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DEVELOPMENT OF AN EROSION MAP USING GEOGRAPHIC INFORMATION SYSTEMS (GIS) AND BASED ON THE HIERARCHICAL ANALYTIC PROCESS (AHP) CASE STUDY OF BOUMERDES-ZEMMOURI, EASTERN OF ALGIERS

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Abstract: The objective of the study is to provide a comprehensive assessment of the vulnerability to future erosion in the region of Boumerdes-Zemmouri located in Eastern Algiers. A multi-criteria analytical Hierarchy Process (AHP) combined with (GIS) analysis was used to evaluate the effects of various geomorphologic factors that influence the land, these include slope, geology, land use, and rainfall. The results showed that the most vulnerable surfaces occupy more than 63% of the study area.

The vulnerability of this region is significantly high due to the multiple factors that affect its preservation and sustainability.

Keywords: AHP, Boumerdes, Erosion dynamics, Geographic Information System, Geomorphology, Vulnerability

* * * * * *

INTRODUCTION

The primary cause of soil erosion is the transport and detachment of soil particles through the combined effects of rainfall and runoff (Dumas, et al., 2010). This phenomenon is common in the Mediterranean basin countries (Sánchez-Lozano, et al., 2013) and the study area represents one of the basins that belong to the Mediterranean regions. The factors that influence the development and maintenance of this process are identified as four domains: topography (relief), lithology (soil), climate, and land use.

The Wilaya of Boumerdes is located along the coast of Algeria and Africa, and it serves as a prominent illustration of the vulnerability that can be found in this region (Haythem, et al., 2023). The multiple geological, climatic, and geographical features that make up this area make it incredibly susceptible to different influences (Meghraoui, 2004; Tout & Rebouh, 2024). The various factors that contribute to the development of the Wilaya's vulnerability profile are not limited to its composition. Besides its geographical features, other factors such as the land use practices and the climatic dynamics also affect the area's vulnerability. This is why it is important that the Boumerdes is focused on its efforts in becoming resilient and sustainable (Christine , 2017; Batouche, et al., 2024). The study conducted in this project aims to explore the various factors that influence the vulnerability of the Boumerdes. Through the use of the AHP, an analytical tool, it will be able to gain a deeper understanding of the multiple factors that affect this region (Oudni, Dinar & Zedam, 2016). The objective of the study is to reveal the cumulative effects of these factors on the vulnerability fabric of the landscape. Moreover, through an efficient analytical method, the research can evaluate the intricate nature of the interaction between these elements. The study's core objective is to provide a comprehensive analysis of the vulnerability of the Boumerdes. Through the use of the AHP, it will be able to disentangle the various factors that influence this region's vulnerability (Haythem, et al., 2023). This study places a spotlight on the multiple facets of the vulnerability of the Wilaya of Boumerdes, providing a more precise comprehension of the issue and allowing for quick resolution. As Algeria struggles with its evolving problems, this research contributes to the discourse by providing a comprehensive picture of vulnerability, facilitating the creation of sustainable development plans and strategic decisions.

The analytical hierarchy process, which is commonly referred to as an AHP (Saaty, 2008), is a multi-criteria method that can be used to solve problems related to the selection and implementation of solutions (Le Cozannet, 2013). It combines multiple criteria to produce a cartographic result that shows the areas that are most likely to be able to solve the issue. One of the most important steps in the process of implementing an AHP is the selection of the appropriate criteria to perform a successful spatial multi-criteria analysis (Malczewski, 1996). This method has been widely used in different domains to identify the factors that can affect a decision-making process (Sabrina, et al., 2025).

AREA OF STUDY

The Wilaya of Boumerdes is located in the center of the country and has a coastal profile of 100 kilometers. It is an integral part of the East of Algiers metropolitan area (Figure 1). The area of the Wilaya of Boumerdes is approximately 1,456,16 km² long between 36° 46' 3.346" North and 3° 42' 10.441" East. The wilaya of Boumerdes is limited by: the Mediterranean Sea to the North; the wilaya of Algiers to the West; the wilaya of Tizi Ouzou to the East and the wilaya of Blida (Mitidja plain) to the South West.

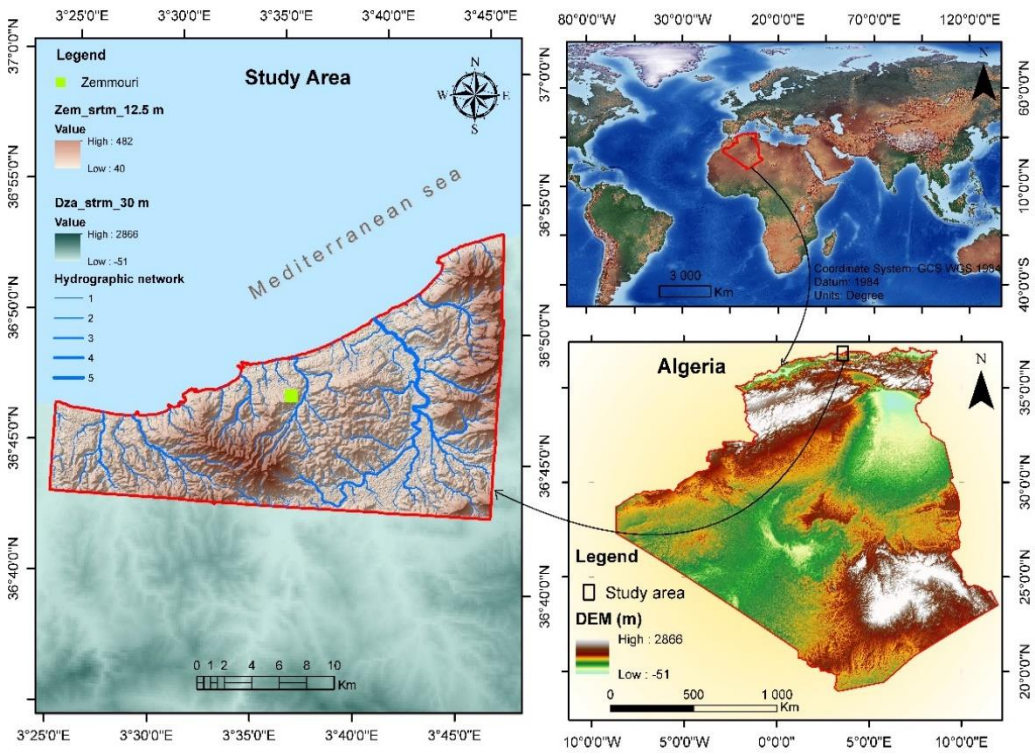

Figure 1. Location of the Study area
(Source: Google Earth Pro, ArcGIS)

The Wilaya of Boumerdes has a unique combination of physical settings, with varying terrains and plains. Due to its Mediterranean climate, the city of Zemmouri experiences hot and humid summers and cold winters. The rainfall in the area varies between 500 and 1,300 millimeters annually.

The region of zemmouri in the Wilaya of Boumerdes receives an average rainfall of 900 millimeters annually. This is higher than the other areas of the region. The low thermal amplitudes are usually found in the Wilaya of Boumerdes due to its location near the sea. The average temperature in the area is around 18° near the coast and 25° inland.

MATERIALS AND METHODS

The AHP is commonly used as a tool for developing a strategy or a method for analyzing and ranking various entities. It can be used as a technical estimation or a multi-criteria decision-making method (MCDM) (Rebouh, et al., 2025). It requires a hierarchy of properties to perform its operations. This includes a pairwise comparison of the various entities in the hierarchy (Saaty, 1990).

The AHP process is usually performed in phases. It first involves identifying the possible factors that could affect the decision-making process (Omidipoor, Jelokhani-Niaraki & Alizadeh, 2019). Then, it arranges the factors for each alternative and develops a list of alternatives. In addition, the AHP process also takes into account the importance of the other factors that are related to the vulnerability assessment. Finely it analyzes the weight of each factor (King, 2015).

The list below (Table 1) shows the various factors that are involved in the spatialization of the vulnerability to local erosion.

Table 1. Parameters involved in the assessment
(Source: Dinar Haythem)

Parameters	Weights
Slope	C 1
Lithological formations	C 2
Rainfall	C 3
Land use	C 4

The Slope

The slope of a topographic area (Table 2) can highly affect the severity and amount of runoff (Sánchez-Lozano, Teruel-Solano, Soto-Elvira & García-Cascales, 2013). When the slope is too steep, the water is allowed to flow profusely, and the rock formations become more susceptible to water erosion (Kheir, et al., 2001). This is because its gravitational action can greatly influence the flow of water and its erosive energy (Dumas, et al., 2010).

Table 2. Ranking of slope Influencing
(Data source: ArcGis)

Values	Class of Parameters	Ranking
0 - 10	Gentle	1
10-30	medium	2
30 - 60	Steep	3
60 - 90	Very Steep	4

The slope factor is a critical parameter that can be used in the analysis of the spatial distribution of the study area. It shows the potential risk of erosion in areas with steep and very steep slopes (Figure 2).

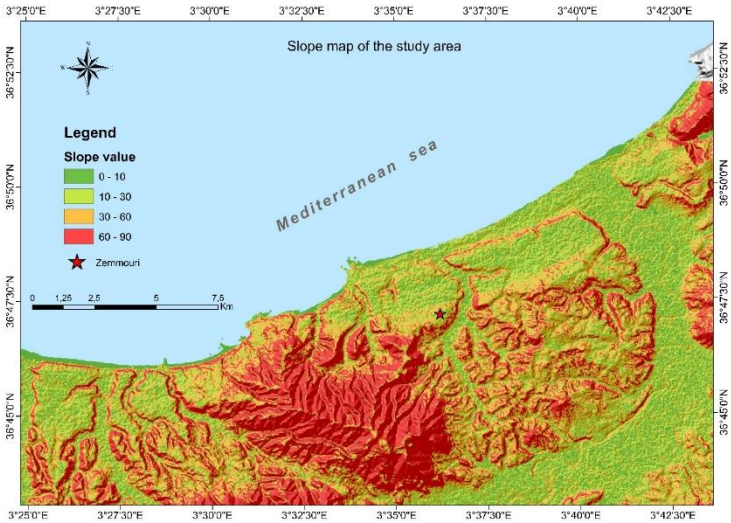

Figure 2. Slope map with relief of the Zemmouri region and surroundings
(Data source: United States Geological Survey, SRTM-12.5m, DEM)

The lithological formations

The quality of the lithological properties of the formations and the spatial distribution of the structures influence the erodibility of the various reliefs (Mueller & Pitlick, 2013). Based on the 1/500.000 Soil map of Algeria (Figure 3), the soils were classified into four classes according to their resistance (Table 3).

Table 3. Ranking of the friability materials according to lithological formations
(Data source: Dinar Haythem)

Lithological formations	Materials friability	Ranking
Association of calcareous soils and solonetz	Resistant materials	1
Alluvial soils	Relatively resistant	2
Unsaturated soils	Susceptible materials	3
Dune soils	Highly Susceptible materials	4

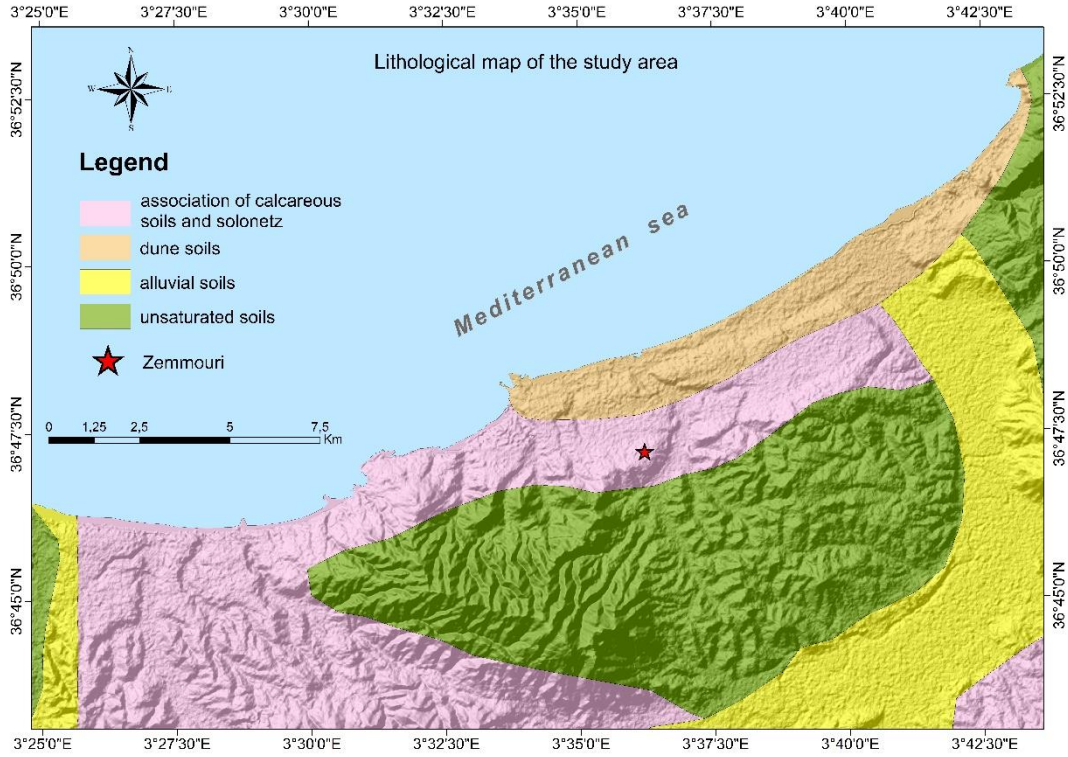

Figure 3. lithological map of the study area
(Data source: 1/500 000 Soil map of Algeria)

Average annual rainfall

The spatial distribution and intensity of rainfalls are the factors that contribute to the development of the erosion phenomenon (Chakhar & Mousseau, 2006).

The friction forces on the soil surface decrease as the runoff collects in nets. It then becomes more abrasive and moves deeper into the soil surface (Roose & Sterrer, 1984; Nouali, et al., 2025). To further contextualize the impact of rainfall, (Table 4) presents a ranking of different rainfall intensity ranges and their corresponding influence. These rankings provide insight into the varying degrees of erosive potential associated with different levels of rainfall (Figure 4).

Table 4. Ranking of rainfall Influencing
(Data source: High-resolution gridded datasets)

Rainfall (mm)	Ranking
510 - 519	1
520 - 527	2
528 - 536	3
537 - 545	4

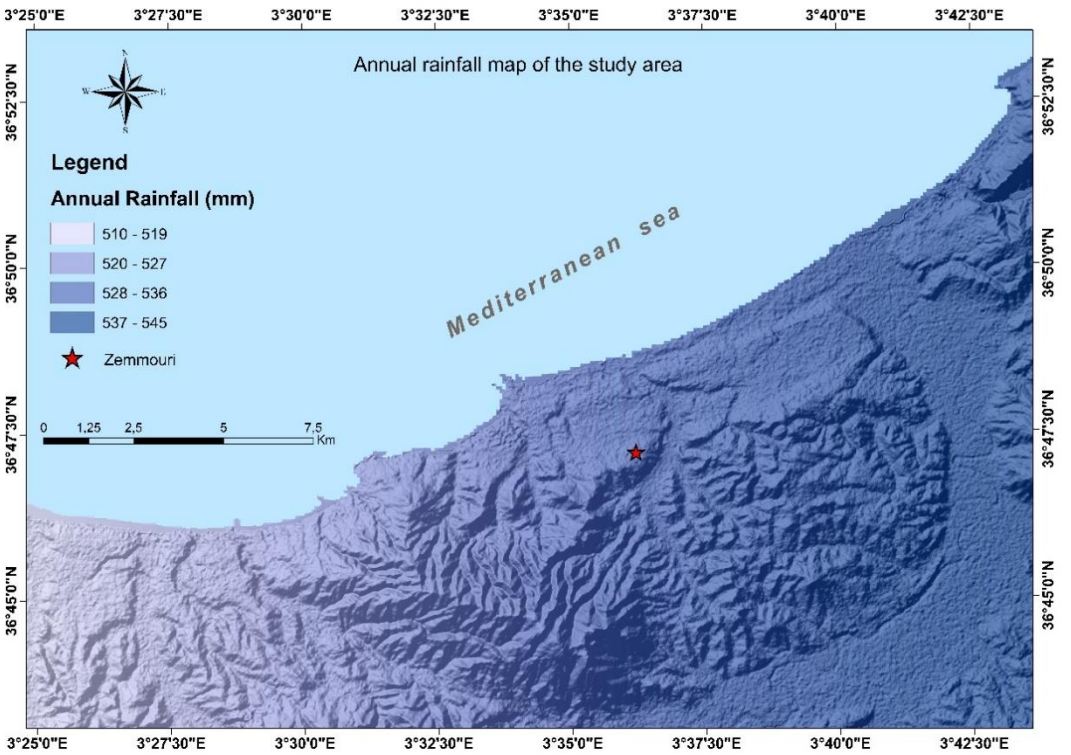

Figure 4. Annual rainfall 2022
(Data source: from High-resolution gridded datasets)

Land use

The land cover is responsible for controlling the various morphogenic processes that occur in the area. It is also related to the land use pattern and contributes to the protection of the soil (Dumas, et al., 2010) . A map of the land cover was created using a 30 m resolution image of the satellite ETM+ Land SAT 8 (Figure 5). The classification of the various land-use elements allowed us to gain a deeper understanding of their spatial distribution (Table 5).

Table 5. Ranking of land use impact on the study area
(Data source: Dinar Haythem)

Row Labels	Sum of Area (Km²)	Percentage (%)
Water Body	3,0165	1%
Barren Land	44,2469	13%
Built Area	56,2379	17%
Vegetation	228,1534	69%
Total	331,6547	100%

Table 6. Surfaces and percentages of land cover lithology
(Data source: ArcGis)

Land use	Ranking
Water Body	1
Barren Land	2
Built-Up Area	3
Vegetation	4

Although, it should be noted that the zero-vulnerability criterion excludes aquatic environments and urban areas, such as lakes and dams. The weight for each class of criterion is computed the same way as for the other criteria (Table 6). The goal of pairwise comparisons is to determine which item has the most influence over another in terms of a given attribute's importance.

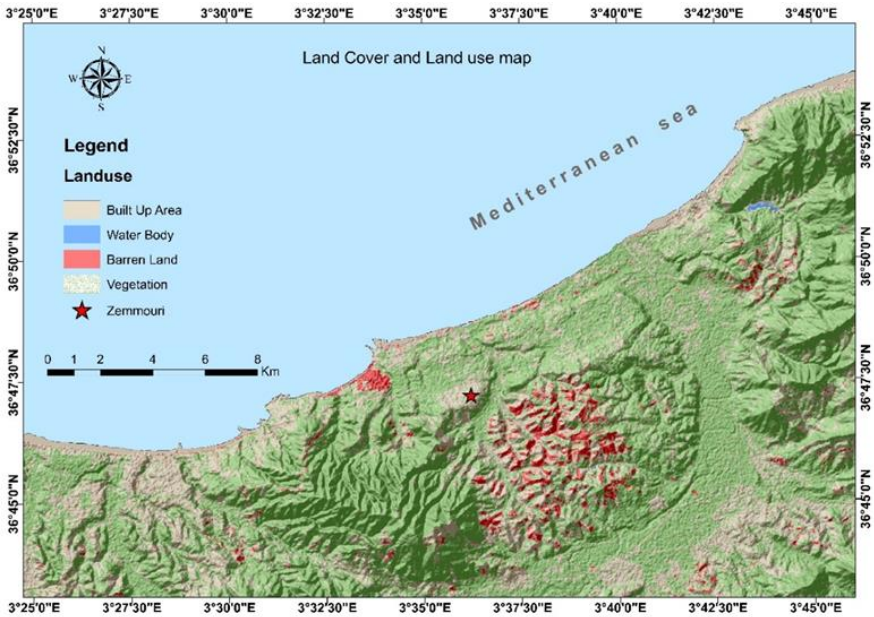

Figure 5. Land Cover and Land use Map (LcLu)
(Data source: USGS, Land SAT Oli 8 satellite image classification)

This process is carried out using a scale known as Saaty's scale (Le Cozannet, (013). It takes into account the various qualitative assessments and transforms them into numerical values from 1 to 9 (Table 7). The priority scales are then calculated by taking into account the eigenvector associated with each comparison matrix (Saaty, 1990).

Table 7. The basic scale for comparison between absolute numbers (Saaty, 2003)
(Data source: Dinar Haythem)

Scale (importance)	Degree of preference (definition)	Explanation
1	Equal importance	Two actions contribute equally to the objective
2	Weak or slight	-
3	Moderate importance of one factor over another	Experience and decision slightly favor one parameter over another
4	Moderate plus	-
5	Essential importance	Experience and decision strongly favor one parameter over another
6	Strong plus	-
7	Very strong importance	One parameter is favored very strongly and is considered superior to another in practice. This demonstrates the dominance of this parameter.
8	Very very strong	-
9	Extreme importance	Proof of the superiority of one parameter over another is of the highest possible order of affirmation
2,4,6,8	The number for inverse comparison	Can be used to specify mid-range values

The AHP procedure begins by making pairwise comparisons between the various criterion. The results of these comparisons are described in terms of integer values from 1 (equal value) to 9 (extremely different). For instance, if the chosen factor has a higher number, it will be considered more important than the other factor being compared with.

RESULTS AND DISCUSSIONS

Analysis of Erosion Vulnerability Using AHP and GIS

The AHP can play an important role in deciphering complicated project components and identifying associated risks (Yang, et al., 2020). The AHP's widespread adoption can be attributed to its ease of execution (Table 8). This approach helps users quickly identify the relative weight of various criteria in complex projects (Malczewski, 1996).

The AHP's intuitive approach to decision-making makes it an ideal choice for projects that require quick and precise evaluations (Fernandes, Quintela & Alves, 2018).

The pursuit of spatial accuracy requires the use of geographic information systems. With its broad capabilities, such as storage, analysis, and visualization, GIS can play a vital role in making informed decisions (Arda, Bayrak & Uzar, 2025).

The AHP's ability to accommodate different spatial analysis techniques makes it an ideal choice for projects that require quick and precise evaluations (Kiberet, Nebere, Workineh & Jothimani, 2025).

By utilizing the capabilities of geographic information systems, we can unravel intricate coastal patterns, empowering them to make more sound choices and improve their efficiency in planning and executing projects (Hasan, et al., 2023).

Table 8. Comparison matrix
(Source: Dinar Haythem)

Factor	Slope	Lithology	Rainfall	Landuse	Eigenvalue (Eg)	weight
Slope	1,000	2,000	3,000	4,000	2,213	0,470
Lithology	0,500	1,000	2,000	3,000	1,316	0,280
Rainfall	0,333	0,500	1,000	1,000	0,639	0,136
Landuse	0,250	0,333	1,000	1,000	0,537	0,114
Total					4,706	1

Number of Criteria =	4	
C. I. =	0,010	
R. I. =	0,890	
C. R. % =	1,160	Consistency OK

Ensuring Consistency in Decision-Making

One of the most critical factors that decision-makers need to consider when it comes to making decisions is the logical and coherent interconnection of their data structures (Rebouh, et al., 2025).The Consistency Ratio is a metric that can help them determine if their decisions are being made properly (Zheng, et al., 2013).

A decision matrix with a consistent CR value of less than 0.10 can be considered robust (Tout, et al., 2024).This can help prevent statistically irregularities and ensure that the outcomes are being made correctly (Bekhouch, et al., 2023).

The study's meticulous calculations resulted in a consistent CR value of 0.0116 (Table 8). This finding substantiates the construction of the matrix and helps strengthen the reliability of the conclusions and analyses that follow.

Quantifying Vulnerability through a Composite Equation

The study's objective is to quantify coastal erosion's vulnerability. This intricate phenomenon is affected by different contributing elements.

The vulnerability equation can be calculated as follows:

Vulnerability = 0.470 * Slope + 0.280 * Lithology + 0.136 * Rainfall + 0.114 * Land use.

The vulnerability equation condenses the interrelationships of lithology, rainfall, land use, and slope into a quantifiable form, making vulnerability more relatable (Rocha, Antunes & Catita, 2020).

Mapping Complex Phenomena and Classifying Vulnerability

The study's spatial analysis method allowed to thoroughly study coastal dynamics and reveal the intricate processes that drive vulnerability (Figure 6). Through this approach, we can also map the multiple factors that affect coastal erosion. In addition, the flexibility of the study's design allows to utilize different techniques to fit our specific needs.

The study's final report, which includes the vulnerability classes and their corresponding percentages, is presented in (Table 9). The resulting data categorized coastal erosion's vulnerability into four subclasses: High, Medium, Very High, and Low.

