL SECURITY ON BURKINA FASO'S POLITICAL LANDSCAPE

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Abstract

This paper examines how environmental degradation, geopolitical competition, and governance failure intersect to shape political instability in Burkina Faso. Once considered a relatively stable democracy in West Africa, Burkina Faso has undergone two coups since 2022 amid mounting social and environmental crises. Using the Modelling Dense Urban Networks (MDUN) analytical tool, this study identifies the sociocultural, economic, and political dimensions of vulnerability that preceded these events. MDUN's multidimensional analysis demonstrates how public sentiment particularly declining confidence in government, growing xenophobia, and demands for national sovereignty crossed critical thresholds months before the second coup. These dynamics were shaped by worsening environmental stressors, including land degradation, resource competition, and declining agricultural productivity.

The analysis situates Burkina Faso's experience within a broader theoretical framework linking environmental security and political ecology. It underscores how global and local forces converge in multi-scalar ways foreign mining interests, regional insurgencies, and global rivalries between France, Russia, and China all of which influence domestic legitimacy and governance. Environmental scarcity and political marginalization reinforce one another, eroding state capacity and fuelling public discontent.



Findings suggest that societal vulnerability in Burkina Faso is best understood as a dialectical process: environmental stress undermines governance, weak governance deepens vulnerability, and both are shaped by internal and external actors seeking strategic advantage. Addressing instability in the Sahel requires more than counterterrorism or aid. It requires integrated approaches that strengthen environmental management, equitable access to resources, and political legitimacy at multiple scales. By combining environmental security theory with a structured vulnerability assessment, this study offers a framework for anticipating and interpreting sociopolitical instability in environmentally stressed regions.

Key words

Environmental Security, Political Instability, Burkina Faso, Societal Vulnerability, Geopolitical Competition.

INTRODUCTION

The Sahel region continues to experience political instability, compounded by growing geopolitical interest, intensifying conflicts, resource conflict, and the overuse and misuse of land. The intersection of geopolitics and environmental insecurity has significantly influenced the political development of the Sahel countries. This paper utilizes the Modeling Dense Urban Networks (MDUN) analytical model to examine the critical economic, geographical, and political factors influencing the local population's sentiment in Burkina Faso, as well as how these factors are impacted by resource conflict and environmental degradation. Burkina Faso faces significant societal vulnerability due to economic inequalities, regional instability from ongoing Sahel conflicts, substantial environmental challenges, and a deep-seated distrust in the government and the former colonial power, France. Declining access to resources acts as a threat multiplier, exacerbating these existing issues. Internal instability significantly contributed to the two military coups in Burkina Faso in 2022. Additionally, Burkina Faso is a focal point of intense competition between global powers, who manipulate societal opinion on local vulnerabilities to enhance their influence while undermining rivals. This multiscale impact of vulnerability demonstrates that societal vulnerability is often an interaction of local conditions and global forces competing both within and between scales to gain access to dwindling environmental resources.

THEORETICAL FRAMEWORK

Societal Vulnerability and Change

Traditionally, most studies of societal vulnerability and resilience emphasize environmental stressors and episodic disasters due to their dramatic nature and the immediate strain they impose on societies. Understanding societal vulnerability is crucial for effective risk management, yet definitions and frameworks for assessment widely vary. Nuanced approaches are essential to grasp its dynamic



and context-specific nature. Urban specialists focus on people's livelihoods and coping capacity, while disaster specialists focus on the vulnerability of individuals and critical institutions to disasters. Increased susceptibility in vulnerable societies leads to severe impacts from natural disasters due to inadequate infrastructure and preparedness, resulting in higher damage and casualty rates.

While vulnerability analysis is widespread, scholars such as Adger (2006) and Turner et al. (2003) criticize its reliance on generic quantitative methods, which often fail to capture the complexity and specific experiences of diverse societal groups. Vulnerability is unequally distributed, with the social impacts of hazard exposure disproportionately affecting the most vulnerable. It is also a dynamic concept that evolves over time and space, influenced by social-ecological interactions such as the interplay between environmental stresses and socio-economic factors. For example, climate change can exacerbate existing economic inequalities, increasing vulnerability for marginalized groups. Weak governance can amplify these vulnerabilities by failing to provide adequate resources and support mechanisms.

Some scholars have applied concepts of resilience and vulnerability to explain dramatic societal changes. O'Lear (2005) observes that these studies tend to bifurcate societal vulnerability as either the result of global forces exerting influence on a state's political system (environmental security) or others that tend to focus on the struggles of individual agents and their inability to access local resources (political ecology). This parallels a critical debate in geography over the influence of globalization on local regions. A reaction to the globalization thesis is the glocalization approach, which explains contemporary societal change. Glocalization takes globalization to task for its "eco-centric view," "binary" world view, and "focus on overpowering homogenization" (Drori et al, 2014: 85). In other words, glocalization emphasizes that themes of globalization are filtered through local contexts to create unique local reactions. While the debate between top down and bottom-up approaches to vulnerability is essential for explaining processes of vulnerability and resilience, Roudometof (2016) views both as a reductionist exercise, looking to focus on one method at the expense of the other process. O'Lear (2005) emphasizes this as a critical deficiency in studies of environmental geopolitics and political vulnerability influenced by environmental stressors. Often, both the global and local interact to influence vulnerability within a region.

In addition to the directionality of vulnerability, there is also a dialectical aspect to understanding vulnerability as societies evolve in response to societal stressors. Aguirre views vulnerability and resilience as a "dialectical duality" in societal development, with societies continually evolving and developing new resiliency strategies as they experience shocks and recover. However, new influences on vulnerability often emerge that are not always visible or assessed by society.



Frerks et al. (2011) emphasize that resilience does not always return to a previous equilibrium state.

Explaining complex social systems involves developing frameworks to assess the impact of stressors on societal vulnerability or resilience. Various scholars have used different approaches to construct these frameworks. Wilches-Chaux (1989) identifies several factors that influence vulnerability, including environmental, political, cultural, and economic factors. Weichselgartner (2001) focuses on vulnerability characteristics, including preexisting conditions, differential impacts on social groups, and site-specific vulnerabilities. Christmann and Ibert (2012) build on this by identifying "structurally induced vulnerability," where socio-economic situations shape vulnerability levels. These scholars emphasize the importance of acknowledging and addressing vulnerabilities to develop resilience.

Recent studies have focused on social and economic aspects of vulnerability and resilience. Tanner and Williams (1981) identify five key aspects of society: economic production, technical adaptation, education, science, political relationships, and conflict management. Frerks et al. (2011) define vulnerability as poor governance, inadequate development schemes, and political or military destabilization, with a focus on political development. This economic approach contrasts with environmental explanations. While Jonas and Gibbs (2004) highlight the significance of environmental issues in societal development, such as river cleanups and the redevelopment of industrial sites for gentrification. Richmond et al. (2015) focus on household-level vulnerability, identifying key areas such as food, water, energy, environment, livelihood, and health. These interconnected factors significantly increase vulnerability, especially in poorly managed urban settings.

Studies emphasizing sustainability often integrate economic and environmental aspects. Shen, Ochoa, Shah, and Zhang (2011) studied sustainable development plans in nine cities, reducing the dimensions of sustainable development to four: environmental, economic, social, and governance. They apply these dimensions to identify commonalities and differences among cities, providing a method for implementing sustainable development programs at various stages of development.

However, research on development that emphasizes economic or environmental aspects often briefly mentions political, cultural, and social factors. These studies minimize the importance of identity, political legitimacy, social networks, and political penetration, which also strongly influence urban development. This gap is addressed through a model emphasizing sociocultural variables within a political development framework. Binder's approach to political development categorizes it into five key areas: production, identity, legitimacy, participation, and penetration. Scholars like LaPalombara (1971) and Fierman (1991) have added a sixth category, allocation. This model, situated within discussions of societal development, illustrates how vulnerability and resilience



emerge from the continuous interaction and evolution of regional networks and their interactions with the global political-economic system. Influenced by local populations and external forces, these networks shape societal resilience and vulnerability. Giddens' (1979) duality of structure emphasizes that people both change and are changed by societal networks through interaction with these networks, a duality central to any analysis of societal resilience and vulnerability.

Environmental Security

The relationship between armed conflicts and natural resources, particularly oil, diamonds, and narcotics, is increasingly scrutinized. Africa, with its vast mineral reserves and high-value exports like crude oil, cobalt, and natural gas, faces rampant violence and forced displacement due to military activities. Scholars must examine the intersection of natural resource governance and military policy in these regions. The association between natural resource availability and armed conflicts is complex. Some studies find positive effects of new natural resource discoveries on conflict, while others show negligible effects when controlling for other factors. Differences in datasets and empirical methodologies contribute to these contradictory results. However, the military's role in shaping governance decisions in the natural resources sector remains understudied.

Environmental security is a multifaceted concept intersecting various disciplines, including environmental science, political science, and security studies. It broadly concerns the interplay between environmental changes and the security of human societies. Socioeconomic variables influence vulnerability in relation to environmental stress. Environmental security emerged in the late 20th century, gaining prominence as the world's increasing awareness of global environmental challenges grew. Early works by Homer-Dixon (1994) and Mathews (1989) emphasized the potential for environmental degradation to trigger conflict and exacerbate existing vulnerabilities. Homer-Dixon introduced the concept of "environmental scarcity" as a driver of social instability and conflict, arguing that scarce renewable resources, such as water, arable land, and forests, could lead to violent conflicts, particularly in developing countries. Mathews proposed that environmental changes could undermine national security by contributing to political instability, economic decline, and social fragmentation. This perspective broadened the traditional understanding of security to encompass non-military threats, highlighting the interconnection between environmental health and human security.

Environmental security has multiple dimensions, reflecting its complex and interdisciplinary nature. These dimensions include ecological, social, economic, and political aspects:



1. **Ecological Dimension:** Focuses on ecosystem health and stability. Degradation of ecosystems can lead to the loss of crucial ecosystem services.
2. **Social Dimension:** Addresses the impact of environmental changes on human communities. Environmental changes can exacerbate social inequalities, displace populations, and increase vulnerability to natural disasters.
3. **Economic Dimension:** Examines the relationship between environmental resources and economic stability. Environmental degradation can undermine economic development by reducing resource availability.
4. **Political Dimension:** This involves the role of governance and political institutions in addressing environmental issues. Effective governance structures are essential for addressing environmental challenges and ensuring sustainable resource management.

Historical and contemporary events show that environmental stress often leads to conflict, frequently along ethnic lines. This trend persists as environmental changes stress marginal environments, particularly in regions with weak governance. Non-sustainable environmental practices, migration, and resource shortages in developing states further destabilize regions with weak governance. Environmental stress enables violence when combined with weak governance and social fragmentation, manifesting along latent ethnic and political divisions.

Homer-Dixon and Klare argue that environmental stressors, such as resource scarcity and environmental degradation, act as catalysts for conflict, particularly in areas with weak governance and high poverty levels. These stressors exacerbate existing tensions, leading to violence. Empirical studies support the link between environmental factors and conflict, highlighting how competition over scarce resources, such as water and arable land, can result in violent disputes, particularly in developing countries.

O'Lear (2005, p. 297) offers a critique of environmental security that highlights several key deficiencies in traditional studies of environmental security. First, she emphasizes the need to position resource conflict at a proper scale of analysis. She sees studies focusing either on local-scale resource scarcity and its impact on local dynamics or on global-scale resource demand and its implications for state development. The focus on a specific scale tends to limit the ability to see resource conflicts as multi-scale, with local, meso, and global scale influences on local vulnerability and state-level political legitimacy. In addition, global actors enter a dialectical relationship with the local scale, in which they attempt to manipulate local and state factors to gain control of resources. However, they are often influenced by local and state-level dynamics that support or limit the effectiveness of global actors in gaining influence at the local level.

In addition, O'Lear (2005, p. 298) identifies the focus on state-level analysis and the significance of state boundaries as sacrosanct in studies of resource conflict. She sees the studies from the environmental security perspective as a zero-sum



competition for control of resources bounded by state boundaries. Often, these conflicts ignore state boundaries as groups cross borders in search of resources and influences.

Environmental instability significantly enables conflicts, especially in sub-Saharan Africa, where non-sustainable practices and environmental changes combine with failing governments to ignite ethnic and religious conflicts. This paper presents a model illustrating the relationship between natural resources and political stability in Sub-Saharan Africa, demonstrating a significant link between arable land, access to fresh water, and political stability. The concept of human security, introduced by the United Nations Development Programme (2016) (UNDP) in 4, broadened the traditional understanding of security to include various dimensions of human well-being. Environmental security is a critical component of human security, as environmental changes directly impact individuals' health, livelihoods, and safety. Integrating environmental security into the broader human security framework emphasizes the protection of individuals and communities from environmental threats. This approach advocates for policies addressing environmental and social vulnerabilities to enhance human security.

A detailed and localized analysis is essential to address human security concerns effectively. Vulnerability research often focuses on global assessments, allowing for comparisons across countries, but does not identify specific vulnerable groups or locations. Regional analyses can result in generalizations that overlook localized concerns, potentially preventing aid from reaching the most vulnerable populations. Current research indicates that access to environmental resources, particularly clean water, is essential for maintaining state stability, fostering peace, upholding human rights, and promoting economic development. Pervasive political instability and environmental stress in West Africa create complex problems for relief agencies.

Political Ecology

Political ecology is closely linked to environmental security, as both fields examine how access to resources, power dynamics, and governance shape environmental vulnerabilities and conflicts. By analyzing how political and economic structures influence environmental degradation and resource scarcity, political ecology provides insight into the root causes of environmental crises that contribute to instability and insecurity. In regions like the Sahel, where climate change exacerbates food insecurity, displacement, and land conflicts, political ecology helps explain how environmental stressors interact with social and political factors to drive insecurity and conflict.

Political ecology extends cultural ecology by incorporating critical social science perspectives, emphasizing power dynamics and equity in environmental issues. Watts (2017) defines it as analyzing access and control over resources and their



effects on environmental health and sustainable livelihoods. This approach shifts from sustainability-focused studies to examining political-economic relationships and their environmental consequences. Walker (2005) critiques traditional resource constraint theories, highlighting poverty and resource access as primary drivers of environmental crises. Political ecology also explores broader political negotiations, incorporating dimensions like gender, race, and ethnicity (Sultana, 2020).

The “politics of scale” is central to political ecology, with crises manifesting at multiple levels (Watts, 2017). Loftus (2018) challenges the state’s role, arguing global forces increasingly shape local conditions. Tzaninis et al. (2021) link urbanization to modern environmental crises like wildfires. While some theories critique state authority, O’Lear (2005) warns that resource scarcity and economic growth can erode state legitimacy, fostering corruption and instability. Political ecology offers a framework for understanding environmental issues, geopolitical interests, and local political dynamics. In the Sahel, climate change exacerbates poverty, food insecurity, and displacement, shaped by policies, market forces, and land tenure. Global powers exploit environmental vulnerabilities for strategic gain, deepening conflicts and governance challenges. Sustainable solutions require local engagement, leveraging indigenous knowledge within a multi-scale perspective.

Burkina Faso: A Case Study of Political Instability and Environmental Challenges

Burkina Faso, a landlocked country in West Africa, is characterized by significant societal vulnerability driven by a complex interplay of political instability and environmental challenges. Vulnerability is not equally distributed, and the social impacts of hazard exposure often fall disproportionately on the most vulnerable people in society. Vulnerability is not static but a dynamic concept that changes across time and space (Flanagan et al., 2011). This necessitates considering social-ecological interactions, such as how environmental stresses and socio-economic factors interact and exacerbate one another. This combination of factors has created a cycle of vulnerability that impedes development and exacerbates the difficulties faced by its population. In addition, these vulnerabilities are often exploited by global, regional, and state-level actors in an effort to gain influence in key regions in the north of Burkina Faso.

Political Instability

Power struggles, protests, and revolutions characterize Burkina Faso’s history. In the late nineteenth century, the French colonized Burkina Faso, integrating it into French West Africa. The French colonial administration exploited the country’s resources, relying heavily on Burkinabe labor in agriculture and mining. Calls for independence grew post-World War II, culminating in Burkina Faso’s independence from France in 1960. However, Burkina Faso faced economic



underdevelopment, social inequality, and political instability like many of its regional counterparts (Engles, 2018, p. 363). The economy was primarily geared towards cotton production for export, with limited diversification (Bourdet & Persson, 2001). This economic structure, compounded by a lack of human capital and financial resources, hindered the country's ability to develop and manage its industries and infrastructure.

Since gaining independence, Burkina Faso has been plagued by political instability and violence. The country has experienced numerous coups and military regimes, with notable coups occurring in 1966, 1980, 1982, 1983, 1987, 2014, 2015, and 2022. Contemporary challenges include the rise of violent extremist groups (VEOs) and ethnic conflicts, particularly in the northern and eastern regions (Bado, 2015). Factors contributing to the threat of terrorism include poverty, political instability, weak governance, and the influence of extremist groups in the region. Key terrorist organizations operating in Burkina Faso include the Group for the Support of Islam and Muslims (GSIM), Jama'at Nasr al-Islam wal Muslimin (JNIM) affiliated with Al-Qaeda, and the Islamic State in the Greater Sahara (ISGS) (Bureau of Counterterrorism, 2021). These groups have carried out numerous attacks on civilians and security forces, leading to a humanitarian crisis and the displacement of thousands.

The internally displaced population increased from 50,000 in December 2018 to 270,000 by August 2019 (International Commission of the Red Cross [ICRC], 2019). Burkina Faso is experiencing one of the fastest-growing displacement crises in the world, driven by violence, poverty, food shortages, and the impacts of climate change (UN High Commissioner for Refugees [UNHCR], 2022, n.p.). Regional instability, particularly in neighboring Mali and Niger, has led to an influx of over 90,000 refugees into Burkina Faso. Attacks have significantly impacted the country's economy and development, targeting religious sites, businesses, and infrastructure, and discouraging foreign investment. The Burkinabe government has implemented measures to address terrorism, including increasing security forces and collaborating with international partners to strengthen border security and intelligence-sharing (Bado, 2015).

Violence and instability have continued to escalate, with GSIM blocking access to several cities in northern and eastern Burkina Faso by attacking and destroying infrastructure, affecting access to food, water, health, and education (Ochieng, 2022). In January 2022, a military coup led by Damiba occurred due to the ineffective handling of ISGS and GSIM militants. Continued dissatisfaction with the government's inability to manage militant attacks led to a second coup in September 2022, led by Captain Ibrahim Traoré, who became the new president after Damiba's resignation (Booty, 2022). Since November 2022, rising violence targeting civilians based on ethnic and religious identity, led by non-state armed groups, has driven over 60,000 Burkinabe people to neighboring countries



(Sy, 2023). Most of those fleeing are women and children, who have also been subjected to gender-based violence, stating, 'when the armed groups came, everything changed.' (Sy, 2023) These challenges have exacerbated the fragility of an already destabilized region struggling with security challenges and food insecurity.

The politics of independent Burkina Faso have been marked by frequent coups, political unrest, and violence. The most recent successful coup occurred in September 2022, disrupting governance and public order, followed by a thwarted coup attempt in January 2024. Constant unrest creates disorder in the government, weakens state institutions, leads to human rights violations, and fosters economic instability, thus contributing to widespread violence and insecurity. Violence stems from militant groups attacking military and civilian targets. The country's insecurity is aggravated by its location in a region with instability in neighboring countries, forcing many refugees to seek safety in Burkina Faso. The militant groups' threats to overthrow the government and terrorize villages, coupled with the spillover of conflict from neighboring countries, have further exacerbated the situation, leading to internal displacement and humanitarian crises.

Environmental Challenges

Environmental change acts as a "threat multiplier" in Burkina Faso, worsening existing vulnerabilities and driving instability across the region. The environmental issues faced by the country are multifaceted and deeply interconnected with the social, economic and political factors influencing vulnerability in the country. There are three main categories of environmental challenges influencing vulnerability in Burkina Faso: land degradation, conflicts over access to resources, and declining agricultural productivity.

Burkina Faso's arid and semi-arid landscapes are increasingly affected by land degradation and desertification. Overgrazing, deforestation, and unsustainable agricultural practices have led to soil erosion and reduced fertility. As arable land shrinks, rural communities face heightened competition for dwindling resources, escalating local conflicts over land ownership and usage. The United Nations' Food and Agriculture (FAO) (2024) estimates that around one-third of Burkina Faso, or over nine million hectares of productive land, is degraded. This number is increasing by 360,000 hectares per year. As the amount of productive land decreases, competition for land use increases, often resulting in conflict between different groups seeking to use the shrinking stock of useable land.

The FAO (2021) also reports that conflict over resources is increasing. This includes both mining conflict and conflicts over rural land, which could be used for agriculture and transhumance. Their project (FAO, 2021: 3) reports more conflict in the regions in the Sahel than in the other regions of Burkina Faso. They (FAO,



2021, p. 4) identify several different types of conflicts in the region to include land conflicts between local and migrant farmers looking for better conditions, conflicts between crop and livestock farmers, conflicts over access to cattle tracks and traditional pastoral areas. All of these could be seen as resulting from degrading agricultural conditions causing groups to search out suitable land for either crops or livestock.

Additionally, the FAO (2021) identifies mining conflicts as a significant category of resource conflict in the country. Most of the conflicts is related to the exploitation of gold which “does not take into account the needs of other users of the natural resources” (FAO, 2021, p. 5). Often mining permits are issued by the government without considering the concerns of the local population (FAO, 2021, p. 6). In addition, mining companies often fail to anticipate the results of mining on the local community. For example, the FAO (2021, p. 6) identifies the uncontrolled use of heavy metals in gold mining as a significant cause of livestock poisoning and the decline of plants used by livestock for forage. Again, as with land degradation, competition over declining resources leads to increased conflict throughout the region.

Finally, due to the increased degradation, agricultural productivity is declining in Burkina Faso. Since agriculture is the primary source of income for the citizens of Burkina Faso, (the United States Agency for International Development (USAID) states that 80% of the population is engaged in the agricultural sector (USAID N.D.)) most of the population remains food insecure due to low agricultural productivity. This low productivity is the result of variable rainfall, persistent drought, and low soil fertility. As the Sahel expands, agricultural productivity will remain a concern, as less land will be available for crops. As with the other environmental concerns, this will lead to increased conflict over dwindling resources.

In response to these challenges, Burkina Faso's government has implemented policies to promote economic growth and development through infrastructure investments, education, technical training, and economic diversification. These policies focus on achieving national self-sufficiency, reducing dependence on external forces, promoting internal development, alleviating poverty, and enhancing access to basic services.

Infrastructure development policies have included investments in roads, bridges, and other projects to enhance transportation and communication nationwide. One key economic policy was the establishment of state-owned enterprises in vital sectors, including agriculture, mining, and energy. These investments aimed to promote rural development, boost local production, and reduce imports. Additionally, the government promoted education and training by investing in the construction of schools and universities, expanding access to education, and developing technical skills to support economic growth and industrial development.



However, these policies have faced limitations due to limited financial resources and inadequate technical expertise. Social inequalities further exacerbate Burkina Faso's poor economic development. There is a wide gap between the rich and the poor, with unequal access to education, healthcare, and other essential services. Poverty remains a significant issue, with around 40 percent of the population living below the poverty line.

Women face numerous challenges in terms of social equality. Despite constitutional guarantees of gender equality, women in Burkina Faso face widespread discrimination and violence. They often have limited access to education, healthcare, and economic opportunities, and are frequently subjected to early marriage, female genital mutilation, and other harmful practices. According to the United Nations, the literacy rate for women aged 15 and older in Burkina Faso is only 32 percent, compared to 50 percent for men.

There is also a stark inequality between those who live in rural and urban areas. Rural communities face greater poverty, limited access to education and healthcare, and inadequate infrastructure compared to urban areas. The literacy rate in urban areas tends to be higher than in rural areas due to limited access to educational opportunities, lack of resources, poverty, and a shortage of qualified teachers.

The government has adopted policies aimed at promoting social development, including investments in education to address gender inequality, and has implemented programs in rural areas to increase enrollment, provide access to educational materials and resources, and train teachers. However, progress has been slow, and social inequality remains a significant challenge for Burkina Faso. This economic instability has fed into growing political instability. Research on societal vulnerability, environmental security, and political ecology focuses on the intersection of political, economic, social, and environmental stressors as influences on societal stability. In Burkina Faso, the intersection of political instability, failed economic development programs, social conflicts, and environmental degradation has significantly increased societal vulnerability and political instability. At this nexus, Burkinabe society has destabilized, making it susceptible to foreign influences looking to exploit these triggers of instability to gain influence at the expense of regional competitors.