The findings show that 63.68% of the studied area falls under the High category, which highlights the scale of the threats that coastal erosion poses.

Table 9. Surfaces and percentages of vulnerability classes
(Data source: ArcGis)

Vulnerability	Areas in km2	Percentage	
Low	42.98	12.96 %	
Medium	77.47	23.36 %	
High	159.79	48.18 %	**63.68 %**
Very high	51.41	15.50 %	
Total	**331.65**	**100 %**	

Validation and Future Prospects

The study's findings have helped improve our knowledge about coastal erosion's vulnerability in the region of Nemourid (Figure 6). But, further research is needed to expand our understanding of this phenomenon.

A field-based validation is needed to strengthen the credibility of the methodology and its practical applicability. This process can help stakeholders feel more confident about its reliability.

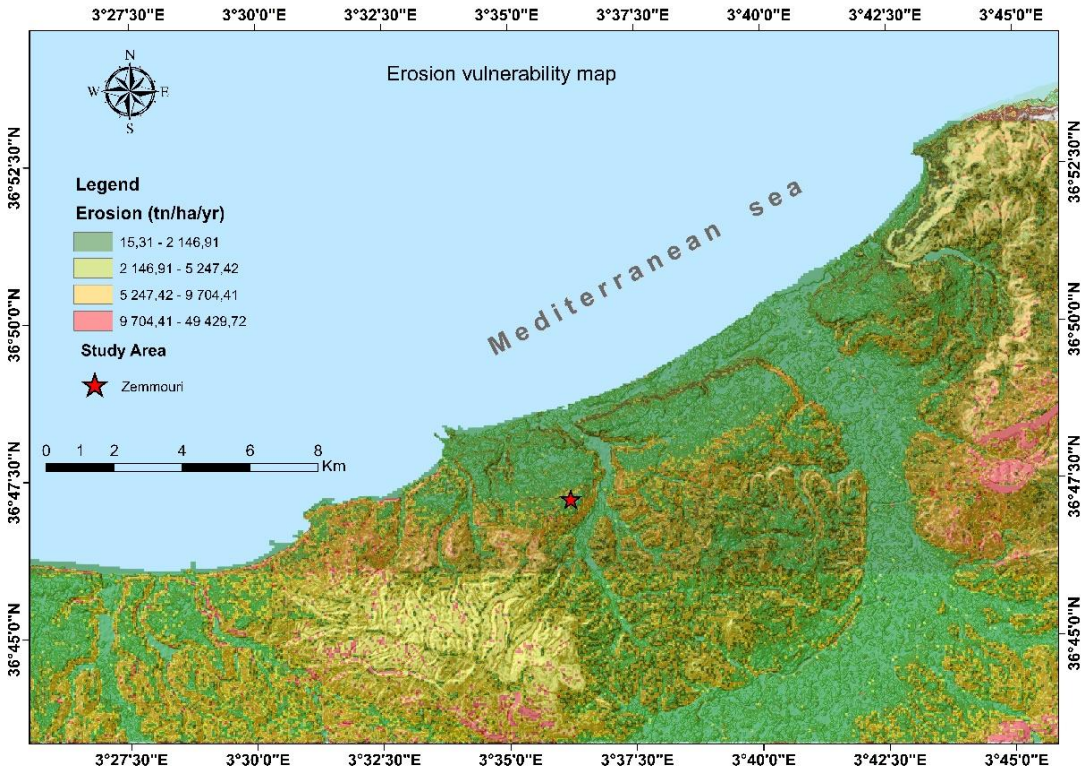

Figure 6. Erosion vulnerability map
(Data source: USGS, Land SAT Oli 8 satellite image classification)

The study's comprehensive assessment of coastal erosion's vulnerability shows the link between the various elements of GIS, AHP, and analysis (Taib, et al., 2022).

The study's combination of methodologies allowed planners, researchers, and decision-makers to thoroughly study coastal erosion's dynamics and develop targeted interventions (Singh, Jha & Chowdary, 2018).

CONCLUSION

The study revealed the outcomes of the AHP's application in identifying and mapping the erosion vulnerability in the Wilaya of Boumerdes in Zemmouri. The study also utilized the GIS's synergistic capabilities. Through the use of the AHP, the study was able to navigate through the vast amount of data sources and ultimately gain a deeper understanding of the vulnerability of the area.

The study revealed that a significant portion of the area's erosion vulnerability is higher than 63.68%. This vulnerability can be attributed to the multiple factors that affect the region's development trajectory. The study also highlighted the multiple factors that influence the development of the region's erosion vulnerability. These factors are interrelated with the region's sustainability.

The study's successful use of the AHP method in mapping the erosion vulnerability of the Nemourid region has highlighted the advantages of this technique. By combining various criteria and weights, this method can help identify and categorize the vulnerability patterns.

The AHP method's ability to provide decision support in the formulation of strategies related to the management of erosion is clear. However, it is also important to note that its effectiveness can be affected by various factors such as the accuracy and quality of the input data and the assumptions supporting the hierarchy. The study's importance in providing a comprehensive understanding of the multiple factors that affect the development of the region's erosion vulnerability is also acknowledged by the wider community.

The study's findings have also highlighted the importance of continuing to explore the various aspects of the erosion vulnerability of the area. It is clear that conducting comprehensive assessments of this type requires ongoing validation and refinement.

By utilizing the AHP technique alongside the GIS, we can create a resilient strategy to manage and mitigate the effects of erosion on our communities and landscapes.

AUTHOR CONTRIBUTIONS

Author Contributions: H.D conceptualized the study, conducted the experiments, and wrote the initial draft. N.R contributed to data analysis and interpretation. F.T provided expertise in statistical analysis. T.B and Z.M reviewed and edited the manuscript. All authors approved the final version of the manuscript.

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The research presented in this study was conducted without external financial support. The study's design, execution, and interpretation were carried out solely by the authors.

DATA AVAILABILITY STATEMENT

The data sets generated and analyzed during the current study are available in the https://earthexplorer.usgs.gov/; https://crudata.uea.ac.uk/cru/data/hrg/. Additional data supporting the findings of this study are available from the corresponding author upon reasonable request.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest that could affect the integrity or impartiality of the research presented in this paper.

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THE ROLE OF BEACH BOYS IN SHAPING SUSTAINABLE TOURISM OPERATIONS: AN EXPLORATION OF THEIR INTERACTIONS, BEHAVIOURS, AND IMPACTS IN COASTAL REGIONS OF SRI LANKA

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Abstract: Beach tourism plays a vital role in the economic development of Sri Lanka's coastal regions. However, the presence and activities of "beach boys" pose both opportunities and challenges to sustainable tourism. This study explores their impact on tourism sustainability through semi-structured interviews with key stakeholders and beach boys. Findings reveal that while beach boys are central to the tourism experience, they are often linked with illegal activities, sex tourism, scams, and socio-cultural issues. At the same time, they face challenges such as social stigmatization and lack of formal support. The study recommends capacity-building, regulatory frameworks, and formal integration into tourism operations to reduce negative impacts and enhance their positive role. A balanced approach is essential to promote sustainable tourism practices while encouraging community involvement. The research offers valuable insights into managing informal tourism actors within coastal destinations and aligning their contributions with broader sustainability goals.

Keywords: Beach boys; Impacts; Issues and Challenges; Sustainability; Tourism

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INTRODUCTION

A key challenge in Sri Lanka's coastal tourism is the emergence of "beach boys," a group of young men from coastal communities who engage with tourists as informal guides and facilitators. The origins of beach boys in Sri Lankan tourism are uncertain, but they are typically young males aged who provide services ranging from organizing boat rides and entertainment to offering more controversial services, such as transactional relationships with tourists (Miller, 2011). Some beach boys are described as dressing flashily, often wearing gold chains and living lavish lifestyles.The interaction between beach boys and tourists, particularly Western women, has raised

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public health and ethical concerns. Some tourists, single women in particular, engage in casual relationships with beach boys, with many such encounters driven by financial motives. While some beach boys operate openly as sex workers, others aim to build relationships in hopes of financial gain (Oppermann, 1988; Baumeister, & Vohs, 2004). Critics argue that these behaviors contribute to the spread of drugs, sexually transmitted diseases, and a deterioration of traditional cultural values, creating a negative image of Sri Lanka as an unsustainable tourist destination (Miller, 2011; Herold, Garcia, & DeMoya, 2001; Arachchi, 2011; Samarathunga, 2018).

Despite these concerns, there is ongoing debate about the impact of beach boys on the tourism sector. Some researchers emphasize the potential harm they pose to Sri Lanka's image due to their involvement in informal and, at times, illicit activities (Fernando & Shariff, 2013; Arachchi, 2011). Conversely, others argue that beach boys contribute to the vibrancy of the beaches and may even attract certain tourists seeking personalized local experiences (Miller, 2011; Brown, 1992). Due to socio-cultural and economic factors, beach boys have become key players in the informal tourism sector, and a significant number of tourists visit Sri Lanka due to connections they have established with them (Perera, 2007). Consequently, addressing the role of beach boys in Sri Lanka's tourism industry is complex, necessitating a nuanced approach that considers both their contribution and the challenges they bring to sustainable tourism development.

PROBLEM BACKGROUND

Beach boys, known by various names around the world, play a recognizable yet often controversial role in tourism. These individuals are commonly found in beach resorts, where they interact closely with tourists and shape the tourism experience in both direct and indirect ways. Despite their widespread presence, the term "beach boys" frequently carries a negative connotation. According to Venables (2009), this term is often used in a derogatory way, casting beach boys in a negative light. In Sri Lanka, discussions about beach boys have frequently centered on the negative impacts associated with their activities. These young men, typically operating outside formal employment structures, work as informal tourism service providers and often engage with tourists at various levels. Their role can range from serving as unofficial tour guides and organizing local excursions to establishing relationships with tourists, some of which may result in financial or other personal gains.This study seeks to investigate the multifaceted impacts of beach boys on sustainable tourism operations in Sri Lanka's coastal regions, focusing on both positive contributions and challenges posed by their presence.

By exploring the economic, social, and cultural effects of beach boys, this research aims to understand their influence on the overall sustainability of coastal tourism. Additionally, the study will examine the specific issues and challenges associated with beach boys in Sri Lanka, such as their integration into the informal tourism sector, interactions with tourists, and the potential social and economic consequences of their activities. Through this analysis, the research aims to provide insights into how beach boys contribute to and impact sustainable tourism in Sri Lanka's coastal areas, while also identifying strategies that can help mitigate any adverse effects and support a balanced approach to tourism development.

Based on this background the objective of this study is to explore the influence of beach boys on the sustainability of tourism operations in coastal areas, focusing on their roles, behaviors, and interactions with tourists and local communities. This chapter begins by discussing the problem background, focusing on the impact of beach boys on the sustainability of the tourism industry. It then provides a comprehensive review of the existing literature to highlight the current knowledge and perspectives on this issue. The subsequent section outlines the research methodologies employed, followed by an in-depth presentation of the study's findings and a detailed discussion. The chapter concludes with key insights and implications drawn from the research.

LITERATURE REVIEW

BEACH BOYS

Beach boys are not only common in Sri Lanka but also operate all over the beach tourism destinations. As Jamison (1999) highlighted, beach boys exist in every corner of the world under different names. Beach boys can be found around the world, and they are addressed differently: in Italy, they are called "Papagalli", in Vienna "Praterbuben", in Germany "Bauernfaenger", in Dominican Republic "sanky panky", (Venables, 2009; Herold, Garcia, & DeMoya, 2001; Cabezas, 2004; Sanchez, et al., 2001), Gambia "bumster" (Brown, 1992; Nyanzi, Rosenberg-Jallow, Bah, & Nyanzi, 2005); in Senegal "coteman" (Venables, 2009). In Sri Lanka, they are colloquially known as "beach boys," a term that reflects their primary setting the beach and the nature of their activities, which often include guiding tourists, organizing entertainment, and engaging in informal services.

As Cabezas (2004) stated, the term beach boy refers to young men who work near or on beaches, typically tourist beaches, and offer sexual services in exchange for payment. These young men may also function as unauthorized tourist guides and may not all identify as beach boys. Beach boys may also be working in restaurants, hotels, guest houses, divine centers, and boat-related tourism businesses. Presently, beach boys themselves and a few other people call them beach operators or beach facilitators.

Beach boys are rending their services at most of the beach resorts around the globe. They are generally young men whose age is more or less than 17 and 30 years, and offering various informal services to the tourists. Nowadays, they provide different services for the guests such as arranging excursion tours, safari tours, village tours, arranging accommodation facilities, and many more. These beach boys typically approach the tourists at the beach and negotiate with their businesses. They ask the guests whether they want to explore the nightlife, go for a trip or excursion, or visit their rural settings and their lifestyles.

The different researchers have discussed the involvement of beach boys in sex tourism practices (Samarathunga, 2018; Herold et al., 2001; Bozicevic et al., 2020, Jenkins et al., 2021). Traditionally, many motives influenced vacations in other countries, such as nature, adventure, cultural & religious activity, education, sports & recreation, and visiting friends and relatives (Kozak & Rimmington, 2000). The term sex has become one of the purposes for people to move from tourist origins to destinations.

BEACH BOYS AND THE SUSTAINABILITY OF BEACH TOURISM

Beach boys are widespread in beach tourism. They can be found in most beach tourism destinations worldwide except some beaches with strict rules and regulations, cultural and ethical restrictions, and naturally created conditions. They are generally young men making a living by providing various informal services to tourists. Beach boys are also a part of the area's community and play a significant role in beach tourism. The beach boys provide different services such as guide services, organizing excursions and tourists, linking other stakeholders as a middleman, serving as lifeguards, bodyguards, surfing and diving instructors, entertainers, drugs and prostitutes, sex workers, etc. (Samarathunga, 2018; Herold, Garcia, & DeMoya, 2001). Beach boys are a small number of people who engage in activities informally, sometimes illegally with the tourists who stay at the beach; however, they are significant in the informal sector tourism of beach tourism in any destination (Wijethunga & Jayarathna, 2020).

There are many arguments about beach boys in terms of their behaviour and impacts on the industry. Most of the researchers have defined and discussed beach boys in negative contexts such as the media of spreading drugs, in tourism destinations (Samarathunga, 2018; Herold, Garcia, & DeMoya, 2001; Bozicevic, Manathunge, Beneragama, & Gadjaweera, 2020; **Jenskin et al., 2021**). However, some argue that beach boys have a positive impact and could be an attraction on the beaches to attract tourists, especially the females, most of the time repeat visitors. In contemporary beach tourism operations, the beach boys have become an inevitable party since they mainly play the dominant role in the informal sector. Also, the Beach Boys become one of the attractions, and a significant number of tourists' patronage every destination to get their services and associations.

There are many stakeholders involved in tourism operations in beach destinations such as hoteliers, tourist shops, guest houses entertainment-providing firms, travel agencies, etc. Beach Boys affect those parties directly or indirectly. So those parties perceive beach boys differently. In this study, the researcher will pay attention to the impacts of beach boys on different parties involved in the tourism industry. Beach boys are directly and indirectly involved in the tourism activities happening in the coastal areas. Beach boys can be seen in the whole coastal belt and they have dominated those areas. According to the researcher's observation beach boys do not allow native young males who are coming from other areas to work as beach boys. They are very much fluent in foreign languages. Conflicts may arise among beach boys when attracting tourists.

Tourism developments in coastal areas directly influence the socio, cultural, economic, and natural environment of the areas. If tourism development is sustainable, it will affect positively both the local community and the tourists. Otherwise, tourism development will deteriorate the living conditions of the local community on the coastline (Markovic, Satta, Skaricic, & Trumbic, 2009).

The growth of tourism in some coastal areas has reached its peak in recent decades and most tourism researchers are highlighting it as over-tourism (Milano, Cheer, & Novelli, 2019; Seraphin, Sheeran, & Pilato, 2018). The economic significance of coastal tourism is unquestionable; however, there is accurate and comprehensive data on the economic contribution of coastal tourism contribution to the economy as a whole (Ryan, & Hall, 2001).

Sri Lanka's coastal regions possess significant potential for socio-cultural and environmentally sensitive economic development, driven by the area’s rich natural beauty, unique ecosystems, and vibrant cultural heritage. These regions offer diverse opportunities for sustainable tourism, which, if well-managed, can provide substantial economic benefits to local communities while preserving cultural values and environmental integrity. However, unchecked tourism growth can lead to the degradation of these valuable resources, undermining the very attractions that draw visitors. Studies have shown that when tourism development prioritizes economic gain over environmental and cultural preservation, it can result in adverse outcomes such as pollution, habitat destruction, and cultural commodification. This not only threatens local biodiversity but also risks eroding the socio-cultural fabric of the communities involved, ultimately nullifying the long-term benefits of tourism (Gössling, 2017; Seraphin, Sheeran, & Pilato, 2018). It is therefore essential for Sri Lanka to adopt sustainable tourism practices that balance economic interests with the need to protect cultural and environmental assets, ensuring the sector's resilience and continued contribution to national and local well-being.

Research has increasingly shown that tourism in many coastal regions has reached critical levels, often described as "over-tourism," where the negative impacts of tourism growth begin to outweigh its economic benefits. This phenomenon, observed in coastal destinations globally, results in environmental degradation, overcrowding, and disruption to local communities and their socio-cultural practices. Studies highlight that such excessive tourism pressure can ultimately reduce the attractiveness and sustainability of these areas as travel destinations if not managed effectively (Gnanapala & Karumathilake, 2016; Milano, Cheer, & Novelli, 2019; Seraphin, Sheeran, & Pilato, 2018).

Beach boys are frequently associated with coastal tourism, and numerous studies have examined their roles and impacts on the sustainability of beach tourism (Bozicevic et al., 2020; Cohen, 1988; Forsythe et al., 1988; Weniger et al., (1991). Beach boys are frequently associated with coastal tourism, and their impact on tourism sustainability has been widely studied. Research often addresses the dynamics of beach tourism, focusing on social interactions and relationships that shape the experience of popular coastal destinations. Literature highlights both the roles beach boys play within tourism and the associated socio-cultural and health implications. These insights provide valuable context for understanding how their presence influences tourism sustainability in coastal areas. Much of the literature highlights the relationships between beach boys and female tourists, often framed within the context of sex tourism or romance tourism (Bozicevic, Manathunge, Beneragama, & Gadjaweera, 2020; Cohen, 1988). Early discussions in tourism studies identified the

involvement of beach boys as a significant issue, with researchers raising concerns about their engagement in unethical practices and potential harm to local cultural and social values. Prostitution and sex tourism emerged as prominent areas of concern, particularly in light of heightened awareness around HIV/AIDS and sexually transmitted diseases (STDs) in the 1980s. This awareness spurred extensive research on health risks associated with tourism interactions, with substantial studies exploring these dynamics and their impacts (Bozicevic, Manathunge, Beneragama, & Gadjaweera, 2020; Cohen, 1988; Forsythe, Hasbún, & Butler de Lister, 1998; Weniger et al., 1991).

Beach boys' involvement and their role have changed/evolved during the past few decades, they work as sex workers, robbers, drug dealers, beach helpers, facilitators, etc. Most of the literature has discussed the beach boys in negative contexts and society and media also discussed the negative aspects of them mostly. However, later they identified the blame that they were having.

Venable (2009), conducted a study on Senegalese beach boys, describing them as young, unemployed men involved in beach tourism. The study highlighted that these individuals offer both sexual and non-sexual services to tourists, while also seeking opportunities to migrate with the support of foreign tourists, particularly female tourists, as a means to improve their lives (Venable, 2009). Similarly, Nyanzi et al. (2005) studied beach boys, known as Bumsters, in Gambia, focusing on their interactions with white women. Their research emphasized that beach boys engage in a variety of sexual activities with foreign tourists, ranging from commercial and non-commercial engagements to voluntary and socially imposed interactions. These encounters can be individual or peer-driven, and include both heterosexual and homosexual engagements, with varying degrees of casualness and regularity (Nyanzi, Rosenberg-Jallow, Bah, & Nyanzi, 2005).

Dahles and Bras (1999), conducted a comparative study on beach boys and street guides in two tourist destinations in Indonesia. The study revealed that small-scale tourism entrepreneurs act as "romantic entrepreneurs" by attempting to develop intimate relationships with female tourists to gain benefits and improve their living conditions. The researchers also found that beach boys try to start their own businesses with the financial support of female foreign tourists, while street tour guides try to migrate with the help of female tourists to achieve a more comfortable life.

Herold et al. (2001), conducted a research study on the Caribbean Islands to investigate the connection between female tourists and beach boys. They also looked into whether this connection was categorized as romance tourism or sex tourism. The study also pointed out that beach boys were engaging in various sex roles particularly homosexual activities with male tourists. Additionally, the beach boys were described as young men who interacted with Western tourists. They often engaged in informal tourist ‘hustles,’ lived or grew up in beach communities, and were involved in activities such as sex tourism and the provision of drugs.

Beddoe (1998) highlighted that beach boys were earlier adapted to the hippie culture and provided goods and services demanded by the market, however, now they have become culture brokers and engage in sex and child sex tourism for economic gain. They also have engaged in child prostitution or prostitution, and further, motivate low-income families to give up their young children to go with tourists for financial and other gains.

Miller (2011) defined the beach boys in Sri Lanka as young men who have voluntarily serviced as child prostitutes in their childhood and later became service providers in the informal tourism sector, working as a social group helping out each other. Miller further stated that beach boys have sex with tourists for monetary gains and this is the only way they can get the benefits of tourism, however, they are rejected by the local community highlighting them as social deviants.

In Sri Lanka, the phenomenon of beach boys, similar to those found in other parts of the world, has gained considerable attention due to its complex interplay with tourism and local socio-economic conditions. Beach boys, typically young men, often from lower-income rural areas, engage with foreign tourists—mainly women—by offering a combination of services that range from acting as informal tour guides to providing sexual services. These young men, aged between 18 and 30, often see tourism as an opportunity to improve their socio-economic standing, sometimes through both legal and illegal means.

The beach boys in Sri Lanka, especially along popular tourist destinations such as Hikkaduwa, Unawatuna, and Negombo, are known for their interactions with tourists, often targeting vulnerable individuals, particularly female travelers. As highlighted by Ratnapala (1984), these interactions often involve not just informal guidance but also more transactional exchanges, which may include sexual activities in exchange for money, gifts, or other material benefits. They operate in a somewhat blurred moral and legal space, with some engaging in commercial sexual activities while others participate in non-commercial relationships, depending on their personal motivations and the social circumstances surrounding the tourist's visit.

Research by scholars like Nyanzi et al. (2005) on the phenomenon of "beach boys" or "bumsters" in West Africa offers a comparable perspective. It notes that these young men often enter into both voluntary and socially imposed sexual relationships with tourists. The relationships range from one-time encounters to more regular engagements, and can be heterosexual or homosexual in nature. These activities are driven by the perceived opportunity to gain monetary or material rewards, as well as the potential for migration opportunities or a better standard of living (Nyanzi, Rosenberg-Jallow, Bah, & Nyanzi, 2005).

In the context of Sri Lanka, this phenomenon has raised concerns regarding its impact on the country's image, the exploitation of both locals and tourists, and the sustainability of its tourism industry. According to Aas, Ladkin & Fletcher (2005), while tourism is an essential contributor to the Sri Lankan economy, the involvement of beach boys in the sex trade can lead to reputational damage, especially for a country attempting to position itself as a family-friendly or cultural tourism destination. Moreover, the involvement of young men in such activities also presents serious concerns related to human rights, exploitation, and the erosion of traditional values, which are central to Sri Lanka's cultural identity. The relationship between beach boys and tourists, therefore, poses a challenge to the sustainable development of tourism in Sri Lanka. While these interactions may temporarily benefit some individuals, the long-term social and economic implications are far-reaching, leading to questions about how tourism can be managed in a way that respects the local community and ensures economic benefits are equitably distributed (Hall & Page, 2014). Additionally, the rise of commercial sex work in coastal tourist destinations like those in Sri Lanka complicates the broader efforts to foster responsible and sustainable tourism that respects both cultural values and the well-being of all stakeholders involved.

In conclusion, the dynamics of the beach boys' role in Sri Lanka's tourism sector demand a nuanced approach that considers the socio-economic drivers behind their involvement, the potential harm to Sri Lanka's image, and the need for stronger policies to safeguard both the local population and the tourists who visit the country for leisure. Addressing these issues through sustainable tourism strategies, enhanced regulation, and local community engagement will be essential to mitigating the negative impacts while ensuring the long-term success and ethical management of Sri Lanka's tourism industry.