The MDUN Sociological Situational Awareness Modeling Tool

Perceptronics Solutions developed the Modeling Dense Urban Networks (MDUN) tool to enhance situational awareness by visualizing and explaining societal vulnerability (Grannis, 2023). Unlike a mere incident tracker, MDUN goes beyond identifying events; it anticipates that inciting incidents will occur regularly and evaluates and forecasts their probable impact. Given MDUN's focus on sociological situational awareness, its inputs are geo-tagged and time-stamped sociocultural,



socioeconomic, and sociopolitical data about a population's perceptions, beliefs, values, and experiences. MDUN computes a social entropy index to measure societal resilience, extracting micro-information about emergent disorders. Social entropy refers to a measure of disorder within a society. As a society fragments and becomes more vulnerable, social entropy increases. Social entropy modeling has been previously used to predict and explain societal resilience and vulnerability (Liang, Hu, Chen, & Zhou, 2017; Liu, Stanley, & Gao, 2016). A low entropy value (near zero, or close to the center of the radar chart (figure 1-4)) suggests stability, while a high value (approaching 1, or towards the edge of the radar chart (figure 1-4)) indicates that the societal system is vulnerable to collapse and may require reconstitution (Liang, Hu, Chen, & Zhou, 2017; Liu, Stanley, & Gao, 2016). MDUN uses these multiple measures of vulnerability as inputs to an artificial intelligence/machine learning routine that learns optimal weightings for each input by training on over 320 known events worldwide, producing a social entropy score for 12 comprehensive measures of vulnerability. Each of these measures, or dimensions, represents a critical aspect of societal development and resilience. This enables MDUN to understand a population's sentiment and resulting behavior, gaining insight that surpasses any human analyst's understanding.

MDUN conveys this understanding of societal dynamics across 12 sociocultural, economic, and political dimensions, offering a nuanced understanding of societal vulnerability. These dimensions were derived from a factor analysis of data from dozens of countries across all geographic regions. Notably, MDUN's 12 dimensions complement the six dimensions identified by Verba et al. (2015), Fierman (1991), and Wolfel et al. (2017), providing quantitative metrics to the analytical framework of political development and triangulating the model both quantitatively and to the academic literature. MDUN displays the 12 dimensions in a radar chart, with each dimension originating from a central point and separated by equivalent angles. A circular terminal edge connects all axes, with the central point representing complete stability and the terminal edge indicating a critical phase transition, suggesting an event that triggers a social catastrophe. A polyline connects each dimension, indicating the current state of societal areas on that dimension.

The influence of environmental security on societal vulnerability

Beginning in May 2022, the research team used MDUN to analyze Burkina Faso and explore its sociocultural fabric, aiming to identify the major factors influencing societal vulnerability that contributed to the January coup four months earlier. MDUN utilized over twenty different data sets, ranging from local sentiment data collectors to large international organizations. (See Table 1 for the data sets used). These data were drawn from international agencies with a strong tradition of producing reliable data sets. The results each of the various survey questions for each data set were assigned to one of the 12 dimensions of the MDUN model by



the researcher, using a standard definition of the dimension. From May 2 to July 25, 2022, weekly assessments of Burkina Faso's sociological situational awareness were conducted using these observed data sets. These data sets were updated as new data became available in the time frame between May 2 and July 25, 2025. Figures 1, 2, and 3 display the assessments for May 2 (the beginning), June 13 (midway), and July 25 (the end).

Tab. 1: Data sources used in conjunction with the MDUN to analyse Burkinabe society

• ACLED conflict data project	• UN Economic Commission for Africa
• African Development Bank Group	• UN Office for Disaster Risk Reduction
• Afrobarometer	• UN Office for the Coordination of Human Affairs
• Burkina Faso Displacement Center	• UN Office for the Coordination of Humanitarian Aid
• Burkina Open Data Initiative	• UN Refugee Agency
• Catholic Agency for Overseas Development	• US Agency for International Development
• Global Health Advancement Organization	• World Bank
• Humanitarian Data Exchange	• World Food Programme
• Internal Displacement Monitoring Center	• World Health Organization
• OxFam	• World Values Survey
• Oxford Poverty & Human Development Initiative	
• UN Development Program	

All the figures (1-4) represent MDUN's evaluation of currently observed data taken from the sources listed in table 1. Beyond merely evaluating the current situational awareness, on June 13, 2022, we used MDUN to make month-by-month

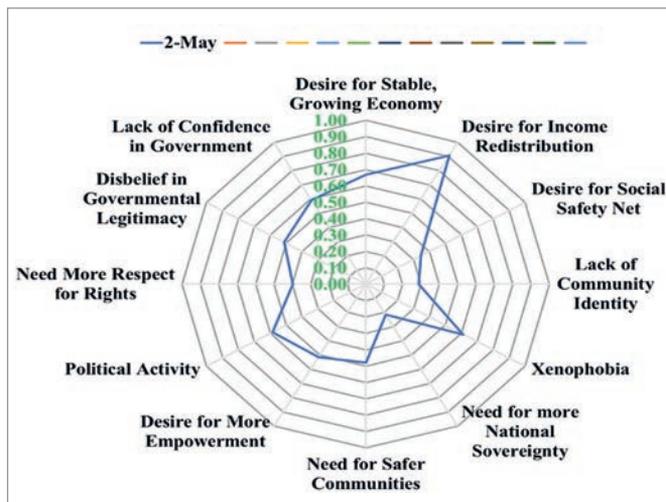


Fig. 1 Burkinabe society as measured on 2 May 2022



Fig. 2 Burkinabe society as measured on 13 June 2022

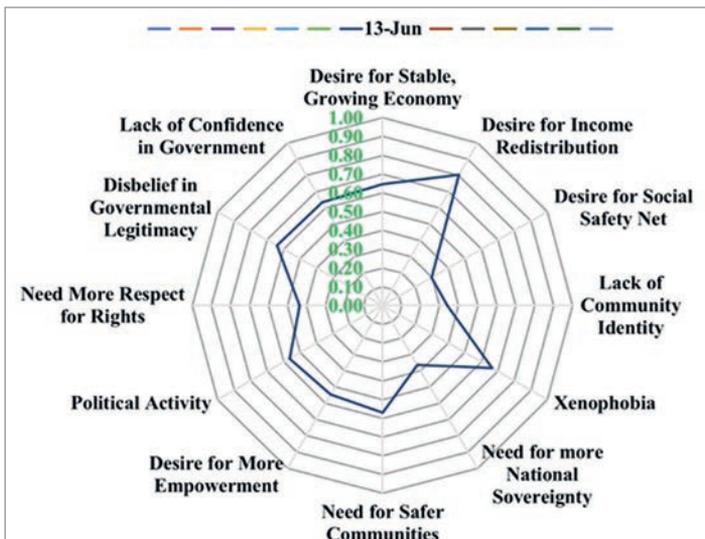


Fig. 3 Burkinabe society as measured on 25 July 2022

predictions (from July 2022 to January 2023) about the country's direction. These predictions were made by projecting current trends forward based on micro-level data analysis. MDUN projected the potential outcomes if individuals' perceptions, attitudes, and behaviors continued to evolve unchecked.

These patterns were evident in the perceptions, beliefs, and attitudes of the local population. MDUN did not assess inciting incidents or actions taken by leaders



but evaluated the evolving perceptions and attitudes of the general population, what they perceived and experienced, and how these perceptions and experiences would likely impact their decisions to act. MDUN identified micro-level signs of entropy and emergent disorder already present in the population and projected them forward, showing when they would become so great that the state could not survive. The specific incident that formally ignited the coup was less relevant than the fact that the population had reached a point where they would react to any inciting incident.

Interestingly, all predictions made on June 13, 2022, were based on the assumption that the situation for individuals on the ground would continue to evolve as it had. At a time when the situation appeared to be stabilizing, MDUN identified the underlying issues. If leaders had taken appropriate actions, they might have altered the course. Still, by only being aware of the macro-level and not the individual-level perceptions and attitudes, they failed to perceive the evolving crisis.

The September 30, 2022 projection (Figure 4) showed that the lack of confidence in the government had crossed the criticality threshold. Other concerning factors included disbelief in governmental legitimacy, the need for national sovereignty, the need for safer communities, and xenophobia. Together, these factors suggested that by September, the government would have lost popular support due to a palpable decline in confidence in its ability to protect its population from external threats, both nationally and locally. Five months earlier, all these factors had been no more than moderate, and the need for national sovereignty was very low.

MDUN's projection on June 13, 2022 (Figure 4), accurately foresaw the military coup on September 30, 2022, which ousted the established government. At the time of the prediction, the large-scale scenario looked stable. In three months, the lack of confidence in the government rose by about 40 percent, from moderate to destabilizing. The need for national sovereignty transitioned from stable to critical in the same period. Burkina Faso does not have a long history of robust political participation. The country has experienced at least ten coups since 1966, with at least six additional attempted coups. The government has also conducted eight elections since its independence in 1960, with most of these not being considered free or fair. In fact, only one election, 2015, was considered free, fair, and where the results of the election were in doubt (Africa Research Bulletin, 2016). The 2015 election was only the second time in the country's history that a civilian was elected president.



Fig. 4 Expected state of Burkinabe society on 30 September 2022 given evolving individual perceptions and attitudes (forecast on 13 June 2022)

Initial State after the first coup: The Crisis of Production

Political ecology highlights marginalization and restricted access to resources as key drivers of instability within a country (Walker, 2005, p. 74). The production crisis following the first coup underscores the widespread marginalization of Burkinabe society and its exclusion from valuable resources. In early May (Figure 1), four months before the second coup, MDUN assessed that those concerns over income redistribution had reached near-critical levels. Local citizens increasingly demanded a fairer distribution of wealth. At the same time, the xenophobia score was likely influenced by frustrations over foreign-controlled mining operations, which provided minimal economic benefits to the local population.

Official unemployment rates were reported at 5.1% in 2020, 5.4% in 2021, and 5.1% in 2022 (Trading Economics, 2023). While official data should always be cautiously approached, trends indicate that this three-year period marked the highest unemployment levels in the past eight years. Alongside rising unemployment, self-employment remains exceptionally high. Hanson (2004, p. 30) estimates that 85% of Burkinabe workers are self-employed, with approximately 70% of the labor force engaged in the informal sector (International Organisation of Employers, 2023, p. 2). While specific figures may vary, it is evident that a substantial portion of Burkina Faso's economy relies on informal or self-employed labor. These employment sources are often unreliable, exacerbating economic insecurity, fueling public discontent, and contributing to broader societal instability.



In addition to the employment structure, the mining industry is one of the largest contributors to economic development in Burkina Faso. Burkina Faso is one of the largest producers of gold, manganese, and zinc. Some sources list Burkina Faso as Africa's fifth-largest gold producer (Trade Commissioner Service, 2022). While this has the potential to be a positive influence on societal production and resiliency, the lack of government oversight, foreign influence, and corruption makes it less of an influence on resiliency and more of a source of negative sentiment and vulnerability. The seven largest mining companies in Burkina Faso are all foreign-owned (four Canadian, one British, one Australian, one Russian). This results in minimal local control over resources and very little wealth distribution throughout the country. The lack of local control could be a factor influencing the increased sense of xenophobia, as seen in public sentiment before the January coup (Figures 1, 2, 3). Additionally, most of the relationships and contracts between the Burkinabe government and mining companies are opaque and lack transparency and oversight. Those contracts are also being terminated as governments change, causing significant problems with political and economic development in Burkina Faso. Additionally, the mines often operate outside the jurisdiction of Burkinabe law. The US Department of Labor's Bureau of International Labor Affairs (2022) reported that up to 50 percent of the labor in the gold mines is under the age of 15, working as forced labor in hazardous conditions. Additionally, when the junta closed the country's borders after the coup, this order did not apply to the mining companies (Africa Intelligence, 2022).

Environmental Security and Economic Vulnerability

Environmental degradation also has a major impact on economic production and societal resiliency, in Burkina Faso, especially agricultural production. This could also influence the elevated Examples of human activities that lead to the deterioration of the environment include soil erosion and climate change. These processes reduce agricultural productivity and threaten food security. Environmental degradation is a multi-faceted issue in Burkina Faso, leading to increased social vulnerability throughout the country. Societal vulnerability often increases due to inequalities in access to resources. Burkina Faso's economy is primarily based on agriculture, with sorghum, millet, maize, and rice being the main crops produced for local consumption (Adger, 2006). Cotton alone accounts for around 73 per cent of Burkina Faso's export revenues, making it one of the top five cotton producers in Africa. Livestock is also a significant contributor to the country's exports (Simonsson, 2005). All forms of agriculture and livestock production are mostly dependent on rainfall and, therefore, extremely vulnerable to droughts.



Cotton production is a significant contributor to soil degradation, exacerbated by overgrazing and deforestation. Soil degradation ultimately leads to decreased agricultural productivity, which in turn jeopardizes food security and livelihoods for a predominantly agrarian population. Environmental factors, such as, climate change and environmental degradation, contribute to societal vulnerability by disrupting livelihoods. Vulnerable communities are often located in hazard-prone areas and lack the resources and infrastructure to cope with and adapt to environmental risks. However, wealthier farmers can often mitigate environmental degradation with the use of fertilizer (Cutter et al, 2008, p.601). Poorer farmers, on the other hand, may have less of a negative environmental impact on the land, but do so at the expense of their economic development and well-being.

As the amount of fertile land decreases, the competition for scarce resources in Burkina Faso intensifies. Furthermore, climate trends and variability are contributing to the rise in environmental degradation. This leads to increased social tensions and displacement as the migration of displaced farmers can lead to increased competition for formal and informal employment opportunities. In addition, in rural regions, climate change is leading to conflicts between farmers and herders for land use and access to water (Climate Diplomacy, n.d.). This conflict has been exacerbated due to drought and livestock encroachment onto cultivated lands.

Being in a semi-arid region, Burkina Faso is highly vulnerable to climatic stressors such as droughts. While there is an established wet and dry season in the North and South, there is an extreme variability in the amount and timing of the rainfall each year (Simonsson, 2005). Being prone to recurrent droughts, this poses challenges to agriculture, food security, and water resources. For agriculture, the droughts exacerbate the soil degradation of the overused land leading to reduced crop yields. For food security, the reduced crop yield affects food scarcity leading to an increase in food prices and a reduction of demand for labor creating a job shortage (Simonsson, 2005). It is the most vulnerable population, the poor, who will face the greatest impacts of climate change due to their already limited access to resources. By mid-June, the situation appeared to stabilize somewhat (Figure 2). While the desire for income redistribution remained high, it was moving away from criticality, indicating a potential shift towards stability in Burkinabe society.

As the Second Coup approaches: The Crisis of Allocation, Presence, and Legitimacy

In 2022, the Burkinabe military conducted two coups. The MDUN analytical model visualized the societal factors that created societal acceptance of the September coup. To explain the context of rising societal vulnerability leading to the September coup, we use Binder's model of political development as an



explanatory framework. Several scholars have used Binder's 1964 model to explain societal political development, which includes six dimensions: political presence (political penetration in Verba et al. (2015)), identity, political legitimacy, political participation, production, and allocation.

As 2022 progressed, the July (Figure 3) and September radar plots showed the impact of a declining security situation and the beginnings of a crisis of allocation (security and food) and legitimacy. Due to this decline in personal security, local citizens began to lose trust in the government, resulting in higher vulnerability scores for lack of confidence in the government and a desire for more national sovereignty. As these scores approached critical levels, societal change became more likely. As the coups approached in 2022, the allocation of security became a more significant factor of societal vulnerability. Along with global supply chain issues, local terrorist activities increased global food insecurity (Hanson, 2024, p.27). The International Rescue Committee (IRC) (2023) reports that an estimated 3.3 million citizens in Burkina Faso are suffering from hunger. Security also deteriorated in multiple regions. Hanson (2024, p. 31-32) reported a doubling of organized political violence incidents in Burkina Faso between 2020 and 2021, with an 80% increase in related fatalities, reaching nearly 2,600 deaths in 2022. Additionally, up to 1.5 million people were internally displaced due to escalating violence. These trends illustrate how the government's inability to allocate security and resources contributed to rising instability.

The Collapse of Essential Services and the Rise of Local Defense Groups

The breakdown of governance extended beyond security concerns, with the education system facing collapse. Engles (2022, p. 316) reported that over 120 attacks on schools were reported, and 2 500 schools were closed due to the security situation. This number continues to rise post-coup, with a 44 per cent increase reported in 2023 (Africa Center for Strategic Studies, 2023). The Africa Center for Strategic Studies (2023) estimates that 25 per cent of the schools in the country are currently not operating. This led to a significant decline in the allocation of education for the youth, plus this shows the lack of security provided by the local government. All of this impacts a significant rise in the "want safer communities" dimension on MDUN, almost rising to a level of criticality.

The security situation continued to deteriorate even after the coups. According to the Africa Center for Strategic Studies (2023), the number of people killed by militant Islamic violence has tripled since the coups. In 2023, they estimated that 8 600 people were killed in violence linked to militant Islamic groups, representing a 137 per cent increase in violence compared to the previous year. Not only is the amount of violence increasing, but the spatial extent of the violence is also increasing. The Africa Center for Strategic Studies (2023) estimates that the violence



occurred on 6 975 square kilometers of land in Burkina Faso, an increase of 46 per cent from 2022 estimates.

To provide security at the local level, locally organized self-defense groups have taken security roles typically provided by the government. Several groups, including the Dozos, Ruggas and the Koglweogos (now known as Vountaires pour la défense de la patrie (VDP)) have transformed from local farmer and herder groups into self-defense organizations (Hagberg et al., 2023, p.110–111). The rise of local organizations demonstrates the vacuum of security created by the Burkinabe government and begins to explain the rising discontent within the Burkinabe population that led to the collapse of the government.

Political Legitimacy and the Role of Anti-French Sentiment

Political legitimacy refers to the local population's belief that the government legitimately represents their interests and deserves their loyalty. As the coup approached, political legitimacy became one of the most critical dimensions of vulnerability as measured by MDUN. By the time of the coup, the "Lack of Confidence in Government" reached criticality in terms of vulnerability. This follows the government's inability to control the insurgency in the north.

The coup makers took advantage of two major grievances within Burkinabe society. First, there is significant anti-French sentiment in the country. According to Hanson (2024), 'young people all over West Africa have animosity for France which the coup makers have taken advantage of in their quest for power. The population blames France for involvement in government deficits.' By ending French operations in 2023, the Burkinabe government hopes to gain support and increase legitimacy.

Second, the former president's inability to deal with the insurgency in the north and provide security for the population was a major influence on the success of the coups. According to Engles (2022, p. 316), the "putschists" used the government's inability to deal with the deteriorating security situation in the north as justification to overthrow the government. Similarly, Hanson (2024) noted that surveys of the local population showed that most Africans still support democratic institutions, but public trust has declined due to the government's inability to "live up to democratic expectations." Hanson goes on to note that the government's inability to combat poverty and insurgencies led to a "democratic crisis," or a crisis of legitimacy, in the country. Finally, Hagberg, et al. (2023, p. 108) contrasted the success of the 2022 coups to the resistance to the September 2015 coup. They attributed the differing levels of support and legitimacy to the exhaustion of the population suffering from insecurity and the hope that an "unconstitutional change" (i.e., coup) would help solve the security situation. This demonstrates the connection between allocation and legitimacy in



Burkina Faso. The lack of security led to a crisis of legitimacy in the government, creating an environment of support or ambivalence towards the coups.

Political Presence and the Fragmentation of Authority

Political presence refers to the government's ability to disseminate its messages and actions to the local population (Binder, 1964). Political presence has been low in Burkina Faso for several years. Haavik Bøås and Iocchi (2022, p. 318) characterized the Burkinabe government as weak since 2014. Additionally, Hanson (2004, p. 34) believed that local strongmen, religious organizations, and the state have used militias, rebel groups, jihadists, and the military as their private armies to settle disputes over resource access and to promote their influence, or political presence. Most of this power projection was for personal gain and provided the local population with little messaging of their goals as agents of influence in the country.

In addition to local groups stepping into the security vacuum, Russia and China have also provided support for security, and by extension, their own political presence, in Burkina Faso. In January 2024, Russia deployed 100 people to provide security to the president and the population (Lechner & Eledinov, 2024). These are likely members of the new paramilitary Africa Corps that will perform the functions of the disbanded Wagner Group (Bartosiewicz & Zochowski, 2024). China also provided 900 security cameras in the country (Agence France Press, 2021). In addition, China provided 400 000 doses of the Sinopharm COVID-19 vaccines to Burkina Faso (National Library of Medicine, 2021).

As the Second Coup Approaches Part 2: Foreign Influence on Burkina Faso (The Crisis of Identity)

Figure 3 highlights that by the end of July, new threats had emerged. While the desire for income redistribution continued to slowly recede, the population's lack of confidence in their government neared criticality, and several other factors became more concerning. The coup makers took advantage of two major grievances within Burkinabe society. First, there is a significant anti-French sentiment in the country. According to Hanson (2024, p.35), 'young people all over West Africa have animosity for France which the coup makers have taken advantage of in their quest for power. The population blames France for involvement in government deficits'. By ending French operations in 2023, the Burkinabe government hopes to gain support in the country and increase their legitimacy.

The presence of 400 French Special Operations Forces in Burkina Faso, even after Operation Barkhane officially ended, may have contributed to the 2022 xenophobia score. The Burkinabe government finally asked them to leave in January 2023. The three Sahelian countries involved in Barkhane (Mali, Niger, Burkina Faso)



used anti-French rhetoric during this period. If these concerns reached a critical threshold, it suggested that the population might act to destabilize Burkinabe society, potentially leading to civil unrest, riots, land occupations, insurgencies, or a wholesale revolution. However, most other factors were moderate, with none approaching the critical edge. Recently, the coup leaders have begun pushing an agenda for their government. Initially, Engles (2022, p. 315) noted that coup occurred to “put the country back on track” and “restore the territorial integrity and sovereignty.” The focus of this message of restoring territorial integrity and sovereignty was directed at the insurgencies in the north of the country. This message would resonate with the local population who have expressed concerns with security for the past several years.

At the international scale, the government has reoriented its geopolitical orientation away from the French and towards China and Russia. In 2018, Burkina Faso switched its diplomatic recognition from Taiwan to the People's Republic of China (PRC). This was accompanied by a large investment by the PRC into Burkina Faso. Even after the coup, the Burkinabe government has maintained a close relationship with China. In recent years, the Traoré government has grown its relationship with Russia. This includes humanitarian aid, an agreement to build a nuclear power plant in the country, cultural exchanges, and most recently, security forces to support the government. On 16 January 2024 Africa Defense Forum (2024b) reported the creation of a paramilitary Africa Corps that would replace the now defunct Wagner Group as Russia's main armed presence on the Continent. Two weeks later, a report by Poland's Center for Eastern Studies (see Bartosiewicz & Zochowski, 2024) reported that 100 members of the Africa Corps landed in Burkina Faso in late January, with an additional 200 to arrive later. This roughly equals the number of French Special Operations forces that were present until asked to depart in January 2023.

The departure of the French, the removal of diplomatic relations with Taiwan, and the increased cooperation with China and Russia demonstrate a new geopolitical orientation for Burkina Faso. While these actions have garnered attention outside of the country, their influence in the country is not seen with the same interest. For several years, the country's governments have struggled to promote a coherent message and follow through with actions to improve security conditions in the north. The government seems to be out of touch with the population, especially in the north.

Political Ecology, Identity, and the Rise of Pan-Africanism

Political ecology research suggests that identity conflicts increase during environmental stress and resource conflict. As measured by Lack of Community Identity in MDUN, identity was not a significant factor in societal vulnerability



in Burkina Faso. However, while not significant, the impact of identity increased throughout 2022. Two main aspects of Burkinabe societal development help explain the impact of identity on societal vulnerability, both of which are impacted by growing xenophobia as seen in the MDUN measures from 2022.

First, there is a strong anti-French sentiment in West Africa, particularly in Burkina Faso. Historically, according to Hansson (2024: 25) the French government used culture, or *diplomatie culturelle*, as an instrument of foreign policy, benefiting long-term political and economic objectives by creating a shared identity between the French and their colonies through language and culture. In modern Burkina Faso, the local population is beginning to challenge the supremacy of French culture and chart their own course of development. While research focuses on culture, the French have also been historically interested in economic exchanges in the region.

The decline in French-African identity has led to a renaissance of Pan-Africanism. Pan-Africanism emerged in the early twentieth century to foster unity among all people of African descent worldwide and promote self-reliance and self-government, particularly in Africa. During the 1990s, the movement underwent a shift towards a more aggressive, anti-European version of Pan-Africanism, which sought to dislodge traditional European influences from the region. There is a strong tie between economics and culture, as seen in protests against the Central African Franc. In recent years, the movement has been co-opted by foreign powers to shift political influence away from traditional colonial powers to new suitors, particularly Russia. This shift confirms O'Lear et al's observation that local disasters must be "understood within the context of the global-political system of capitalism that underpins processes of environmental change" (O'Lear et al, 2002, p. 2). While their focus is on environmental crises, the application of this observation to political crises is not difficult to perceive. Foreign actors are manipulating political vulnerability in a region to gain influence and access to key strategic minerals.

The Russians have used their social media influence campaign to promote their regional interests and discredit other potential influencers they see as competitors. Pan-Africanism is one of the key narratives pushed by Russia to break traditional colonial linkages (Afrocentrism) and allow Russian companies to fill the void. Russia launched a large-scale social media influencing campaign in Africa through Yevgeny Prigozhin's Internet Research Agency (Stanford Cyber Policy Center, 2019; US Department of State, 2022). In Burkina Faso, Eckles (2024) chronicles how Russian social media exploited legitimate concerns of the Burkinabe population to build a campaign that blamed France and presented Russia as a savior. They also promoted the authoritarian coup leaders, like Traoré, who look to partner with Russia.



In addition to social media, Russia has funded and supported modern Pan-African leaders to promote Pan-African and Afrocentric identities to deteriorate European influence further. One example is Kemi Seba, a French-Beninese writer and political activist focused on anti-colonialism in West Africa and the reliance on the West African CFA Franc (LE Cam, 2023). Seba's connections to Russia are well-documented, including funding from Prigozhin and invitations to several Russian-African Summits in Russia (Coakley & Vetch, 2022; Roger, 2023). In the wake of Burkina Faso, Mali, and Niger's departure from the Community of West African States, there are hints that all three states are considering dropping the CFA. Jeune Afrique quoted Nigerien Transitional President Tiani, 'There is no longer any question of our states being France's milk cow. Money is a sign of sovereignty. We are in the process of recovering our complete sovereignty' (Jeune Afrique, 2024). As a form of political participation, Hanson (2024) stated that the Russian flag has become a symbol of France's declining influence in its former African colonies. Following the coup, Hanson (2024) observes that numerous Russian flags were raised in the capital.

Ethnic Conflict and the Fulani Crisis

In addition to the anti-colonial identity conflict, ethnic conflicts are also crucial to modern political development in the country. One of the most significant is the Fulani crisis. The Fulani are a group of Islamic pastoralists in the Sahel region. The increased desertification of the Sahel has reduced the rangelands available to pastoralists, leading to environmentally driven violence as farmers clash with pastoralists over land access. According to Cisse (2020), the Fulani have militarized and joined jihadist groups in the region, often for economic gain. While this growth of violent extremist organizations (VEOs) has not significantly influenced identity in Burkina Faso, the government's inability to control these VEOs has contributed to vulnerability in terms of security and trust in the government.

The decline of French cultural influence in the region creates an identity void and increased vulnerability. Various actors promote anti-French sentiment through modern interpretations of Pan-Africanism and Afrocentrism. Russia seized the opportunity to exert its influence by supporting leaders in the Pan-African movement and pushing disinformation through social media. This leads to increased vulnerability in Burkina Faso, as seen in growing xenophobia. The departure of the French, the removal of diplomatic relations with Taiwan, and the increased cooperation with China and Russia demonstrate a new geopolitical orientation for Burkina Faso. This new orientation enables new suitors to access resources and raw materials within the country. China and Russia's desire to access resources in Africa, along with their methods, is well-documented in the literature. While these actions have garnered attention outside the country, their influence



within the country is not seen with the same interest. For several years, Burkina Faso's governments have struggled to promote a coherent message and follow through with actions to improve security conditions in the north. The government seems to be out of touch with the population, especially in the north.

CONCLUSIONS

The analysis shows that Burkina Faso's instability cannot be understood without looking at how social, political, and environmental pressures built over time and intersected in 2022. The MDUN results highlight several dimensions that moved toward critical levels well before the September coup. Rising distrust in the government, stronger demands for national sovereignty, concerns about personal security, and growing xenophobia all intensified between May and July. These shifts in public sentiment aligned with worsening environmental pressure, declining agricultural productivity, and local conflicts over land and water. Taken together, these factors help explain why any major incident during this period could trigger large-scale political change.

The MDUN projections make this connection clearer. By mid-June, the model showed that confidence in the government and belief in its legitimacy were on track to cross a critical threshold by September. These same dimensions later became the core justifications presented by coup leaders. The model also showed rising concerns about community safety and national sovereignty, which matched the growing frustration with the state's inability to contain violence in the north and the widespread rejection of French involvement. The alignment between these sentiment trends and the political events that followed demonstrates how environmental stress and governance failures created conditions that foreign actors could exploit to gain influence.

These findings point to the broader pattern in Burkina Faso: environmental degradation, resource competition, political marginalization, and weak state presence reinforce one another and shape how people interpret both local crises and external actors. This is not a simple story of outside interference or internal decline. It is a multilevel process where global, regional, and local influences interact, feeding shifts in public attitudes that weaken state authority and open the door to political upheaval.

As environmental pressures deepen across the Sahel, countries will face similar cycles of declining state presence, rising security needs, and growing distrust in government institutions. These conditions create space for violent groups, local



militias, and global powers seeking strategic advantage. Understanding how these environmental and political pressures shape public sentiment is essential for anticipating instability and designing responses that strengthen both resilience and legitimacy.

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EAST-WEST AND GENDER MORTALITY GAPS IN EUROPE'S ELDERLY POPULATION DURING THE COVID-19 PERIOD

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Abstract

This study examines changes in old-age mortality in Europe during the COVID-19 pandemic period, focusing on two critical disparities: the East-West mortality gap and the gender mortality gap. Motivated by long-term variations in mortality rates across European regions and between sexes, this research aims to clarify how these inequalities changed during the pandemic. By addressing the interplay between regional and gender-based disparities, the study contributes to a deeper understanding of the pandemic's effects on vulnerable populations, particularly the elderly. Factor and cluster analyses were employed to categorise European countries into clusters for comparison of mortality trends and to evaluate the persistence of the East-West gradient. The research on mortality gaps utilises a quantitative approach, analysing data from the Human Mortality Database and Eurostat for the years 2019–2022. Annual weighted and unweighted mean differences in life expectancy at age 65 were calculated to assess changes during the pandemic. Gender-specific differences were examined alongside regional disparities to highlight the compounded impacts of the pandemic on old-age populations. The study reveals that during the COVID-19 pandemic, the East-West mortality gap among the elderly widened. Before the pandemic, the life expectancy difference at age 65 between Eastern and Western Europe was 4.44 years for men and 3.24 years for women. By 2022, this gap widened to 6.02 years for men and 4.75 years for women. Western European countries showed signs of recovery in 2022, whereas Eastern European countries experienced prolonged declines in life expectancy. Gender disparities remained relatively stable during the pandemic, with differences of approximately 4.4 years in Eastern Europe and 3.2 years in Western Europe. The findings underscore the pandemic's role in amplifying regional inequalities while maintaining gender disparities. This study provides novel insights into the compounded impacts of the COVID-19



pandemic on old-age mortality in Europe, emphasising the interplay between regional and gender gaps. It contributes to the literature by demonstrating how crises, such as pandemics, can exacerbate existing inequalities. The findings have significant implications for public health policies, highlighting the need for targeted interventions to address regional disparities and support ageing populations in vulnerable regions.

Key words

life expectancy at age 65, East-West mortality gap, gender mortality gap, COVID-19, European countries

INTRODUCTION

The COVID-19 pandemic significantly altered long-term mortality trends in Europe. Even before its outbreak, despite general improvements in mortality during the second half of the 20th century, specific convergent and divergent trends were observed. These were particularly observable between traditional democratic countries and states of the socialist bloc (“East-West mortality gap”) and between sexes (“gender mortality gap”). Differences in political and healthcare systems, behavioural factors (e.g., smoking habits or alcohol consumption), and environmental conditions (e.g., air pollution) have notably influenced the East-West mortality gap (Tleshova et al. 2025; Janssen 2020; Velkova et al. 1997; Bobak and Marmot 1996). Since the turn of the millennium, mortality in post-socialist regions has decreased, narrowing the East-West mortality gap (Velkova et al. 1997; Meslé 2004; Leon 2011). The gender gap reflects stable differences in life expectancy between men and women, shaped by biological, socioeconomic, cultural, and behavioural factors (OECD 2023; Dahlgren and Whitehead 1991; Allel et al. 2021).

As the pandemic has affected many dimensions of human life, including health and the economy, Schöley et al. suggested that the homogeneous mortality perceptions of Europe were disrupted by the different impacts of the pandemic on populations, depending on their age-sex structure, vaccination coverage, or health system capacity (Schöley et al. 2022). Regarding the gender mortality gap during the COVID-19 pandemic, Beegle et al. expected it to increase in 2020, particularly in high-income countries, such as the Netherlands, Switzerland, or Canada (Beegle et al. 2024). In general, the progress in gender equalisation observed in 2010–2019 has slowed or even reversed in many countries in the years that followed (Pinho-Gomes et al. 2022).

Despite a growing body of research documenting the impact of the COVID-19 pandemic on life expectancy and excess mortality in Europe, most studies focus on the total population or on life expectancy at birth, and rarely systematically examine higher-age mortality, particularly in relation to long-standing East-West differentials. Moreover, there is a lack of empirical work that jointly quantifies both the East-West mortality gap and the gender gap at higher age within a unified



analytical framework, while explicitly linking pandemic-period developments to pre-pandemic convergence or divergence trends.

OBJECTIVES

The study is focused on two main aims. The first objective is to assess the persistence of the East-West mortality gap in Europe, particularly among the elderly population. The second aim is to examine mortality gaps (the gender gap and the supposed East-West gap) among European countries during the COVID-19 pandemic and to investigate how the pre-pandemic mortality trends were affected during the pandemic years.

In contrast to previous studies on this issue, which employed basic comparisons of mortality indicators between groups of countries or sexes (Velkova et al. 1997), the present study applies a unified, yet straightforward quantitative framework that jointly captures East-West and gender mortality gaps at age 65 using weighted and unweighted mean differences between empirically derived country clusters. By tracing these gaps from pre-pandemic years through 2020–2022, it uniquely shows how, during the COVID-19 pandemic, long-standing mortality inequalities among Europe's elderly population were reshaped.

THEORETICAL FRAMEWORK

The East–West mortality gap can be understood through the lens of fundamental cause theory (Link and Phelan, 1995). It emphasises that, above all, socio-economic resources and institutional capacities shape long-term health outcomes. During COVID-19, countries with stronger structures recovered faster, while those constrained by historical and systemic inequalities continued to experience elevated mortality, highlighting the role of deep structural determinants beyond individual behaviours.

This study builds upon existing research on mortality disparities in Europe, focusing on the interplay between regional inequalities and gender differences. It incorporates established theories on socio-political, behavioural, and environmental determinants of mortality trends (Bobak and Marmot 1996; Meslé et al. 2002; Pinho-Gomes et al. 2022). These studies agree on the existence of the East-West mortality gradient in Europe, supposing convergence over the latest decades before the COVID-19 pandemic (Shkolnikov et al. 2024; Velkova et al. 1997; Meslé et al. 2002; Leon 2011) as well as a narrowing of the gender mortality differences (Pinho-Gomes et al. 2022). Additionally, it integrates recent findings on the impacts of the COVID-19 pandemic on vulnerable populations, emphasising the compounded effects of health crises on pre-existing disparities (Schöley et al. 2022; Bamba et al. 2020; Igari 2023). Generally, it could be assumed that a pandemic or any health crisis leads to an increase in mortality inequalities (Shkolnikov et



al. 2024). Specifically, during the COVID-19 pandemic, a greater mortality excess was observed in Eastern Europe and the Baltic countries, where pre-pandemic mortality was also traditionally higher. This trend is often associated with higher levels of poverty or income inequality and lower vaccination rates in those affected countries (Pizzato et al. 2024). There were also differences in the pandemic burden and population vulnerability (Igari 2023). The increase in mortality differences was driven primarily by the second pandemic year, 2021 (Igari 2023; Shkolnikov et al. 2024). Analyses suggest that the stringency of pandemic control measures played only a minor role in explaining regional mortality differences; instead, trust in government and in the measures, and thus compliance with them, as well as, above all, the use of vaccination in 2021, emerge as key factors (Shkolnikov et al. 2024). Also, the health system's capacities and overload in relation to the timing of the spread of infection played an important role (Igari 2023).

Particular aspects may be discussed related to gender-specific impacts of the COVID-19 pandemic. Both sexes are assumed to be influenced by different factors, but potentially with similar resulting effects on mortality increase (Pinho-Gomes et al. 2022; Pinho-Gomes et al. 2023). During the first pandemic year, globally, in high-income countries, the excess mortality was much higher for men than for women, likely due to the accumulation of gendered advantages for women (lower infection fatality risk, different occupational exposure, better access to care). In 2021, sex ratios of excess mortality fell, probably reflecting vaccine rollout and the earlier depletion of the most vulnerable groups (Beegle et al. 2024).

In general, gender differences in mortality during the pandemic are assumed to be driven primarily by a combination of biological factors, social roles, inequalities, and other health determinants. While analyses of biological (genetic, hormonal, etc.) factors show rather inconclusive results, apparent gender diversity has been documented, stemming from gender differences in multimorbidity, in health-related behaviours (e.g., smoking, alcohol overuse, use of preventive tools), or in the structure of employment (Lemarchand et al. 2025).

DATA AND METHODS

The analysis involves three particular steps. The first two steps aim to classify the European countries into several groups with similar mortality conditions. This enables us to compare the studied mortality gaps not only among nations but also between and within groups of countries at a comparable level of demographic development. Additionally, this part of the analysis enables evaluation of the persistence of the East-West mortality gap and the differences between post-communist countries and other European countries. The third step is a crucial part of the analysis, focusing on quantifying the mortality gaps themselves.



The first step involves applying factor analysis to pre-pandemic life expectancy values (life expectancy at age 65 for men and women in 2017, 2018, and 2019) to aggregate them into factors that cover the 35 European countries studied (Table S1 in the Supplement). The calculated factor scores are then used as input variables in the second step's cluster analysis, enabling a multivariate classification of the countries studied. In this second analytical step, groups of countries with the most similar pre-pandemic mortality characteristics are identified. As there are no extreme observations in the dataset, the Euclidean distance was used in the hierarchical procedure and the average linkage method of clustering. In line with the objective of assessing whether a traditional East-West mortality pattern persists in Europe, we retained two dominant clusters encompassing most European countries for further analyses. If it were confirmed that the two dominant clusters do not correspond to the traditional East-West differences, then this would reflect a violation of this pattern in Europe. As will be seen from the description of the results, a small third cluster was formed based on the analysed data, including only two countries with specific developments. This remained part of the descriptive analysis but was not used to study the East-West mortality gap, as it brings together countries that currently deviate from this East-West distribution in their values and trends.

The third step was analysing mortality gaps and the changes observed during the pandemic period, with a focus on older ages. To estimate both the East-West gap (differences between the clusters of countries) and the gender gap, and to present them in a complex manner, we used a measure based on the mean difference in life expectancy at age 65 between and within the clusters of countries. For the analysis, two forms of the mean difference are proposed: the population-unweighted form (which reflects heterogeneity among countries) and the weighted form (which reflects heterogeneity among inhabitants in the studied countries). The weight is the population size at age 65 and over as of July 1 in each year of analysis (see Data availability for details) for each country, published by Eurostat (Eurostat 2024).

For analysis of the East-West gap (gap between the clusters of countries), the mean difference measure (MD) could be defined as:

$$MD^{E-W}_{e65} = \sum_{ij} (w_i \times w_j) \times \frac{(e65_i - e65_j)}{[(w_i \times w_j) \times (I \times J)]}$$

or

$$MD^{E-W}_{\Delta e65} = \sum_{ij} (w_i \times w_j) \times \frac{(\Delta e65_i - \Delta e65_j)}{[(w_i \times w_j) \times (I \times J)]}$$



where $e65$ represents life expectancy values at age 65 and $\Delta e65$ their annual differences, i and j represent countries in the particular clusters, $i = 1, \dots, I$ and $j = 1, \dots, J$; I and J are the total numbers of countries in both the clusters, $I \times J$ is the number of studied inter-country differences. w_i is the weight of the i -th observation, where $w_i =$ number of males or females aged 65 and older in country i or $w_i = 1$ in the population-unweighted approach. The calculation was done separately for males and females. Regardless of the direction of subtraction, we maintain the established term East-West gap.

Similarly, the gender gap was calculated as the mean difference in life expectancy at age 65 for females and males ($e65^{females}$ and $e65^{males}$) in particular clusters, in the same manner, we analysed also the mean difference of the annual changes of the life expectancy gender gap:

$$MD^G_i = \sum_i (e65^{females}_i - e65^{males}_i) / I$$

or

$$MD^{\Delta G}_i = \sum_i \Delta (e65^{females}_i - e65^{males}_i) / I$$

for the unweighted form

and

$$MD^G_i = \sum_i w_i^{females+males} \times (e65^{females}_i - e65^{males}_i) / \sum_i w_i^{females+males}$$

or

$$MD^{\Delta G}_i = \sum_i w_i^{females+males} \times (\Delta (e65^{females}_i - e65^{males}_i)) / \sum_i w_i^{females+males}$$

for the weighted form for the cluster i . The calculation was done separately for particular groups of countries (clusters).

We do not use the absolute (or square) value of the difference in the numerator of the proposed measure, allowing negative differences to contribute to a decrease in the calculated gap. While the analysis based on annual values of the examined indicators allows for a description of the development of the East–West and gender mortality gaps, the analysis based on annual changes in the indicators will make it possible to better track the evolution of both gaps and, above all, to capture the periods when long-term trends began to change. The use of weighted and unweighted differences enables a more detailed examination of regional and gender inequalities compared to previous approaches. However, since the primary purpose of the article is to identify differences among European countries in the analysed mortality gaps, the following text will focus on interpreting unweighted indicators. However, in presenting the results, the weighted form, which maps



the differences between inhabitants of individual clusters, is also included for comparison. As will be seen in the following text, the basic trends of both indicator types are essentially identical. The analysis was performed using both Excel and SAS software, version 9.4.

The crucial data – life expectancy at age 65 for men and women – was taken from the Human Mortality Database (Max Planck Institute for Demographic Research (Germany), University of California, Berkeley (USA), and French Institute for Demographic Studies (France) n.d.) or the World Population Prospects database (United Nations, Department of Economic and Social Affairs, Population Division 2022). Countries with fewer than 1 million inhabitants were excluded from the analysis because of the high variability in their mortality trends, which makes it challenging to distinguish systematic patterns from random fluctuations.

The analysis comprises three pre-pandemic years (2017, 2018, and 2019) and three pandemic years (2020, 2021, and 2022); the complete input data are provided in Supplementary Table S1.

RESULTS AND DISCUSSION

The clusters formed using the cluster analysis (Figure 1; for more details, see Supplementary Table S1 and Figure S1) almost precisely reflect the distinction between post-communist countries and traditional European economies. Western, Northern, and Southern European countries were combined into a single cluster. Most of the post-communist countries formed a second cluster. There were only a few exceptions – Slovenia, which was based on the pre-pandemic (2017–2019) life expectancy values added to the first cluster of countries, and an independent cluster containing North Macedonia and Bosnia and Herzegovina. The last two mentioned countries do not fit into either of the previous two clusters; their demographic situations and development are unique within Europe. Although both countries merit attention in demographic research, in line with the focus of this paper, they will be excluded from further analysis, and the focus will be on the two presented clusters. Their composition reflects the persistent East-West mortality gap in Europe. However, it is worth noting that pre-pandemic developments foreshadowed a possible loosening of this East-West gradient, as seen in the case of Slovenia. In the following analysis, in accordance with the paper's issue, the first cluster will be labelled "West," and the second, comprising Central and Eastern European countries, will be labelled, for simplicity, as "East."

Figure 1 illustrates not only the clusters (distinguished by colour) but, above all, the development of mortality in European countries from 2019 to 2022, based on life expectancy at age 65. Clearly, in both studied groups of countries (East and West), the pandemic period brought visible changes in mortality levels. Trajectories show that most countries experienced a leftward shift (decrease in life expectancy,



as represented by the male values in Figure 1) and an upward trend (increasing gender differences) during the pandemic. In other words, the pandemic's onset worsened (decreased) life expectancy in all the studied countries (accompanied by a slight increase in the gender gap). The East cluster experienced a more pronounced change in mortality, with a notable decrease in life expectancy and a widening gender gap, resulting in greater variability across European countries. In the West cluster, the end of most trajectories (arrows) in 2022 is more favourable than the initial year (dots), indicating recovery or improvement since 2019. In the East cluster, the most recent studied year was less favourable than the pre-pandemic period, showing no full recovery until 2022.

Another potential factor contributing to the increase in mortality in 2022 in the East cluster may be the onset of the Russian–Ukrainian armed conflict, which may give rise to further changes in mortality patterns that warrant more detailed analysis once sufficient post-conflict data become available.

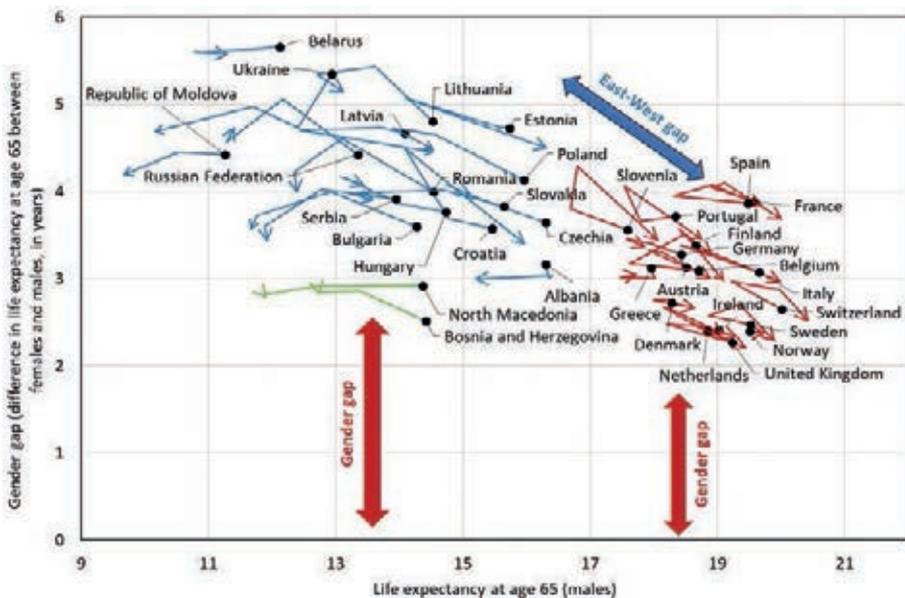


Fig. 1 Visualisation of the East-West mortality gap and gender mortality gap: trajectories of European countries according to the gender gap in life expectancy at age 65 (y-axis) and male life expectancy at age 65 (x-axis), 2019, 2020, 2021 and 2022
Notes: Colours – classification of the countries according to the results of the cluster analysis (see Supplementary Figure S1) into West cluster (red), East cluster (blue), and residual cluster (green). Dots correspond to the initial mortality situation (2019) and start particular country-specific trajectories. Arrows represent the last year under observation (2022).

Source: United Nations, Department of Economic and Social Affairs, Population Division 2022; Max Planck Institute for Demographic Research (Germany), University of California, Berkeley (USA), and French Institute for Demographic Studies (France) n.d.; Eurostat 2024



The simple quantitative expression of the East-West gap or the gender gap proposed above aims to evaluate the changes in these gaps during the pandemic directly in numerical terms. We focus specifically on the differences between countries (e.g., the unweighted measures) in the text; weighted differences between the clusters and sexes are usually more pronounced than country-based differences. The main trends, however, are the same. The results for both (weighted and unweighted) measures are shown in Figure 2.