METHODOLOGY

The study explores the influence of beach boys on the sustainability of tourism operations in coastal areas, focusing on their roles, behaviors, impacts and interactions with tourists and local communities. Mainly a qualitative approach was used, including document analysis, semi-structured interviews, personal observations, and secondary data from existing literature. This triangulated approach was adopted to enhance the credibility of the findings, following the guidance of Bowen (2009), Patton (2015), and Creswell & Poth (2018).

DATA COLLECTION METHODS

The study covered major destinations on Sri Lanka's South Coast and East Coast, including Bentota, Galle, Hikkaduwa, Mirissa, Unawatuna, Trincomalee, Passikudah, and Arugam Bay. Sixteen semi-structured interviews were conducted with a variety of stakeholders such as hoteliers, small-scale tourism entrepreneurs, tourist police, government officials, and representatives from

non-governmental and community organizations. This qualitative approach aimed to gain insights into their views on the roles of beach boys and the implications for sustainable tourism development in coastal areas. Participants for the interviews were initially selected through convenience sampling and later expanded using snowball sampling based on recommendations from initial participants. This process also involved further semi-structured interviews with hoteliers and other key stakeholders.

Twelve additional semi-structured interviews were conducted specifically with beach boys to understand their roles in beach tourism, challenges they face, and their expectations from authorities. Interviews were chosen for their effectiveness in capturing meaning beyond mere factual data, allowing a deeper exploration of these participants' perspectives. The beach boys were selected using a snowball sampling method to facilitate access to individuals within this informal sector. Observations were made to validate the statements from stakeholders, enabling a firsthand understanding of the beach boys' activities, tourist responses, and related impacts.

Direct observation was employed to gather primary data and observe the behaviors of beach boys. This allowed the researchers to corroborate the findings obtained from surveys and interviews, providing an additional layer of data verification. By personally visiting popular beach locations along the southern coast, researchers were able to witness how beach boys interacted with tourists, including the techniques they used to approach visitors and how they behaved among themselves.

DATA ANALYSIS

The qualitative data from semi-structured interviews were analyzed through content analysis, allowing for a nuanced interpretation of the views expressed by stakeholders. This multi-faceted approach ensured a comprehensive understanding of the role of beach boys in coastal tourism and their influence on sustainable practices, providing valuable insights for stakeholders and policymakers.

RESULTS

The following section will analyze and present the data collected from semi-structured interviews, and personal observations.

IMPACTS OF BEACH BOYS ON SRI LANKA SUSTAINABLE COASTAL TOURISM

Based on the study, it has been identified that beach boys in Sri Lanka engage in a variety of activities targeting foreign tourists. In many cases, they serve as facilitators, enhancing the holiday experience by assisting tourists with activities like souvenir shopping, acting as informal tour guides, connecting with service providers, and more. However, some of their activities, which include socially and culturally unacceptable practices, negatively impact tourist satisfaction. Interestingly, certain tourists are drawn to these less conventional offerings, which may influence their decision to visit Sri Lanka.

The primary reason beach boys engage in these activities is to earn a livelihood. Many have aspirations of traveling abroad, securing foreign employment, marrying a foreign partner, or investing in assets like land or businesses, often hoping for financial support from foreign connections. To achieve this, beach boys put effort into building trust and rapport with tourists, offering assistance and companionship with few boundaries to foster empathy and potential financial support. Initially, many beach boys enter this line of work intending to sell goods or services. However, they soon observe that those who develop close relationships with tourists earn higher incomes and enjoy greater economic stability, leading others to adopt similar roles. Young beach boys are particularly in demand for their energetic and engaging presence, especially among tourists seeking companionship or intimate relationships.

However, as they age, these men find it challenging to maintain the same level of demand. Consequently, older beach boys often shift to other roles, such as selling souvenirs, offering tour guidance, or connecting tourists with service providers. Despite the clear economic opportunities, many beach boys recognize the negative reputation and social stigma attached to their role. Over

time, they have attempted to transition from the stereotyped “beach boy” image to “informal beach operators.” Yet, some persistent challenges continue to undermine the sustainability of tourism in these coastal areas, as unsanctioned and controversial activities occasionally persist.

A secondary trend has emerged where older men, unable to sustain themselves as beach boys, take on intermediary roles. Acting as middlemen, they connect younger men in the community with male tourists and earn a portion of the resulting financial benefits. These elderly men are conscious of their limited economic opportunities and view this intermediary work as a survival strategy, even as they become less visible participants in the tourism sector.

The demographic shift toward budget-conscious travelers has also affected beach boys’ income. With tourists more aware of local pricing, it has become challenging to maintain profit margins. Wealthier tourists tend to avoid public beaches, preferring the privacy and safety of beaches managed by large hotels, which beach boys cannot access. Moreover, tourism industry insiders and media often portray beach boys negatively, further discouraging tourists from interacting with them, even when tourists may need services or products that beach boys can offer.

In response to the challenges faced by beach boys, both government bodies and NGOs have initiated training programs to support and guide them, aiming to integrate their services into the broader tourism framework sustainably. However, beach boys often report that these programs offer little tangible benefit, focusing primarily on guidance rather than concrete economic support or alternative livelihood opportunities. For many, engaging with tourists remains the only viable means of income at these beach destinations.

DARK ROLES OF BEACH BOYS

This section begins by exploring the dark roles of beach boys and then delves into the issues and challenges associated with their activities in the context of beach tourism. It examines their influence on shaping tourist experiences, as well as the socio-cultural and environmental impacts they create. While beach boys have the potential to enhance tourist satisfaction through personalized services, their unregulated activities frequently result in adverse outcomes.

INVOLVEMENT IN ILLEGAL ACTIVITIES

Some beach boys engage in illegal activities, including drug trafficking and illegal sales of controlled substances to tourists. These actions not only create security concerns for tourists but also taint the image of Sri Lanka as a safe, family-friendly destination, attracting scrutiny from law enforcement and the tourism sector.

SEX TOURISM AND EXPLOITATION

A segment of beach boys engages in sex tourism, offering companionship or sexual services to both male and female tourists, which can sometimes lead to exploitation. Younger individuals are particularly vulnerable to being groomed or pressured into such roles, which raises serious ethical and safety issues. This involvement also brings health risks and fuels a harmful cycle of dependency on such services for income.

SOCIAL AND CULTURAL DEGRADATION

The behaviors associated with the darker side of beach boy culture, such as drug use, transactional relationships, and other socially frowned-upon behaviors, can lead to a degradation of local cultural values. This cultural shift is particularly concerning in smaller, close-knit coastal communities, where beach boys’ activities are seen as influencing local youth and undermining traditional social norms.

CRIME AND VIOLENCE

With competition high and resources limited, conflicts often arise between beach boys, leading to instances of theft, intimidation, and occasional violence. Tourists who reject or try to avoid interactions with aggressive beach boys may find themselves in uncomfortable or even threatening situations, which can damage the reputation of the destination.

DECEPTION AND SCAMS TARGETING TOURISTS

Some beach boys engage in deceptive practices, overcharging for services, pressuring tourists to buy fake or low-quality goods, or pretending to offer exclusive tour deals that turn out to be scams. Such practices damage tourists' trust, as well as their perception of local hospitality, contributing to negative reviews and a damaged destination reputation.

HEALTH RISKS TO LOCALS AND TOURISTS

The involvement of some beach boys in high-risk sexual activities without proper health precautions leads to an increased risk of sexually transmitted infections within both local and tourist populations. This risk poses significant public health concerns, particularly in regions with limited access to healthcare and awareness campaigns.

MANIPULATION AND DEPENDENCY ON FOREIGN RELATIONSHIPS

Some beach boys build relationships with tourists under the guise of companionship but with the hidden intention of obtaining financial support or other benefits, such as visas or gifts. While not inherently criminal, this creates a cycle of manipulation and dependency that often results in disappointment or even psychological harm for both parties involved.

NEGATIVE INFLUENCE ON LOCAL YOUTH

The behaviors exhibited by some beach boys, such as substance use, casual relationships with tourists, and an emphasis on material gains over traditional occupations like fishing, can influence local youth to follow a similar path. This impact erodes traditional livelihoods, creates a dependency on tourists for quick earnings, and steers young people away from more sustainable, long-term careers. Addressing these darker aspects requires a multifaceted approach, including community support programs, stricter regulation, and training for sustainable tourism practices that empower beach boys to play a constructive role in the tourism industry.

ISSUES AND CHALLENGES FACED BY THE BEACH BOYS

Over time, the perception of beach boys within the local community has undergone a notable transformation. Initially, they were met with significant rejection and disapproval, largely due to their association with negative social impacts. However, in recent years, there has been a shift toward greater recognition and acceptance. This change can be attributed to various factors, including the economic contributions they make to the area, their growing involvement in tourism-related activities, and a broader shift in societal attitudes toward professions linked to tourism. Despite this evolving acceptance, beach boys continue to face numerous challenges while serving tourists and contributing to the development of beach tourism destinations. These challenges include both societal and operational difficulties, as detailed below.

NEGATIVE STEREOTYPES AND SOCIAL STIGMA

Beach boys in Sri Lanka often face negative perceptions and stigmatization from the local community and even within the tourism industry. Media portrayals and stereotypes frequently paint them as opportunistic or engaged in illicit activities, such as sex work. This stigma impacts their social acceptance and limits opportunities for formal work or career progression within the tourism industry.

LEGAL AND REGULATORY CONSTRAINTS

While government regulations are in place to create a safe and secure environment for tourists, these regulations can often restrict beach boys' activities. Frequent encounters with law enforcement and restrictions around public beach spaces sometimes limit their ability to engage with tourists freely. As a result, many beach boys operate in a gray area within the informal tourism sector, lacking access to legal support or workplace protections.

COMPETITION AND DIMINISHING DEMAND FOR SERVICES

With the rise of private beaches managed by large hotels, wealthier tourists have less access to public beaches where beach boys operate. Additionally, budget-conscious tourists are often aware of general pricing and may negotiate for lower costs, squeezing beach boys' income levels. The demand for younger, more energetic beach boys also creates competition, with older beach boys often struggling to secure clients.

HEALTH AND PERSONAL SAFETY RISKS

Some beach boys engage in risky activities, including sexual work, which exposes them to health risks and personal safety challenges. Limited access to healthcare and awareness around sexual health, combined with a lack of protective resources, makes this a particularly vulnerable area for those involved in such practices. Additionally, confrontations with aggressive tourists or conflict with other beach boys can result in physical harm.

ECONOMIC INSTABILITY AND SEASONALITY

Beach tourism in Sri Lanka is highly seasonal, with fluctuations in visitor numbers based on global travel trends and weather patterns. This seasonality creates unstable income for beach boys, making it difficult to rely solely on tourism for financial security. During off-peak times, income drastically decreases, putting significant strain on their livelihood.

LIMITED EDUCATION AND TRAINING OPPORTUNITIES

Although education levels have improved among younger beach boys, many still lack formal education and training. This limitation hinders their ability to develop alternative skills, secure jobs outside of tourism, or advance within the tourism sector itself. Training programs offered by government or non-governmental organizations are often limited in scope, leaving many beach boys without practical or financially beneficial skills.

ABSENCE OF LONG-TERM CAREER DEVELOPMENT PATHS

Beach boys have limited access to structured career paths, making it challenging to build long-term careers within the tourism sector. As they age, their attractiveness and appeal to tourists diminish, reducing earning potential. Many lack opportunities to transition into more stable roles within tourism, which forces older beach boys to work as middlemen or intermediaries, often on low commissions.

SOCIAL AND PSYCHOLOGICAL CHALLENGES

Living under constant economic and social pressure can lead to stress and mental health issues. Many beach boys also face societal rejection, impacting their self-esteem and mental well-being. The transient nature of relationships with tourists can make it difficult to build stable, lasting connections, leading to feelings of isolation.

DIFFICULTY ADAPTING TO CHANGING TOURIST PREFERENCES

Tourist preferences have shifted over the years, with many now seeking cultural experiences beyond traditional beach offerings. While some beach boys have adapted by acting as local guides or selling souvenirs, others struggle to meet these evolving demands. Without guidance or formal support, adapting to such changes remains a challenge, especially for those who rely on traditional beach-related services.

LIMITED SUPPORT FROM TRAINING AND DEVELOPMENT PROGRAMS

Although some training programs are offered by NGOs and government bodies, beach boys often feel that these programs are more advisory than practical, offering limited financial or educational benefits. This lack of actionable support leaves many beach boys without clear pathways to improve their livelihoods or professional standing.

INCONSISTENT RELATIONSHIPS WITH TOURISTS

Beach boys rely heavily on forming personal relationships with tourists, which can be inconsistent and unpredictable. Building trust with tourists requires time and effort, and competition among beach boys makes it challenging to maintain steady relationships. Additionally, some tourists avoid interactions with beach boys due to negative stereotypes, limiting their chances of forming productive, mutually respectful connections.

Addressing these challenges requires a holistic approach that includes improved regulation, career development programs, health and safety awareness, and a societal shift in perception. Through a well-structured support system, beach boys can play a more productive role in sustainable tourism, contributing positively to Sri Lanka’s beach tourism landscape.

CONCLUSIONS

Tourists visiting beach resorts in Sri Lanka seek a diverse range of products and experiences, given the limited time they spend at each destination. The landscape of Sri Lanka's beach tourism has evolved significantly from the 1970s and 1980s when mass tourism dominated, and many visitors opted for all-inclusive package holidays. Today, beach tourism attracts a broader and more varied demographic, including independent travelers, solo adventurers, millennials, and budget-conscious backpackers, each with unique expectations.

In the early years, beach boys often had limited education and came from underprivileged backgrounds, which led them to engage in various questionable practices for survival. However, today's beach boys are generally more educated and knowledgeable, allowing them to establish more positive relationships with tourists. Some young men even balance their roles as beach boys with academic pursuits, eventually advancing to higher education and finding stable careers. Tourism education has also grown, particularly in the southern coastal areas, contributing to more sustainable practices among beach boys compared to past generations.

In recent years, the government has established regulatory bodies to ensure a safe and harassment-free environment for tourists, allowing them to enjoy the beaches with minimal concerns. Changing tourist profiles and motivations have also shaped the industry; while beach tourism was once centered around "sun, sea, sand, and sex," many modern tourists now seek additional cultural and adventure-based experiences. As a result, there is a greater interest in engaging with local communities and experiencing authentic Sri Lankan culture, a demand that is only partially met by large hotels focused solely on traditional beach amenities.

Beach boys have identified and embraced this trend, providing tourists with a bridge to local experiences. Although there may be challenges in meeting these evolving expectations, tourists generally appreciate the efforts beach boys make to satisfy their needs. Today's tourists are also better informed than ever before, researching their destinations through media and social platforms. This awareness has increased their ability to make educated choices about their travel experiences, and tourists are vigilant about potential misrepresentation.

Feedback from tourists on websites and social media, both positive and negative, provides valuable insight to future visitors, as research indicates that dissatisfied tourists are often more vocal. This cycle of shared experiences allows new visitors to access firsthand information from past travelers, often shaping their expectations and decisions.

Simultaneously, local culture in beach areas has shifted gradually, adapting certain values, customs, and behaviors once deemed unacceptable. Enhanced awareness about tourism's benefits and challenges has led to a community mindset that understands tourism as both beneficial and potentially harmful. Like a fire that can cook a meal or burn a house, tourism must be carefully managed for sustainable benefits.

For many beach boys, entering the beach tourism industry initially involves selling goods to tourists for basic survival. However, tourism's seasonal nature and income fluctuations create economic challenges, leading some to seek more lucrative relationships with tourists. Observing friends and relatives who earn more through these connections, younger beach boys may see this path as a quick route to financial stability. They tend to have higher earning potential when young and attractive, but as they age, demand decreases. To adapt, older beach boys often transition to roles like selling souvenirs, providing guided experiences, or working as intermediaries.

Beach boys have the potential to contribute positively to Sri Lanka's tourism industry, often establishing personal connections with foreign tourists who return to the country. They can act as valuable facilitators for beach tourism, but this potential requires a structured approach, with strategies that ensure their involvement aligns with the tourism industry's needs and ethical standards. Without careful planning, unregulated interactions may lead to unintended negative consequences.

To support beach boys in transitioning to more sustainable roles, it is essential to provide awareness, training, and rehabilitation programs. Their personal hygiene, appearance, and dress code

also need to be addressed to create a positive impression. Despite some resistance from beach boys—who fear that changing their appearance may diminish their appeal—these adjustments could enhance their professional image and broaden their role within the tourism sector. With the right support and awareness, beach boys could become key contributors to sustainable tourism in Sri Lanka, bridging the gap between tourists and the vibrant local culture.

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EXAMINING THE (GEO)DEMOGRAPHIC AND SOCIAL EVOLUTION OF ROMANIAN VILLAGES DURING THE PAST CENTURY. CASE STUDY: STRAJA COMMUNE IN BUCOVINA

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Abstract: Since the late eighteenth century the rural settlements of Romania have undergone significant transformations under the influence of evolving population structures, shifting political regimes, economic reorganisation, and cultural change. Within this historical context, this investigation focuses on Straja commune located in the mountainous region of Bucovina near the Ukrainian border. Straja benefits from continuous statistical records, which make it a valuable case study for tracking demographic and social developments across generations. The research examines

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population dynamics by analysing birth, fertility, and mortality rates, alongside internal and international migration based on archival sources, numerical data spanning over two centuries, and insights gathered through fieldwork, including a student-led survey. This comprehensive perspective enables the reconstruction of past trajectories and the projection of future trends through 2050. The findings reveal how variations in population structure have shaped community organisation, exposing forms of continuity, adaptation, and vulnerability in a peripheral context. Beyond its empirical scope, the work contributes to ongoing debates on sustainability, territorial cohesion, and the resilience of historically rooted settlements, providing a relevant reference point for researchers and decision-makers engaged in planning strategies for marginal rural regions.

Key words: rural Romania; Straja commune; Bucovina; demographic dynamics; migration patterns; population forecasting

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INTRODUCTION

Romanian rural settlements have evolved towards a distinctive way of life, shaped by the natural environment, ancestral customs, and strong social cohesion. After the Great Unification of 1918, Romania became a predominantly agrarian country, where the majority of people relied on rural agricultural settlements not only for work and livelihood, but also for identity and social belonging. Rural population was prevalent in the national structure, serving as a key demographic for agricultural production, as well as a keeper of cultural legacy shaped by many generations through close interaction with the land. This form of social organization, rooted in collective values and inherited practices, played an important role in strengthening national identity during the early twentieth century (Șandru, 1996).

The interwar period brought increased political and intellectual attention to the rural condition. Land reform initiatives aimed at redistributing property sought to alleviate structural inequalities yet failed to overcome persistent vulnerabilities such as land fragmentation, subsistence agriculture, and technological backwardness. Later on, a decisive rupture came with the rise of the communist regime after World War II, when forced nationalization and collectivization, initiated in the late 1940s and early 1950s, dismantled traditional structures of rural life (Avram, Radu, & Bărbieru, 2014).

Peasants were dispossessed of their fields and absorbed into collective farms, leading to the gradual erosion of personal autonomy and the disintegration of historical relationships between people and the land they had once owned. The socialist centralized state imposed an ideological standardization across the countryside, deliberately sidelining centuries-old customs in favour of a homogenized social model that reflected its vision of order and progress. Despite these pressures, rural communities demonstrated enduring resilience, even when it was not visible within the dominant ideological discourse. By the end of the communist period, villages in Romania displayed signs of social atomization, economic stagnation, and the fading of cultural continuity.

The collapse of the totalitarian regime in 1989 ushered in a new transition period marked by the restitution of agricultural land to former owners. However, the resulting landscape was fragmented, with many holdings too small or economically unviable to support competitive agriculture (Rusu & Florian, 2003). In the absence of strong institutional support, and access to modern technologies and know-how, a large portion of the rural economy reverted to subsistence-level practices, and the infrastructure lagged significantly behind that of urban areas.

The long-term evolution of rural population in Romania reveals the layered impact of evolving social, economic, and political conditions on the demographic profile of the nation. Statistical data from national censuses shows that while in 1948, rural residents accounted for 76.6%

of the country's total population, this share declined steadily to 68.7% in 1956, 61.8% in 1966, and 56.4% in 1977, following a trend driven by socialist modernization policies that encouraged rural-to-urban migration and redirected the workforce toward industrial sectors. After the disintegration of the authoritarian regime, the 1992 census revealed that the rural population had dropped to 45.7%. Although subsequent censuses recorded small fluctuations (47.3% in 2002, 46.0% in 2011, and 47.8% in 2021), these were not signs of genuine rural revitalization but reflected demographic trends, such as declining birth rates in urban areas and continued outbound migration.

This gradual decline of the rural population, from more than 75% of the national total in 1948 to under half by the early 1990s, underscores the scale of structural transformation in the Romanian society, while also revealing the mounting demographic pressures confronting villages: diminishing birth rates, pronounced aging, and large-scale outmigration, both internal (toward urban centers) and international (Stașac, Albu, & Stupariu, 2010). Young people, in particular, have increasingly pursued better economic prospects and improved living conditions elsewhere, leaving behind a population largely dominated by adults and elderly residents, with significant implications for labour supply, the viability of local services, and social cohesion.

Traditional agricultural practices which were previously the economic backbone of the countryside, have declined due to mechanization, land consolidation, and shifting market demands. In response, many rural residents have sought alternative livelihoods, embracing non-agricultural sectors such as rural tourism, services, small-scale manufacturing, and entrepreneurship. These transitions also point to opportunities for diversification and rural renewal (Mihalache & Croitoru, 2011).

While present day Romanian villages continue to posess natural and man-made assets, inherited knowledge, and a strong cultural identity, their long-term sustainability depends on the capacity to integrate innovation with the preservation of traditional values. In this context, mountain villages have undergone notable transformations, reflecting their vulnerabilities and efforts to pursue enduring development while preserving local identity. Each community narrates its own story, shaped by geography, history, and human agency.

Straja commune, which has been selected as a case study for this analysis, is an emblematic settlement within the historical region of Bucovina, in the northern part of Suceava county, at the national frontier with Ukraine. While the origins of the settlement likely date back before the 18th century, documented evidence attests to its function as a guard outpost of the Putna Monastery around 1750. The name, deriving from the Old Slavic term straža (meaning "watch post" or "place of vigilance") reflects the role of its inhabitants as guardians.

This study examines the population changes in Straja from the late eighteenth century to the modern era, by combining historical reconstruction with contemporary demographic analysis, and tracing the impact of political, economic, and cultural forces on the local population, in order to provide a deeper understanding of the evolution of rural areas in Romania.

STUDY AREA

Straja commune is located in Suceava county, within the Northern Group of the Eastern Romanian Carpathians, at their eastern limit, on the upper valley of Suceava River (Figure 1). The neighbouring administrative units are Crasna-Ilschii to the north (across the border in Ukraine), Putna to the south, Brodina to the west, and the town of Vicovu de Sus to the east. Access is provided by county road 209 (Rădăuți-Brodina), whereas prior to 2008 the area was also accessible by railway (Dornești-Nisipitu). The latter was decommissioned following the major floods in the summer of 2008 and is no longer in use.

Straja is positioned in the relative vicinity of two important border crossing points to Ukraine, located at Siret and the neighbouring town of Vicovu de Sus. Additionally, two more crossing points are currently under construction near Izvoarele Sucevei and Ulma. The existence of 4 functional border crossing points to Ukraine near the study area, as well as the construction of the express road connecting the A8 highway from Siret to Vicovu de Sus, which is under progress, are regarded as

major assets for the development of rural areas in northern Bucovina along the border with Ukraine. Furthermore, the modernization of the county road linking Brodina to Brodina de Sus-Izvoarele Sucevei-Carlibaba (the Hutsul road) will facilitate considerably the connection of rural communities in this mountain region, while also providing an alternate connection between Transylvania and Bucovina and Northern Moldova (Botosani).

Straja commune covers an area of 4663 ha, extending in altitude between 488 m asl and 1141 m asl, at an average of 683 m asl. In terms of the land use/land cover, forests composed mainly of coniferous species (spruce and fir) account for approx. 63% of the communal territory (2922 ha), whereas the remaining area is occupied predominantly by pastures. Straja has a total population of 5,940 inhabitants (July 1st 2024), the majority of which are Romanian ethnics, despite the closeness to the border with Ukraine and the predominance of Hutsul population in neighbouring communes along Suceava River valley.