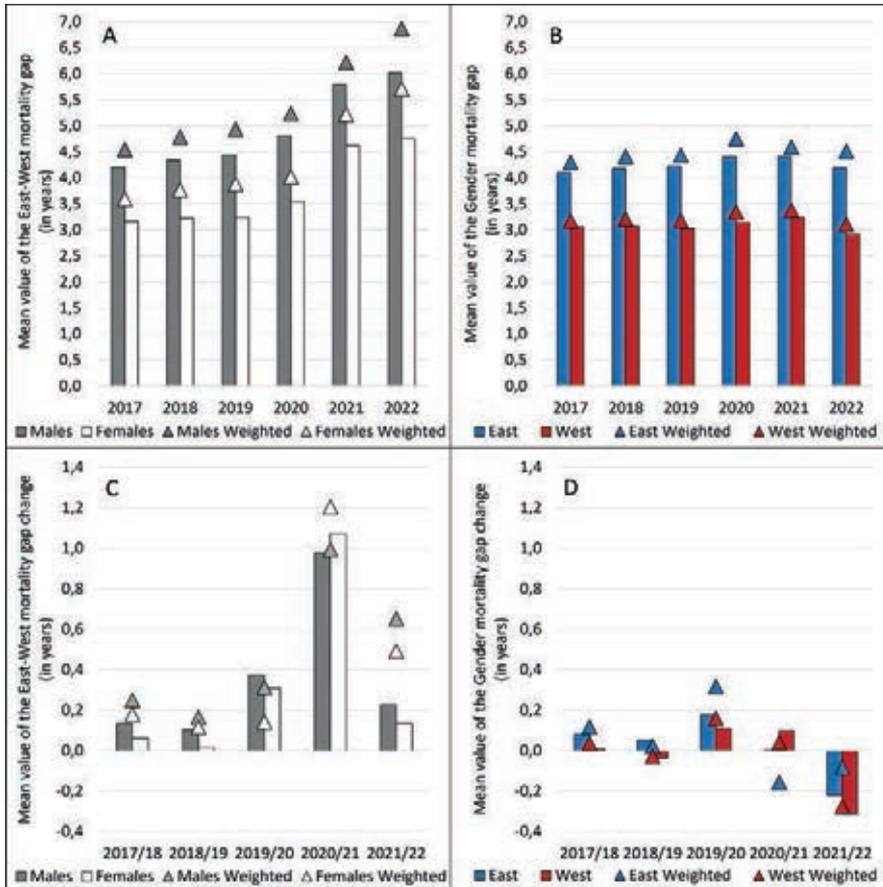


Fig. 2 Mean difference of the East-West mortality gap (A) and the gender mortality gap (B) based on life expectancy at age 65, unweighted and population-weighted, 2017–2022 (in years, upper panels), the mean difference of the East-West mortality gap (C) and the gender mortality gap (D) based on annual changes in life expectancy at age 65, unweighted and population-weighted, 2017–2022 (in years, lower panels)

Source: United Nations, Department of Economic and Social Affairs, Population Division 2022; Max Planck Institute for Demographic Research (Germany), University of California, Berkeley (USA), and French Institute for Demographic Studies (France) n.d.; Eurostat 2024



According to the results in Figure 2, before the onset of the pandemic (2017, 2018, and 2019), the mean difference (MD) in life expectancy at age 65 between the countries in the East and West clusters was above 3 years for females and more than 4 years for males (Figure 2, panel A). Before the pandemic, the East-West gap had already slightly increased, especially for males; therefore, the pandemic did not alter this trend. Above all, in the second pandemic year (2021), the East-West gap rose exceptionally, by about a year for both sexes (Figure 2, panel C). In 2021, the mean difference in life expectancy at age 65 between the East and West clusters was 5.79 years for males and 4.62 years for females (values for the unweighted measures are presented in the text unless otherwise specified). There was also a slight increase in 2022. The East-West gap increased to 6.02 years for males and 4.75 years for females. In other words, the first year of the pandemic (2020) already saw an increase in mortality differences in Europe; however, this change was not fundamental, as practically all countries were negatively affected by the pandemic, with the degree of impact varying. In contrast, the second year of the pandemic (2021) saw a much greater shift towards heterogeneity in Europe, as a significant portion of the countries in the West cluster experienced an improvement in mortality rates, while most countries in the East cluster continued to decline in life expectancy.

The development of the gender gap (Figure 2, panels B and D) remained relatively constant over the period under review. Still, the gap was approximately one year higher in the East cluster (gender gap exceeded four years) than in the West cluster (with a gender mortality gap of about three years). In the first two years of the pandemic (2020 and 2021), the gender gap increased slightly, reaching its maximum. In the Eastern cluster, it was 4.41 years, while in the Western cluster, it reached 3.14 and 3.24 years. In contrast to the East-West gap, the gender gap in 2022 decreased in both clusters, returning to pre-pandemic values (4.19 and 2.92 years in the East and West clusters, respectively).

DISCUSSION

Given that life expectancy gains before the pandemic were increasingly driven by reductions in mortality at older ages, particularly in Western Europe (Jasilionis et al. 2023; Schöley et al. 2022), it could be expected that the COVID-19 shock disproportionately reversed these improvements among the elderly and thereby reinforced the long-standing East–West mortality gap at age 65. Furthermore, because both male and female mortality at older ages were strongly and simultaneously affected by COVID-19, we hypothesised that the pandemic primarily amplified regional (East–West) inequalities in old-age mortality, while leaving the relative magnitude of the gender mortality gap at age 65 broadly stable within each macro-region.



Europe was divided in terms of mortality already before the onset of the COVID-19 pandemic (Debón et al. 2017; Meslé et al. 2002; Shkolnikov et al. 2024; Vågerö 2010). Carracedo et al. identified the East-West mortality gradient (gap) for the population aged 65 and older; however, in contrast to our results, their study (covering years 1990–2012) placed Slovenia into the Eastern cluster (Carracedo et al. 2018). Previous studies have highlighted that economic conditions, alcohol consumption, and smoking habits are critical determinants of mortality differences between Western and Eastern Europe, with the behavioural factors reinforcing the long-standing East-West mortality gap (Bobak and Marmot 1996; Meslé et al. 2002). Bobak and Marmot also discussed the effect of pollution, health behaviours, or social environment (Bobak and Marmot 1996).

The gender mortality gap in the pre-pandemic years (2010–2019) was reported to be decreasing (Pinho-Gomes et al. 2022). According to our results, only the West cluster showed a slight decrease in the gender gap value just before the onset of the pandemic. In the East cluster, its values were increasing slightly. The East-West differences in the gender gap could, among other factors, be related to gender disparities in particular spheres of life (work participation, political and economic power). It has been demonstrated that these factors affect not only sex-specific life expectancies but also health disparities (Leão et al. 2024; Ningsih et al. 2024).

Our findings confirm previous conclusions about the significant impact of the COVID-19 pandemic period on long-term mortality trends and on changes in the distribution of mortality levels in Europe. During the pandemic period, the mortality gap between Western and Eastern Europe widened to a level not observed in over 20 years (Shkolnikov et al. 2024). Huang et al. also confirm that 17 out of 27 European countries would have experienced an increase in life expectancy at age 65 in 2020 if the COVID-19 pandemic had not occurred (Huang et al. 2023).

Our study emphasises the pronounced regional divergence between Eastern and Western Europe, particularly in the second pandemic year, highlighting the pandemic's disproportionate impact on Eastern countries. Among the relevant factors are higher poverty levels and inequalities in society, in general, a higher pandemic burden in vulnerable populations (Pizzato et al. 2024; Igari 2023). Bambra et al. emphasised the importance of policy responses during the pandemic, particularly at its outset, when adequate protection against the virus was not yet available (Bambra et al. 2020). Regulation enforcement, vaccination coverage, as well as trust in science and government, or individual behaviour, may also contribute to the observed differences in mortality between countries (Shkolnikov et al. 2024; Ylli et al. 2022). However, the effective implementation of regulations in most Eastern European societies is expected to be constrained by past experiences with authoritarian regimes, during which many people may remain more sceptical of government regulations (Miller et al. 2004; Tleshova et



al. 2025). This is also related to the effectiveness of vaccination implementation – vaccination coverage rates are lower in Eastern Europe (Ylli et al. 2022). It can be assumed that vaccination coverage contributed to the East-West mortality differences, which peaked in 2021, rather than specifically at the outset of the pandemic.

In contrast to some previous studies (Pinho-Gomes et al. 2022), the gender gap remained nearly stable across the above-analysed countries in the years preceding the pandemic. Moreover, we confirmed the East-West gradient in the gender mortality differences; the gender differences in life expectancy at the age of 65 in the Eastern cluster (a difference of about four years in favour of women) are approximately one year higher compared to the West (females' life expectancy at age 65 is about three years longer than that of males).

The COVID-19 pandemic had only a slight impact on the stable development of the gender gap in Europe; the general East-West pattern of the gender gap remained stable. The proven stability of the gender gap during the pandemic years may be surprising, as crises typically exacerbate socioeconomic or other inequalities in society (Bambra et al. 2020). Some studies from the COVID-19 pandemic show that men were at greater risk of serious complications or death from infection, which may have temporarily widened the gender gap. Indeed, only a small change is evident during the first year of the pandemic, particularly in the East cluster. On the other hand, women faced greater economic uncertainty, including job loss and lower income, on average (Pinho-Gomes et al. 2022).

Despite the long-term East-West mortality gradient (Shkolnikov et al. 2024; Meslé et al. 2002; Vågerö 2010), we confirmed that mortality levels in some Central European countries were similar to those in the West cluster before the onset of the pandemic. Despite these similarities, the general pattern of the East-West mortality gap not only persists, but it is also reflected in the observed pandemic mortality development. Our study shows that the long-standing East-West mortality gap at age 65 widened markedly during the pandemic, as Western European countries began to recover by 2021 while most Eastern countries continued to experience declines in life expectancy. At the same time, it confirms that the gender mortality gap at older ages remained relatively stable within both regions, with women maintaining an advantage of about four years in the East and three years in the West.

Limitations of this study

This study benefits from robust data availability and quality, given its focus on developed European countries. However, some of the latest data had to be replaced with older datasets due to gaps in availability, which may slightly affect the precision of results for certain countries. Additionally, reporting inconsistencies



during the pandemic and variations in data-collection methodologies could impact the accuracy of statistics in specific regions. Summary indicators used in the analysis, while effective for identifying broad trends, cannot fully capture the complexity of underlying social, cultural, or healthcare factors.

A key limitation of our approach is that using only two main clusters necessarily simplifies the diversity of mortality patterns across Europe, and excluding countries with populations below one million, while reducing random fluctuations, may also omit potentially relevant small-state trajectories. The relatively short time frame of the study – covering three pre-pandemic and three pandemic years – limits its ability to reflect long-term historical and socio-economic developments that shape mortality trends. Therefore, the findings should be viewed as a foundational quantitative overview, providing a guide for more detailed and country-specific analyses in future research.

CONCLUSIONS

The observed East-West mortality gap mirrors global patterns of health inequality, in which socio-economic disparities and lifestyle and structural differences remain critical determinants. The widening of the East-West mortality gap during the pandemic cannot be understood as a temporary deviation, but as a manifestation of long-term accumulated structural inequalities in health. It also reflects broader global challenges in addressing health crises and highlights the importance of international cooperation in mitigating disparities. In Eastern Europe, the persistent East-West mortality gap underscores the need for better-targeted health interventions and information campaigns that go beyond individual behaviour change. Such efforts should focus on prevention, lifestyle-related risk factors, and vaccination coverage, while simultaneously addressing underlying socio-economic and structural determinants of health.

The simplicity of the presented method, as well as the focus on confirmed mortality disparities in Europe, may help policymakers assess the fulfilment of Agenda 2030 for Sustainable Development Goal 10 to reduce inequities within and between countries, and set realistic and efficient goals for the upcoming years.

Our findings contribute to the existing body of literature by offering a nuanced perspective on mortality trends during the COVID-19 pandemic in Europe. It highlights regional divergence, with Eastern Europe experiencing a sharper decline and a slower recovery compared to Western Europe. This divergence highlights the need for targeted health interventions, improved healthcare infrastructure, the promotion of preventive measures, increased vaccination coverage, and the reduction of socioeconomic inequalities.



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FRAMING MEDIA IMAGINARIES OF NATO'S POLITICAL GEOGRAPHY IN THE WESTERN BALKANS NATO IN THE WESTERN BALKANS

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Abstract

This paper deals with the framing of NATO's political-geographic imaginations in the Western Balkans. The focus of the research is on the media portrayal of NATO, i.e. it includes a media analysis of 190 articles on NATO's enlargement to Albania, Croatia, Montenegro and North Macedonia. The selected articles were researched over three time periods from 2008 to 2021. The results show that over the period of three NATO enlargements, the number of articles framed negatively in today's non-members nor the number of articles framed positively in today's NATO members of the Western Balkans has not increased. In fact, the opposite processes have occurred; a decrease in negative articles in members and an increase in positive articles in non-members. The research confirmed that the choice of photographs and keywords in members is consistent with NATO's professional political-geographic imagination. The results confirm that the media, by choosing the mentioned countries and the mentioned politicians, emphasize Euro-Atlantic integration. In the end, it turned out that Serbia and Russia are presented as "enemy" states with the aim of opposing the leading Euro-Atlantic narrative.

Key words

NATO, Western Balkans, media analysis, imaginary geography, political geography

INTRODUCTION

One of the purposes of domestic media is to shape the universal perception of citizens without excessive influence from foreign media. By creating perceptions, an imaginary geography is also created, which shapes people's understanding of the space around them (Balogh et al., 2022). Imagination plays a special role in political geography, within which different views on states, wars, conflicts, international relations, etc. often manifest (Al-Mahfedi, 2011). The development



of international organizations further complicates the situation because their perception is created through all members. Specifically, the focus of this paper is the political-geographical imagination of NATO, an alliance that has 32 members and is currently the largest military alliance.

This paper analyses the political-geographical imagination of NATO in the so-called Western Balkans, which includes Albania, Bosnia and Herzegovina, Montenegro, Kosovo, North Macedonia and Serbia. The Western Balkans is a "product" of the European Union from 1997, listed in the document "The Role of the Union in the World" (Slukan Altić, 2009). Initially, Croatia was also included in it, but since 2013 and its accession to the European Union, it is no longer considered a Western Balkan country (Kolstø, 2016). For this reason, it is listed separately from the other countries in this research. The European Union brought these six (seven) countries together under one name so that they could work together on the Euro-Atlantic integration process (Milardović, 2009). However, 28 years later, it is evident that the idea of a common regional approach has not led to the much-desired integration.

OBJECTIVES

The main research goal of this paper is to gain insights into NATO's political-geographic imagination in the Western Balkans through the analysis of media articles. Accordingly, the presentation of positivity (the number of stated advantages of NATO membership) and negativity (the number of stated negatives of NATO membership) in members and non-members, as well as the imagination of NATO through photographs and keywords, is comparatively investigated. Furthermore, the presentation of Euro-Atlanticism through the mentioned countries and the mentioned politicians (presidents, prime ministers, NATO secretaries general and others) in the articles is research. The last research objective relates to the analysis of the formation of the presentation of "enemy" states. The chosen media articles from internet portals relate to three events refer to the region, namely the NATO expansion to Croatia and Albania, then to the Montenegrin accession and finally to the North Macedonian enlargement. The paper also includes Croatian articles, given that Croatia was, after all, the part of the research area, and was included in the first media-analysed event of NATO enlargement. In this research, Croatia is used as a case study, but the results related to it do not enter into the testing of hypotheses and the main conclusions. In accordance with the selected events, the time frame of this research is from 2008 to 2021. Ultimately, based on the research questions, the following hypotheses were formed:

H1: Over the period of three NATO enlargements, the number of articles framed negatively in today's non-members and the number of articles framed positively in today's NATO members of the Western Balkans increases.



- H2: The choice of photographs and keywords is consistent with NATO's professional political-geographic imagination.
- H3: By choosing the Western Balkans countries and politicians, the media emphasizes Euro-Atlantic integration.
- H4: Serbia and Russia present themselves as "enemy" states with the aim of opposing the leading Euro-Atlantic narrative.

THEORETICAL FRAMEWORK

Edward Said (1978) first introduced the idea of imagination into geography through his book *Orientalism*. In the book, he explains how the Orient is presented as a discursive construction that serves political power. Said called this way of perceiving space imaginary geography. The idea of imagination enters political geography in the 1990s under the influence of geographers Derek Gregory (1994), Gearóid Ó Tuathail (1996), Simon Dalby (1991), etc. They emphasize how maps, regions, travelogues, etc., are produced through discourses, imaginations and narratives of power. Entering into the 2000s, there has been a more intensive development of the study of imagination in political geography; in particular, imaginations in security strategies, media, culture, migrations, etc. are beginning to be investigated (Bialasiewicz et al., 2007). In the context of this paper, the role of media imaginations is important because the focus of the research is on the media representation of NATO. Already in the 19th century, the media played a key role in shaping colonial imaginations, and during the first half of the 20th century they were often at the service of ruling political structures, promoting their ideas of political geography (Said, 1978). Through the selection of images, narratives and metaphors, the media shape the perception of the space of "us" and "them", "safe" and "dangerous", "civilized" and "barbaric", etc. (Bialasiewicz et al., 2007). Visual and textual representations in the media often reproduce the geopolitics of threat. It is also known as the "CNN effect", which shows how televised images of war (e.g., Gulf War 1991) can shape the foreign policy and public opinion of a particular country (Livingston, 1991). After September 11, 2001, the "war" against terrorism was significantly portrayed in the media, and a significant globalization of the media was also noticeable (Reese and Lewis, 2009). Media imagination is further complicated by the development of the Internet and social networks, which leads to the fragmentation of media representations (Pratap and Pathak, 2025). From a geographical point of view, the approach to media as maps is interesting. Maps serve orientation in physical space, and media serve orientation in informational and political-geographical space. People rely on the media to know "where they are" in relation to social processes, crises or global events (Couldry and Hepp, 2017). Just as geographic maps simplify and depict space, media also simplify and depict social, political-geographic and cultural processes (Monmonier, 1996).



Recent work in human geography points to a broader metamodern turn that blends material analysis with reflexive, semiotic approaches. Matlovič and Matlovičová (2025) frame this shift as an oscillatory, post-disciplinary mode of thinking that treats geopolitical representations as both symbolic constructions and material interventions. Building on this, we approach media imaginaries of NATO in the Western Balkans as hybrid “hylosemiotic” assemblages: images, narratives, and strategic deployments that co-produce political space through a constant back-and-forth between certainty and skepticism. This metamodern stance supports a method that reads NATO’s visual and textual messaging alongside its on-the-ground practices, allowing a more nuanced account of how political geography is staged, circulated, and contested.

It is also necessary to mention imagination in the geography of propaganda. Spatial dimensions of propaganda have been present since the time of the Great War, and peaked during the Second World War (Monmonier, 1996). The explicit notion of the geography of propaganda appears in the military and political literature of the USA in the 1950s with the aim of practical application within different regions. The so-called “blue-red” maps that symbolize the division of the world into NATO members and Soviet republics (Tyner, 2007). The geography of propaganda was not discussed after the end of the Cold War because its role was mostly taken over by critical geopolitics and media geography (Ó Tuathail, 1996). However, in the last ten years, various propaganda maps have come to the fore again, which involve very strong imagination. For example, the map of the terrorist group ISIS is well-known, which represented all the territories that the group wants to conquer (Bixler, 2015). The last theoretical concept of this paper concerns the imagination of “enemy” states. This process starts from the theoretical definition of the chosen space as “Other”, that is, distant, exotic, but also dangerous (Couldry, 2017). Following this, the imagination of “enemy” states arises for the purpose of legitimizing a particular conflict (creating a moral framework for war or sanctions), for the purpose of mobilizing the public (us = good, them = evil) and for the sake of geographical forces (enemy space as threatening, expanding, etc.) (Vuorinen, 2012). It rarely happens that a certain international organization is characterized as an “enemy state”, but there are also such cases, for example, NATO in Serbia in 1999 (Moskovičević and Lazović, 2024).

For the full theoretical context of this paper, it is necessary to look at the imagination of NATO and the Western Balkans. In political geography, NATO has always had the symbolism of a military connection of the West, or an opponent of the Warsaw Pact (Gheciu, 2019). At the end of the Cold War, it was expected that NATO would be dissolved but this did not happen. The exact opposite happened, NATO carried out its first military action in Bosnia and Herzegovina, and then in other neighbouring countries; Serbia, Montenegro, Kosovo and North Macedonia (Tereziev et al., 2018). In the late 1990s and early 2000s, NATO membership



became extremely desirable among the former Eastern European countries and symbolized joining the political West. Military operations in the Balkans “opened the door” to NATO interventions around the world; Iraq, Afghanistan, Pakistan, Sudan, etc. (Newman, 2024). NATO’s imagination turned it into a “world policeman”. The last NATO intervention on which all major powers agreed was in Libya in 2011 (Gheciu, 2019). After that, NATO’s imagination begins to acquire a negative component, especially emphasized in Russia. With the almost constant expansion towards Eastern Europe, the membership of these countries in NATO is a serious point of contention in American-Russian relations, which culminates on February 24, 2022 with open Russian aggression against Ukraine (Zhurzhenko, 2024). NATO’s imagination is mostly depicted through collective defence, that is, in the event of an attack on one member, the others must defend it (Blease, 2010).

If the imagination of NATO could conditionally be called positive, the imagination of the Western Balkans is negative in most of the world. This area is often synonymous with war conflicts, riots, political instability, corruption, underdevelopment, etc. (Todorova, 1997). The initial positive idea of Euro-Atlantic integration was replaced by exhaustive accession negotiations and numerous blockades, and full integration seems almost unattainable for some countries of the Western Balkans (Tereziev et al., 2018). NATO’s imagination in the Western Balkans is a complex phenomenon, which differs from country to country. Albania, Montenegro and North Macedonia are members of NATO, while Bosnia and Herzegovina and Serbia is member of the Partnership for Peace (Fig. 1) (NATO, 2023). Kosovo officially does not have an army, that is, the Kosovo Security Forces should turn into an official army by 2028. For this reason, Kosovo is not a member of the Partnership, but it is the location of the largest NATO military base (Bondsteel base) in this part of Southeast Europe (Blumi, 2019). NATO plays the role of a factor of stability in the Western Balkans, that is, the Alliance is still politically and militarily present after more than 30 years since the beginning of the first conflicts (Mulchinock, 2017).

Building on this theoretical foundation, it is essential to embed the study within the specific media-political landscape of the Western Balkans, where imaginative geographies are both produced and amplified through structurally constrained media systems. Research shows that many states in the region experience varying degrees of media capture, in which political and economic elites exert influence over editorial agendas and news framing (MCIC, 2022). In such environments, photographs and keywords related to NATO do not merely illustrate events they become symbolic instruments through which geopolitical identities and threat perceptions are constructed. Studies of disinformation and media narratives in Bosnia and Herzegovina demonstrate that visual elements such as images of military interventions, ruins, or NATO soldiers are systematically mobilised to evoke historical memories and cultivate negative imaginaries of Western security actors



(Agović et al., 2019). A similar dynamic is evident in Serbia, where mainstream media frequently reproduce a dual geopolitical narrative: pragmatic cooperation with NATO at the institutional level, contrasted with overwhelmingly negative visual and textual portrayals in news coverage, often centred on the 1999 bombing or on idealised representations of Russian military power (Anastasijević, 2017). Comparable processes occur in North Macedonia, where political communication and media framing commonly revolve around questions of nationalism, security, and Euro-Atlantic integration, often reflecting broader political contestations (Trpevska and Micevski, 2017). Croatia exhibits its own pattern, with media outlets periodically mobilising security-related narratives to shape public attitudes toward NATO, particularly in moments of regional tension or global crises (Šalaj, 2013). In Montenegro, the media landscape often reflects the country's oscillation between strong pro-NATO governmental narratives surrounding the 2017 accession and persistent domestic contestation linked to identity politics and external influence (Džankić, 2019). In Albania, where NATO membership is widely supported, media



Fig. 1 Years of joining NATO and the Partnership for Peace

Source: NATO (2023)



representations tend to frame the Alliance as a guarantor of security, modernisation and international legitimacy, often invoking narratives of Euro-Atlantic belonging (IDM, 2019). Kosovo presents yet another configuration: although not an official NATO member, NATO is symbolically central due to KFOR's security role and the political significance of international protection, which strongly shapes predominantly positive or aspirational media imaginaries of the Alliance (KCSS, 2020). Regional assessments of media freedom also highlight how weakened journalistic standards, clientelism, and politicised newsrooms create fertile ground for such affective geopolitical framings (Brogi et al., 2014). From a geopolitical perspective, the Western Balkans continue to be discursively represented as a space of instability, contested identities and external influence, a narrative reproduced in academic and policy literature (Belgrade School of Security Studies, 2007).