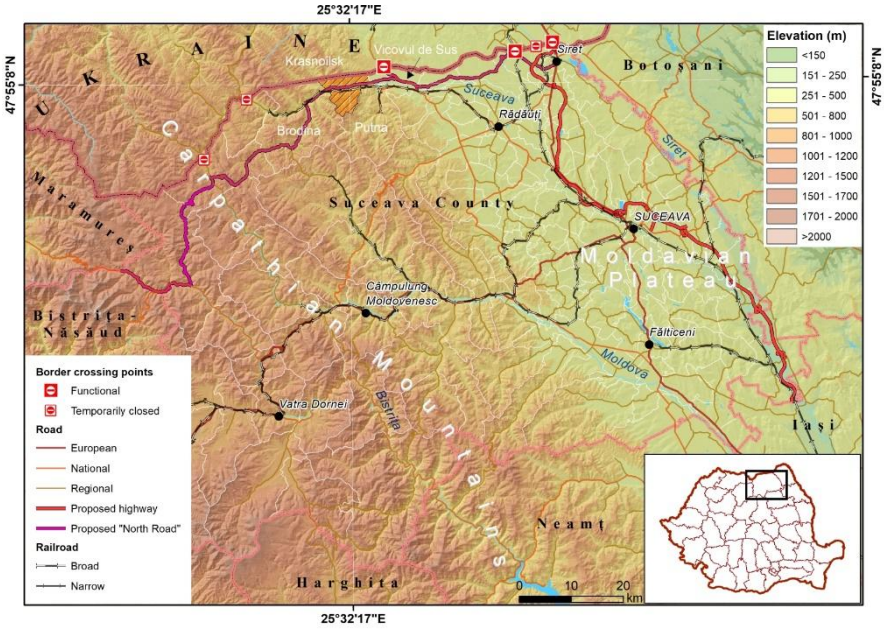

Figure 1. Location of the study area: Straja commune in Suceava county

METHODS

For this investigation, we employed a mixed methodological approach that integrated historical investigation, statistical interpretation, and field-based qualitative insights. The initial phase consisted of a thorough examination of literature and documentary evidence related to the past of Bucovina and Straja commune in particular, including mainly the Austrian conscriptions and census records from 1775 to 1918, on which the reconstruction of long-term demographic trajectories is based. For the more recent period (i.e. the late twentieth and early twenty-first centuries) the relevant data was provided by the Suceava County Directorate of Statistics and the Tempo Online platform, which supported the construction of a coherent data set reflecting the evolution of the local population over time.

Furthermore, fieldwork was carried out in the Straja commune to address data gaps and to add context-specific interpretation to the statistical perspective, by including direct observation, semi-structured interviews, and researcher field notes as supplementary resources. Such methods provided a valuable qualitative layer to the demographic analysis, helping to contextualize observed

trends. By using standard indicators, the quantitative study traced population shifts between 1992 and 2023, concentrating on birth and mortality patterns, natural increase, and migration dynamics. Additionally, an original segment of the methodology involved online data collection using Google Forms, where a questionnaire was distributed to 8th-grade students at the local school in Straja to gather perspectives on migration intentions and aspirations of the younger demographic.

RESULTS AND DISCUSSIONS

Trends in population size

Between 1775 and 2024, the population of Straja experienced fluctuations determined by important political and historical events: the annexation of the northwestern part of the Principality of Moldavia by the Austrian Empire; the unification of Bucovina with Romania, officially recognized through the Treaty of Saint-Germain on September 10, 1919; the two world wars; the establishment of the communist regime; the 1966 abortion ban; the liberalization of family planning after 1990 and the increased freedom of movement; the accession of Romania to the European Union in 2007 and the subsequent elimination of visa requirements; the onset of the global economic crisis in 2008; the COVID-19 pandemic (2020-2022); and the ongoing Russian invasion of Ukraine which started on February 24, 2022.

The Austrian conscription records from 1775 to 1784 are the basis for the demographic reconstruction. Some inhabitants avoided being counted, fearing new tax burdens. The estimated population figures rely on an average household size of five, in line with commonly accepted demographic standards of the 18th and 19th centuries. These early censuses reveal moderate fluctuations in the number of families and total inhabitants during the first decade of the Habsburg administration. Straja was inhabited by 78 families (approximately 390 people) in 1775, with an increase up to 91 families (around 455 people) in 1779. This growth trend did not persist, as by 1780 the population had declined to 430 inhabitants (86 families), and around 400 people (80 families) by 1784 (Werenka, 1895). By the early 19th century, following the Napoleonic Wars, military service became mandatory across the empire. The military census of Galicia in 1808 recorded 108 families and 634 inhabitants in Straja (Kumor, 1972), indicating and increase corresponding to an average annual growth rate of 1.9% compared to 1784 (Figure 2).

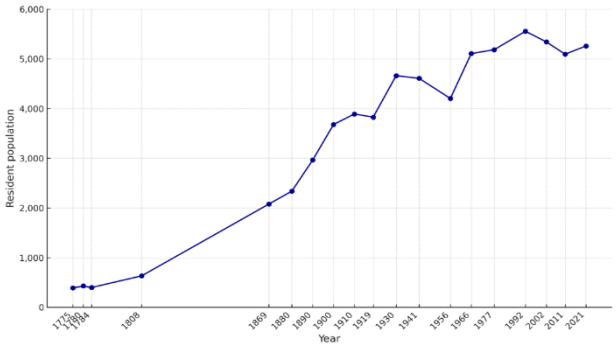

Figure 2. Evolution of the resident population in Straja (1775-2021)

The March 1869 implementation of the Census Law (also known as the Taaffe Law) established the framework for subsequent population enumerations under the Austrian administration. The five Austrian censuses indicated continuous population growth between 1869 and 1910, reaching a total of 1,812 individuals, with an average annual increase of 44 persons and a growth rate of 1.5% (Figure 2).

The population of Straja declined by 64 people between 1910 and 1919 as a consequence of World War I, due to decreased fertility, increased health-related mortality, and military service

deaths, with soldiers serving in the 22nd and 80th regiments on multiple fronts. In the aftermath of the Great Unification of 1918, the Romanian society experienced significant reforms, and by 1930, the population had increased by 835 individuals (Figure 2).

Following the signing of the Ribbentrop-Molotov Pact on August 23, 1939, the Soviet Union annexed Northern Bucovina, along with Bessarabia and the Hertza region, on June 28, 1940, which affected all administrative units separated by the newly established border, including our study area. Thus, the census of April 1941 determined that Straja was inhabited by 4,608 people (Figure 2) living within an area which had been significantly reduced after the loss of more than 2,700 hectares of forests and pastures to the Soviet Socialist Republic of Ukraine. Although initially regarded as provisional, the new border became permanent in March 1944, producing long-term economic consequences for the commune, as well as the entire region of Bucovina.

The change in political regime after World War II brought about a shift in demographic policy, particularly with the Decree 463 of 1957, which liberalized access to abortion, ultimately leading to a decline in birth rates across Romania. In response, the Communist Party enacted Decree 770/1966, which prohibited abortion and Decree 779, which restricted access to divorce, measures aimed at preventing family dissolution and stimulating population growth. Locally, between 1956 and 1977, Straja experienced an average annual growth rate of 1%, and this upward trend continued, with the population reaching 5,278 inhabitants in 1986 and 5,497 in 1990 (Figure 2).

Conversely, the post-1989 period was marked by a steady demographic decline, driven primarily by the repeal of Decree 770 and the liberalization of borders, which facilitated labor migration, especially toward Western and Southern Europe. After the 1992 census which recorded a resident population of 5,555 inhabitants, ensued a slow decrease, reaching 5,094 in 2011. However, by 2021, the population increased slightly to 5,258 people (Figure 2). From a long-term perspective, population numbers between 1775 and 2021 show an absolute increase of more than 13x and an average annual growth rate of 1.06% throughout the entire time frame.

Trends in village size and number of buildings

A spatial analysis of the village size and the number of buildings throughout the period between 1856 and 2014 shows significant changes between the three distinct socio-political periods as follows. During the time frame when Bucovina was under Austrian administration (i.e. in 1856), the inhabited area of Straja consisted of 334 housing buildings and annexes covering 3.2 ha, which accounted for approx. 0.07% of the territory of the commune (Figure 3).

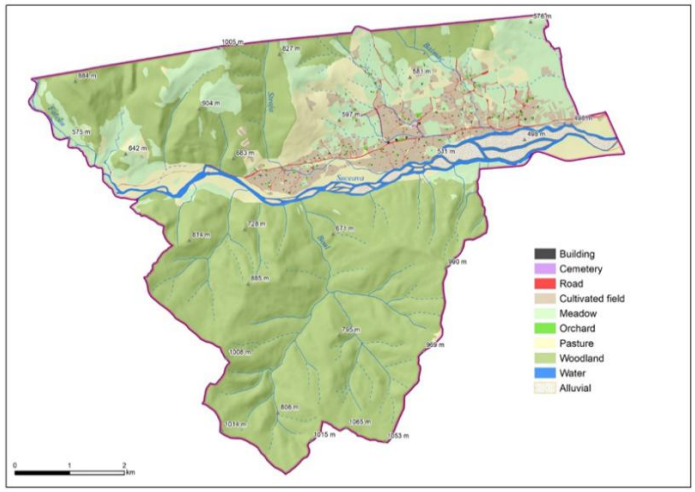

Figure 3. Reconstructed land use and settlement pattern in Straja (1856), based on the Second Austrian military survey

By the late socialist period (1980), the territory of the settlement had increased significantly, by expanding particularly towards the north, in the direction of the national border with Ukraine, where the characteristics of the terrain were more suitable for the developing village, as well as upstream along the valley of Suceava River (Figure 4). Thus, in 1980, the inhabited space of Straja included 2405 buildings and annexes, covering a total area of 36.9 ha (0.8% of the current area of the commune). Overall, the number of households increased by more than 7 times compared to the previous period, when the village was under Austrian administration.

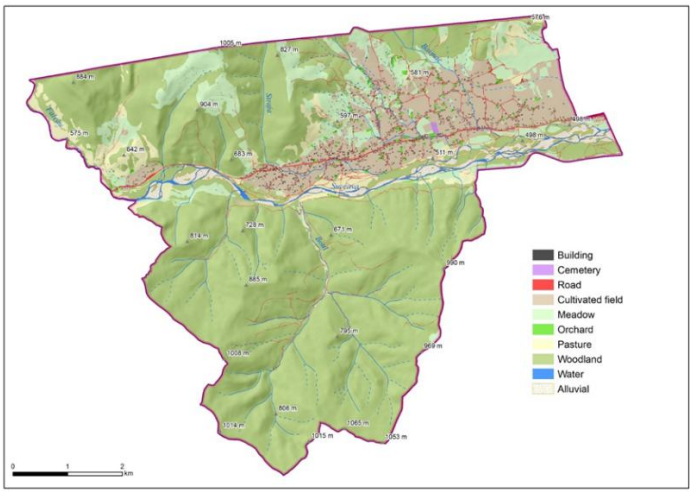

Figure 4. Reconstructed built environment in Straja in 1980, based on CORINE Landcover data

In the post-socialist period (2014), the number of housing buildings and annexes had nearly doubled compared to the previous time framer (1980), reaching a total of 4721, which covered an area of 47.5 ha (1.02% of the current area of the commune). Despite the consistent outbound emigration occurring particularly after the integration of Romania into the European Union, the inhabitants of Straja continued to build new housing units and preserve, at least for the time being, a relatively constant size of the population, which has increased slightly in the last decade, illustrating a positive trend, in contrast with some of the neighbouring communes.

Geodemographic changes over the last 32 years

Understanding recent population dynamics in Straja requires access to structured and comparable data spanning the last three decades. The Tempo Online platform, developed by the National Institute of Statistics (Institutul Național de Statistică, INS), provides detailed information across multiple territorial levels, allowing for an interpretation of demographic patterns, from broad national tendencies to local particularities. The total population data used in this analysis refers to the number of individuals officially registered by domicile on July 1st of each year (INS, 2024a). Although these numbers do not fully reflect the resident population, especially in rural areas with active seasonal as well as long-term migration, they provide the most consistent and accessible basis for longitudinal demographic assessment. We focused on several core indicators that describe natural population change and aspects of family structure, including birth and death rates, general fertility, marital dynamics etc. These variables illustrate the pace and direction of demographic transformation, offering insight into comprehensive social change, including reproductive behavior and partnership patterns.

Nuptiality is a demographic phenomenon closely tied to the organization of family life and the evolution of household arrangements. Shifts in marriage patterns provide insight into the timing and frequency of unions, intergenerational structures, and the cultural norms that shape long-term

commitment. The marriage rate in Straja between 1992 and 2023 presents a nuanced demographic profile, marked by alternating phases of contraction and relative stability, especially when compared with rural trends in Romania (see Figure 5). In 1992, the marriage rate in Straja was 7.3‰, close to the rural national average of 7.7‰, whereas in the following year, Straja exceeded the rural average with a marriage rate of 8.0‰, compared to 7.2‰ in rural Romania. By 1994, the average rural marriage rate had already begun to decline significantly, thus signalling a more immediate demographic response to the broader societal transformation, while the marriage rate in Straja dropped to 4.7‰ in 1994 and 4.5‰ in 1996, well below the rural averages of 6.9‰ and 6.3‰ for the same years.

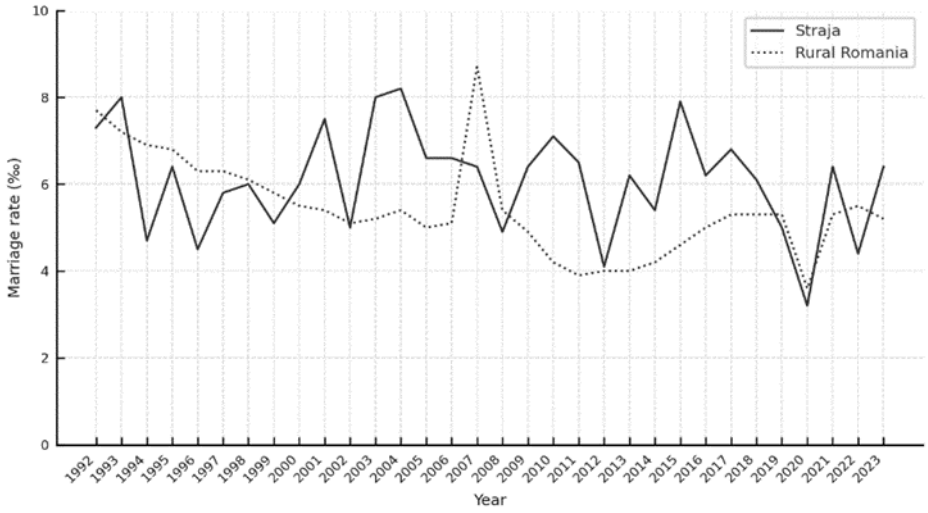

Figure 5. Marriage rate dynamics in Straja compared to rural Romania, 1992-2023

These discrepancies highlight the village's heightened demographic sensitivity to post-transition uncertainty, economic restructuring, and increasing individual mobility. Such shifts led many locals to postpone or avoid formal unions altogether, diverging from the more gradual adjustment in the rural landscape. After a period of relative stagnation, the early 2000s brought a temporary rebound of the marriage rate in Straja, reaching 8.0‰ in 2003, 8.2‰ in 2004, and maintaining high values in the following years, of 6.5‰ in 2005 and 2006. In 2007, marriage rates in rural Romania peaked at 8.7‰, following the implementation of Law no. 396/2006, which introduced a one-time financial incentive for first-time married couples. However, in Straja the rate in 2007 remained at 6.4‰, virtually unchanged from the prior years, suggesting that government incentives did not resonate equally across rural areas. A particularly sharp decline occurred in 2020, when the marriage rate in Straja dropped to just 3.2‰, the lowest value recorded over the entire interval, and slightly below the rural national average of 3.6‰. The COVID-19 pandemic, which restricted civil ceremonies, travel, and social gatherings in general, resulted in delayed or cancelled weddings across the country, including in small rural communities such as Straja. In the following years, both Straja and rural Romania experienced a modest recovery: 4.4‰ and 6.4‰ in 2022 and 2023 in Straja, compared to 5.5‰ and 5.2‰ at the rural national level. These post-pandemic figures, however, remain well below the rates observed in the early 1990s, underscoring the broader demographic shift toward delayed or foregone marriage, shaped by evolving social norms and increasing cohabitation without legal union.

By comparison, *the divorce rate* reveals an even more striking contrast. In rural Romania, divorce rates remained generally low, mostly below 1.1‰, with only moderate increases during periods of economic or social stress. In Straja, however, the divorce rate shows a pattern of episodic spikes and longer intervals of very low values (Figure 6). In some years, such as 1993 or 1997, the rates were extremely low (0.2‰), while in others, like 1996 or 2005, the annual averages reached 1.2‰. These variations may result from the small population size of the commune, where even a modest number of divorces can influence the rate significantly. A sharp and unexpected spike occurred in 2012, when the divorce rate more than doubled, reaching 2.2‰, the highest value recorded in the entire interval. This abrupt change stems from the adoption of Law No. 202/2010, aimed at accelerating legal procedures, which introduced simplified administrative routes to divorce, including the possibility of mutual consent procedures handled by civil registrars or public notaries. This legislative reform significantly lowered both the bureaucratic and financial barriers to marriage dissolution, thereby influencing the dynamics of divorce in smaller, more traditional communities such as Straja. However, the long-term trend remains aligned with the national rural pattern, showing low and relatively stable levels of divorce rates, which may reflect the endurance of cohesive family structures and limited formal dissolution of marriages.

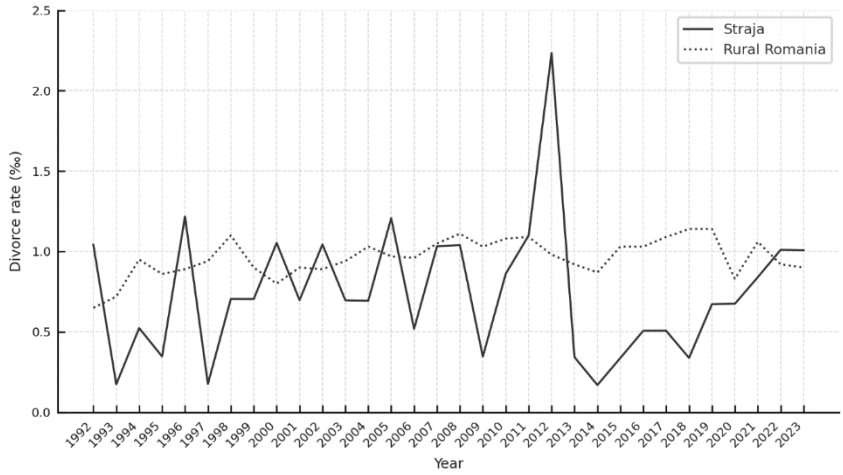

Figure 6. Divorce rate dynamics in Straja and rural Romania, 1992-2023

The fertility rate in Straja, defined as the number of live births per 1,000 women of reproductive age (15-49), has shown noticeable fluctuations over the past three decades, shaped by a mix of structural, social, and economic factors (Figure 7). In 1992, the fertility rate stood at a remarkable 90.4‰, illustrating the continuation of traditional reproductive norms in rural Northern Romania during the early post-communist period. However, this elevated level proved unsustainable in the context of rapid societal transformation. By 1997, the fertility rate had dropped to 55.9‰, and although it fluctuated in the following years, the long-term trend was downward. Throughout the 2000s, the rate oscillated between 52‰ and 62‰, with brief increases such as in 2001 (64.9‰), but without stabilizing at those higher thresholds. Several factors help explain this decline: greater access to education and contraception, evolving family aspiration, economic insecurity, and the emigration of young adults, including many women of childbearing age (Sobotka, 2011). These dynamics gradually reduced the size of the reproductive-age population and the average number of children per woman.

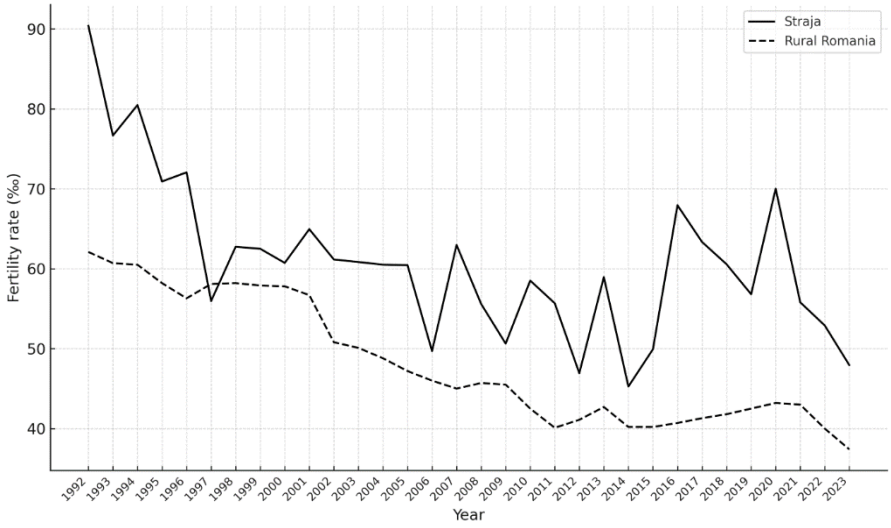

Figure 7. Comparative trends in the fertility rate in Straja and rural Romania, 1992-2023

The fertility rate reached its lowest levels in 2012 (46.9‰) and 2014 (45.3‰), before rebounding in 2016 to 67.9‰, a rare deviation from the overall trajectory. A similar upward shift occurred during the first year of the COVID-19 pandemic, when the fertility rate unexpectedly climbed to 70.0‰. Several pandemic-specific factors contributed to this temporary rise, including return migration, postponed emigration, and changes in reproductive intentions. Nevertheless, the recovery was short-lived: the values for 2021 (55.8‰), 2022 (52.9‰), and 2023 (47.9‰) point to a renewed decline, with the last figure being among the lowest of the entire interval (Figure 7).

The national rural trend reveals a more gradual yet consistent contraction. In 1992, the fertility rate in rural Romania was 62.1‰, but by 2023 it had dropped to just 37.4‰, the lowest value of the entire period (Figure 7). This steady decline reflects broader demographic transitions, including population ageing, sustained outmigration, and the ongoing reshaping of reproductive behavior. While the fertility pattern in Straja includes sharper fluctuations and temporary surges, both trajectories ultimately converge toward the same outcome: decreasing fertility potential and heightened demographic fragility across the rural landscape.

The *birth rate* indicates the frequency or intensity of births within a population and is influenced by various economic, political, and social factors. In the early 1990s, birth rates remained relatively high; in 1992, Straja recorded 19.4‰, in line with reproductive patterns still rooted in rural traditions (Figure 8). Over time, birth rates declined as the commune moved from a state-run system to market-based structures, and local life reorganized around new norms and constraints, while women regained the right to abortion which had been completely restricted after 1966 under the communist regime. The dissolution of state-supported industries, rising unemployment, and financial insecurity discouraged family formation. At the same time, large-scale outmigration, particularly among young adults, reduced the number of potential births, amplifying the natural demographic contraction. Socio-cultural changes also played an important role, as the growing participation of women in the workforce contributed to shifting preferences toward smaller families, delayed parenthood, and the increasing costs of raising children further influenced reproductive behaviour (Mureșan, Hărăguș, Hărăguș, & Schröder, 2008). Overall, Straja recorded consistently higher birth rates compared to the national rural average throughout the analysed timeframe, particularly due to demographic inertia inherited from earlier decades.

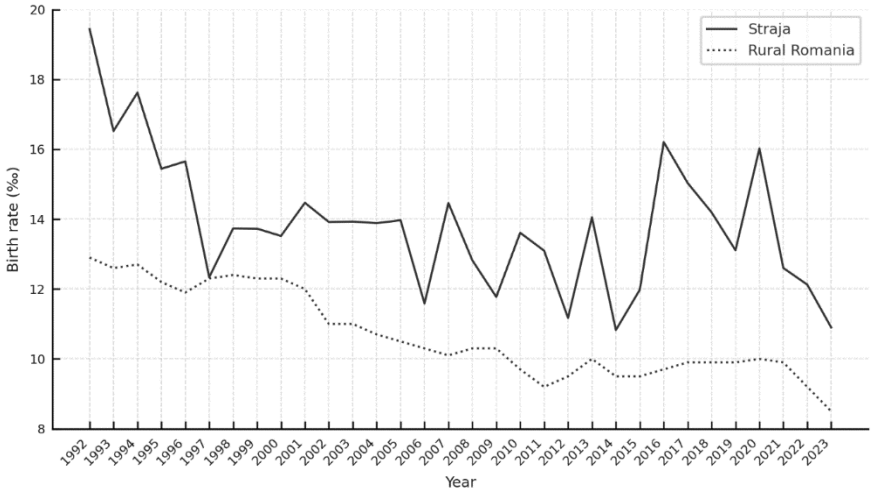

Figure 8. Comparative trends in the birth rate in Straja and rural Romania, 1992-2023

Rural Romania followed a similar yet more gradual path of decline, with an average birth rate of 12.9‰ in 1992. Over the next decades, the rate followed a consistent downward trajectory, reflecting the cumulative impact of depopulation, aging, migration, and social transformation. Unlike the irregular pattern observed in Straja, where local dynamics triggered occasional rebounds, the national rural average declined steadily, with fewer oscillations. Despite the overall decrease, Straja showed isolated episodes of increase, most notably in 2016 (16.2‰) and 2020 (16.0‰). These temporary improvements may have been generated by state incentives, such as child allowances and maternity benefits, designed to encourage family growth. Additionally, return migration, either permanent or seasonal, may have played a role in boosting local birth numbers during these years (Figure 8).

Nevertheless, the general trend continued downward, with the birth rate dropping to 12.6‰ in 2021, 12.1‰ in 2022, and 10.9‰ in 2023, the second-lowest value of the entire period. In contrast, rural Romania saw its rates stabilize slightly above 9‰ in 2021-2022 before dipping to 8.5‰ in 2023, its lowest point in the entire interval (Figure 8). This parallel decline underlines the fragility of natural population growth and raises serious questions about the long-term viability of generational replacement in local and regional rural settings.

Throughout the last three decades, *mortality* in Straja showed a generally irregular pattern, marked by a gradual upward tendency shaped by demographic aging further accentuated by the migration of younger residents. In 1992, the rate reached an average of 11.1‰ and remained relatively stable during the 1990s, with occasional declines, such as 7.9‰ in 1995 and 8.0‰ in 2001, alternating with years of noticeable increase (e.g., 13.7‰ in 1997). The mortality saw sharp rises in 2010 (14.1‰) and 2016 (14.2‰), standing out as the highest values in the reference interval (Figure 9). These surges mirror mainly the progressing aging of the local population, the reduced share of younger adults due to outmigration, and the growing health issues often observed in rural settings with limited access to medical services. After 2005, the increasingly elderly structure of the population maintained the annual death rates above 11‰ in most years.

Figure 9. Mortality rate dynamics in Straja and rural Romania, 1992-2023

The high mortality of 2020 and 2021 (12.6‰) likely reflects the prolonged impact of the COVID-19 pandemic, which disproportionately affected older inhabitants of the village. In 2022, the rate dropped to 8.6‰ (the lowest since 2001), before climbing again to 10.2‰ in 2023 (Figure 9). These recent fluctuations may point to a partial post-pandemic recovery and some improvements in healthcare availability.

By contrast, rural Romania followed a more linear and consistently elevated trajectory. The national rural mortality rate reached 14.8‰ as early as 1992 and stayed above this threshold throughout much of the period. The rate peaked in 2021 at 17.4‰, underscoring the severe toll of the pandemic on structurally vulnerable populations (Figure 9).

Overall, the national rural average remained consistently higher compared to the death rate recorded in Straja, likely reflecting underlying contrasts in local age distribution, health infrastructure, or social cohesion. Nevertheless, both trajectories point to the cumulative effects of population aging and health vulnerability in the rural regions of Romania.

The natural increase, reflecting the balance between birth and death rates, provides a comprehensive perspective on the demographic vitality of the Straja community. In 1992, this demographic indicator reached a positive value of 8.3‰, driven by the relatively high birth rates and moderate mortality (Figure 10). However, the trend reversed soon after, signaling the onset of demographic decline. By 1997, the natural balance had dropped to -1.4‰, marking the first year with more deaths than births. Subsequent years, such as 2012 and 2014, continued this negative trajectory, with values of -0.7‰ and -1.7‰, respectively. The downward shift resulted from the combined effect of falling birth rates and elevated mortality.Persistent outmigration further weakened the potential for demographic renewal, as the exodus of young, reproductive-age individuals reduced the potential for population growth. Economic difficulties, including financial instability and limited employment opportunities, discouraged larger families and contributed to a lower birth-to-death ratio. Despite these long-term challenges, occasional signs of recovery emerged, for instance, in 2001 (6.4‰) and 2018 (4.4‰).

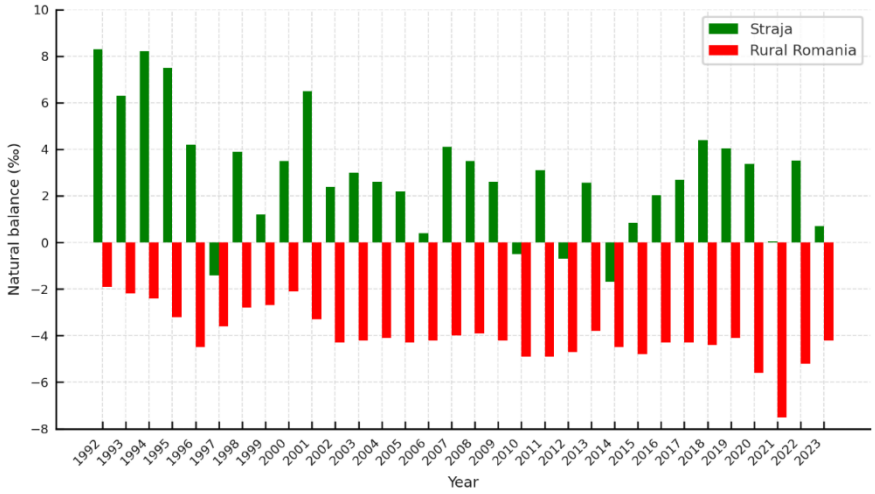

Figure 10. Long-term variation in natural balance in Straja and rural Romania (1992-2023)

However, temporary improvements, such as minor upturns in birth rates, sporadic return migration, and marginal decreases in mortality, proved insufficient to reverse the broader pattern of demographic decline. The evolution of the natural balance in this rural commune reveals the depth of demographic transformation: declining reproductive capacity and sustained emigration against the backdrop of an aging population. These dynamics underscore the urgent need for long-term strategies to counteract population loss and strengthen local demographic, social and economic resilience. Comparative data from rural Romania reinforce the relevance of these observations. In 1992, the national rural rate stood at just -1.9‰; over the next three decades, the annual rural average of the natural balance rate remained persistently negative, indicating a deeper and more consistent demographic contraction. The lowest value was recorded in 2021, at -7.5‰ (Figure 10). The comparison highlights a relative demographic advantage of Straja, though recent convergence between the two suggests that, without effective intervention, the commune may eventually align with the national trend.

Spatial mobility of the population

Mobility has strongly influenced the demographic and social landscape of rural communities throughout Romania. In the decades before 1989, many people left their home villages for nearby towns or industrial regions, drawn by employment opportunities offered by the rapidly growing socialist economy. Entire families moved from their rural homes into urban apartment blocks, exchanged agricultural routines for factory shifts, thus becoming part of a nationwide transformation project. After the Revolution of 1989 which overthrew the communist regime, the motivation and direction of migration shifted. State-run factories closed, and the rising cost of city life reduced the appeal of urban living. In parallel, the 1991 Land Fund Law returned land to former owners and encouraged people to reconnect with rural life, and agriculture, even at the subsistence level, became a fallback for many families. Moreover, family support networks provided stability where state institutions no longer could. The liberalization of borders opened new routes for international migration, while the 1996 Housing Law made it easier to own property, often in the form of new houses built near their parents' homes.

In Straja, these transformations became visible in everyday life, with some young couples returning and building new dwellings on inherited plots, while other locals left to study or work in cities like Cluj or Bucharest, or Western European countries such as Italy, Spain, and the UK. The rural landscape transformed: many homes stood empty, whereas others expanded and were modernized with new extensions or annexes. Thus, in the past three decades, movements in and out

of the commune added layers to its demographic story, shaped by departure, return, and a constant search for a higher quality of life.

In 1995 the net migration rate fell to -10.1‰, revealing the extent of demographic destabilization, while in the following year the emigration reached 16.9‰, reflecting a wave of departures amid ongoing uncertainty (Figure 11). Between 1999 and 2001 the migration balance temporarily steadied, with net rates close to zero. However, after Romania joined the European Union in 2007, adults and younger people took this opportunity to seek jobs as well as financial and social security elsewhere. In 2008, amid the global economic crisis, the emigration rose to 13‰, and the net loss reached -9.2‰.

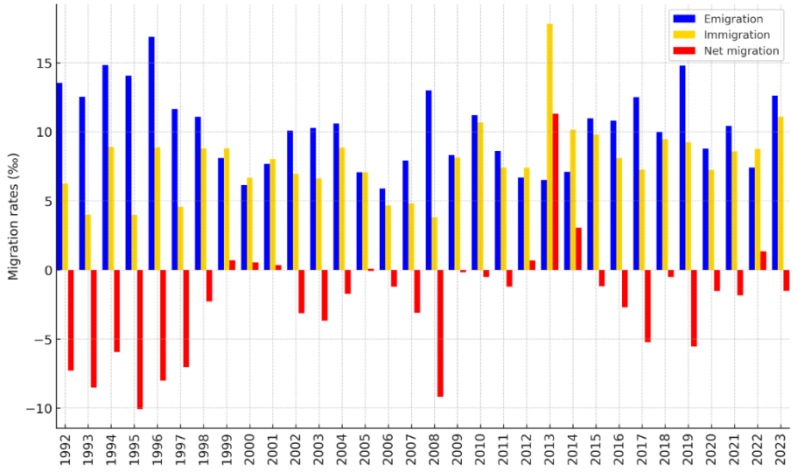

Figure 11. Evolution of migration rates in Straja commune, 1992-2023

In 2013 the immigration increased to 17.8‰, whereas the emigration dropped to 6.5‰, with the net migration reaching 11.3‰, the highest value of the three decades. The COVID-19 pandemic disturbed the established migration patterns and further influenced demographic movements. In 2021, the rate of the net migration was -1.9‰, while in 2022 it briefly turned positive (1.4‰), likely reflecting the return flows triggered by lingering health concerns or shifting job markets abroad (Figure 11). By 2023, the number of people leaving the commune once again surpassed those arriving, reflected by the drop in the net migration rate to -1.5‰ (INS, 2024b).

A significant share of the migrating population once studied at the secondary school in Straja, the educational institution where we conducted a sociological research through using a questionnaire to which 8th-grade students responded in 2022, aiming to explore how young people perceive migration. Forty students responded, of which three-quarters were female, mostly aged 14. More than half reported that a close family member (usually the father) worked abroad, with Germany cited as the most common destination. When reflecting on their plans for the future, no less than 74% intended to leave Straja. The majority of students hoped to pursue higher education (85%) or to find better-paying jobs (50%). Some took into account settling in nearby towns, while others looked toward cities like Bucharest or destinations abroad: Italy, Spain, France, and the UK. For these adolescents, mobility was not regarded as a dramatic rupture, but more like an expected step, familiar for young people growing up with absent parents, with whom they had kept in touch through regular calls. Therefore, the vast majority of teenagers schooled in Straja see relocation as part of the life cycle, and their answers show a community in quiet transformation, where staying in their home village is no longer the default, and leaving is part of planning.

This insight brings depth to the demographic data and highlights the persistence of migration across generations and the manner in which households pass along attitudes shaped by mobility. In

Straja, as in many villages of the region, population change reflects stories, decisions, and directions envisioned by young people in the community, and connects them to everyday realities common across rural Romania.

Population projections and prospective challenges

Demographic projections play a key role in understanding population evolution and anticipating future developments, particularly in rural areas marked by structural and demographic vulnerabilities. For Straja commune, the current forecast draws on a combination of classical extrapolation techniques and advanced time-series models, applied to demographic records spanning from 1992 to 2024. The figures represent the population officially registered by domicile as of July 1st of each year, a commonly accepted statistical proxy in Romania, given the lack of continuous data on the de facto resident population.

The first method used for projection was linear regression, a basic approach that extends long-term tendencies along a straight trajectory, using the equation:

$$y_t = a + b \cdot t \quad (1)$$

where:

- y_t is the estimated population in year t,
- a is the intercept (baseline population),
- b is the annual rate of change.

According to this approach, the population of Straja is expected to grow slowly but steadily, from 5,940 in 2024 to around 6,027 by 2030, 6,154 in 2040, and 6,282 by 2050. The projection is based on the assumption that the gradual increase observed over the past thirty years will continue without major fluctuations.

The second technique uses polynomial regression of degree two, which is well-suited to capturing non-linear developments in historical population trends, and is defined by equation (2):

$$y_t = a + b \cdot t + c \cdot t^2 \quad (2)$$

where a, b, and c are coefficients estimated from the data.

This projection method infers a population of approximately 6,277 residents in 2030, increasing to 6,501 by 2040 and 6,693 by 2050. The upward curvature points to a modest acceleration in growth. However, without substantial improvements in local socioeconomic conditions, the model may overstate the long-term demographic capacity of Straja commune.

Finally, the third technique applied was an ARIMA model (AutoRegressive Integrated Moving Average), a time-series forecasting tool that builds on past values and their evolution over time. ARIMA integrates three components: an autoregressive term (AR(1)), which accounts for the influence of previous data points; an integration component (I(1)), which involves differencing the series once to achieve stationarity; and a moving average term (MA(1)), which adjusts the forecast based on prior errors. When we applied this method to our data for the 1992-2024 timeframe, the ARIMA (1,1,1) model generated a nearly flat projection: 5,946 residents in 2030, 5,952 in 2040, and 5,954 in 2050. These marginal increases indicate a state of demographic inertia, reflecting the stability observed in recent decades.

While statistically sound, all the models extrapolates past trends and cannot anticipate shifts driven by policy changes, economic renewal, or demographic adjustments. Therefore, the outcomes of these projections should be interpreted with caution and placed alongside scenario-based models that consider structural and contextual developments. The three forecasting exercises reveal the utility and the limits of relying on recorded dynamics to anticipate future demographic change. Although based on the same data series, the models point in different directions and suggest contrasting possibilities, indicating that projections serve best as tools for reflection and planning,

not as fixed predictions.Moreover, in Straja, the foreseeable future will be shaped by what people and institutions choose to do now, whether they find ways to support local life, to create reasons to stay, and to imagine continuity where decline once seemed inevitable.

CONCLUSIONS

Assessing demographic change in Straja proved essential for understanding the deeper social interactions that shape rural life in this part of Romania. The study offers a comprehensive view of local evolution over recent decades by analyzing key processes, respective birth and death rates, migration flows, and their combined effects on population structure. Anchoring the analysis in the local context allowed us to identify distinctive demographic patterns and persistent challenges, while pointing to shifts occurring across northern rural regions.

A defining historical trait for this rural area remains its exemption from collectivization, a rare national exception that reveals strong communal cohesion. This resistance stemmed from traditional agricultural practices, cultural continuity, and a deep attachment to land and identity, which continue to shape the local social tissue.

Beyond its empirical scope, the research contributes to current debates on post-socialist rural change by providing insight into the evolution of a traditional community from the mountain region of northern Romania. The integrative methodology, blending archival research, statistical analysis, and fieldwork, outlines a replicable approach for investigating demographic dynamics elsewhere. At the same time, the findings carry practical value for planners, decision-makers and professionals designing policies focused on population stability, territorial equity, and long-term revitalization.

Reinforcing rural vitality requires investment in infrastructure (transport, services, digital access) and people, through access to education, healthcare, and vocational training. Just as important is targeted support for small-scale agriculture, locally rooted businesses, and forms of tourism that respect and build upon the natural landscape and cultural identity of each community. Encouraging the return and reintegration of outmigrants can help restore demographic balance and foster resilience. Durable change depends on institutions, on community initiative, inclusive governance, and the ability to reconnect present decisions with long-standing social resources.

The evolution captured in this study reflects the tensions and transformations that have shaped rural Romania over the past century. Understanding these experiences remains essential for crafting place-sensitive strategies that meet the complex needs of peripheral territories while supporting their resilience and potential for renewal.

AUTHOR CONTRIBUTIONS

Conceptualization, D. Istrate, I. Grădinaru and M. Mîndrescu; methodology, D. Istrate and I. Grădinaru; formal analysis, D. Istrate, I.-A. Cristea and M. Barbacariu; investigation, D. Istrate, I.-A. Cristea and M. Barbacariu; writing - original draft preparation, D. Istrate; writing - review and editing, D. Istrate, I. Grădinaru and M. Mîndrescu.
All authors have read and agreed to the published version of the manuscript.

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SPATIAL ANALYSIS OF URBAN GROWTH AND AGGLOMERATION IN A FACTORIAL CONTEXT (1980-2020)

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Abstract: The complex relationship between demographic growth, urban expansion, and global change has become a central focus of contemporary interdisciplinary research. A simple Google Scholar search yields over one million entries, highlighting the field's significance. This study uses a multivariate analysis to examine factors driving the dynamics of global urban agglomerations from 1980 to 2020. Agglomerations are defined spatially, using a consistent methodology for all 2015 cases with a minimum population of 500,000. Our analysis reveals regional patterns of evolution strongly correlated with geographic location, demographic growth, economic development, and risk levels. The study underscores the increasing tension between urban expansion and natural or anthropogenic risks, demanding urgent solutions for sustainable development. While not explicitly focusing on the urban environment relationship, the study also highlights models for sustainable adaptation across diverse geographical contexts.

Key words: urban expansion; coupling urban agglomeration; growth drivers; cyclical evolution; world scale

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INTRODUCTION

The issue of the expansion of the urbanization process and the driving factors that determine it is hotly debated (Li, Sun, & Fang, 2018). The interdisciplinary perspective, in which geography has long made a significant contribution through the spatial variables it introduces into explanatory models, amplifies this interest (Moudon, 1997). Developments in recent decades have introduced new concepts adapted to the dual phenomenon of urban expansion: *demographic* and *spatial*. Terms such as "global city" or "global urban society" have become common, corresponding to new trends in the localization and development of urban settlements (Clark, 1996). Termed *late urbanization*, these trends certify the importance of intersecting historical and geographical views for understanding current urban processes (Fox & Goodfellow, 2021). The classic dispute between the

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universality and specificity of urbanization is becoming obsolete. Late urbanization manifests itself in the context of the combination of unique conditions specific to the end of the 20th century and the beginning of the current one, which it shapes: the *unprecedented intensity of population growth*; *hyperglobalization*; *centripetal politics of states* and *the specter of catastrophic environmental change* as a result of the evolution of human society in the Anthropocene. This phase corresponds to the vision proposed by Denise Pumain, who separates three major dynamic "regimes" in the process of urbanization: *emergent*, which manifested itself until the threshold of the modern era; *intensive*, generated by the industrial revolution and the demographic transition; *adaptive*, marked by increasingly scarce resources, against the backdrop of the halting of population growth in advanced countries and the need for an ecological transition capable of limiting the negative effects of climate change (Pumain, 2021).

This *evolutionary vision of* urban systems is imposed by its ability to reconcile classical explanatory models developed by Gibrat in 1931, Christaller in 1933 and Zipf in 1942 with the analytical possibilities provided by the information revolution. Provided that the sources used are harmonized, given the great variability in data collection methods and administrative-territorial organization at the national level. According to evolutionary models, the *inequalities between urban centres arise as an effect of their co-evolution*, the formation of new geographical structures, such as metropolitan agglomerations, urban systems or regions, etc (Pumain, 2021). This is because, more than ever before, all interactions between cities (from the transfer of goods and people to investment and information exchange) generate interdependence and, implicitly, unequal relationships that lead to a regular hierarchical distribution.

Urban settlement systems have thus become *adaptive systems* organized to accommodate the exchange of information, diffusion of innovations, reduction of uncertainties, and deriving benefits from complementary resources located far away (Shi, et al., 2021). Against this backdrop, a trend of simplifying hierarchies at the grassroots level has emerged in recent decades, leading to the decline of many urban centers, especially small and medium-sized ones (Pumain, et al., 2015). The dynamics of complex systems, such as the urban one, are unpredictable, but contextualizing them in terms of their demographic, income or access to resources components reduces forecasting errors (Raimbault, Denis, & Pumain, 2020). In this way, the expansion of urbanization in recent decades can be deciphered in a more complex key than through interdependence theory, which simplistically postulates that it is the result of the geographical expansion of capitalism, with the urbanization of Africa and Asia seen as a response to the global economic order (Clark, 1998). For a long time, urban population growth in developing countries has been slower by Western standards, resulting almost exclusively from natural population growth, with no association with industrialization or the expansion of the urban network (Spence, Annez, & Buckley, 2009). The massive migration from the villages (rural exodus) is of very recent date here and is manifested mainly as an effect of the insertion of modern infrastructure, generating disparities but also opportunities (Preston, 1979).

Numerous multivariate models have been developed on the factors (*driving forces*) that determine specific trends in the urbanization process. Recent studies indicate an inverse relationship between population growth and city size, the latter being considered a key variable for the study of urban dynamics. In recent decades, however, a heterogeneous growth has been observed, explained by the increasing importance of the ageing process or by the diversification of migration patterns in 1857 agglomerations of 155 countries for the period 1950-2030 (Egidi, Salvati, & Vinci, 2020). In classical studies, the availability of space for expansion, access to transportation networks, position about the hydrographic network and the presence of resources were privileged. In recent decades, however, factors such as the level of gross domestic product, foreign direct investment, and the share and occupational structure of the non-farm population have gained importance, especially in developing countries (Cheng, Jungxiang, & Jianguo, 2018). Also very important at the national level are government economic policies, institutional and administrative changes, etc. Contemporary urbanization is completely different from classical historical patterns of growth in terms of *scale, pace, place, form* and *functionality*.

Some studies point to the action of *two essential categories of forces*: those of *urban planning*, which shape the relationship between urbanization and the environment, desirable to be integrated with the principles of sustainable development through synergetic adaptation strategies; those of *agglomeration*, often out of control, which lead to the geographical concentration of economic activities at various scales (Seto, Sanchez-Rodriguez, & Fragkias, 2010). This vision is in the spirit of the new economic geography which distinguishes *the dispersive forces of* human activities (cost of land, availability of land, existence of natural resources) from the *concentrating forces* (production linkages, markets, diversification of activities, spatial competition, returns to scale, specialization, creativity and innovation, etc. In this way, natural advantages, with all their ambiguous role, internal market effects, consumption opportunities, all contribute to agglomeration through the formation of regional networks or *clusters* that generate a dominant global trend, stimulating urban growth with massive environmental implications (Schmutzler, 2002).

One should also not lose sight of the push (*restrictive*) factors of the urbanization process, seen as a change over time in the size, density and heterogeneity of human settlements. Thus, authors (Tonne, et al., 2021) consider that in addition to the positive factors of urbanization (demographic growth, economic development, good governance), factors such as poverty, territorial conflicts, social disruption, unemployment, extreme weather events or, especially, income disparities cannot be ignored urban attractiveness is currently enhanced primarily by economic opportunities (diversified jobs and high wages) and access to modern services or facilities

The dissociation between urban population growth and the spatial extension of urban agglomerations has become increasingly difficult, the latter being strongly correlated with the demographic explosion in developing countries and with the changing lifestyles in developed countries (motorization, suburbanization, gentrification). Urban sprawl, by which is meant the extension of built space beyond the administrative boundaries of the city, can be seen as a decentralization of residential space, services and related structure that has led to the coalescence of traditional forms of transition to the countryside (suburbs) through processes of diffusion of reticular or sprawling form (Weir, Wolman, & Swanstrom, 2005). Over time, these lead to the emergence of urban regions (areas), monocentric agglomerations, conurbations, etc. The decentralization of population and labor force implies the formation of *polycentric local systems* that tend to replace the old hierarchical organization. The main effect of this trend can be observed in the increasing social and spatial fragmentation of contemporary urban agglomerations (Dematteis & Governa, 2001). This situation, long specific to North America, has generalized globally, with the area of urbanized land increasing in proportion to, but faster than, population growth. Marshall formalized this process mathematically ($A=P^n$, where A is the area, P is the population and ^{n} *is* an exponent that usually depends on the level of socio-economic development) (Marshall, 2007). The correlation between urban *sprawl* and the human development index has been observed in large global studies, explaining the very rapid rate of increase in space consumption in Europe after 1990 (Behnisch, Krüger, & Jaeger, 2022). The need for a balance between quality of life and land use for sustainable development is urgent, especially in densely populated regions with high greenhouse gas emissions and low availability of ecosystem services. Urban concentration plans to limit land consumption are underway in the Netherlands for example, especially in peripheral areas of agglomerations where facilities are diversified while respecting natural and landscape values (Broitmann & Koomen, 2015). Concerns in this regard are also manifest in countries that have recently undergone alert urbanization, including authoritarian regimes that have overseen the process of urban agglomeration sprawl, such as China (Huang & Liu, 2021). But even in such situations, the dynamics of urban sprawl can spiral out of control, subjecting itself to the same dispersion tendencies that have long been manifest in Western states. One-off studies of very large urban agglomerations have demonstrated this trend, such as the Chinese metropolis Wuhan where a proximity effect has been observed that pushes the edges of the agglomeration further and further away from its center (Jiao, et al., 2018).