DATA AND METHODS

Geographers, but also political scientists, sociologists, experts in international relations, wrote about political-geographic imaginations through the media. Liben-Nowell et al. (2005) explored the concept of geographic focus, which is important for understanding how ideas and propaganda narratives spread through social networks. Dimitrova and Connolly-Ahern (2005) compared how the leading digital media in the USA and the United Kingdom and in Egypt and Qatar portrayed the war in Iraq. They proved that the imaginary geography of that war was significantly different: the media from the United Kingdom and the USA pointed to the reconstruction of Iraq and "liberation", while the Arab media emphasized violence and civilian casualties. O'Loughlin et al. (2010) studied over 5,000 violent events in Afghanistan and Pakistan, mapping their spatial and temporal dynamics using the media. In the research of media imagination, the analysis of then Twitter (today X) announcements are particularly popular; such researches are provided by Takhteyev et al. (2012), Gabel et al. (2020), Kobilke et al. (2023) and Nisch (2024), etc. Through a narrative (content) analysis of a large number of posts on Twitter, they examine the conflict in Ukraine, the conflict in Kashmir, geographical connectivity, but also Finland's entry into NATO. Vukasovich and Dejanovic-Vukasovich (2016) bring comparative media representations of humanitarian interventions, which were justified through narratives about the humanitarian crisis, war crimes and regime responsibility. Thematically close to this research is the research of Lakić (2018), who investigated discursive patterns in the British media during the NATO air strikes in 1999. He argues that NATO's actions were legitimized through the construction of the "Other" and the humanitarian dimension. Similar research is also provided by Purcell and Rogelj (2025), who describe the imagination of the USA in Slovenia through media investigation of articles.



In this paper, media articles on the most widely read internet portals of the Western Balkan countries were searched. In accordance with the three NATO enlargements, three time periods of research were determined; I. from 15. 3. to 15. 4. 2009, II. from 15. 5. 2017. to 15. 6. 2017. and III. period from 15. 3. 2020. to 15. 4. 2020. The plan was to explore ten articles from each country for a defined period, from the two most read portals in each country. This is a total of 70 articles for a certain period of time, or a total of 210 articles. However, three challenges were identified during the research. In the first research period, the planned 70 articles, or ten per country, were not found. A total of 50 articles were identified, as many of today's most widely read portals did not yet have digital editions in 2009. Internet portals were selected based on two rankings of the most visited websites for each country; Semrush.com and Similarweb.com. Accordingly, the second problem related to the selection of articles on portals that are not among the two most read (Tab. 1) in order to collect a sufficient number of them. Articles were searched in order of readability (visitation) of each portal. The third problem related to the publication of articles within the planned time periods, namely, a certain number of articles related to the topic were not published exclusively within the planned periods. The principle of thematic relevance in media analysis was applied, which is more important than strict chronological precision when events have a premature or prolonged media impact in public discourse (Purcell and Rogelj, 2025). Therefore, articles were searched in the following order: 1. most visited portals, 2. time of publication and 3. topic. The content analysis of media articles on internet portals was conducted in July and August 2025. They were studied in terms of content, keywords, selected photographs, mentioned countries, mentioned politicians, positivity and negativity in the member states, and presentations of "hostile" countries. The following programs were used when processing qualitative data: QDAcity and NVivo. The aforementioned programs were used in the process of coding quotes from politicians and in the process of coding the "hostile" state narrative.

To address copyright considerations, all photographs analysed in the study were sourced exclusively from publicly accessible news portals, and no copyrighted material outside the published articles was downloaded or reproduced. The availability and stability of online archives were verified at the time of data collection, and for earlier years with limited digital records this limitation is explicitly acknowledged as a structural constraint of the sample. Furthermore, the selection of media portals and the potential biases arising from uneven digital accessibility were carefully evaluated, and these factors are transparently discussed as methodological limitations of the study.



Tab. 1 Most visited and analysed internet portals by country

Country	Most visited portals	Analysed online portals and number of articles
Albania	Shqiptarja.com, Balkanweb.al	Shqiptarja.com (10), TV Klan.al (9), Balkanweb.al (5), Top Channel Albania.al (4), Gazeta.al (2)
Bosnia and Herzegovina	Klix.ba, Avaz.ba	Klix.ba (15), Avaz.ba (8), Nezavisne novine.ba (2)
Montenegro	Vijesti.me, CdM.me	Vijesti.me (10), CdM.me (9), Analitika.me (4), RTCG.me (2)
Kosovo	Telegrafi.com, Klan Kosova.com	Telegrafi.com (10), Klan Kosova.com (7), Gazeta.com (6)
North Macedonia	Točka.mk, Makfax.com.mk	Točka.mk (10), Slobodna Europa.mk (5), Utrinski.mk (4), Slobodenpoečat.mk (3), Makfax.com.mk (3), Lokalno.mk (2), Tvm.mk (1)
Serbia	Blic.rs, Kurir.rs	Blic.rs (15), Kurir.rs (10), Mondo.rs (5)
Croatia	Indeks.hr, Jutarnji.hr	Indeks.hr (13), Jutarnji.hr (13), Dnevnik.hr (1), Net.hr (1), Tportal.hr (1)

Source: Authors based on analysed articles, *Similarweb.com* and *Semrush.com* (2025)

RESULTS

Positive and negative imagination of NATO

Positivity can generally be defined as presenting a particular topic from a favourable perspective – emphasizing benefits, progress, praise or support. On the other hand, negativity is defined as the occurrence of criticism, expressing concerns, highlighting problems, conflicts or harmful consequences in articles (Kamel et al., 2018). Analysing positivity and negativity contributes to understanding media bias, monitoring public discourse and imagination, detecting disinformation or propaganda, assessing the impact on readers, etc. (Hamborg et al., 2021). There are already established patterns of words used in positive articles in the media: important step, success, progress, praise, support, approved, opportunity, benefits, etc. (Kim, 2023). On the other hand, in negative connotations, the following are used: danger, imposition, threat, unnecessary, unacceptable, distrust, failure, insufficiently clarified, division, etc. (Kim, 2023). With the beginning of the 1990s, advanced forms of content analysis began to develop, and the term “tone of coverage” was introduced.

In this research, the positivity and negativity of the articles is determined by the number of mentions of the advantages and disadvantages of NATO membership. When more than 50% of the text of the article is related to advantages or disadvantages, the articles are classified as positive or negatively connoted. The presentation of positivity and negativity through articles on NATO news is written by Rozado et al. (2022), while the main advantages and disadvantages of NATO



membership are written by Le Jeune (2010), Tomz et al. (2023) and Rockwell (2024). Based on these works, five main advantages of NATO membership were selected: collective defence, political stability, modernization of the armed forces, more investments and more state cooperation. Five main disadvantages were also selected: reduced sovereignty, participation in military conflicts, financial costs, deterioration of relations with non-members and internal divisions.

In the time period related to the Albanian and Croatian accession into NATO, the most articles (Fig. 2) refer to the advantage of collective defence and more state cooperation, and the least to more investments. Albanian articles mention the most advantages, and Bosnian and Herzegovina the least. A total of 13 articles were recorded, with more than 50% of the text focused on the advantages. The positive tone of the articles does not necessarily correlate with the number of benefits, but the more important focus is on how much the article is directed at them. On the other hand, the reduction of sovereignty is mentioned as the main disadvantage of NATO membership the most (Fig. 5), while the financial costs are the least mentioned. Most of the shortcomings were mentioned in the Croatian and Macedonian articles, which shows a certain paradox because Croatia had just become a member of NATO in that period. The media clearly state what Croatia expects in NATO, which is why the negative side of membership is also shown.

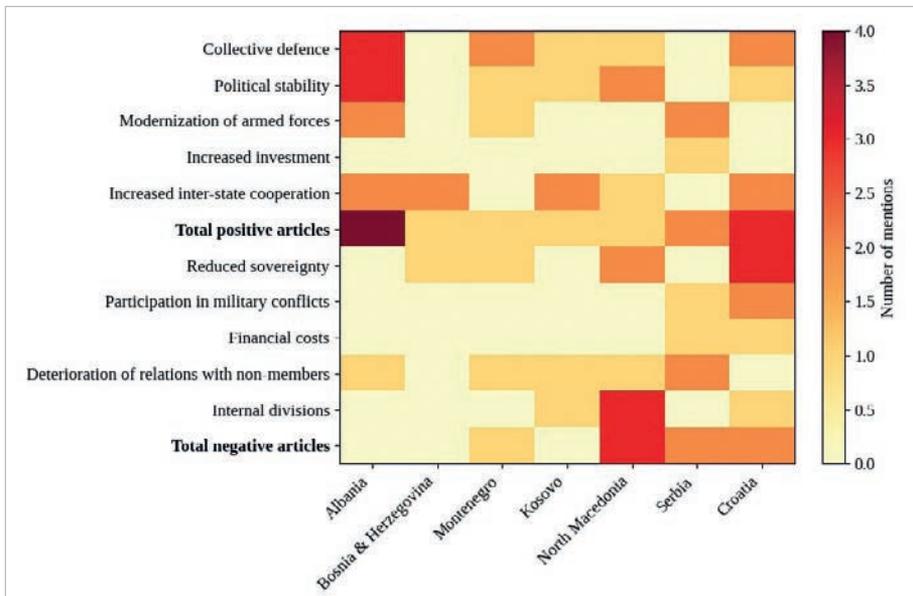


Fig. 2 Quantitative analysis of positive and negative articles related to Albanian and Croatian membership

Source: Authors according to analysed articles (2008-2009)



In the Macedonian case, the media express their regret for not joining due to the dispute over the name by stating the lack of membership. The total number of articles with negative connotations is eight. Here it is important to mention that 29 articles are not classified in either the positive or the negative category, because in their texts they do not refer mostly to benefits or disadvantages. They mostly represent shorter media reports on the entry of Albania and Croatia into NATO.

In the case of media reporting on Montenegro's accession to NATO, an increase in the number of articles with positive connotations to 16 is visible (Fig. 3). The advantage of political stability is mentioned the most, and the greater number of investments the least. In general, the advantages are mentioned the most in Montenegrin, and the least in Bosnian, Croatian and Serbian articles. In terms of disadvantages, the deterioration of relations with non-NATO member states is mentioned 18 times (Fig. 3), with Russia and Serbia being the primary focus. Internal divisions and the reduction of sovereignty are also strongly emphasized. Three Serbian articles have a negative review, but most of the disadvantages are mentioned in Montenegrin articles. The same paradox was observed in Croatian articles in 2009, but here too, they are inquiring into what awaits Montenegro as a NATO member. It is noticeable that not a single article from Bosnia and

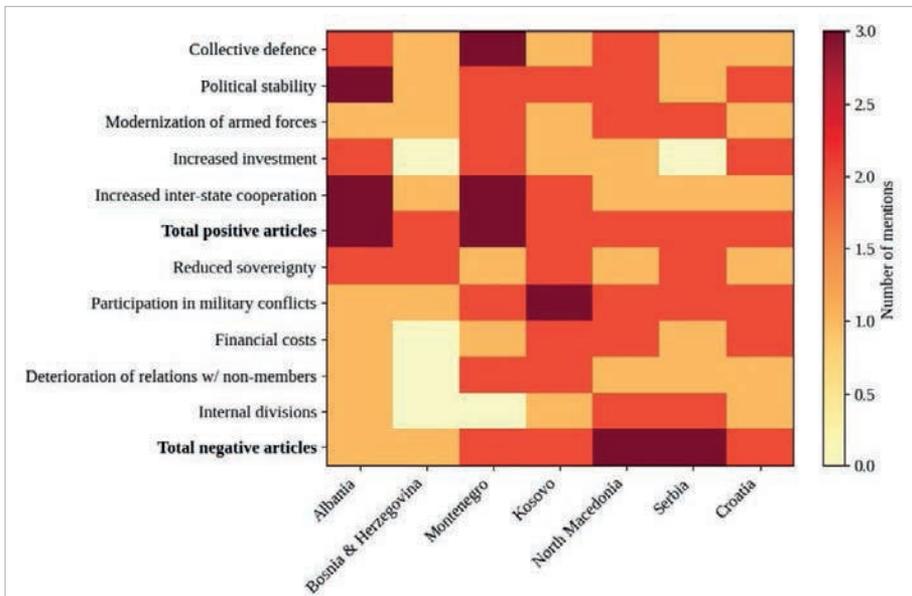


Fig. 3 Quantitative analysis of positivity and negativity of articles related to Montenegrin membership

Source: Authors according to analysed articles (2016-2017)



Herzegovina is negative. Compared to the first period, the analysis included more articles, but no significant increase in positivity or negativity in them was found.

In the last, third period, there is a visible increase in the number of positively oriented articles (Fig. 4), 20 of them. Most positive were written in North Macedonia and Bosnia and Herzegovina, which is part of a noticeable trend in these countries. To the same extent, collective defence, political stability and a greater number of state cooperation are written about, while the increase in investments is least mentioned. Macedonian media are most positive about the benefits of membership, and it is surprising that in Serbian articles a total of ten benefits is mentioned, which North Macedonia will feel when it becomes a member of NATO. Only two of them (Fig. 4) stand out with more than 50% connection with membership deficiencies. It is mostly stated that membership can contribute to the deterioration of relations with non-members, while internal divisions are mentioned twice. The Albanian media point out the most shortcomings, while the Bosnian only points out one. It is obvious that the negativity about the membership of North Macedonia is reduced to a minimum.

Processing the overall trend in the number of positive and negative media articles, certain trends can be observed (Fig. 5). In today's member states (Albania, Montenegro, Croatia and North Macedonia), there is a continuous decrease in

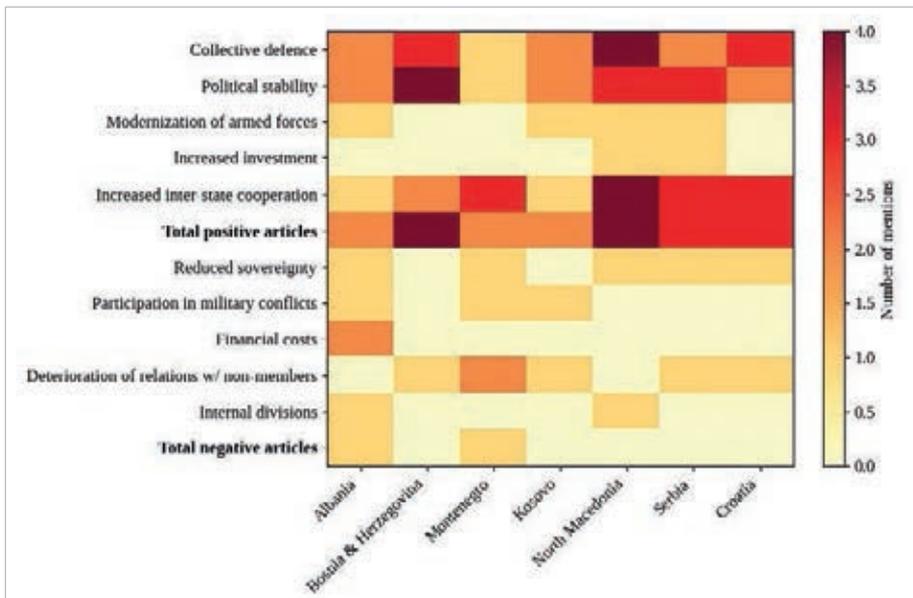


Fig. 4 Quantitative analysis of positive and negative articles related to Macedonian membership

Source: Authors according to analysed articles (2018-2021)

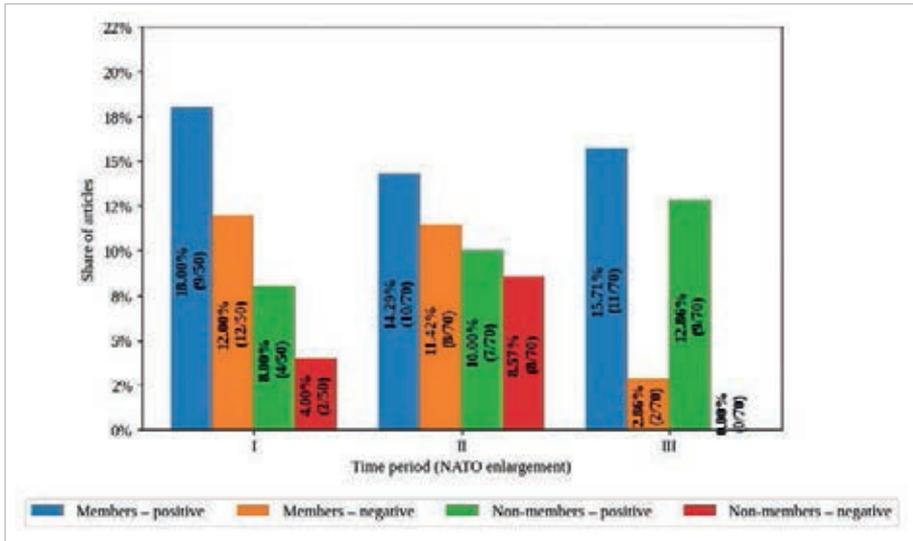


Fig. 5 The difference in the number of positively and negatively connoted articles between NATO members and non-members

Source: Authors according to analysed articles (2008-2021)

negatively oriented articles, while there is no clear trend in positive articles. In the case of non-members (Bosnia and Herzegovina, Kosovo and Serbia), an increase in positively connoted articles is visible. A continuous trend pattern of decreased negatively connoted articles is not visible. In the case when Croatian articles are excluded from the total results, the trends are the same.

NATO's Imagination through Photos and Keywords

Most of the examined articles, out of 190, include at least one photo that is thematically related to the text of the article. In the 1990s, critical analysis of photographs developed, which primarily manifested itself through visual representations of wars, poverty, deprivation, etc. With the development of digital media in the 2000s, the social significance of photographs increased, and the focus of research expanded to include gender and racial presentation, integration with the text, aesthetics, etc. (Tran, 2017). On the other hand, keywords can be defined as selected terms or phrases that represent the basic concepts, themes, methods, or spatial determinants that an individual article addresses. In media articles, they are used for searching within the portal, for search engine optimization (improving the visibility), and for linking similar content (thematic articles, the same people, events, etc.) (Kim, 2021).

To understand the professional political-geographic imagination, the NATO Public Diplomacy Handbook 2020 (ACO/ACT, 2020) was used. Based on



this booklet, five concepts were selected that NATO emphasizes as key in its professional political-geographic imagination. These are: 1. security and stability - NATO as the protector of collective security, 2. political-institutional framework - alliance, integration, democratic values, 3. Euro-Atlantic identity - NATO as a symbol of the transatlantic community, 4. technological-military standard - modernization, interoperability, military standard and 5. protective and value character - humanitarian missions, protection of the civilian population. According to these five concepts, five keywords were selected, which will be comparatively searched for in the examined articles: security, integration, Euro-Atlanticism, modernization and protection. When investigating the photographs, a classification is made according to the five selected concepts based on what they depict. For example, for the fourth concept "Technological and military standard" it is necessary to have a certain modern weapon depicted in the photograph.

In all countries, the most common political-institutional depictions in the photographs (Fig. 6), which include various handshakes, flags, meetings, signings, etc. This concept closely overlaps with the concept of Euro-Atlantic identity, which is marked by the EU and NATO flags, the cooperation of diplomats within Euro-Atlanticism, NATO maps, etc. The concept "Technological-military standard" is depicted in the fewest photographs. Based on this, it can be seen that NATO is primarily portrayed in the media as a political and diplomatic organization, and less as a military force. In all countries, the number of photographs in the articles is approximately the same, and in some articles, it is noticeable that the photographs were once present, but have since been removed. It can be concluded that the

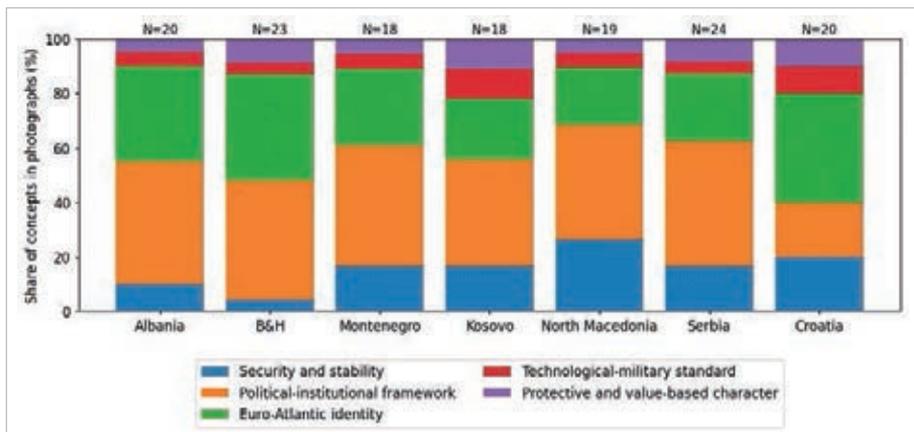


Fig. 6 Quantitative analysis of photographs of articles according to NATO's professional political-geographical imagination

Source: Authors according to analysed articles (2008-2021)



photographs are significantly in line with NATO's own professional political and geographical imaginations. Also, if photographs from Croatia are excluded, the overall results do not change, i.e. the Croatian media select photographs according to the same principle as the Western Balkan media.

In the case of keywords (Fig. 7), the most frequently mentioned word is "integration" (which also includes the word "membership"). The words "security" and "Euro-Atlanticism" also stand out in terms of the number of mentions (within which linguistic variants were also considered). Words related to the military component of NATO are used in the smallest number. This leads to the conclusion that the media, even though keywords, emphasize the institutional and integration imagination more than all others. The highest number of selected keywords was recorded in texts on portals in Croatia and the lowest number in Serbia. For a complete understanding of the relationship of the selected keywords to other keywords; five additional keywords were selected (ratification, membership fee, opposition, summit and invitation). These selected words were used to compare their occurrence with words consistent with NATO's professional political-geographic imaginations. The occurrence of these other words is as follows: ratification – 39, membership fee – 23, opposition – 43, summit – 35, invitation – 27). In comparison, other keywords appear less frequently, on average 44% less, meaning that there is a significant alignment of primary keywords with professional NATO imaginations. When those mentioned in Croatian articles are excluded from the keywords, the overall results again do not change. Croatian media select keywords in line with the rest of the other media.

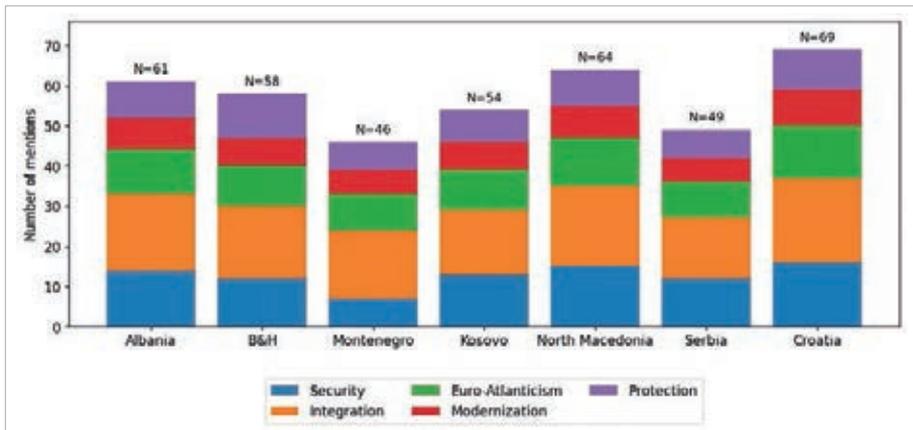


Fig. 7 Quantitative analysis of key words in articles according to NATO's political-geographic imagination

Source: Authors according to analysed articles (2008-2021)



Overall, the examination of photographs and keywords in media articles in the Western Balkan countries clearly shows that the media largely reproduce NATO's professional political-geographical imagination. Visual and textual analysis show a degree of homogeneity in the way NATO is represented, despite differences between countries in terms of membership and political positions. Omitting photographs and keywords from Croatian articles does not lead to significant changes in the results.

The role of politicians and states in the media imagination about NATO

Hamborg et al. (2021) states that politicians are individuals who participate in the process of making and implementing collective decisions through formal positions within political institutions. As in the case of keywords and photographs, the appearance of politicians was first investigated quantitatively until the 1970s. A significant shift was recorded with the development of television, after which the focus on personalizing politicians in the media began (Miller and McKerrow, 2010). In the 1990s and 2000s, political rhetoric in the media has been increasingly addressed in detail; the content and target audience of political messages are explored. On the other hand, the countries mentioned in the media can provide insight into who the media try to perceive as key influential forces or problematic factors. The mentioned countries to a certain extent maintain the current political-geographical trends in the countries of the Internet portals (Segev and Blondheim, 2012).