Although considered outdated (Billen, Garnier, & Barles, 2012), the concept of *hinterland* becomes important in this context. In the past, relations between large cities and their neighboring territories was much closer, the latter being structured to meet supply needs (food, energy, water or labor, etc.). With globalization, cities seem to have become mere nodes in a worldwide network of trade (Short, Breitbach, Buckman, & Essex, 2000). The urban dispersion of recent decades, however, expresses new aspirations to reconnect the city, whatever its size, with the surrounding area. It is in fact the product of a *transition from the compact, mono-centered and highly densely populated compact city to the semi-compact or dissociated city of intermediate density* (Salvati, Morelli, Rontos, & Sabii, 2013). This transition seems to be completed in the United States, where it is more likely to be a filling of available spaces within the agglomeration or a restructuring of those already occupied. In developing countries, however, the transition is at an early stage, with demographics and economic conditions still the key drivers (Kuang, Chi, Lu, & Dou, 2014).

The conversion of land area to urbanized space is a process with irreversible impacts on the biosphere, affecting local climate, fragmenting natural habitats, reducing biodiversity. All studies that have used satellite imagery to observe such transformations certify this impact (Seto, Fragkias, Güneralp, & Reilly, 2011). The cited authors, studying the period 1970-2000, observed a 58 000 km^2 increase in the area occupied by cities in India, China and Africa alone. The highest rate of expansion, however, was in North America, exceeding the rate of urban population growth. There is an increasingly strong correlation with growth in gross domestic product everywhere. Alongside this, international capital flows, the informal economy, land-use policies, and transportation costs have also become very important, factors that have been too little studied. Average forecasts by the same authors estimate that by 2030, the land area occupied by urban areas will exceed 5 000 000 km^2, of which one third will be due to the expansion between 2010 and 2030, mainly in developing countries. There is a lack of understanding of how urban population growth will affect the expansion of the territory occupied by cities in the future. The *population growth/economic growth* dilemma persists, even though some large studies with representative samples show a relative importance of both factors (Peterson, 2017). Level of development and good governance are essential criteria for balanced development and after 2000, the effect of gross domestic product growth on land consumption seems to dominate (Mahtta, et al., 2022). For example, in Africa, the urban population grew at a rate of 4.91% per year between 2001-2019 and the area occupied by cities by 5.92% per year, with a particular intensity in countries with large populations (Nigeria, D.R. Congo, Ethiopia), the environmental effects being far from known (Bloch, Monroy, Fox, & Ojo, 2015) (Jiang, et al., 2021). In Europe, after a massive expansion (78% increase between 1950−2010, with only 33% in population), the process has reached saturation. Comprehensive strategies to reconsider urban-rural relations are needed for a sustainable future: better coordination of transportation; use and planning of greenfield land; urban isolation and densification through the development of a green compact city; preservation of blue and green infrastructure; saving agricultural land and promoting local agricultural production; reducing urban-rural disparities, etc., coordinated by *strengthening governance at regional level* (Nillson, Nielsen, Aalbers, Bell, & Boitier, 2014).

As a result, the study of urban dynamics is becoming increasingly complex and the trends observed can often appear contradictory and unpredictable, limiting the ability to forecast. The global divergences manifested as an effect of asynchronous driving forces are also felt at the national level. Thus, Kroll and Kabisch show that the impact of the consequences induced by the changes manifested in Germany's urban dynamics is dependent on the differentiated way in which demographic developments are managed, especially in terms of labor migration (Kroll & Kabisch, 2012). Processes such as ageing or demographic decline affect both growing and shrinking regions, proving once again the existence of systemic particularities.

Beyond this complexity, the issue of urban dynamics can be addressed at a global level. At least at the level of large urban agglomerations, as argued by some authors (Novotný, Chakraborty, & Maity, 2022), similar global macro-models of urban growth can be identified, based on three consecutive processes: *suburbanization*; *expansion towards the edges*; *filling of the interstices*.

Using an urban scaling model they have identified two effects that can predict the expansion of urban space: the *agglomeration effect* (increase of built space based on available floor space) and the *hinterland effect* (land availability in the neighboring space). The agglomeration effect is essential for the process of filling in the interstices and the hinterland effect for the expansion of the edges and peripheral spaces. This is contrary to the view that the formation of urban agglomerations is a *diffusion-coalescence* process that develops simultaneously (Li, Li, & Wu, 2013). Urban sprawl has been resiliently adaptive, with large metropolises appearing in deserts (Dubai, Las Vegas) or in small coastal areas (Singapore, Hong Kong). Fears that urban sprawl in developing countries may reduce agricultural production possibilities are considered unfounded by many authors, given the contradiction between developed countries (where the area occupied by cities increased 1.8 times between 1990-2015 while population grew only 1.2 times) and developing countries (where the same indicators increased 3.5 and 3 times respectively, starting from a much lower level). The example of countries such as India and China is invoked, where alert urbanization has not led to a reduction in food availability; on the contrary, by using superior agro-techniques they have ended up with surpluses on some levels (Zhang, Wang, Xie, Rao, & He, 2020). The process of urbanization of the two demographic giants is considered by the authors as the key factor that will shape the new configuration of the world in the 21st century.

The objectives of the study, as foreshadowed by the literature review, propose a geographical perspective. The main aim is to test the extent to which *the geographical position expressed by morphological and climatic characteristics or by the manifestation of certain risks is a favorable or restrictive factor* for the evolution of the two essential elements that determine urban dynamics: demographic growth and economic dynamics expressed by the level of Gross Domestic Product.

The main hypothesis of the study postulates that, in line with the results of other studies, *demographic growth is determinant especially for developing countries and the level of Gross Domestic Product for developed* and, increasingly, emerging *countries*. At the same time, a secondary hypothesis was also tested: *rapid urban population growth is primarily concentrated in areas marked by natural or man-made hazards*.

MATERIALS AND METHODS

It has become evident that in the current context it is difficult to approach the issue of urban dynamics other than through the prism of *spatial forms of agglomeration* (metropolitan areas, agglomerations, etc.), especially in comparative studies. Some authors attest that these forms of agglomeration are faced with the prospect of continuous expansion of the surface and intensity of spatial use leading to the increasing manifestation of climatic excesses (Wernstedt & Carlet, 2014). Thus, with these points of support, which constitute only a tiny part of the vast specialized literature, the database set up to analyze population dynamics and a series of determining factors used *urban agglomeration* as a unitary spatial support. This was defined in terms of the *potential distance of interaction with the neighboring space*, closely dependent on population density. A number of *2015 agglomerations* have been identified, with a lower limit of 500 000 inhabitants, considered relevant to express the capacity of integration into the higher hierarchical levels of the global urban network. The calculation of this distance is based on the following mathematical model:

$P_{1\ldots n} = (\pi r^2_{1\ldots n})*100+k,$ where P is the population, r *is the* radius of the circumscribed circle and k is a correction coefficient, calculated as follows:

$k =(n-1)* (\pi/4*100)$, where n *is* the correction coefficient of the previous distance expressed in km. Its multiplication by the fourth of π expressed in percent is based on the evidence that with distance there is an increase in the polarized population.

This mathematical model takes into account both the decreasing attractiveness with distance from the center and the increasing attractiveness with the size of the center of attraction (*figure 1*). All potential agglomerations were thus identified according to the limit up to which the polarization capacity can be expressed. In the case of densely populated areas with a dense urban network,

complex aggregates, centered on the most populated city, were thus formed. Agglomeration capacity increases as the population of the center becomes denser and more numerous, depending on the level of population density in the hinterland.

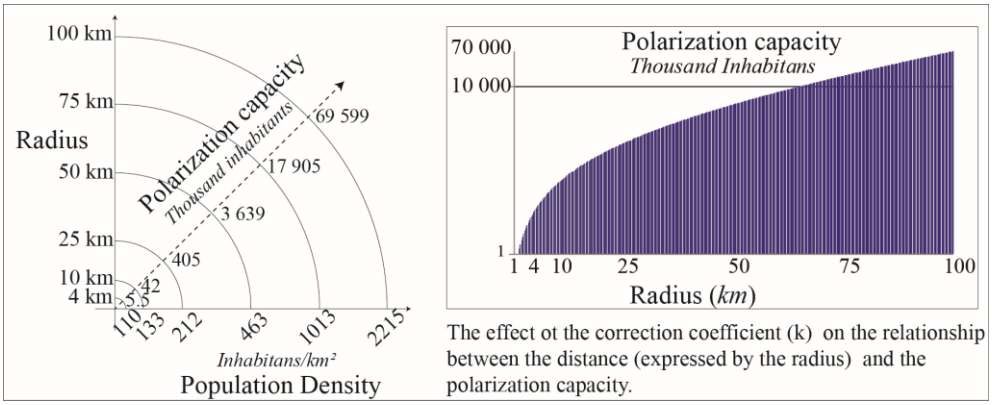

Figure 1. The model of the delimitation of the maximum polarization capacity of the urban agglomeration centers retained for analysis
(Source: own design)

For the *descriptive analysis*, information on the population of each agglomeration has been aggregated from 1980 onwards, every ten years until 2020. The study period selected, 1980-2020, corresponds to a period for which information from various databases was accessible. The population for the 5 points in time was aggregated using the following source of information: *Citypopulation (www.citypopulation.de)*, which collects detailed official data for all states and territories in chronological profile, in tabular or cartographic format. Data collection started in 2010, with the currently available form removing information older than three decades. *The websites of the national statistical institutes* were also consulted to fill in missing information, in particular information from censuses conducted after 1980. From the primary database, a derived database was obtained by interpolation, adjusted to the same time benchmarks (1980, 1990, 2000, 2010, 2020). These were used to calculate *the average annual* population *growth rate (APG)* for each decade, according to the relation: $APG= ((P_1-P_0)/10)/((P_0+P_1)/2)$. Values are expressed as percentages and were standardized with Z-scores to eliminate extreme variations. They were used to identify patterns of urban growth and the dynamics of the agglomeration process. The statistical procedure used was AHC (agglomerative hierarchical clustering), available in the program Xlstat (https://www.xlstat.com), 2014 edition. The typological analysis retained 6 distinct classes, with a clearly outlined profile and a strongly regionalized distribution.

For the *multivariate analysis*, information on geographical position, predominant climate type, hierarchical position in the proximity network, natural and anthropogenic hazards, population growth, gross domestic product were used. The decadal average rate of population growth served as the dependent variable in a PLS (partial least square regression) analysis using a number of explanatory variables (Table 1). The data processing used the same Xlstat.

Table 1. Variables used in the multivariate analysis

Variables	Measurement unit/ Calculation method	Data source	Reference year/period	Standardization
Average annual population	%	(Brinkhoff, 1998-2025)	1981−1990; 1991−2000; 2001−2010; 2011−2020	Z score

growth rate (APG)				
Population density of agglomeration (DNS)	inhabitants/km^2	Own calculation	1990, 2000, 2010, 2020	
Average distance to neighboring agglomerations (ATN)	Km	(Great World Atlas, 2002)	Invariable	
Primacy index (PRM)	*Pna/Pa*, where *Pna* is the sum of population fo neighboring agglomerations and Pa, population of the agglomeration concerned	Own calculation	1990, 2000, 2010, 2020	
Gross domestic product (GDP)	USDppa/inhabitant	(Countries by GDP Growth, 1980-2024) (Worldbank, 2023)	1990, 2000, 2010, 2020	
Rate of Natural Increase (RNI)	‰	(World Population Data Sheet, 1990-2024) (Demographic Yearbook, 1979-2022)	1981−1990; 1991−2000; 2001−2010; 2011−2020	
Share of crowded population outside the center (SCP)	%	Own calculation	1990, 2000, 2010, 2020	
Geographical position (GPS)	Factorial score: 1 = estuary, delta, strait; 0.9 = coast; 0.8 = major confluence in plain; 0.7 = plain; 0.6 = contact plain/uplands; 0.5 =major confluence in hill area; 0.4 = hill area; 0.3 =mountain valleys; 0.2 = mountains -	own estimation using Great World Atlas and Google Maps	Invariable	Factorial Score
Climate type (CLM)	Factorial score: 1 = equatorial; 0.9 = tropical humid; 0.8 = subtropical humid; 0.75 = tropical dry saison; 0.7 = temperate humid; 0.6 = temperate continental; 0.5 = subtropical arid; 0.4 = tropical arid; 0.3 = temperate arid; 0.2 = boreal humid = 0.1;= boreal continental	own estimation using Great World Atlas and Google Maps	Invariable	
Incidence of Natural Risks (INH)	Factorial score: 1= presence; 0 = absence. Six categories were considered: seismic risk; volcanism; geomorphological risk; flood risk; sea level rise; heat waves and wildfires;	(Shi & Kasperson, 2015)	Invariable	average of the factor score specific to each risk category

Incidence of Anthropogenic Risks (IAR)	Factorial score: 1= strong incidence; 0 = low incidence. Three categories were considered: political regime change; military conflicts; terrorism and endemic criminality.	(World Population Review, 1980-2024) (Quality of Life Index by Country, 1990-2024)	1981−1990; 1991−2000; 2001−2010; 2011−2020	

We point out that the area needed to compute the DNS variable was calculated according to the potential interaction distance mentioned above. This resulted in identical areas for agglomerations of the same size. In case of interference of agglomerations or peripheral position (coastal, border), corrections were necessary, using the facilities provided by Google Maps. Regarding the ATN variable, the average distance to the 6 nearest agglomerations was estimated, irrespective of the natural barriers present, according to the situation at the end of the study period. Regional average values were used as far as possible to calculate the RNI. In the case of seismic and volcanic hazards, specific events over the last 100 years were taken into account, and for the other natural hazard categories, the incidence during the study period. For anthropogenic hazards, the events in each decade, their frequency, were taken into account.

The dependent variable (APG) was calculated for each reference period (1981-1990; 1991-2000; 2001-2010; 2011-2020), and 4 multiple regressions were carried out in order to follow the dynamics of the influence of the descriptive variables over time. Separate analyses were processed, both for all the 2015 agglomerations under consideration and by categories expressing major socio-economic disparities: developed countries; developing countries; Sub-Saharan African countries. The multivariate analyses were primarily aimed at the correlation between variables, the validation of the results being guided by the coefficient R^2.

RESULTS

A synthetic picture of the dynamics of the process of urban agglomeration, as defined, as an expression of the combination of the actual process of urbanization and the process of human agglomeration generated by the increase in the potential for interaction as a result of the massive densification of immediately neighbouring areas, is provided by the evolution of the number of agglomerations at the continental level. A first conclusion is that their number is steadily increasing from 1164 to 1975 between 1980-2020 (*see Table 2*). The difference to the total number of agglomerations taken into account (2015) is due to the progressive fall below the 500 000 inhabitants limit in 40 cases, mainly located in Europe.

Table 2. Numerical evolution of major urban agglomerations at continental level
(Data source: see Table 1)

Continent	Year	Size category (millions inhabitants)									Total
		0.5-1	1−2	2−3	3−5	5−10	10−20	20−30	30−50	>50	
Europe	1980	106	52	13	11	6	4	0	0	0	192
	1990	124	51	17	11	7	4	0	0	0	214
	2000	125	56	18	10	6	5	0	0	0	220
	2010	115	64	21	9	7	5	0	0	0	221
	2020	118	66	17	12	9	5	0	0	0	227
America	1980	66	43	18	10	6	4	0	0	0	147
	1990	91	44	21	12	7	4	1	0	0	180
	2000	97	52	18	25	7	4	2	0	0	205
	2010	106	59	24	24	12	4	2	0	0	231
	2020	130	67	26	28	14	5	2	1	0	273

Asia-Oceania	1980	303	198	64	69	66	18	3	2	0	723
	1990	336	220	83	77	78	26	4	3	0	827
	2000	379	252	92	88	83	37	6	6	0	943
	2010	423	279	97	102	87	45	10	7	1	1051
	2020	471	298	127	95	95	51	14	5	6	1162
Africa	1980	57	25	12	4	3	1	0	0	0	102
	1990	65	38	12	11	5	0	1	0	0	132
	2000	84	46	17	15	8	1	1	0	0	172
	2010	113	54	21	20	12	2	0	1	0	223
	2020	167	74	20	25	17	9	0	1	0	313
WORLD	1980	532	318	107	94	81	27	3	2	0	1164
	1990	616	353	133	111	97	34	6	3	0	1353
	2000	685	406	145	138	104	47	9	6	0	1540
	2010	757	456	163	155	118	56	12	8	1	1726
	2020	886	505	190	160	135	70	16	7	6	1975

This growth was primarily due to Asia (in absolute terms) and Africa (in relative terms). Europe was relatively stable and the Americas were in between. There were significant changes in the size distribution, with a rapid increase in the number of giant agglomerations (over 20 million inhabitants). Absent in Europe, a densely populated continent compared to the world average, and rare in the Americas, these agglomerations are specific to Asia, in line with the human agglomerations in the deltaic and coastal areas of monsoon Asia. In Europe and Africa, most agglomerations are smaller (less than 1 000 000 inhabitants), which can be explained by the age and density of the urban network and, in contrast, by later urbanization. Initially, the world's largest agglomeration was the Japanese capital, Tokyo, which has gradually lost ground to other metropolitan areas favored by the demographic explosion: four in the Indian subcontinent (Delhi, Calcutta, Patna and Dhaka, the last of which is now the largest), one in the Indonesian archipelago (Jakarta) and another in southern China (Guangzhou), all with more than 50 million inhabitants. The excessive agglomeration of the human population on a relatively small area is evident, the share of the occupied area has increased steadily, but much slower than the agglomerated population (30% compared to 108%), also visible in the significant increase in density (see Table 3).

Tabel 3. Changes in the surface area and population of urban agglomerations (1980-2020)
(Source: see Table 1)

Year	Corresponding surface area (km²)		Population of agglomerations		Density
	thousands km²	% of total	Millions inhabitants	% of total	Inhab./km²
1980	6753.8	5.0	2509	56.4	372
1990	7339.6	5.5	3088	58.6	421
2000	7847.8	5.8	3761	61.8	479
2010	8297.2	6.2	4445	64.4	536
2020	8812.1	6.5	5206	67.4	591

Basically, more than two-thirds of the world's current population is crammed into just 6.5% of the Earth's land surface (excluding Antarctica). On the face of it, the spatial footprint of large human agglomerations is not necessarily excessive. But their impact in terms of the demand for resources that ensure a high level of development is enormous, reflected in increasing amounts of greenhouse gas emissions, multiple pollution, reduced biodiversity through shrinking natural ecosystems, etc. The trends of continued concentration of the global population in a few thousand significant agglomerations, extending the rates of evolution of the last decades, will lead to the

occupation, by 2050, of probably around 7.5% of the terrestrial land surface and more than 3/4 of the human population, which will increase by about 20% anyway. The likelihood that many smaller agglomerations, at least in Africa but also in Asia and Latin America, will exceed the 500 000 population threshold must also be taken into account. These may add at least 10% to the above weights. The human pressure of the 7-8 billion people who will live in large agglomerations will increase further as access to the benefits of a modern lifestyle becomes more democratic, even if socio-economic disparities will persist. The world of the future belongs to these human agglomerations, clustered in more or less dense networks, interconnected in what some have long called the 'ecumenopolis' or 'global city' and is considered 'humanity's greatest invention' (Wilson, 2021).

Typology of population dynamics of urban agglomerations

The profile of the types retained from the AHC analysis is very clearly personalized, with a specific growth rate. It generally follows a progressive decreasing trend, with the exception of types 4 and 5, which have diverged (Figure 2).

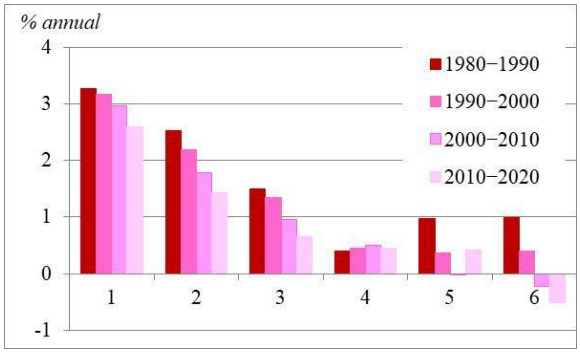

Figure 2. Typology of the evolution of the average annual population growth rate of large agglomerations (*Data source: see Table 1*)

The first three types have recorded high APG values, with type 1 permanently above 2.5%. The steady growth rate follows a similar pattern. Accounting for 3/4 of the total number of agglomerations considered, they are dominant worldwide.

Types 4,5 and 6 are less common and have an equal share. Each one expresses specific ways of adapting to the context of the completion of the demographic transition, the expansion of peri-urban areas and the knowledge and innovation-based economy. Type 4 is an active adaptation, maintaining attractiveness at a modest but constant level. It expresses a high potential for innovation characteristic of the smart city concept and is more common in North America and Western Europe. Type 5 is a particular case, deeply marked by the crisis of the first decade of this century but which has subsequently managed to adapt, approaching the growth pattern of type 4. It is common in Southern and Eastern Europe. The last one, type 6, is the vulnerable variant of the previous type, deeply marked by the crisis, with no chance of improvement for the time being.

The spatial distribution of these types thus indicates a strong regionalization, which attests to the importance of changes in the political and economic-social system. In Europe, the last three types clearly predominate, reflecting the early completion of the demographic transition, with natural growth no longer able to sustain urban expansion. Based on exogenous flows, urban population growth continues at a moderate level in most agglomerations in the west of the continent, while the east, beyond the former "iron curtain", with the change of political regime in 1989, enters a phase of deterioration of economic structures, generating a real dynamic gradient (Kröhnert, Hossmann, & Klingholz, 2008). The negative effects of the transition to a market economy have been stronger in highly industrialized agglomerations (e.g. Donbas, Silesia) than in capital cities or regional centers with diversified economies that were able to gradually recover, after 2010 in

particular, from the shock of the fall of communism (Sandu, Bănică , & Muntele, 2021). Isolated, some capitals (Moscow, Minsk, Madrid) or some coastal agglomerations have experienced sustained growth, in line with type 3 (Figure 3). The local geographical context is very important in the south of the continent, explaining the differences between agglomerations that apparently have the same socio-economic data, such as Barcelona, Rome or Athens (Ciommi, Chelli, Carlucci, & Salvati, 2018). The contrast observed between Europe and neighboring regions (Near East, Maghreb) is very strong.

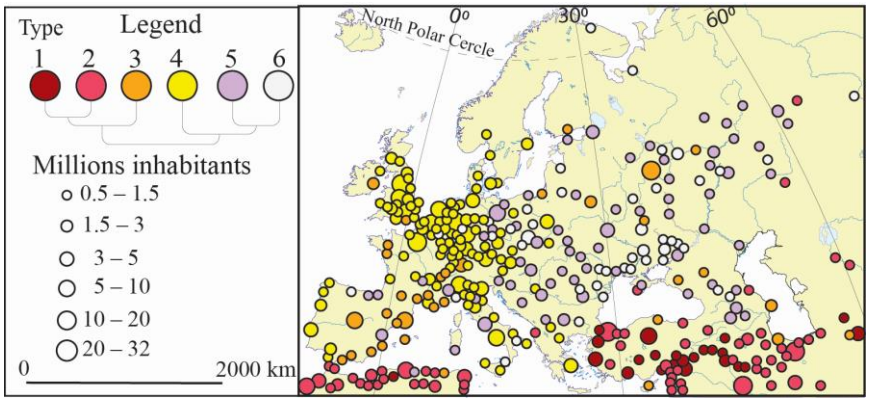

Figure 3. Typology of population evolution of urban agglomerations in Europe
(*Data source: see Table 1*)

In Asia, the typology shows a much more complex evolution, depending on demographic growth, the precocity of industrialization in some regions or the favorable geographical position in relation to the major maritime transport axes (see Figure 4). The strongest growth is observed in areas that preserve an exceptional demographic potential (the north of the Indian subcontinent, the Philippines, some areas of Indonesia, Central Asia, etc.) or express the unprecedented development of industrial-port infrastructure (the Pearl River and Yangtze deltas in China). Intermediate values, corresponding to types 2-3, have a high frequency, especially in the Indian subcontinent, where a gradual north-south disposition is observed, closely linked to the advance of the demographic transition in the south. In East Asia there is a predominance of types 3, 5 and 6, correlated with the size hierarchy. Large agglomerations usually manage to maintain higher growth than smaller ones (Beijing in North China, Seoul in Korea or Tokyo in Japan). China's marginal areas have seen a significant expansion of agglomerations (Inner Mongolia, Xinjiang, Yunnan), reflecting the preservation of a more sustained population growth, but also massive colonization by Han people. The south-east coast of China as a whole is much more dynamic than the inland areas, which are more reminiscent of Eastern Europe, with the predominance of types 5 and 6.

This crisis of more modest agglomerations in inland China is also linked to the demographic policy of the Chinese state but also to the strong migration to increasingly economically advanced coastal areas (Chen, 2013). The Yangtze basin (including the southwestern province of Sichuan) seems to be a marked axis of recovery in the last decade, as in similar areas in Eastern Europe. This situation can also be explained by the diffusion of industrial and service development from the more expansive metropolitan areas (Chengdu and Chongqing in Sichuan, Wuhan on the middle Yangtze or Shanghai and Hangzhou in the delta area). Turning the wide river valley into a development axis may be a counterweight to the overdevelopment of the south-eastern coastal zone. Recent studies confirm this hypothesis of the formation of a so-called *Yangtze Economic Belt* (Ren, Tian, & Xiao, 2022). Important disparities are also evident in other Asian regions. For example, in Indonesia, the central-eastern part of Jawa Island is clearly distinguished by belonging to moderate-dynamic types

that express the overpopulation of the island and the tendency of population migration to the more sparsely populated islands in the north and east of the archipelago or to the huge agglomeration of Jakarta (Pravitasari, el al., 2015). Such differences are also observed in Indochina between the more dynamic coastal zone and the interior. Japan and South Korea resemble in the arrangement of types more closely to Western Europe or North America.

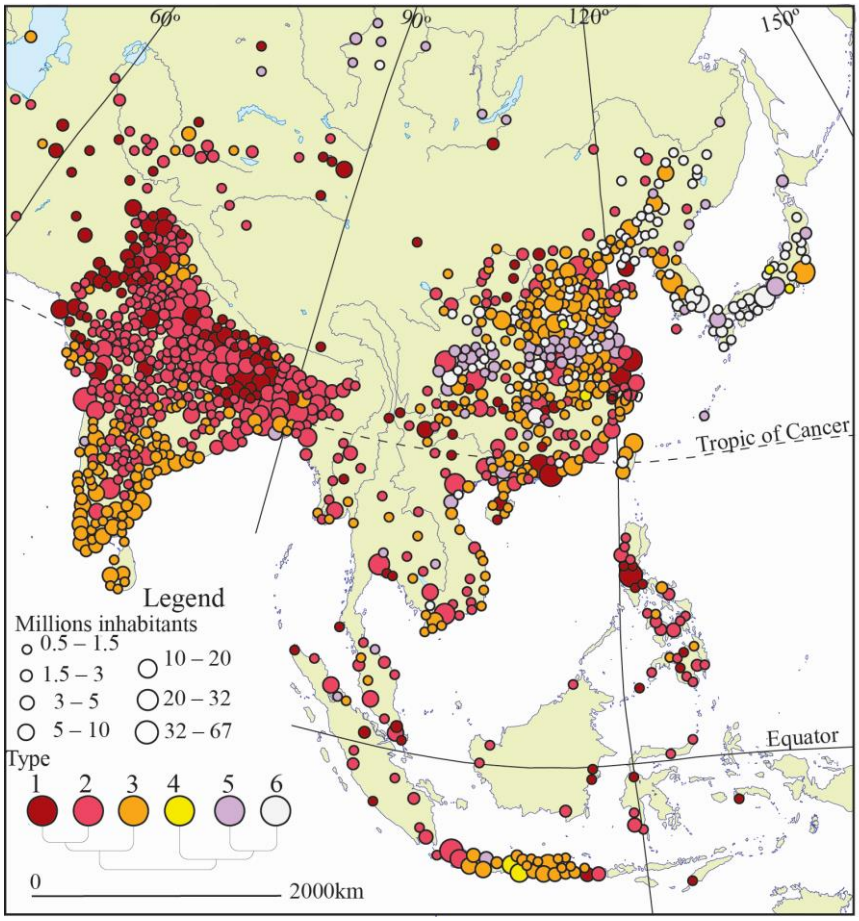

Figure 4. Typology of population evolution of urban agglomerations in South and East Asia (*Data source: see Table 1*)

For America and Oceania, the situation is somewhat similar to that in Asia. The earlier urbanized and industrialized areas (north-eastern United States, the Great Lakes area, etc.) have developed in a similar way to Western Europe, in contrast to Central America where the more dynamic types predominate (see Figure 5).

In contrast to Asia, the large urban agglomerations in Latin America (Mexico City, Sao Paolo, Buenos Aires, Caracas) have slowed their rate of demographic expansion, expressing a state of saturation. In Brazil, the inland agglomerations are the most dynamic (Manaus in the heart of the Amazon, Brasilia enjoying the status of capital city, etc.), as are many smaller agglomerations in the Andean or Central American countries. It may be the expression of a lower demographic pressure, in the context of a sparse population massively concentrated in coastal areas.

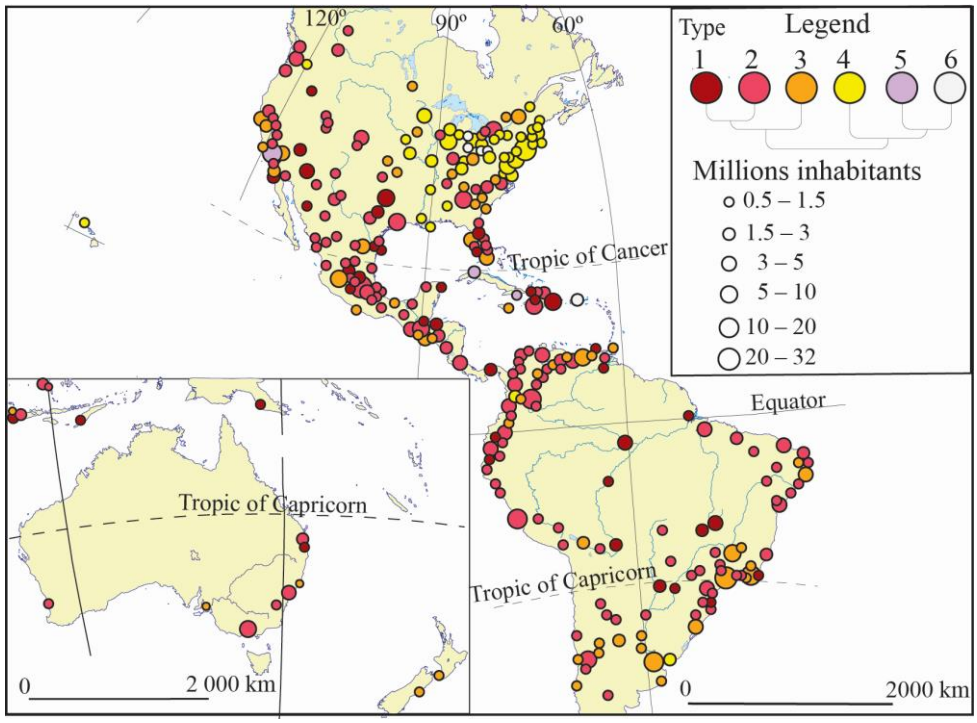

Figure 5. Typology of population evolution of urban agglomerations in America and Oceania (*Data source: see Table 1*)

In contrast to Asia, the large urban agglomerations in Latin America (Mexico City, Sao Paolo, Buenos Aires, Caracas) have slowed their rate of demographic expansion, expressing a state of saturation. In Brazil, the inland agglomerations are the most dynamic (Manaus in the heart of the Amazon, Brasilia enjoying the status of capital city, etc.), as are many smaller agglomerations in the Andean or Central American countries. It may be the expression of a lower demographic pressure, in the context of a sparse population massively concentrated in coastal areas.

In North America, the contrast between the north-east and the south-west continues, with the newer agglomerations on the Pacific coast or in Texas and Florida being much more dynamic. However, the giant agglomerations (like Los Angeles) have reached the limits of population expansion. In Canada, the same contrast is less visible, with Vancouver in the extreme west forming, along with Seattle and Portland in the north-west of the USA, a veritable highly dynamic urban axis. In Oceania, the situation appears much more balanced, with moderate or moderately-dynamic growth, without strong regional or hierarchical differentiations.

Africa presents the most interesting case, along with the Middle East, with the predominance of explosive growth, in line with a delayed demographic transition, against a background of incipient urbanization (see Figure 6).

In sub-Saharan Africa, types 1 and 2 predominate (the latter especially in the economically more advanced extreme south), while type 3 is rarely present. Two broad groupings are distinguished in the first place: that centered in Nigeria, extending along the Gulf of Guinea coast westward; that around the Great Lakes, especially Lake Victoria in eastern Africa. Add the Nile Valley in Egypt or the Maghreb coast. These are similar to those of Monsoon Asia, with densely populated rural areas, and are of interest because of their potential for development, mainly due to their abundant labor force. Other significant urban networks are also taking shape, such as the Abyssinian Plateau or the Congo river basin (controlled by the large conurbations of Kinshasa and Luanda) and others.

In the Arabian peninsula, adjacent to Africa, despite the restrictions imposed by the physical-geographical context, several concentrations have developed. The most well-defined is the one on the southern coast of the Persian Gulf, somewhat linked to the ancient urban systems of Mesopotamia and Iran. Dubai is emerging as one of the most dynamic conurbations in the world, with all the prerequisites to prevail over other large conurbations on the peninsula, such as Riyadh. The dynamics of urban agglomerations in the periphery of the Middle East (Levant, Iran) are more moderate, reflecting the decline in population growth but also the presence of a denser urban network with many small and medium-sized towns.

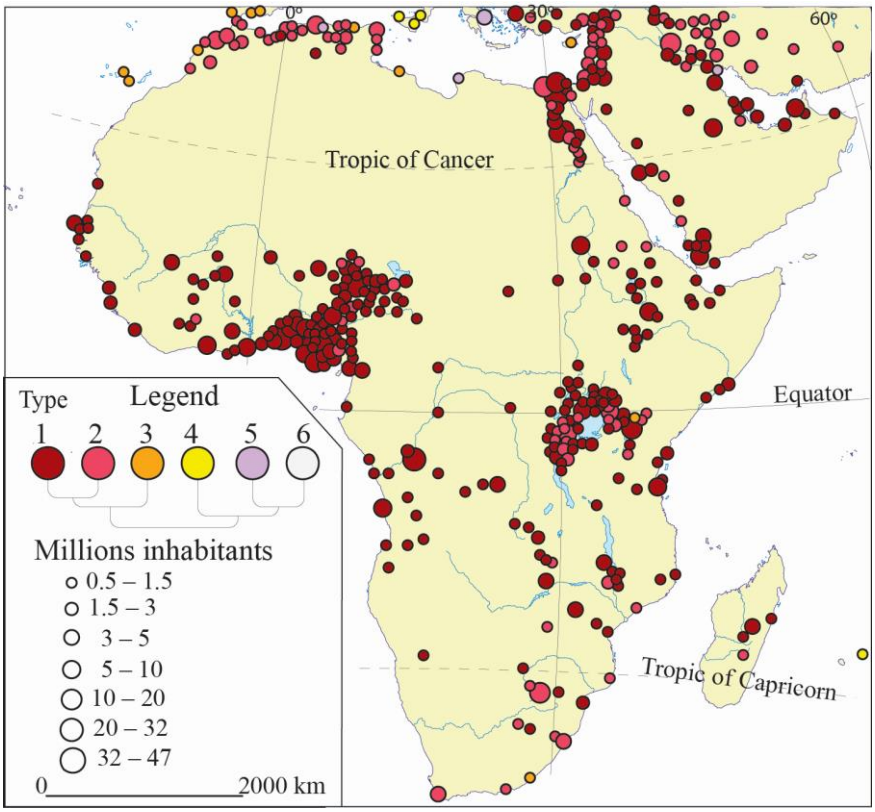

Figure 6. Population typology of urban agglomerations in Africa and South-West Asia (*Data source: see Table 1*)

Africa's urban expansion is inevitable, growth rates may record exceptional values since so far growth has been based more on natural dynamics, with rural exodus on the rise. Some studies point to a trend towards smaller, compact cities that are more manageable in the absence of efficient infrastructure. This development is desirable in Africa in order to avoid the chaotic development that has so far characterized the expansion of capital cities (Linard, Tatem, & Gilbert, 2013).

Multivariate analysis

The variables used to test how the driving factors of urban dynamics manifest themselves were synthesized on the basis of information collected from various sources as presented in the methodological chapter

Analyzed individually, these variables exert a clear influence on urban dynamics, expressed in terms of the average annual growth rate (see Table 4).

Table 4. Evolution of average annual population growth rate by explanatory variables (*Data source: see Table 1*).

Average annual population growth rate in %					**Average annual population growth rate in %(APG)**				
Category	1981-1990	1991-2000	2001-2010	2011-2020	Category	1981-1990	1991-2000	2001-2010	2011-2020
Average distance to neighboring agglomerations in km					0.8	1.82	1.76	1.40	1.43
46 – 100	0.7	1.50	1.10	1.08	0.7	1.61	1.58	1.43	1.08
101 – 200	0.6	1.75	1.41	1.26	0.6	1.47	1.47	0.99	0.93
201 – 300	0.5	1.65	1.63	1.35	0.5	1.60	1.49	1.24	1.51
301 – 500	0.4	1.87	1.74	1.63	0.4	2.10	1.84	1.68	1.52
501 − 1000	0.3	2.07	2.04	1.96	0.3	2.20	1.93	1.59	1,47
1000-4114	0.2	1.90	2.10	1.91	0.2	2.31	2.17	1.63	1.58
Primacy index					Climate type (factorial score)				
0.02 − 0.25	1.76	1.62	1.20	0.97	1	2.26	2.08	1.86	1.61
0.26 − 0.50	1.68	1.50	1.23	1.10	0.9	2.19	2.03	1.64	1.42
0.51 – 1	1.78	1.64	1.31	1.19	0.8	2.45	2.21	1.96	1.69
1.01 – 2	1.71	1.64	1.38	1.27	0.75	3.03	2.75	2.56	2.32
2.01 − 5	1.74	1.84	1.59	1.37	0.7	1.39	1.55	1.06	1.12
Over 5	1.94	1.85	1.63	1.55	0.6	2.33	2.03	1.02	1.58
GDP, ppa in 2020 (thousand USD/inhabitant)					0.5	0.68	0.64	0.45	0.55
0.57 – 2	3.02	2.96	2.81	2.76	0.4	0,98	1.01	0.75	0.48
2.01 – 5	2.59	2.37	2.12	1.84	0.3	1.85	1.69	1.52	1.41
5.01 – 10	1.76	1.70	1.27	1.21	0.2	0,86	0.35	0,75	1
10.01 – 25	1.87	1.87	1.51	1.34	0.1	1.35	0,05	0,47	0,81
25.01 – 50	1.47	1.09	1.15	0.95	Incidence of Natural Risks (factorial score)				
Over 50	0.91	1.02	0.93	0.88	0	2.03	1.68	1.47	1.25
Average rate of natural increase (in‰)					0 – 0.25	2.01	1.69	1.35	1.14
Negative rate	0.63	0.1	0.13	0.11	0.26 – 0,5	2.09	1.87	1.54	1.29
0 – 5	0.93	1.12	0.92	0.66	0.51 – 0.75	2.16	1.95	1.56	1.28
5 – 10	1.57	1.70	1.08	1.19	0.76 – 1	2.03	1.83	1.51	1.16
10 - 20	2.38	2.06	1.74	1.43	Incidence of Anthropogenic Risks (factorial score)				
Over 20	2.97	2.82	2.77	2.66	0	1.96	1.79	1.37	1.08
Geographical position (factorial score)					0 – 0.33	2.10	1.59	1.48	1.33
1	1.76	1.89	1.69	1.44.	0.34 –0.66	2.83	2.42	2.14	1.98
0.9	1.62	1.55	1.39	1.17	0.67 – 1	2.76	2.71	2.45	2.16

The distance from neighboring agglomerations creates a visible gradient, with the values of the pace increasing with increasing distance. This translates the modernity gap between intensely anthropized regions with a dense urban network and those where the urbanization process is at an early stage.

On the other hand, *the primationality index*, which expresses the potential dominance of the neighboring urban network, has a less constant influence. In the first period, there were practically no differences, the values of population growth being rather uniform, the urbanization process not being completed even in the most developed countries. Subsequently, however, there was a gradual differentiation in favor of the dominant agglomerations, with the size gradient being highly visible. This trend towards concentration of population in large metropolitan areas (mega-cities) has been manifesting itself in recent decades, thus contradicting Gibrat's law and, to some extent, the rank-size theory. This phenomenon is confirmed in studies conducted on large urban systems such as the Chinese one, where the exponential growth of the first 32 large agglomerations has been shown to

be exponentially increasing, far above planned projections and inversely correlated with city size (Shuqing, Decheng, Chao, & Yan, 2015).

Gross domestic product, often invoked as a driving force of urban dynamics, is strongly correlated with the rate of growth but inversely proportional, with the highest growth rates characterizing agglomerations with a low level of development. Beyond this, however, at the peak, the agglomerations with the highest levels of GDP are distinguished by the constancy of their growth, which in fact expresses their strong attractiveness. *Demographic growth*, another factor often cited as having a determining role, is clearly important, with the highest values being recorded in geographical areas strongly marked by demographic explosion. However, agglomerations with a low or even negative natural balance (as is increasingly the case in developed countries) are able to maintain moderate growth because of their attractiveness. We can speak of a genuine phenomenon of *compensation* on a global scale, through the generalized migration we have witnessed in recent decades with the democratization of the cost of travel. We may thus witness a convergence that will reduce the importance of demographic growth.

The invariant factors introduced in the model have rather a contradictory influence. It is certain that the favorable *location* (major confluences, coastal areas providing rapid access to the hinterland) is reflected in high growth rates, with most large agglomerations being located in such positions. They may, however, contradict the very high values in mountain or foothill areas, at least in the first decades. Later urbanization or the preservation of a traditional demographic behavior can be invoked in this respect. The evidence of a rapid decline in the rate of growth over time indicates a trend that is still in favor of areas with high interaction potential (plains, coastal regions). There is a latitudinal gradient in *climate* , with the rate of growth being much faster in the warm zone, at least in the first two decades, closely linked to global north-south development disparities. There is a certain fragility in cold climates, but also an apparent contradiction in the strong growth rate in arid (temperate or tropical) areas. The moderate and relatively constant values in humid temperate or transitional zones are explained by the low population growth in these areas, which cover the most developed societies. As in the case of geographical position, a trend towards homogenization seems to have been noticeable in the last decade when the only excessive growth values still characterized the arid zones. This seemingly irresistible attraction to warm arid climates is to a large extent due to the growing share of large human agglomerations in South-West Asia, North Africa and North America (Phoenix for example, one of the most dynamic agglomerations in the United States). Natural and anthropogenic *risks* also manifest themselves contradictorily in relation to the rate of population growth in urban agglomerations. In the case of natural hazards, the influence is minimal, with growth being relatively evenly distributed, irrespective of vulnerability to the various risks. In the case of anthropogenic ones, the maximum increase is concentrated precisely where the incidence is highest over the whole period. This apparent contradiction can be explained by the concentration of vulnerabilities in areas of high population growth, poor economic development, and high levels of inequality, which can be manifested in an upsurge in criminal activity or political instability.

The results of the multivariate analysis indicate a strong correlation between the variables considered in many other studies as determinants of urban dynamics: the level of population growth (expressed by the natural balance) and gross domestic product. The average distance between agglomerations, climate or anthropogenic hazards also shows a satisfactory level of correlation. The R^2 index shows a significant validity of the analysis at the global level (Table 5).

It can be concluded that the population expansion of urban agglomerations over the last four decades has generally been dependent on the factor that objectively drives growth, the natural balance. None of the other factors have recorded such high correlation values. Gross domestic product exerts an inversely proportional correlation, the higher it is, the more it tends to limit the demographic expansion of large agglomerations. The positive correlation of the average distance between agglomerations, even if not at a high level, indicates the presence of a certain tendency for "congestion" in densely populated areas, with expansion tending to occur in agglomerations with more space in their immediate vicinity. Climate had some influence before 2000, linked to the

population preference for more favorable climate types (humid, transitional) which were higher bonality in the model. In the last two decades, however, this dependence has shifted, with urban sprawl occurring despite climate limitations or associated natural hazards. This can only be a worrying development, with an *unprecedented increase in anthropogenic pressure on fragile environments* (coastal, flood-prone, rugged, subject to seismic and volcanic movements, etc.). This correlates with the growing influence of anthropogenic risks, concentrated precisely where the strongest urban sprawl is taking place. Indifference to variables such as population density, primacy index, share of agglomerated population in the area of influence or geographical location may be an effect of the ubiquity of the phenomenon of urban agglomeration at the global level, regardless of factors that previously restricted or favored human presence.

Table 5. Correlations between the evolution of the population growth rate of urban agglomerations and explanatory variables at the global level.

APG	*DNS*	*ATN*	*PRM*	*GDP*	*RNI*	*SCP*	*GPS*	*CLM*	*INH*	*IAR*	R^2
1980 – 1990	−0.14	**0.26**	0.01	**−0.29**	**0.65**	**−0.24**	−0.14	**0.23**	0.03	0.18	**0.43**
1990 − 2000	−0.04	0.15	0.03	**−0.32**	**0.67**	−0.05	−0.13	**0.23**	0.08	0.13	**0.39**
2000 − 2010	−0.04	**0.23**	0.04	**−0.21**	**0.65**	−0.09	−0.07	0.02	0.04	**0.20**	**0.39**
2010 − 2020	0.03	**0.25**	0.07	**−0.23**	**0.71**	−0.07	−0.10	−0.01	0.02	**0.26**	**0.45**

Analyzed by categories of countries, the correlation between the dependent and explanatory variables takes on new dimensions. Thus, in the case of *developed countries*, the validity of the model is higher, especially in the first decades, with a higher incidence than the global average in the case of gross domestic product or population growth in suburbs (Table 11).

Table 6. Correlations between the evolution of population growth rates of urban agglomerations and explanatory variables in developed countries.

APG	*DNS*	*ATN*	*PRM*	*GDP*	*RNI*	*SCP*	*GPS*	*CLM*	*INH*	*IAR*	R^2
1980 – 1990	0.19	−0.11	0.06	**0.57**	**0.48**	**0.34**	0.05	**0.31**	**0.27**	**−0.55**	**0.54**
1990 – 2000	**0.23**	−0.11	0.06	**0.57**	**0.61**	**0.33**	0.05	**0.31**	**0.27**	**−0.55**	**0.51**
2000 – 2010	0.14	**−0.30**	0.06	**0.42**	**0.62**	**0.20**	0.02	0.09	0.05	**−0.29**	**0.37**
2010 – 2020	0.10	**−0.35**	0.09	**0.40**	**0.64**	0.10	0.01	0.00	−0.01	−0.14	**0.43**

Most of the factors recorded, at least episodically, significant values, which shows that the proposed model is more adapted to the specific evolutions of developed countries. The population density or the share of population in peri-urban/metropolitan areas had a clear influence in the context of counter-urbanization, a term which is increasingly contested today, when we observe a revalorization of agglomeration centres. *The level of economic development is very important in advanced countries, with a share close to that of population growth*. The reasons for population agglomeration in large territorial structures are linked to income levels, access to basic services, etc. The average distance between agglomerations in developed countries is becoming increasingly important, disfavouring sparsely populated, isolated areas and favouring densely populated major urbanization axes such as the famous 'Blue Banana' or the megalopolises of North America and Japan. The influence of climate and natural hazards appears to be decreasing in developed countries, possibly as a result of global climate change awareness and the development of a more environmentally friendly attitude.

By contrast, in *developing countries*, the model used has less explanatory power, but there is an increasingly significant conformity with the global trends already presented (Table 7). Urban sprawl, initially less dependent on population growth, is now more closely linked to it. The influence

of the average distance between agglomerations is similar to the situation in developed countries, with densely populated areas (especially in Asia) certainly playing a determining role. The significant differences with the developed countries are certainly due to the economic and social disparities between them, which are in line with the early stages of urban transition.