As already mentioned, in this paper, certain politicians are considered: the president, the prime minister and the secretary general of NATO (Tab. 3). For the sake of clarity and simplicity of the research, it was decided that other officials will be classified in the category of "others". The aim is to discover the existence of Euro-Atlanticism through the mentioned political functions, i.e. whether the mentioned politicians are in line with Euro-Atlantic integration and whether they personally see a Euro-Atlantic perspective. The emphasis on Euro-Atlanticism is reflected in the number of mentions of politicians from the European Union and the USA and through selected quotes from politicians, which clearly show support for these integrations. Although there are politicians within the USA and the EU who are not supporters of Euro-Atlanticism, in this case their mention was used as a reference to the countries that are one of the main creators of the Euro-Atlantic political geography of the Western Balkans and Croatia. Domestic politicians are not included in the analysis of highlighting Euro-Atlantic integration, since their mention primarily reflects media subjectivity and does not provide a clear insight into the Euro-Atlantic orientation itself. In total, when the mentioned EU and US politicians are added, the number we get is 73 politicians (61.3%), while on the other hand, the sum of Russian and other politicians (European outside the EU



and Asian) gives a number of 46 (38.7%). In the case of quotations, a total of 89 out of 109 quotations (81.7%) emphasized Euro-Atlantic integration. Emphasis was “crystallized” through five selected codes (Tab. 2). A coding process was carried out in order to get a clear insight into the politicians’ narratives. Overall, it is visible how the mentioned politicians, according to their nationality and quoted quotes, present themselves in accordance with Euro-Atlantic integration. From the attached results (Tab. 2), it is evident that the Croatian media have the same reporting pattern, as they mention politicians in the way as other countries of the Western Balkans. Croatian articles recorded the largest number of citations directed towards Euro-Atlantic integration.

Tab. 2 Quantitative analysis of politicians and Euro-Atlantic orientations in media articles

Category of Politicians		Number of politicians mentioned in articles by country of origin						
		Albania	B&H	Montenegro	Kosovo	North Macedonia	Serbia	Croatia
Prime Minister		4	4	4	4	6	4	7
President		6	4	5	6	4	2	9
NATO Secretary General		3	3	3	2	3	3	4
Others		10	7	21	8	9	12	18
Nationality of Politicians	Domestic	2	3	17	7	10	9	8
	EU	4	3	5	5	6	8	7
	USA	6	4	6	5	6	3	5
	Russia	0	0	2	0	0	2	2
	Others	4	6	5	4	7	9	5
Euro-Atlantic oriented citations		87,5 % (14/16)	90 % (9/10)	80,1 (17/21)	80 % (8/10)	81,12 % (13/16)	73,3 % (9/15)	90,1 (19/21)
Codes used for the analysis of politicians' citations		1 - Support for NATO membership, 2 - European path / EU integration, 3 - Security through alliances, 4 - Partnership with the USA and EU, 5 - Shared values and standards						

Source: Authors according to analysed articles (2008-2021)

In order to gain an additional insight into the perception of Euro-Atlantic integration in member states, the mention of NATO member states and non-member states was additionally analysed. NATO members were mentioned 116 times, and other countries 62 times (Fig. 8). This means that NATO members are referred almost twice as often - 65.2% of all mentions refer to them. It is important



to mention here that membership in NATO is a variable item, which means that in the analysis of the articles before 2020, North Macedonia was counted as a non-member, until it joined NATO in the same year. The smallest difference between the number of members and non-members was recorded in Kosovo, which stems from the frequent mention of Serbia and its concerns about expansion. The overall analysis of the aforementioned politicians and countries clearly shows that the discourse on security and international relations in the Western Balkans is still strongly linked to NATO. The aforementioned politicians and states are significantly connected with Euro-Atlantic integration, and their choice further emphasizes Euro-Atlantic values. In Croatia, there is no deviation from general patterns of media reporting in this case too.

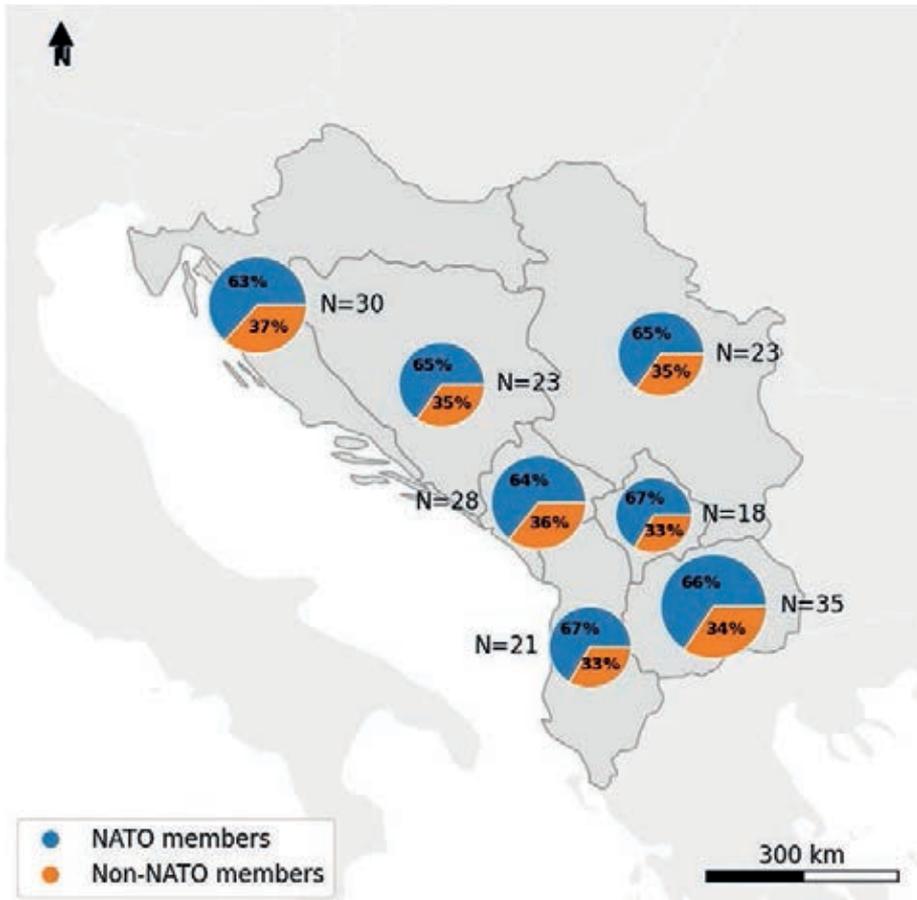


Fig. 8 Quantitative analysis of the mentioned members and non-members of NATO
Source: Authors according to analysed articles (2008-2021)



THE IMAGINATION OF “ENEMY” STATES

Every alliance strives to establish the strongest possible cohesion between its members, and this is especially strong if there is a common “enemy”. Tajfel’s theory of social identity explains how collective identity is most strongly strengthened through the process of differentiation from the “Other”, i.e., through a clearly defined external threat (Tajfel, 1981). At the level of international alliances, Snyder (1997) argues that the “external enemy” is historically the most effective factor in maintaining the cohesion of military-political alliances. In the Western Balkans, there was a complex network of “hostility” between states, which dates back to the 19th century. Relations with NATO have further complicated the situation, but despite this, the Alliance has developed relations with all states and encourages mutual cooperation. However, the examined articles showed that two states regularly stand out as “hostile” in relation to NATO’s activities in the Western Balkans.

Looking at the “hostile” portrayal of Serbia and Russia, it is evident that the largest country in the world is portrayed more negatively by 7.3% (Tab. 3). It is important to point out that not all mentions of Serbia and Russia are included in the analysis, since some of them refer only to the incidental mention of the country’s name, without any meaningful context. The coding process began with expressions that can be described as “hostile” and a total of seven codes were selected. In Montenegro, Russia is most often characterized as “enemy”, while Serbia is the biggest “enemy” in the Albanian member states, which is related to the issue

Tab. 3 Analysis of the “hostile” portrayal of Serbia and Russia

Country	Codes of the “hostile” state narrative	% and number of references to Serbia within the „hostile“ narrative	% and number of references to Russia within the „hostile“ narrative
Albania	1, 3, 4, 6	78 % (7/9)	82 % (9/11)
BiH	2, 3, 5, 6	70 % (5/7)	75 % (6/8)
Montenegro	1, 2, 4, 5, 7	76 % (10/13)	85 % (11/13)
Kosovo	1, 3, 6	72 % (8/11)	80 % (8/10)
North Macedonia	2, 3, 4, 6, 7	68 % (9/13)	79 % (11/14)
Croatia	2, 3, 4, 5, 6	74 % (11/15)	81 % (13/16)
1 - Threat to security and stability, 2 - Destabilization of the region, 3 - Opposition to NATO/EU integration, 4 - Expansion of Russian influence/pro-Russian policy of Serbia, 5 - Misinterpretation of history & conflicts, 6 – Disinformation & propaganda, 7 - Isolation and rejection of international norms			

Source: Authors according to analysed articles (2008-2021)



of Kosovo's independence (Tab. 3). The most common codes are related to threats to security and stability, opposition to NATO/EU integration, and disinformation and propaganda. This indicates that the narrative about the "enemy" is based on the security and informational threat, and less on the "total" threat that leads to the questioning of statehood. It is clearly visible from the results that the imagination of the legitimization of NATO and the Euro-Atlantic path is supported by the construction of Serbia and Russia as "enemies". In the case of Croatia, the results are the same as for the rest of the Western Balkans, i.e., Serbia and Russia are largely mentioned as "hostile".

DISCUSSION

The first research objective sought to investigate the positivity and negativity of NATO portrayals among members and non-members. For this purpose, the first hypothesis is tested: Over the period of three NATO enlargements, the number of articles framed negatively in today's non-members and the number of articles framed positively in today's NATO members of the Western Balkans have increased. Descriptive insight leads to the realization that there is no clear linear growth of positive articles in members (12.0% → 11.4% → 11.4%), but there is a significant decrease in negative (20.0% → 8.6% → 2.9%) articles. Such a strong decrease in negative articles can have several explanations; increasing media focus on the advantages of membership, increasing NATO's influence on the media and their striving for more homogeneous reporting (especially after 2014), shortening the "depth" of the articles themselves, the COVID-19 pandemic as a focus for the media in 2020, etc. In the case of non-members, there is a visible increase in positive articles (8.0% → 10.0% → 12.9%), while negative ones do not grow but fall (4% → 8.6% → 0%). More precise statistical calculations in SPSS Statistics showed that the differences between positivity and negativity were not ($p > 0.05$) statistically significant ($p = 0.458$, $p = 0.847$, $p = 0.503$). Descriptive statistics can be used to conclude that the first hypothesis was rejected, or rather, it was neither confirmed nor refuted by precise calculations, because no overall conclusions can be drawn about the overall tone of articles about NATO through the three selected time points. The results of the first research objective are consistent with the findings of Vukasovich and Dejanovic-Vukasovich (2016), who discuss of the contradictions in narratives related to NATO. Some media legitimize NATO through a humanitarian framework, while others emphasize violence and losses, which coincides with the obtained research findings on oscillations of positivity and negativity. Lakić (2018) states that in the case of the British media, positive and negative perceptions coexisted during the NATO intervention, which is also visible in the chosen member states. Rozado et al. (2022) showed through their longitudinal analysis how positive and negative sentiment in the news oscillates depending on the context



and political moment, which is also the case in this research, visible most when reporting on the accession of North Macedonia during the COVID-19 pandemic.

In the case of the second research objective, NATO's political-geographic imagination was analysed through the selection of photographs and keywords. The second hypothesis was set and tested: The selection of photographs and keywords is consistent with NATO's professional political-geographic imagination. From the 121 photographs, it was concluded that only three photographs are not consistent with the selected concepts of professional NATO political-geographic imagination. In the case of keywords, five conceptually selected keywords are mentioned as many as 336 times. For comparison, keywords that are not consistent with NATO's concepts of imagination were selected and they appear 167 times. Descriptively, it is clear that the selected photographs and words are consistent with NATO's professional imagination, and this is confirmed by the statistical binomial test for photographs ($p < 0.001$) and the test for keywords ($= 57.6$, $p < 0.001$). These insights build on research on the importance of visual and discursive representations in the construction of security imaginaries. Schlag (2025) indicates that visual representations of NATO over time systematically shape the perception of NATO as a political-institutional and identity actor. Tran (2017) and Moldez and Gomez (2022) point out that visual elements in the media convey connotations and myths that often go beyond the event, which in this case is reflected in the dominance of political-institutional and Euro-Atlantic symbols. The results are consistent with NATO's professional public diplomacy, ACO/ACT (2020) emphasizes security, integration and Euro-Atlantic values, all of which were also highlighted in this research.

The third research goal refers to the understanding of Euro-Atlanticism through the selected countries, as well as the mentioned politicians. Therefore, the third hypothesis is tested: By choosing the mentioned countries and politicians, the media emphasizes Euro-Atlantic integration. A total of 61 politicians from the EU and the US were mentioned in the chosen countries, which is 22% more than the mention of Russian and other politicians. Also, 70 out of 88 (79.5%) quotes from politicians are directed towards Euro-Atlanticism. On the other hand, of the mentioned countries, 97 (65.5%) times NATO members were mentioned, and 51 (34.5%) times non-members. The test results show that EU and US politicians are referred significantly more often than Russian and other countries ($p < 0.05$), that most of the quotes are directed towards the Euro-Atlantic framework ($= 30.2$, $p < 0.001$) and that NATO members are referred significantly more than non-members ($= 15.1$, $p < 0.001$), thus confirming the third hypothesis. Bialasiewicz et al. (2007) have demonstrated how imaginative geographies of security, especially in American and Euro-Atlantic strategies, are produced and reinforced by perceptions of alliances and threats. This is clearly reflected in the emphasized presence of Euro-Atlantic politicians and states in the studied documents, and here



in the examined articles. Furthermore, Miller and McKerrow (2010) researched the development of political communication through increasing personalization. This coincides with the findings in this paper, as a significant mention of politicians (presidents, prime ministers, chief secretaries and others) was observed, which is one of the key elements of the articles. Gheciu (2019) emphasizes that NATO acts as a "security community" in a political and symbolic sense. This ensures that the media highlighting of politicians and countries with a Euro-Atlantic orientation is not accidental.

The last research goal relates to the formation of the representation of "enemy" states. Accordingly, the hypothesis was set: Serbia and Russia are presented as "enemy" states with the aim of opposing the leading Euro-Atlantic narrative. Out of the total mentions of Serbia on 53 occasions, 39 times (73.5%) it was described as an "enemy" state according to the codes selected. Russia was referred a total of 56 times, or "hostile" 45 times (80.3%). It is evident that these two states are presented "hostile" in the articles in order to provide a kind of contrast to the Euro-Atlantic narrative. So, the last hypothesis is also confirmed. These results are consistent with the findings of Vuorinen (2012), who emphasizes that the imagination of the "enemy" represents a key instrument of propaganda rhetoric. Bartoszewicz and Prucková (2023) also show in their work how Russia is systematically constructed as a hostile state in the security documents of European countries. Moskovljević and Lazović (2024) emphasize the role of the media in creating narratives about NATO and its enemies, which further confirms the importance of understanding political-media frameworks. In a broader context, the results are also consistent with the concepts of "imaginative geographies" developed by Ó Tuathail (1996) and Gregory (1994), which explain how spatial and political imaginaries produce categories of "ours" and "theirs". In total, the research led to a frequent imagination of NATO as a symbol of the "West" (positive imagination among members, spreading also among non-members), while Serbia and Russia are constructed as the concept of the "Other" (negative imagination). Tomz et al. (2023) pointed out how membership in NATO transforms the public perception of war, which is visible through very similar results of media portrayal of NATO as a symbol of security and stability, regardless of the very different state relations with the Alliance in the 1990s.

Although Croatia has not been part of the Western Balkans since 2013, there is still similar media coverage of NATO as in other countries. Such findings coincide with the claims of Bieber and Tzifakis (2019) about the existence of a "regional security community" in Southeast Europe, where common narratives about NATO are formed and transmitted independently of the state. Mulchinock (2017) emphasizes that Euro-Atlantic discourses are shaped transregionally, which explains the similarity of the Croatian media portrayal of NATO with that in neighbouring countries. In conclusion, it can be said that there are some



specificities of the Western Balkans in relation to broader NATO imaginaries. The regional component of the “hostile” portrayal of Serbia is noticeable, the almost non-existence of differences in media reporting between members and non-members, the homogeneity of visual and discursive imaginations, etc.

CONCLUSIONS

This research was focused on a media analysis of 190 articles on NATO expansion to Albania and Croatia, Montenegro and North Macedonia. The articles are divided into three time periods from 2008 to 2021, and the results show that during the period of three NATO enlargements, the number of articles framed negatively in today's non-members and the number of articles framed positively in today's NATO members of the Western Balkans did not increase. In fact, the opposite happened: a decrease in negative articles in members and an increase in positive in non-members. Furthermore, the research confirmed that the choice of photographs and keywords in the articles is consistent with NATO's professional political-geographic imagination. The results of the research confirm that the media, by choosing the certain countries and the politicians, emphasize Euro-Atlantic integration. Ultimately, it was shown that Serbia and Russia are presented as “hostile” states with the aim of opposing the leading Euro-Atlantic narrative. The research also included articles from Croatian media, but it turned out that they report on NATO enlargement in almost the same way as other Western Balkan media. Overall, the imagination of NATO's political geography in the Western Balkans has a high level of homogeneity across all six (seven) countries. The results indicate that imagination is not just a theoretical concept, but that the media practically use it to shape the public perception of NATO in the Western Balkans.

While the results provide a coherent empirical basis for the study's conclusions, they should also be viewed in light of several structural conditions that shape media production in the region. Differences in portal ownership, political influence, market competition and the uneven digital archiving of older articles—especially in the 2008–2009 period—may have influenced both the availability and the tone of coverage. These factors do not undermine the validity of the results, but highlight that media imaginaries of NATO are embedded in broader systemic conditions that future research should examine more explicitly. Expanding the dataset, incorporating ownership and audience metrics, or comparing printed and online media could further clarify the causal mechanisms behind the observed trends. By acknowledging these contextual constraints, the study provides a more nuanced and transparent foundation for understanding how NATO's political-geographical imagination is constructed and circulated in the Western Balkans.

The scientific contribution of this paper is reflected in the research of imagination in the Western Balkans, which strives for full Euro-Atlantic integration



and currently represents a “bridge” between past conflicts and future integrations. The research showed that imagination is not an abstract concept, but is concretely manifested in media discourse across as many as six Western Balkan countries and through Croatian media. The contribution is manifested through a systematic approach to different media, which enables comparisons between the countries. The methods combine quantitative media analysis and qualitative interpretation, which shows how imagination can be operationalized and measured. Therefore, the results of this paper can contribute to further research on imagination, especially through a larger media sample and through more, but also wider time periods. Also, the paper contributes to the interdisciplinary nature of political geography because it combines scientific knowledge from the fields of political science, communication science, sociology, etc.

Ultimately, this paper has clear implications, which are manifested towards the media, NATO and the general public perception in the Western Balkans. The results clearly show that the media do not only transmit news but also actively produce imagination, which indicates the power of the media. Furthermore, the results indicate that NATO's policy is successful because its key messages (security, integration, Euro-Atlantic identity) are recognized through the analysed articles. In the case of the general public, the homogeneity of the imaginations produced through the researched media is visible, i.e. a general public impression of the importance of stability and security provided by NATO is created.

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THE PARADIGM SHIFT FROM SUSTAINABLE TO REGENERATIVE TOURISM: A CASE STUDY OF HERITAGE WOODEN CHURCH PRESERVATION IN ROMANIA

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Abstract

The study responds to the paradigm shift that is taking place within the concept of sustainable tourism development. The so-called “regenerative shift” moves the goals of its development from minimizing impacts on sociocultural-ecological systems (SES) towards the ability of tourism to contribute to the improvement and restoration of SES. Many authors consider it a significant paradigm shift, which they also refer to as a separate line of development outside sustainable tourism. Although there are already relatively solid theoretical frameworks for



the concept of regenerative tourism, it has not been sufficiently developed in the area of cultural heritage restoration. This study responds to this gap by applying a regenerative framework to a specific case of a historical building – the wooden church of Sfântul Gheorghe in Prodănești, Romania. The aim of the research is to empirically assess the extent to which the microclimatic and environmental conditions of the building are compatible with the principles of regenerative cultural heritage management and how they affect its physical integrity and usability in the context of local tourism and community needs. Methodologically, the study is based on long-term monitoring of the internal microclimate, which took place between August 2024 and January 2025. The subject of monitoring was the measurement of temperature, relative humidity, particulate matter PM2.5 and PM10, volatile organic compounds, light intensity, acoustic intensity, negative and positive ions. Within the research, biological degradation factors (lichens, microorganisms) were examined, and the research was supplemented by a non-invasive investigation using infrared thermography to capture the momentary condition of the surface temperature and interior painting in the wooden church, which is in a state of significant decay. The results show a significant exceedance of the recommended temperature and relative humidity values, a high dependence of the interior environment on external climatic conditions, and the presence of biological degradation processes that negatively affect the authentic building materials and preserved fragments of interior decoration. It transpires that the physical degradation of the building is not an isolated technical problem, but a manifestation of the broader dynamics of the SES within cultural heritage management. Recommendations include the introduction of continuous microclimatic monitoring, the application of non-invasive conservation measures. The proposals include adaptive management, which combines data-driven decision-making with community participation, and enables flexible responses to the SES dynamics of cultural heritage systems.

Key words

Regenerative turn, regenerative tourism, sustainable tourism, degrowth, heritage, microclimate, preservation.

INTRODUCTION

Recently, in connection with research into minimizing the potential impacts of tourism development on *sociocultural-ecological systems* (SES), issues related to its ability to contribute to their improvement and restoration have been increasingly addressed. This shift in the discourse on tourism sustainability is now considered by many authors as a significant paradigm shift and is referred to as the “regenerative turn” (e.g., Bellato et al., 2023; Dredge, 2022; Khater et al., 2025). Thanks to the growing number of studies focusing on this issue, the concept of regenerative tourism basis has been established. Numerous applications in the field of cultural heritage have thus led to the formation of the foundations of regenerative tourism frameworks, mainly at the normative-conceptual level. Current literature points to the need to move from abstract principles to empirically comprehensible tools that would make it possible to assess whether and how tourism actually contributes to the regeneration of SES of heritage (Bellato et al., 2023; Dredge, 2022; Khater et al., 2025). The key problem remains the operationalization of



the concept of “regeneration” at the level of specific locations, processes, and measurable indicators. In the context of cultural heritage, the regenerative approach is not limited to protecting the physical integrity of monuments, but also includes restoring their functionality, significance, and relationships with the local community, institutional structures, and environmental conditions (Bellato et al., 2023; Dredge, 2022). In this case, cultural heritage is understood as a living SES, whose vitality depends on interactions between the physical condition of the object (in the case of buildings, including the complex of interior attributes), modes of use, forms of management, and broader environmental processes (Rani et al., 2025). It is these relationships that represent the critical interface between the theoretical foundations of regenerative tourism and its practical implementation.

This study responds to the existing gap between the existing conceptual framework of regenerative transition and empirical research by applying the principles of regenerative cultural heritage management to a specific case of a historic object – the wooden church of Sfântul Gheorghe in the village of Prodănești (Sălaj County, Romania). The case study serves as an empirical research context for assessing the extent to which physical, environmental, and microclimatic conditions are consistent with the requirements of regenerative cultural heritage management and its integration into local tourism practices and the sociocultural needs of the local community. The focus on internal microclimatic parameters (temperature, relative humidity, air quality, and biological factors of degradation of building materials and other interior elements) allows the physical condition of the monument to be interpreted not as an isolated technical problem, but as part of a broader regenerative system of relationships between the environment, visitors, and methods of building management. This approach corresponds to the epistemological shift in regenerative tourism from static indicators to a process-oriented assessment of the vitality of the system. The aim of the study at the empirical level is therefore not only to document the microclimatic conditions of the wooden church, but also to interpret the results obtained in the perspective of a regenerative framework for cultural heritage management. The case study contributes to the discussion on how the principles of a systemic approach, resilience, and ecological regeneration can be linked to specific conservation and management measures at the local level. At the same time, it emphasizes the need for integrated and non-invasive conservation approaches that ensure not only the preservation of the physical integrity of the monument, but also the long-term compatibility of its protection with the conditions of the local environment.



THEORETICAL FRAMEWORK

The regenerative shift in tourism: context and premises

The discussion on the relationship between tourism and cultural heritage has long been conceptually anchored primarily in normative “sustainability” – i.e., minimizing the negative impacts of visitor numbers on the tangible and intangible cultural heritage values of sites. In recent years, however, there has been intense discussion in tourism about the so-called regenerative shift, which moves management goals from the principle of “do no harm” to the ambition of “net positive impact.” In other words, the development of tourism should not only focus on reducing its negative impacts on the natural and sociocultural environment, but expectations are shifting towards its active contribution to improving the condition of the entire system of which it is a part (Bellato, Pollock, 2023; Dredge, 2022).

The regenerative approach is particularly relevant to cultural heritage management. In this case, natural and cultural heritage is not understood as an isolated element (attribute, artifact) of the environment, but as a living SES, whose “health” (viability) is the result of interactions between the physical location, community, land management structures, and local authorities (such as various levels of governance, institutional management structures, etc.), tourism-related flows of resources and benefits, and environmental limits (Bellato, Pollock, 2023; Boros, Korcsmáros, 2024; Sharma et al., 2025). In the heritage context, this shift is beginning to be explicitly linked to the themes of community renewal, participation, and empowerment, as indicated by recent studies on “reviving heritage through regenerative tourism” or “heritage revitalization” (Khater et al., 2025).

Research into regenerative tourism is undergoing rapid conceptual consolidation. Bellato, Frantzeskaki, and Nygaard (2023) summarized the conceptual frameworks and specifics of regenerative tourism, pointing out its key difference from sustainable tourism, namely that it aims to improve the vitality of living systems (Bellato et al., 2023). Dredge (2022) adds another distinguishing attribute in this context, namely a shift towards a change in mindset, systemic transformation, and “boundary spanning” practices, i.e., practices that bridge boundaries between sectors, actors, disciplines, and levels of governance decision-making. In other words, regenerative tourism connects these epistemic worlds to create a common understanding of the problem and its solutions. To do this, it needs actors and institutions that can act as “bridges” between the tourism sector, heritage protection, communities, and politics (Dredge, 2022).

The main pillars of regenerative tourism are considered to be: (a) systems thinking, (b) resilience theory, (c) ecological regeneration, (d) place-based development, and (e) tourism degrowth/post-growth.



(a) Place as a dynamic system - systems thinking

Regenerative tourism taps into the practice of systems thinking, which highlights non-linear connections, feedback loops, time lags, and the spontaneous behaviour of intricate systems (Meadows, 2015). Rather than focusing on the individual “impacts” of a problem, it shifts our attention to the system as a whole (for example, how visitors move through a place, the local economy, the way decisions are made, and ecological limits). It also looks at places where intervention has a particularly big effect (Meadows, 2015; Kostilníková et al., 2022). This approach builds on the traditional “*systems view of life*,” where “*life*” is interpreted as a network of relationships between elements of the system. This framework is important for regenerative approaches in that it shifts planning from the optimization of isolated variables to the promotion of relational quality (Capra, 1996). In tourism, this means that success is not defined solely by the volume of visitors or the amount of revenue (not outputs), but also by the *quality of the relationships* between visitors, hosts, institutions, and the place, i.e., the ability of the system to maintain and develop functional, cooperative, and long-term stable relationships, or to function and renew itself in the long term.

(b) Resilience theory: adaptation, transformation, recovery capacity

The second pillar is resilience theory, which is based on Holling’s (1973) traditional differentiation between stability and resilience. In his view, resilience is not just a return to the original state, but also the ability of a system to absorb shocks and maintain key functions (Holling, 1973). Later developments of the concept in the perspective of SES emphasize adaptation, learning, and transformability, i.e., the ability of a system to change its configurations while maintaining its viability (Folke, 2006; Walker, Salt, 2006; Szilágyi et al., 2025). Resilience is key to heritage management in tourism because the “pressure” on a location (tourist destination) is not only environmental but also social (between visitors and the community), institutional (capacity limits of land management), and economic (dependence on a single source of income; Kostilníková et al., 2022). In this regard, the regenerative framework shifts the emphasis from limiting visitor numbers to building the system’s ability to adapt and renew its capacities.

(c) Ecological regeneration and regenerative design: from recovery to improved functionality

The regenerative discourse is also based on traditions of ecological recovery and regeneration, where the goal is not only to “repair damage” but, above all, to restore the functionality and integrity of the system (Martin, 2017). In a broader sense, this shift reflects the thesis of a transition from “sustainability”



to “regeneration” – i.e., from maintaining the status quo to actively improving it (Reed, 2007). In tourism, this principle is transformed into the logic of “net positive,” i.e., revenues and activities associated with visitor numbers should generate the restoration of ecosystems, cultural practices, and infrastructure, while monitoring the balance of impacts and benefits across the dimensions of the system (Bellato, Pollock, 2023; Dredge, 2022).

(d) *Place-based development: locally embedded change and territorial governance*

Another pillar of the concept is place-based development, which emphasizes the need for development strategies to be based on local specifics, endogenous resources, and multi-level governance, rather than universal “best practices.” In this case, integrated interventions and institutional coordination, which are an important part of place-based development policy (Barca, 2009), are considered a key way of addressing complex territorial inequalities. In regional development theory, the place-based approach is normative in nature, as it raises the question of “what kind of development is being pursued and for whom,” explicitly addressing issues of values, social justice, and the distribution of costs and benefits (Pike et al., 2007). In regenerative tourism, place-based logic is present in the emphasis on locally defined values, socially legitimate goals, and the connection of tourism with local life strategies rather than with externally anchored demand maximization.

(e) *Degrowth / post-growth in tourism: criticism of growth as a target function*

The regeneration shift is part of a broader re-evaluation of the growth paradigm in tourism. For example, degrowth and post-growth literature in tourism explicitly questions the idea that growth in visitor numbers and consumption is compatible with ecological limits and social justice, and proposes a new research and development orientation towards well-being, justice, and resource limits (energy use, fossil fuels, renewables capacity; materials, land, water; carbon budget) and the assimilation capacity of ecosystems (waste, pollution; e.g. Higgins-Desbiolles et al., 2019; Fletcher et al., 2019). Current academic discourse also shows that the degrowth agenda is already considered a separate school of thought (Murray et al., 2025; Dredge, 2022). Degrowth tourism represents a more radical school of critical thinking of growth, based on normative criticism of growth and the reduction of material and energy throughput associated with tourism activities (Murray et al., 2025). Post-growth tourism represents a more moderate, reformist framework for criticizing the logic of growth, i.e., a “beyond growth” framework without the need for explicit reduction, but with an emphasis on quality, stability, well-being, local prosperity, and systemic transformation. Regenerative tourism stands between them, taking from degrowth its criticism of quantity and from post-growth



its focus on the qualitative transformation of systems. What both concepts (regenerative tourism and degrowth) have in common is their criticism of “quantity” (growth) as an indicator of success. In both cases, greater emphasis is placed on transforming systems and strengthening local capacities (Dredge, 2022; Bellato, Pollock, 2023).

Axiological, ontological, and epistemological divergence between sustainable and regenerative tourism

Despite the above characteristics, regenerative tourism cannot be reduced to a simplified idea that it is just a set of certain management tools or techniques for optimizing visitor numbers. Regenerative tourism is rather perceived from a metatheoretical perspective as a concept that redefines the possible goals of tourism, as well as from an ontological perspective the nature of interconnected relationships within social (e.g., actors, community, institutions) and natural systems (Dredge, 2022; Bellato et al. 2023; Bellato, Pollock, 2023; Kostilníková et al., 2022) that constitute it. In addition, the integrative ontological unit of “place” is also considered, which connects the social (people, communities, institutions), natural (ecosystems, landscape) with meaning (identity, memory, values; Matlovcova, 2024). In this case, place encompasses location (where), identity (who), meaning (what it means), and relationships (how it lives; Matlovcova, 2024). Regenerative logic thus makes it possible to bridge the traditionally perceived binary between conservation and exploitation (use). In this case, it is replaced by the perspective of relational co-evolution, in which tourism acts as a potential catalyst for SES restoration. From an axiological point of view, regenerative tourism shifts the value horizon from minimizing negative externalities to a “net positive impact,” i.e., the active production of positive effects on SES. At the same time, however, the goal is not only to stabilize the existing state, but above all to improve the vitality of the SES as a whole (Reed, 2007; Bellato et al., 2023). The shift described thus represents a qualitative change from the sustainability paradigm, which was primarily focused on maintaining a balance between the economic, social, and environmental dimensions of the SES, not on its restoration (Higgins-Desbiolles et al., 2019; Fletcher et al., 2019; Sharma et al., 2025). The normative criterion for assessing success is therefore not only damage reduction, but also the ability of tourism to contribute to strengthening local capacities, restoring ecological and cultural functions, and ensuring the long-term resilience of the SES.

Currently, there are two opposing views on regenerative tourism. One group of authors considers it to be a conceptually different normative and epistemological framework, while the other group considers it to be merely an extension or “advanced version” of sustainable tourism. In this case, it should be emphasized that both approaches jointly criticize uncontrolled growth and environmental



and social externalities, but their basic ontological assumptions, target functions, and operational logics differ significantly (Bellato et al., 2023; Dredge, 2022). While sustainable tourism is historically rooted in the paradigm of “*harm reduction*” – that is, in an effort to reconcile economic development with environmental and social limits – regenerative tourism shifts the focus to the paradigm of systemic renewal, in which tourism is understood as a potential tool for the renewal of SES (Reed, 2007; Bellato et al., 2023). This shift is not only terminological, but also represents a change in the understanding of the subject of regulation itself, i.e., while sustainability aims to manage impacts, regeneration focuses on managing relationships and transformation processes (Bellato et al., 2023). Sustainable tourism is therefore based on an implicit understanding of a destination as a set of resources that must be managed so that they are not depleted (Butler, 1999; UNWTO, 2004). Such an approach assumes a relatively stable system in which the main variables are the rate of use and the rate of damage.

Conversely, regenerative tourism is predicated on systemic ontology, wherein the concept of place is understood as a dynamic SES that is subject to nonlinear changes, feedback, and adaptive processes (Capra, 1996; Meadows, 2015; Bellato et al., 2023). Fundamental methodological implications are presented by this ontological difference. The focus of sustainability is on the maintenance of balance (the achievement of equilibrium). By contrast, regeneration is associated with the concepts of transformation, learning, and co-evolution between tourism and place (Folke, 2006; Walker and Salt, 2006; Dredge, 2022). It’s not just about managing things anymore, it’s about working together to make things better.

From a normative perspective, sustainable tourism is defined in the first instance as an endeavour to minimise the environmental and social damage caused by tourism (UNWTO, 2004; Butler, 1999). Success here means reducing pressure on resources and making sure they’re available for future generations. However, regenerative tourism does not stop at criticizing or minimizing negative phenomena, but explicitly sets goals, values, and directions for change that are desirable to achieve. In other words, the goal is not to achieve a state that is “less bad,” but rather a “net positive impact,” i.e., “better than before” (Reed, 2007; Bellato et al., 2023). In practice, this normative shift means that the state of tourism development is assessed according to the extent to which it contributes to the restoration of cultural and ecological functions, increased community resilience, or the strengthening of local capacities and the restoration of the condition, function, and significance of cultural heritage (Dredge, 2022; Matlovcova et al., 2022; Matlovcova, 2024; Szilágyi et al., 2025; Khater et al., 2025). The value of regeneration in regenerative tourism thus goes beyond environmental sustainability into the sphere of social and cultural transformation.

The above considerations suggest that the epistemological divergence between sustainable and regenerative tourism lies in different understandings of



the goals of tourism development. At the methodological level, in the context of measuring change, static indicators of the state of the environment are replaced by process- and relationship-oriented metrics of system dynamics. Unlike sustainable tourism, which is based mainly on indicators measuring environmental impact, social impact, and sustainable economic benefits (UNWTO, 2004; McCool, Lime, 2001). These indicators allow for monitoring a predominantly linear perspective of development (e.g., number of visitors, energy consumption, resident satisfaction). However, regenerative tourism is oriented towards processes, relationships, and long-term trajectories of change, which are mostly non-linear, and therefore requires a different type of approach (Bellato, Pollock, 2023; Dredge, 2022). From an epistemological point of view, it therefore requires a change in approach:

- from measuring the existing state to examining the dynamics of development,
- from identifying (static) thresholds of development to monitoring feedback,
- from isolated indicators to their systemic configurations (Folke, 2006; Meadows, 2015).

The epistemological shift outlined above is often accompanied by a growing use of transdisciplinary and participatory methodological approaches, which are better able to capture the nonlinear dynamics of relationships, changes in institutional practices, and the meanings of “place” in changing contexts (Bellato et al., 2023; Matlovcova, 2024; Matlovcova, Kormanikova, 2014; Klimovský et al., 2016; Dredge, 2022).

Another difference between sustainable tourism and regenerative tourism is the different understanding of governance. This political-institutional divergence between them manifests itself in the replacement of regulatory mechanisms with transformative ones, as well as in the promotion of participatory institutional arrangements (Khater et al., 2025). In other words, within the framework of governance, sustainable tourism promotes regulation and control, i.e., visitor limits, environmental standards, certifications, and regulatory instruments (UNESCO, 2012). Regenerative tourism, on the other hand, prefers the transformation of institutional relationships, primarily through participation, co-management, and locally based governance (Dredge, 2022; Khater et al., 2025). In the field of management, sustainable tourism is usually based on an expert, technocratic model of decision-making, while its regenerative alternative emphasizes social learning, collective responsibility for heritage, and community legitimacy, which does not stem primarily from expert authority, the market, or the state, but from the recognition and consent of the local community as the primary bearer of the relationship to the place (Bellato et al., 2023). The governance (who decides, how they decide, based on what values, and with what legitimacy) of cultural heritage in tourism is thus a process of constant negotiation between actors in the destination about the values of protection, development, and social justice (Khater et al., 2025).



Regenerative framework for cultural heritage management in tourism

In the context of the above considerations, the regenerative Heritage Tourism System can be defined as a SES consisting of four interconnected subsystems:

1. *cultural-material subsystem*, which includes the material values of heritage, their maintenance, restoration, and issues of physical integrity and material authenticity of heritage sites;
2. *social subsystem*, represented by community participation, social cohesion, and the legitimacy of decision-making processes in the field of heritage management;
3. *economic-institutional subsystem*, which includes various forms of governance¹, redistribution, or benefit-sharing mechanisms resulting from tourism, as well as the capacity of institutions responsible for heritage management;
4. *environmental subsystem*, reflecting the ecological limits of tourism development, the possibilities for landscape regeneration, and the adaptive capacity of SES (Holling, 1973; Folke, 2006; Barca, 2009; Meadows, 2015; Dredge, 2022; Bellato et al., 2023; Boros, Korcsmáros, 2024; Rani et al., 2025; Sharma et al., 2025).

More recent state-of-the-art reviews point to conceptual plurality and the risk of “buzzwordization” of the term regenerative tourism. Regenerative discourse can thus be misused if it is not clarified what exactly “net positive” means and how it will be measured. (Bellato, Pollock, 2023).

Based on studies published to date, it can be argued that the difference between sustainable and regenerative tourism lies in the nature of the measures taken, which represents a paradigm shift in the understanding of tourism as a social phenomenon (Dredge, 2022; Bellato, Pollock, 2023). Regenerative tourism thus replaces:

- the logic of development limits → the logic of transformation,
- resource protection → system renewal,
- quantitative indicators → qualitative dimensions of vitality
- and technocratic regulation → participatory governance (Bellato et al., 2023; Khater et al., 2025).

In this sense, regenerative tourism can be seen as a synthesis of systems thinking, resilience, place-based development, and post-growth criticism in tourism, which allows us to transcend the dilemmas between heritage protection

¹ Governance of cultural heritage (or tourism) can take hierarchical, market-based, network-based, participatory, and place-based forms depending on the source of legitimacy, decision-making methods, and normative orientation (Rhodes, 1996; Hall, 2011; Healey, 2007; Ansell & Gash, 2008; Graham et al., 2000).



and exploitation and thus formulate a new horizon for the development of tourism as a tool for social and cultural renewal (Higgins-Desbiolles, 2019; Fletcher et al., 2019; Bellato et al., 2023).

Case study Wooden Church „Sfântul Gheorghe” (Prodănești Village, Sălaj County, Romania)

Despite relatively broad theoretical discourse on regenerative tourism, there are still few empirically oriented studies in the field of cultural heritage management. Most existing works focus on conceptual models, principles, and governance frameworks, while less attention is paid to examining the specific physical and environmental conditions that form the basis of the material vitality of heritage. However, the regenerative approach assumes that the restoration of the sociocultural functions of tangible cultural heritage is inextricably linked to its physical condition and the environmental context in which the object is situated. It therefore requires detailed knowledge of the processes of degradation, adaptation, and regeneration at the level of specific sites.

In this context, the case study of the wooden church of Sfântul Gheorghe in the village of Prodănești (Sălaj County, Romania) is understood as an empirical contribution to the application of the theoretical principles of the regenerative framework of cultural heritage management. The building represents a cultural-ecological system in which microclimatic processes, biological factors, building materials, and forms of use associated with liturgical and tourist activities intersect. The analysis of the microclimate of the interior of the object and its impact on the building structure, as well as other elements of the interior, allows us to interpret the physical condition of the monument as a manifestation of the overall vitality and adaptability of the SES.

The case study is not only a technical assessment of the condition of a cultural heritage site, but also a contribution to the discussion on the possibilities of linking specific conservation measures to the management of regenerative tourism – systemic thinking, adaptive management, and a focus on long-term restoration (Ciangă, 2007; Wendt et al., 2018; Elian, Stoean, 2013; PFB, 2017). The example of the wooden church in Prodănești thus serves as an illustration of the possibilities, but also the limits, of applying a regenerative framework in the conditions of small rural cultural heritage sites.

Research object

The object of the research is the wooden church “Sfântul Gheorghe”, which is located in Prodănești village in Sălaj County in northwestern Romania. Dating back to 1730, the church is a notable historical monument and an important part of the local cultural heritage (MCR, 2015). The edifice stands out through its reduced



dimensions, 8.55 m long and 3.55 m wide, being one of the smallest wooden churches in Sălaj County. Construction-wise, it has a rectangular plane, with square, unhooked apse. The wooden church walls are made of thick beams and have small, cut windows, and the tower is directly proportional with the edifice's dimensions, being of medium height (MăruŃoiu et al., 2017). The coverage is made in the narthex by a straight ceiling and, in the nave and altar, it has a semicircular vault which ends in the eastern side with a tympanum prolonged with the wall (Godea et al., 1978). Due to the small size of the wooden church, the iconostasis presents only two entrances, compared to the usual three, and, due to the small surface of the altar, the altar stone is placed in the nave. Inside the church, there are only traces of painting (MăruŃoiu et al., 2017).

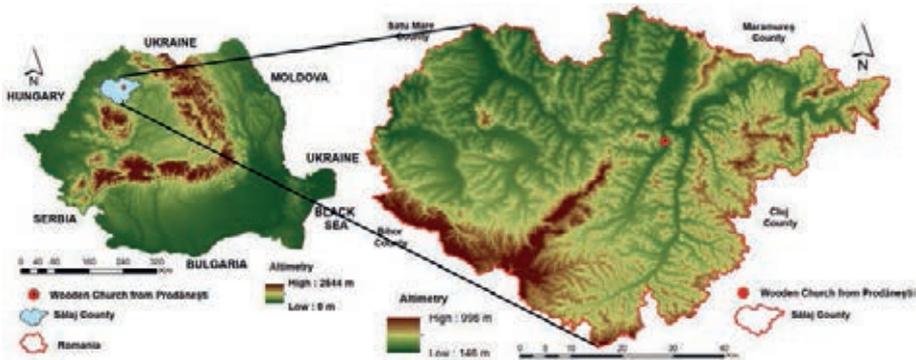


Fig. 1 The location of the wooden church in Prodănești at the level of Romania and Sălaj County

Source: visualized by the authors



Fig. 2 The wooden church is a historical monument in the locality of Prodănești, exterior (left) and interior (right)

Source: Authors' archive



In the field of indoor microclimate, numerous studies were carried out, investigating the effects of parameters characterizing it upon cultural heritage (Alterio et al., 2010; Fabbri et al., 2019; Mihincău et al., 2019b; Ilieș et al., 2022; 2020; Rosina et al., 2023; Tringa et al., 2024).

Wooden churches have been an interest point for researchers, both internationally and nationally. Nawalany et al. (2020; 2021; 2025) conducted many studies on wooden churches in Poland, investigating temperature and humidity conditions inside them. The studies concluded that temperature and relative humidity exceeded optimum values over long periods of time and, during Mass, the number of present people influenced temperature and relative humidity levels. It was also concluded that when wooden churches were heated inside, temperature and relative humidity values were more optimum.

Temperature fluctuations can be a risk for the paintings within wooden churches and, in this context, Califano et al. (2024) made a study on this topic and provided useful preservation advice, based on possible scenarios.

Andres et al. (2024) investigated the microorganisms and the role of humidity inside a wooden church from Poland, showing the high humidity values within walls, as well as the need for conservation measures which must be considered to protect the wooden church.

Nationally, the indoor microclimate features were studied in many wooden churches. Numerous studies were made at the wooden church in Oradea, where Mihincău et al. (2019a) investigated the indoor microclimate inside the Wooden Church from the University of Oradea Campus and the way in which it could be influenced by religious activities. From the data obtained, it was concluded that the interior microclimate was not optimum and that it could represent a risk factor for the construction itself and for human health. Ilieș et al. (2021; 2022) investigated the microbiological, health and comfort aspects of air quality within this wooden church.

Regarding the research of wooden churches in Sălaj County, studies were made at the Wooden Church from Răstolțu Deșert, investigating the indoor microclimate and its influence on the edifice. The second part of the research focused on visitors' perception on air quality and its effects on human health. The research concluded that the indoor microclimate parameters systematically exceeded optimum values and represented a potential risk factor for the edifice (Noje et al., 2025).

Other studies regarding indoor microclimate were also accomplished and indoor well-being factors and environmental infrastructure represented a preoccupation in researches carried out in Romania (Marcu et al., 2021; Ilieș et al., 2021; 2022).



DATA AND METHODS

The research methodology consisted in the indoor microclimate parameters' analysis and the way in which it influences the edifice and visitors' human health.

Determination of microclimate features

The study was carried out over a period of six months, from the 1st of August, 2024, till the 31st of January, 2025, with the aim to research the indoor microclimate features over several seasons, and the way in which outdoor climate changes influence the indoor microclimate of the wooden church. For gathering data, sensors were used and their specifications are presented in table 1.

Tab. 1 Specification of the measuring equipment used

Equipment model	Determined indicators	Producer	Precision
Climate data logger BL30	Temperature, RH	Trotec, Germany	± 1 °C (Temperature), $\pm 3\%$ (RH)
CEM DT-96 mini particle counter PM _{2.5} , PM ₁₀	Temperature, RH, PM _{2.5} , PM ₁₀	Shenzhen Everbest Machinery Industry Co, China	± 1 °C (temperature), $\pm 5\%$ (RH), to $\pm 5\%$ (PM _{2.5} , PM ₁₀)
CEM DT-93 Detector of formaldehyde (HCHO) and total volatile organic compounds (TVOC)	HCHO, TVOC	Shenzhen Everbest Machinery Industry Co, China	$\pm 2\%$ (VOC), $\pm 2\%$ (HCHO)
Split type luxmeter GM1030	Temperature, Natural light LUX	Shenzhen Jumaoyuan Science and Technology Co, China	± 1 °C (temperature) Stage X1 - $\pm 3\%$ rg +5digits Stage X10 - $\pm 3\%$ rg +10digits Stage X100 - $\pm 4\%$ rg +10digits Gear X1000 - $\pm 4\%$ rg+10digits
HOKUTO Model NKMH-103	Positive ions, negative ions	Hokuto Electronics, Inc., Japan	100-19.990.000 (piece/cc) 100-199.900 (piece/cc) 1.000-1.999.000 (piece/cc) 10.000-19.990.000 (piece/cc)
Sonometer SL400	Sound level	Trotec, Germany	IEC 61672-1 class 2, ANSI S1.4 type 2
TD120 Trotec	Distance, surface, volume	Trotec, Germany	+/-1,5 mm
Infrared thermal imaging camera Flir E5	Thermographic images	FLIR Teledyne, United States of America	± 2 °C

Source: Trotec (2025); Shenzhen Everbest Machinery Industry Co. (2025); Hokuto Electronics (2025); FLIR Teledyne (2025).



To determine the wooden church microclimate, several parameters were monitored using multiple procedures. Temperature and relative humidity were automatically monitored every 60 minutes with the help of a data logger climate sensor Trotec BL30 (Trotec, 2025). The sensor was placed in the nave to better cover the church interior, at a height of 1.5 m.

The Particulate Matter (PM_{2.5}, PM₁₀), the amount of VOC, HCHO, NL, I⁻ and I⁺ were manually monitored. The measurement intervals were 7:30 a.m., 1 p.m. and 7:30 p.m. For optimum coverage of the wooden church, 23 gathering points were selected: 6 points in the narthex, 12 in the nave and 5 in the altar, and their positioning can be seen in Fig. 3. Acoustic intensity was recorded over 3-hour intervals. To analyze the effect of temperature and humidity on the wooden church surfaces, thermographic images were taken with an infrared thermal imaging camera Flir E5 (FLIR Teledyne, 2025), and to analyze and interpret the thermographic images, Flir Tools + 6.4 software was used.

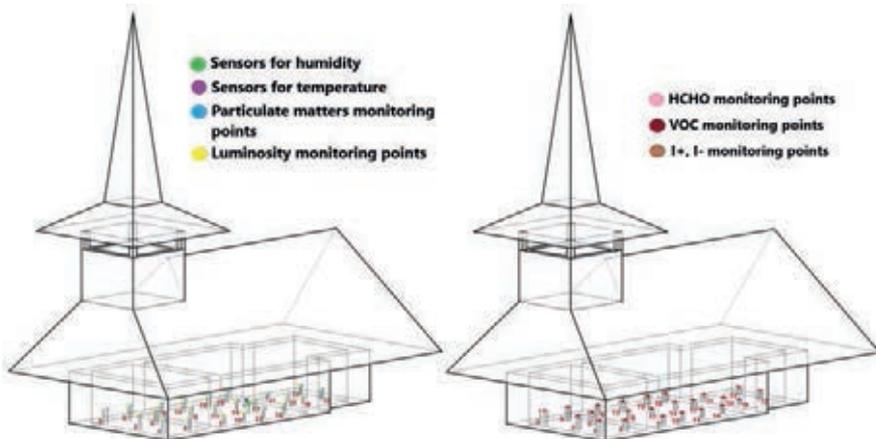


Fig. 3 Spatial distribution of sensors and data collection points inside the wooden church
Source: Authors' own visualization

RESULTS

Indoor microclimate data analysis and interpretation and their influence on the edifice and human health

For proper preservation and conservation of the Wooden Church from Prodănești, but also for human health, the temperature value must be maintained within optimum limits proposed by standards in effect. A first standard is ASHRAE (2011), which stipulates an average temperature of 20 °C ($\pm 1-2$ °C), and for human health, the ASHRAE standard stipulates values between 20–24 °C in the cold season and 23–26 °C in the warm season (ASHRAE, 2020).



Due to the fact that the wooden church does not have a heating source and the construction allows communication with outdoor air, the temperature values inside the wooden church depend on the outdoor air, as seen in Fig. 5. The temperature value, over the monitored period of time, fluctuated almost for the entire period, as seen in Fig. 4. Over the monitored period of time, the highest temperature values were recorded in August and the maximum temperature value of 30.2°C was recorded on the 16th of August, 2024, at 6:39 pm. During the autumn months, the temperature values decreased and significant fluctuations could be noticed during short periods of time of only a few days. In December and January, the temperature values fluctuated between 0° C-10° C, however, short periods of time, of a few days, could be noticed when the indoor temperature decreased under the value of 0° C, respectively, to a minimum value of -4° C, recorded on the 16th of January, 2025, at 9:46 a.m. The average temperature value was of 10.72° C, with thermal amplitude of 34.2° C.

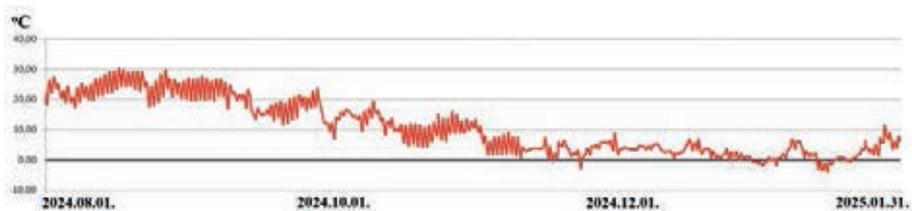


Fig. 4 Indoor air fluctuations (°C) from August 01, 2024 to January 11, 2025

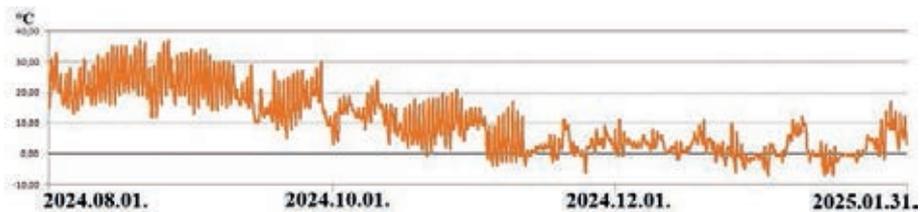


Fig. 5 Fluctuations in outdoor air temperature (°C) from August 1, 2024, to January 11, 2025

As seen in Fig. 6.A., on the north-western roof side of the Wooden Church from Prodănești, *Cladonia transcendens* lichen species dominantly developed. Factors which enhanced their development were the old wood, with water retaining cracks and irregularities (Brischke, Alfredsen, 2020; Cozzolino et al., 2022), and the high relative humidity condition of the wooden church microclimate, with approximate average values of 70%.

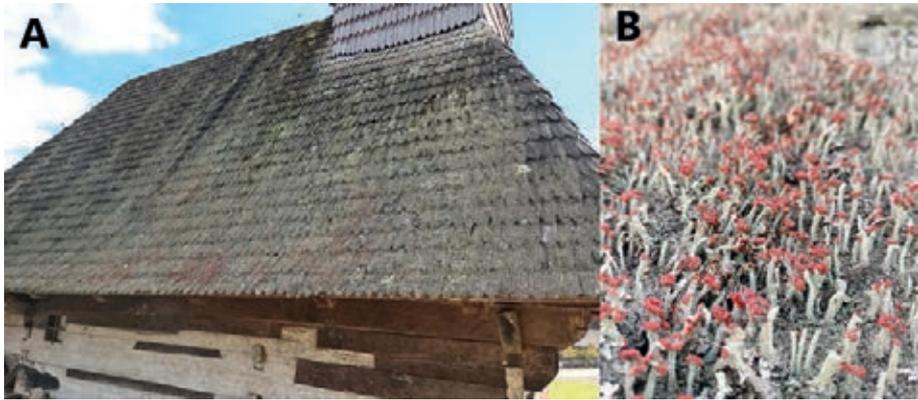


Fig. 6 Roof of the Wooden Church from Prodănești (A), colonized by *Cladonia transcendens* lichen species (B)

On the temperature profile from Fig. 8, it can be observed the way in which surface temperature is distributed, on the left-right diagonal of the wooden church roof, fluctuating from 15.2 °C to 18 °C, and also depending on the *Cladonia transcendens* lichen colonization.

In the thermographic image from Fig. 7.B., it is noticeable the way in which fungi influence humidity distribution on the roof surface (Kraniotis et al., 2016; Madruga et al., 2020; Barreira et al., 2020; Dafico et al., 2022). In the current case, retained humidity has, in time, a rotting effect on wood.

Due to the fact that the wooden church is a historic monument, preservation measures with non-invasive methods are recommended (St. Clair, Seaward, 2004). To prevent *Cladonia transcendens*, the relative humidity level must be monitored and controlled inside the wooden church, to maintain the wood dry and to achieve ventilation of the wooden church (Moron et al., 2016; Walsh-Korb, 2022; Cozzolino et al., 2022).

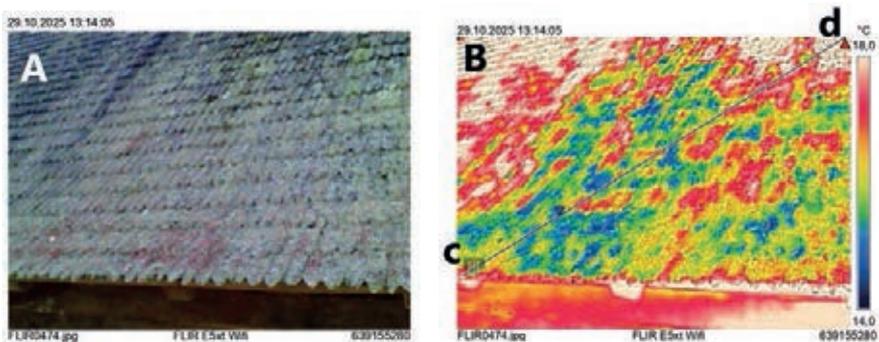


Fig. 7 Roof of the Wooden Church from Prodănești (A) and its thermographic image (B)

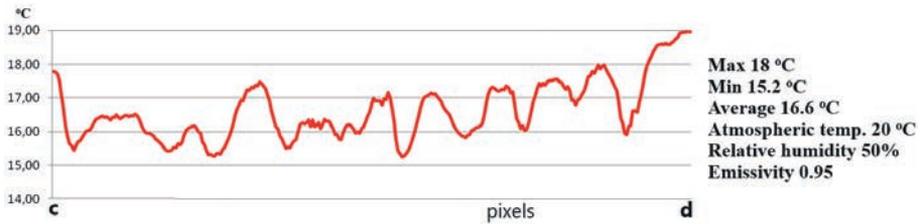


Fig. 8 Temperature profile on the left-right diagonal of the roof area, from the thermographic image B from Fig. 7

Inside the Wooden Church from Prodănești, the painting is in an advanced state of decay and, as seen in the image in Fig. 9. A, the scenes in the painting are barely visible. To observe the way in which the painting is influenced by various factors, infrared thermography was used, being a non-invasive method, and a temperature profile was made for the photographed painting. As it can be seen in both images in Fig. 9, the painting was significantly deteriorated at the construction beam joints.

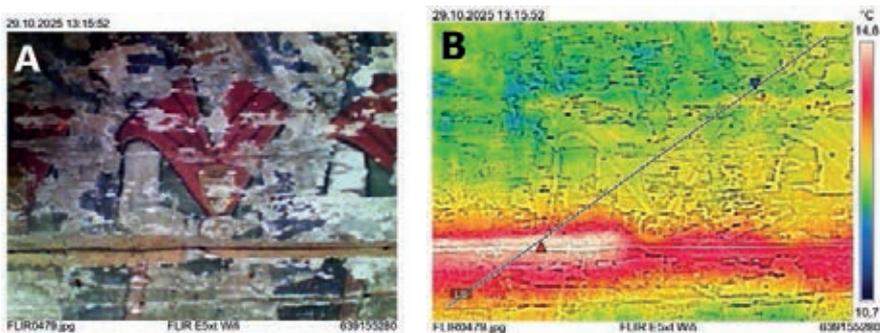


Fig. 9 Wooden Church from Prodănești, Salaj County, narthex painting (A) and its thermographic image (B)

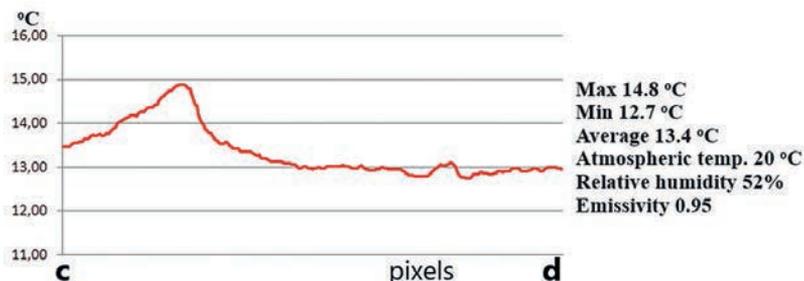


Fig. 10 Temperature profile on the painting's left-right diagonal from the thermographic image in Fig. 9.B



On the temperature profile in Fig. 10, it can be observed the temperature fluctuation on the painting surface. For the left-right diagonal, we notice values from 12.7°C to 14.8°C. Temperature distribution on the painting surface and humidity distribution on the painting surface are both influenced by outdoor air which, over time, can be a high-risk factor for the painting (Kraniotis et al., 2016; Madruga et al., 2020; Barreira et al., 2020; Dafico et al., 2022). At the horizontal beams' joints, the painting is deteriorated, as seen in Fig. 10A, while on the temperature profile, the highest value is in that spot because there is a gap through which it communicates with the outdoor.

Relative humidity must be contained between optimum limits regulated by the standards in effect to preserve and conserve the wooden church and, according to ASHRAE (2011), the relative humidity value must be maintained around the value of 50% ($\pm 3\%$). ASHRAE (2020) stipulates for human health, thermal comfort and prevention of microorganism development or rash occurrence, relative humidity optimum values between 30–60%.

As observed in Fig. 11, relative humidity values were, most of the time, over the optimum intervals proposed by standards in effect and the relative humidity average value was of 73.03%, which depends greatly on the outdoor air values, as seen in Fig. 12. For September, it was noticed a period of a few days in which the relative humidity value had lower values, the minimum value of 32.40% being recorded on the 8th of September, 2024, at 6:39 p.m. During the autumn months, the values fluctuated around the 60–80% interval. During the summer months, the relative humidity value was higher and the maximum value was of 97.10%, recorded on the 8th of January, 2025, at 2:46 p.m.

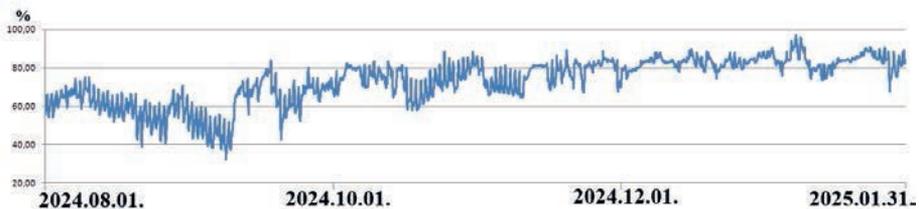


Fig. 11 Indoor humidity fluctuations (%) from August 01, 2024 to January 31, 2025

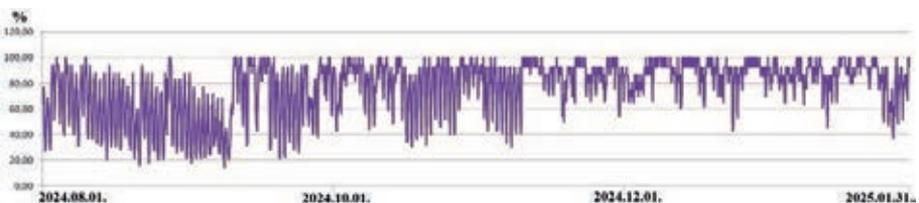


Fig. 12 Fluctuations in outdoor humidity (%) from August 1, 2024 to January 31, 2025



PM_{2.5} concentration values fluctuated during the research period between minimum values of 0.00 µg/m³ and maximum values of 15 µg/m³. As seen in Fig. 13.a., the PM_{2.5} values are not even inside the wooden church, with higher values in the narthex, between 9.00-11.00 µg/m³, and lower values in the nave, between 2.00-10.00 µg/m³, and the altar, between 4.00-7.00 µg/m³. The PM_{2.5} values were influenced by window positions, reduced dusting, the presence of textiles inside the church (towels, blankets, curtains, carpets, etc.).

PM₁₀ concentration, during the research period, showed values between a minimum of 0.00 µg/m³ and a maximum of 25.00 µg/m³. The PM₁₀ average values' distribution was influenced by window positions, indoor textiles, reduced window cleaning and follows greatly the PM_{2.5} values distribution, with higher values in the narthex, of 9.00-17.00 µg/m³, and lower values in the nave, 4.00-9.00 µg/m³, and altar, 8.00-9.00 µg/m³, as shown in Fig. 13.b.

VOC concentration values fluctuated, during the monitored period, between minimum values of 0.00 mg/m³ and maximum values of 2.72 mg/m³, over short periods of time. As seen in Fig. 13.c., VOC concentration average values, during the research period, were between 0.75-0.92 mg/m³, with higher values in the narthex, of 0.80-0.92 mg/m³, and lower values in the nave, of 0.75-0.80 mg/m³, and altar, of 0.76-0.79 mg/m³. Inside the wooden church, VOC average values were according to standards in effect because the acceptance level is of 1.00 mg/m³ (Directive 2000/39/EC → European Commission, 2000)

Light intensity inside the wooden church was, during the research, between 0 and 320 lux, influenced, as shown in Fig. 13.d., by window positions, around which the values were higher. The light intensity average values were between the minimum value of 0 lux and the maximum value of 168 lux, distributed as seen in Fig. 13.d., thus, in the narthex 10–155 lux, and in the altar 48–168 lux. Standards in effect stipulate values between 50–200 lux (BSI, 2011), and inside the wooden church, the average values are optimum; therefore, light intensity does not represent a risk factor for the indoor construction material and wooden objects.

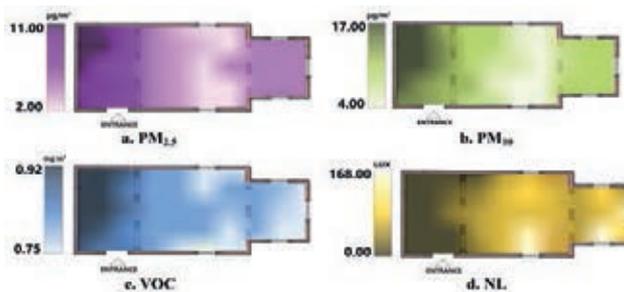


Fig. 13 Indoor average values of PM_{2.5}, PM₁₀, VOC, NL for each monitoring point - (a) Particulate matter PM_{2.5}, (b) Particulate matter PM₁₀, (c) Volatile organic compounds VOC, (d) Natural light NL



The acoustic intensity value inside the wooden church has an important role because the more these values increase, the higher their effect on the human body will be. Levels up to 30 dB are comfortable for the human body, values between 30–60 dB are acceptable and values between 60–85 dB can cause stress and a slight hearing disorder, in case of prolonged exposure. Values over 85 dB represent a risk for human health (Stansfeld, Matheson, 2003; WHO, 2000).

Acoustic intensity monitoring since the 29th of October, 2025, between 10 a.m. and 1 p.m., provided data about the acoustic intensity values inside the wooden church, as seen on the graph in Fig. 14. The acoustic intensity values had an average value of 41.11 dBA and fluctuated between the minimum value of 38.60 dBA at 10:10:50 a.m., and the maximum value of 64.30 dBA, recorded at 11:27:12 a.m. Acoustic intensity values were influenced, firstly, by the wooden church's position near the county road DJ108A (approximately 35 m).

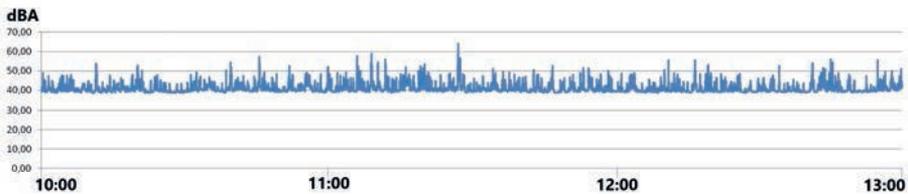


Fig. 14 Acoustic intensity level on 29.10.2025, in the time interval 10:00 a.m. -13:00 p.m.

Ions have effects on human health (Perez et al., 2013; Xiao et al., 2023) and, as seen in Fig. 15, the positive ions concentration values, during the research, were between 100-1800 ions/ m³, with an average value of 606 ions/m³.

The negative ions' values fluctuated, during the research, between -100 and -2200 ions/m³, with an average value of -1013 ions/m³. The interval with most values of negative ions was between -500 and -1575 ions/m³, as seen in Fig. 8.

The specialty literature (e.g. Jayaratne et al., 2008; Perez et al., 2013; Jiang et al., 2018) stipulates values of positive ions smaller than 1000 ions/m³, while for negative ions, values of over -1000 ions/m³. Inside the wooden church, the average values of positive and negative ions were between the limits indicated by the specialty literature.

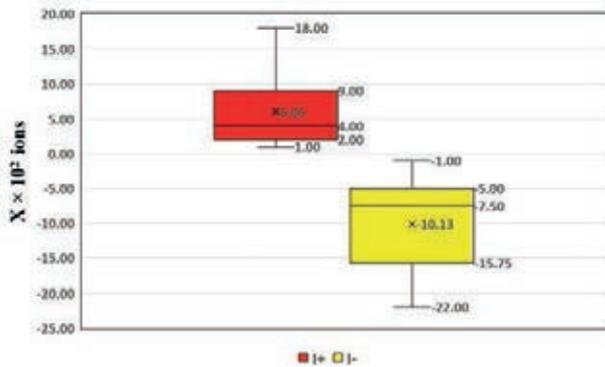


Fig. 15 The concentration of I+ and I- during the period Aug. 01, 2024 -Jan. 31, 2025 inside the wooden church

CONCLUSION AND RECOMMENDATIONS

As we have shown, cultural heritage objects should be perceived as complex SES, whose vitality is determined by the dynamics of relationships between the physical integrity of the object, the environmental conditions in which they are situated, and the ways in which they are used. The case study of the Sfântul Gheorghe church in the village of Prodănești allowed us to empirically grasp these relationships through microclimatic and biological indicators of degradation. The results thus serve not only for the technical assessment of the condition of the monument, but also as empirical verification of the extent to which the processes actually taking place in a specific cultural heritage object are in line with the objectives of regeneration-oriented tourism and cultural heritage management, emphasizing the restoration of systemic functions and the strengthening of adaptive capacity.

Data obtained from monitoring the indoor microclimate of the wooden church of Sfântul Gheorghe in the village of Prodănești indicate a significant exceedance of the recommended temperature and relative humidity values, as well as an increased presence of biological degradation factors (lichens, microorganisms) that have a negative impact on building materials and preserved interior elements. Specifically, indoor temperature values were not optimal during the research, fluctuating from the minimum of -4°C , to the maximum of 30.2°C , being influenced mostly by the outdoor air. Relative humidity had an average value of 73.03%, representing a high percentage which enhanced microorganisms and lichens' development on the wooden church roof. $\text{PM}_{2.5}$ and PM_{10} particulate matter and volatile organic compounds values fluctuated during the research, with periods of time when these values exceeded the optimum limits. Light intensity was, during the research period, within optimum values, but there were short periods of time when the values exceeded optimum limits. Acoustic intensity values



were acceptable for the human body, except when the Mass was delivered, with an average value of 41-45 dBA, being influenced by the position of the historic monument near the county road DJ108A. Positive and negative ions values were, most of the times, between the optimum limits stipulated in the specialty literature.

It is essential to monitor the wooden church's microclimate because the non-compliant temperature and relative humidity values have effects on the construction material, as well as on human health. Moreover, it also enhances microorganisms and lichen development, which can have a negative effect on the construction material. All these indoor microclimate parameters have negative effect on the indoor painting which is currently in an advanced state of decay (the painting is barely visible inside the wooden church). Non-invasive urgent measures should be taken for lichen removal from the roof and for the indoor painting preservation. The monument needs a heating source during the cold season, and a ventilation and air purifying system.

From a management perspective, the building requires adaptive management. This should be based on long-term microclimatic monitoring of temperature, relative humidity, air quality, and biological factors, which are essential for the early identification of degradation processes. In the case of the examined object, we therefore expect future research focused on indoor microorganisms that can affect human health and the artefacts, study of the lichens on the wooden church roof, which affect the construction material, and study of the indoor painting using infrared technology. Regular monitoring of these attributes supports data-based decision-making and thus contributes to increasing the effectiveness of the measures taken. In a broader context, our findings confirm that material degradation is not just an isolated technical problem, but also part of the broader dynamics of the SES of material cultural heritage (Holling, 1973; Folke, 2006; Meadows, 2015). In the context of regenerative SES management, strengthening links to local communities will also be required in the future (Klimovský et al., 2016; Brunn et al., 2018; Matlovcova et al., 2022). The legitimacy of decisions can be enhanced and the long-term sustainability of monument protection can be supported by the active participation of locals in the management of heritage and the harmonisation of the building's liturgical, tourist and conservation functions (participatory governance). The way in which the building is used by tourists should be dependent on its environmental and material capacity. To achieve the goal of improving the site's condition through regenerative tourism, the emphasis should shift from maximising visitor numbers to improving the quality of relationships within the SES, particularly between visitors and local communities, including stakeholders.



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