Table 7. Correlations between trends in population growth rates of urban agglomerations and explanatory variables in developing countries

APG	*DNS*	*ATN*	*PRM*	*GDP*	*RNI*	*SCP*	*GPS*	*CLM*	*INH*	*IAR*	R^2
1980 – 1990	0.00	**−0.24**	0.01	−0.02	**−0.31**	−0.15	0.07	0.10	0.05	−0.08	**0.25**
1990 – 2000	−0.05	**−0.24**	0.01	−0.02	**−0.38**	**−0.21**	0.06	0.10	0.04	−0.08	**0.26**
2000 – 2010	−0.17	**−0.25**	0.09	0.12	**0.54**	−0.19	0.04	−0.16	0.09	**0.26**	**0.31**
2010 – 2020	−0.01	**−0.29**	0.12	0.16	**0.52**	−0.13	0.01	−0.17	0.08	**0.25**	**0.28**

Sub-Saharan Africa stands out in this category as a whole by showing a visible delay in the *relatively high correlation of the primaciality index*, corresponding to the excessive development of capitals to the detriment of regional centers, which is typical of the beginning of the urban transition (Table 8). The negative correlation with the geographical position in the first decade is explained by the incipient nature of the urbanization process as well as the share of the population in metropolitan areas, which are disadvantaged in this phase by strong disparities with respect to agglomeration centres. It is interesting to note the evolution of natural risks, which were initially positively correlated, indicating a certain indifference. Gradually, they have moved to significant negative values, possibly related to the emergence of major agglomerations in less exposed areas, including through the construction of new capitals (Abuja in Nigeria). Some studies emphasize food security risks with public health impacts, correlated with significant connectivity gaps between cities and their peripheral areas (Abu, Maria, Cavinato, Lindemer, & Lagerkvist, 2019). The solution of sustainable peri-urbanization in Africa's large agglomerations by integrating communities into the food production and distribution chains to counter the massive dependence on imports has become imperative.

Table 8. Correlations between trends in urban agglomeration population growth rates and explanatory variables in Sub-Saharan African countries

APG	*DNS*	*ATN*	*PRM*	*GDP*	*RNI*	*SCP*	*GPS*	*CLM*	*INH*	*IAR*	R^2
1980 – 1990	0.08	−0.01	0.00	0.02	−0.05	0.07	**−0.42**	0.17	**0.31**	−0.06	**0.21**
1990 – 2000	0.03	0.02	0.01	−0.05	−0.13	0.08	**−0.47**	0.18	**0.39**	−0.05	**0.27**
2000 – 2010	−0.09	−0.06	0.11	−0.19	**0.34**	−0.08	0.12	−0.07	−0.10	0.02	0.16
2010 – 2020	−0.16	−0.19	**0.21**	**−0.25**	**0.42**	**−0.28**	0.15	**−0.22**	**−0.20**	0.15	**0.31**

Other particularities could be observed if the analysis would go down to the regional level. Given the share of large population countries in the developing countries (China and India in the first place), some correlations can be nuanced. Broadly speaking, however, the analysis presented confirms *the clear role of population growth* in the dynamics of contemporary urban agglomerations and *the ambiguous role of the level of development* expressed in terms of gross domestic product. The latter becomes important where it is associated with maximum diversification of activities, especially those based on creativity and innovation, as is the case in Western countries where the 'smart city' concept is becoming increasingly concrete. The other factors may be of episodic importance at regional level, depending on how long the process of urban agglomeration has been taking place and its consistency. In addition, an increase in the incidence of natural hazards associated with climate change should also be taken into account.

DISCUSSIONS AND CONCLUSIONS

This study demonstrates how complex the analysis of urban dynamics is and how relative the connections with some factors considered *a priori* as determinants can be, both from *a* classical,

descriptive perspective and from a systemic-integrative perspective. The dynamic trends highlighted are generally subject to the overall evolution of the demographic system, which is still characterized by exponential growth in the less developed countries, but is forced to adapt in countries experiencing stagnation or decline. The contradictions between expectations that the dynamics of urban systems should conform to the geosystemic components and the reality of opportunism generated by key factors of economic development, such as the presence of resources or strategic location, may be a cause for reflection in terms of the long-term effects of population concentration in 'unsuitable' areas, which are subject to major risks. *Adaptation strategies based on rigorous planning*, taking existing vulnerabilities into account, are needed everywhere. Whether we are talking about dynamic agglomerations in the middle of a desert or formed by the accumulation of huge population masses in densely populated areas, or about agglomerations that have been in decline for decades (e.g. Central and Eastern Europe; Muntele, 2021). For the latter case, trends of socio-spatial change (industrial restructuring, gentrification/degradation of old neighborhoods, socio-economic polarization) have been observed, which are still insufficiently controlled by strategic planning, essential in managing urban decline (Scott & Kühn, 2012).

It is difficult to answer the *dilemma of spatial expansion/compact concentration.* However, the space occupied by the urban agglomerations under consideration is tiny on a global scale. There are studies which indicate a significant reduction in traffic and hence in greenhouse gas emissions in the compact development model. Some studies indicate a reduction of up to 20-40% in road traffic and 7-10% in emissions using a plausible set of assumptions (Ewing, et al., 2008). Adapting to metropolitan sprawl is a major challenge of the contemporary world especially in the context of globalization and deepening institutional decentralization (Woltjer, 2014). Controlling the suburbanization process becomes imperative, with the focus of strategic planning shifting from the center (usually with symbolic relevance for brand image) to the increasingly fragmented and differentiated periphery. Understanding the regulatory mechanisms of the center-periphery dynamics becomes absolutely necessary to provide adequate institutional responses. The huge share of the population living in interaction with a large urban agglomeration (44% globally) calls for a primary attention to urban-rural relations. The option for polycentric development within national urban systems is in line with the orientation of economic systems towards higher-level functions based on creativity and innovation in a multicultural context. It has already become a reality in Northwest Europe or North America. The chaotic expansion of compact and monocentric cities in Southern Europe is considered a failure of polycentric development strategies (Salvati, Carlucci, & Grigoriadis, 2018)and should give food for thought to planners and decision-makers in the transition states in the Eastern part of the continent. The organization of urban networks into nodes of production with discontinuous and dispersed morphology, based on local competitiveness, urban hierarchies and neoliberal globalization is preferable to autarkic or chaotic developments (Herrschel, 2018). The coming decades will gradually reveal which of the urban systems in transition or emerging states will have adapted to what seems to be the most advanced option. The patterns of evolution and the causes of change can be highly personalized, requiring the diagnosis of carefully selected case studies and locally appropriate public policies (Grigorescu, et al., 2012).

The *rapid growth of urban agglomerations in developing countries* remains problematic and challenging (90% of urban population growth in the immediate perspective will occur here). Providing with jobs, housing or urban infrastructure will induce massive pressure on land management, causing spatial inequities, often against the principles of sustainable development (Wei & Ewing, 2018). The prospect of expanding the occupied area and intensity of spatial use will lead to increasingly intense challenges from extreme climate events (Wernstedt & Carlet, 2014). Land may become a scarce vital resource in overpopulated areas of Asia or Africa, with effects on ensuring sustainable social development rarely addressed and little known. The causal relationships between urban sprawl and spatial inequalities are rarely addressed, motivated by the scarce availability of information. More emphasis is placed on environmental implications but social

sustainability is lost sight of, whose processes, mechanisms are vaguely deciphered, requiring the development of appropriate theoretical models to understand what are the risks of an out of control urban dynamics.

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CONSERVATION AT THE URBAN FRINGE: STAKEHOLDER CONTESTATIONS AND SOCIO-SPATIAL DYNAMICS IN THE CONTEXT OF A NATURE RESERVE

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Abstract: Historically, the relationship between protected areas, conservation and tourism stakeholders, and host communities has been highly contested. This study focused on the Abe Bailey Nature Reserve (ABNR) in South Africa, which has long been plagued by continuous conflicts and disturbances involving the protected area, host communities, and conservation officials. Owing to its unique location within a peri-urban township, its operations and outcomes are characterised by systemic issues of public service failure, poverty, and societal mistrust in government and related projects. This is set against the backdrop of the protected area being leveraged to address socioeconomic challenges through the transition of the land from mining to conservation. In this context, the study explores the interactions between key stakeholders, host communities, conservation authorities, and governing authorities, in order to broaden understanding of protected area and community relations. A

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combination of in-depth interviews and focus group discussions with stakeholders reveals that conservation concerns related to poaching, human population pressures, encroachment, and lingering racial perceptions of the reserve were major sources of conflict among stakeholders. Overall, the study highlights how economic and sociopolitical factors shape conservation effectiveness in peri-urban contexts, suggesting implications for policy rethinking for destination managers.

Key words: protected areas; host communities; conservation; conflict; stakeholders; political ecology

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INTRODUCTION

The African region is globally recognised for its rich biodiversity (Mastrangelo, et al., 2024). These natural resources and spaces have increasingly been leveraged for economic development (Saarinen, 2019; Bollig, 2024). However, they are under growing threat from the progressive and compounding impacts of human population expansion and activity (Bollig, 2024). For instance, Nguyen and Jones (2022) report a 68% decline in mammals, birds, fish, and plant species between the 1970s and 2016. In response to these anthropogenic pressures on the natural environment, conservation and the establishment of protected areas have become central to the global agenda for addressing environmental change and biodiversity loss (Gelves-Gomez, et al., 2024; Bollig, 2024). Nguyen and Jones (2022) further emphasise the significance of effectively managed protected areas in mitigating this crisis. Despite this, several scholars have questioned both the conceptualisation and implementation of conservation, particularly in relation to protected areas. Saarinen (2019) and Barraclough (2025), for example, critique the idealistic, Edenic view of conservation, which has historically separated nature from the people inhabiting these spaces. This ideology was entrenched through the Yellowstone National Park model, which institutionalised the forceful exclusion of host communities in the establishment of protected areas (Dutta & Cavanagh, 2025). Although the late 1990s and early 2000s introduced shifts towards more inclusive and collaborative governance structures, relationships between protected areas, adjacent communities, and conservation authorities remain fractured (Gelves-Gomez, et al., 2024; Di Marzo, & Espinosa, 2025). More recently, scholars have highlighted how protected areas continue to perpetuate colonial legacies through systemic marginalisation, power imbalances, restricted access to resources, and the disproportionate costs borne by African communities in the name of conservation (see Saarinen, 2019; Barraclough, 2025; Dutta, & Cavanagh, 2025; Alexiou, et al., 2024).

The proliferation of protected areas in Africa has resulted in the dominance of nature-based tourism as a means to support both conservation and economic development agendas (Lekgau, & Tichaawa, 2021, 2024; Dutta, & Cavanagh, 2025). This form of tourism has substantial potential to transform the socio-economic realities of communities residing near or adjacent to protected areas. However, due to the context of these destinations, the dynamics between biodiversity conservation and communities remain a significant area of concern for all stakeholders involved (Dutta, & Cavanagh, 2025). Certainly, Matose et al. (2025) acknowledge the volatile nature of the relationship between poverty, environmental degradation, and protected areas in Africa. This arguably has implications for the performance of tourism as well as its ability to filter benefits to the local scale. This contentious relationship is attributed to the competing and often overlapping goals of the new shift in conservation, particularly relating to the use of natural resources (Black, & Cobbinah, 2017; Moswete, & Thapa, 2018; Dutta, & Cavanagh, 2025).

The success of protected area management and tourism, particularly in attaining their goals aligned with conservation and community development, is dependent on the interactions between various stakeholders, power dynamics, and policy implementation (Nyaupane, et al., 2022). This current study seeks to explore the stakeholder relationships in a small protected area, Abe Bailey

Nature Reserve, in Carletonville, South Africa. This reserve presents an interesting case study site, owing to the land and resource use changes that have occurred in the community's recent past. The reserve is situated in an area dominated by mining activities, and the protected area is owned by a mining organisation that has leased the land to the local government for conservation and tourism purposes (Taylor, 2012). The surrounding communities reside in a township and are characterised by high poverty rates, crime, and poor service delivery. As such, the reserve is under pressure to conserve the existing natural resources, support community well-being, and foster economic activities such as tourism. The focus on a small protected area, situated in a peri-urban space, presents a compelling case to examine how context shapes stakeholder dynamics and the subsequent implications for the efficacy of conservation measures. This case study site provides a valuable opportunity to contribute to the broader understanding of the intricate relationships between communities, protected areas, and tourism, and to inform strategies for the sustainable management and development of nature reserves as well as their effective conservation.

LITERATURE REVIEW

Protected areas provide a range of benefits to diverse stakeholders involved (Chiutsi, & Saarinen, 2019; Stone, et al., 2022). As articulated by Stone et al. (2022: 2495–2496), "protected areas no longer simply protect; they also provide ecosystem services and facilitate poverty reduction through local development, ecotourism, and sustainable resource use." Štrba et al. (2020) contend that societies cannot be dissociated from nature and biodiversity. China presents a significant case study, having successfully established a network of over 2,700 protected areas where communities frequently inhabit or are situated in proximity to these zones (Wang, et al., 2019). Consequently, equitable sharing of responsibilities and benefits arising from protected areas has become essential to conservation initiatives, particularly in regions where communities share boundaries with these areas. Nevertheless, the interactions between protected areas and communities remain intricate due to the historical and socio-ecological relationships between humans and nature (Lekgau, & Tichaawa, 2019, 2020; Štrba, et al., 2020; Stone, & Nyaupane, 2018; Allendorf, 2022). Numerous host communities depend on protected areas for subsistence activities such as hunting and fishing, especially in underdeveloped rural regions with limited income-generating opportunities (Tichaawa, & Lekgau, 2024). Given that protected areas are frequently situated in remote locations, communities have developed heightened expectations regarding the socio-economic benefits they can derive from these areas, particularly with the advent of tourism (Stone, et al., 2022).

However, as Synman and Bricker (2019) observe, communities adjacent to protected areas often experience exceedingly high unemployment rates despite the presence of tourism. In sub-Saharan Africa, researchers such as Mabele et al. (2024) underscore the enduring isolation of protected areas, a remnant of colonial conservation practices that excluded local communities. Sabuhuro et al. (2017) further elucidate that this historical exclusion has led to diminished rights over natural resources, fostering resentment and exacerbating human-wildlife conflicts. Cousins (2018) illustrates these tensions through the case of Addo Elephant National Park, where forced removals obliterated the cultural and historical identities of displaced communities.

This history has prompted scholars to scrutinise whether protected areas can effectively fulfil their Sustainable Development Goals (SDGs), particularly when prioritising conservation over social equity (Chiutsi, & Saarinen, 2017, 2019). Some researchers advocate for the continued or regulated consumptive use of natural resources within protected areas as a more viable strategy for community development (Arnett, & Southwick, 2015; Mbaiwa, 2018). For instance, in Spain's Cap de Creus protected area, fishing remains the primary economic driver, bolstering both employment and local development (Higueruelo, et al., 2023). Similarly, hunting tourism has been recognised for its socioeconomic contributions in various contexts (Arnett, & Southwick, 2015; Mbaiwa, 2018). Beyond socio-economic challenges, biodiversity conservation is also impacted by anthropogenic land use change, climate change, and invasive species (Saarinen, 2019; Bollig, 2024; Nguyen, & Jones, 2022). This has broadened the conservation agenda to more explicitly incorporate human

dimensions. Stone et al. (2022) assert that protected areas now serve both biodiversity and recreational purposes. Mabele et al. (2023) conceptualise biodiversity conservation as an endeavour to protect ecosystems while acknowledging human-biodiversity relationships. In the African context, many rural communities attribute spiritual and cultural significance to protected areas. Although African traditions are not homogenous, some communities continue to utilise these areas for ceremonies and healing practices (Sapp, 2023). Such practices bolster the argument for community involvement in the governance of protected areas (Sapp, 2023). Mabele et al. (2023) further contend that integrating indigenous knowledge into conservation strategies may enhance long-term success.

THEORETICAL FOUNDATION

The authors situate this study within the framework of political ecology theory, which is pertinent given the intricate networks surrounding the protected area, host communities, and conservation stakeholders. This theoretical perspective offers a valuable lens through which to examine the relationships between society and nature, as shaped and influenced by economic and political structures (Clark, & Nyaupane, 2024; Koskei, & Glyptou, 2025). The relevance of this theory is particularly pronounced in the context of the Abe Bailey Nature Reserve, especially in light of the contemporary issues concerning conflicts, inequality, and power relations that have impacted both the operations of the reserve and the development of the surrounding area. Gurung and BurnSilver (2024) elucidate the complex interconnections between local ecosystems and economic change, emphasising the necessity of considering the social and political context in comprehending such ecosystems. These relationships have undergone significant transformations due to population growth and its subsequent effects on natural environments, culminating in a global agenda aimed at environmental protection, which has included the establishment of protected areas (Saarinen, 2019; Clark, & Nyaupane, 2024; Koskei, & Glyptou, 2025). Such conversions have drastically altered the relationships between humans and these environments. In Africa, the forced removal of communities from protected areas, coupled with subsequent attempts to reconcile these communities with conservation principles, has engendered hostility, non-compliance, and antagonistic relationships (Lekgau, & Tichaawa, 2019; Dutta, & Cavanagh, 2025). In this context, Mathis and Rose (2016) acknowledge the detrimental use of conservation as a means to exert political control over the natural environment and its resources. The introduction of tourism into these dynamics has frequently resulted in unequal distributions of power, access, and development (Tichaawa, & Lekgau, 2024; Saarinen, 2019). Consequently, political ecology theory can underpin these relationships by examining the social, economic, and political actors and forces competing for control, access, and utilisation of the natural environment and its resources (Mathis & Rose, 2016).

Human-nature relationships are dynamic, as nature itself is a socio-politically constructed concept that varies over time and space, contingent upon socio-economic and political transformations (Mosedale, 2016; Saarinen, 2019). Furthermore, socio-economic transformations further enact change in these relationships (Mosedale, 2016). This is particularly salient in the context of the current study, the Abe Bailey Nature Reserve (ABNR), located in Carletonville. The area has experienced significant trigger events that have shaped human-nature relationships, including the 2007 collapse of the Elandskraal mine, which was a consequence of unstable land conditions resulting from mining operations, as well as economic decline, social unrest, wildfires, and illegal mining activities.

These events have prompted more concerted efforts to conserve the existing natural resources. Additionally, the loss of income due to reduced mining activity and changes in land use within the Abe Bailey reserve necessitates further insights into the existing relationship between the community and the protected area. In this regard, political ecology theory provides a valuable framework to ground this examination and its implications for the attainment of the core mandate of the protected area and the development of tourism.

THE STUDY SETTING: ABE BAILEY NATURE RESERVE

Located approximately 90 km west of Johannesburg and 7 km north-west of Carletonville, the ABNR (see Figure 1) is a protected area formally owned by the Far West Rand Dolomitic Water Association (FWRDWA). There are no registered land claims against its inception, nor are there any formal co-management agreements in place. The total surface area encompasses approximately 4,197 hectares. On 11 May 1988, the administrator of the Transvaal province and the Chairman of the FWRDWA, which functions as an association for mining houses, signed a lease agreement designating the ABNR for conservation and educational purposes. This area has since been leased to the government for a period of 50 years, set to terminate in May 2038. The primary vision of the nature reserve is to establish itself as a leader in the management of natural resources for agricultural purposes, sustainable rural development, and the promotion of sustainable environments in Gauteng.

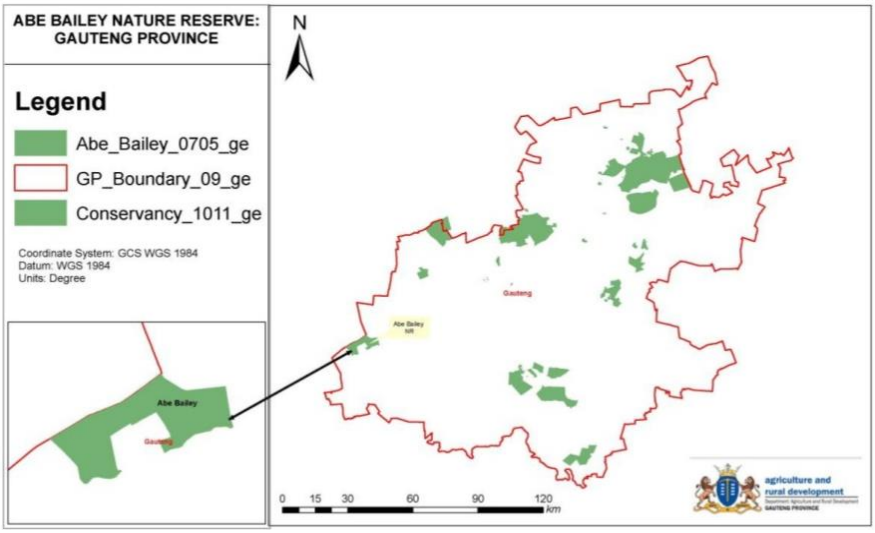

Figure 1. Location of the ABNR
(Source: Department of Agriculture and Rural Development, 2023)

ABNR is a level 2 protected area that contributes 1% to the biodiversity targets in Gauteng and a further 4% towards biodiversity conservation within the national protected area system. Abe Bailey Nature Reserve is rich in a diverse range of flora, consisting of 69 plant families, including the Hypoxis hemerocallidea, commonly known as the 'African potato'. In addition, Abe Bailey Nature Reserve is home to various types of fauna, such as the Baboon Spider, Water Monitor Lizards, the African bullfrog, and majestic birds such as the African Marsh Harrier as well as the African Fish Eagle. Furthermore, Abe Bailey Nature Reserve has a variety of mammal species, including the exclusive protection of the White-tailed rat (*Mystromys albicaudatus*), which is listed as a red-list mammal and considered endangered in South Africa. In addition, ABNR protects the African Marsh Harrier (*Circus ranivorus*), which is considered a red-list bird species in South Africa that is threatened by habitat destruction. There are only 10 pairs of this bird species found in Gauteng. The reserve also protects the genetic purity of the Black wildebeest population (approximately 300 individuals) and is one of only two reserves in Gauteng with a wildebeest population. Other mammals protected include porcupines, zebras, Red Hartebeest, Duikers, springbok, the Cape Fox, African small-spotted genets, African clawless otters, black-backed jackals, and Korhaans. Furthermore, the reserve aims to protect the Wonderfonteinspruit River segment within its boundaries to preserve endangered fauna habitats. The protected area falls within the Merafong Local Municipality, within the West Rand District Municipality. The protected area is managed and guided by several policies, which include the Gauteng nature conservation policy

that is based on the Nature Conservation Ordinance No. 12 of 1983, which was formed to consolidate and make changes to relevant laws concerning nature conservation (Nature Conservation Ordinance No. 12 of 1983).

METHODOLOGY

The current study followed a multiphase qualitative research process. The data collection phase entailed conducting stakeholder interviews with three key groups instrumental to the development and growth of ABNR. These stakeholders, including tourism and conservation officials, local government officials, and community groups and organisations, were selected for their unique perspectives and experiences in managing the reserve. By engaging with these stakeholders, the researcher aimed to gain a deeper understanding of the complex dynamics at play in the reserve, leveraging their insights to inform a comprehensive understanding of the reserve's activities and relationship with stakeholders. The researchers selected individuals to be part of the interviews based on their involvement in tourism and conservation activities of the nature reserve. Seven interviews were held with the tourism and conservation managers, the representatives of local government, NGO and community leaders both inside and outside the reserve. For the focus groups, the participants comprised community members of the ABNR who were a part of the community-based organisations affiliated with the reserve.

Table 1. Research participants

Data collection type	Stakeholder group	No. of participants
In-depth interviews	Representatives of the reserve	2
	Representative of government authority	1
	Representative of an NGO	1
	Community leaders	3
	Total	**7**
Focus group discussion	Working with fire	2
	People and park youth representatives	5
	Community nursery group	5
	Total	**12**

The study involved 12 participants who engaged in focus group discussions. The rationale for employing focus groups as a data collection method was to elicit a diverse array of opinions and perceptions from participants actively involved in various management and conservation activities within the reserve. This approach aimed to obtain a rich and varied dataset, thereby facilitating the researcher's ability to draw multiple insights regarding the reserve. Semi-structured interviews were conducted with three categories of stakeholders: tourism and conservation officials, local government officials (who also serve as conservation and tourism managers), and community groups and organisations. The interview guides were customised for each stakeholder group to gather pertinent information and perspectives. Specifically, separate interview guides were developed for conservation and tourism stakeholders to elicit a range of views and insights into the management and conservation practices within the reserve, as well as the roles and interests in tourism and conservation activities in the area, and the dynamics among stakeholders. The focus group discussion guide was formulated based on a review of the literature concerning community involvement in tourism and conservation in peri-urban areas such as Khutsong. Data collection occurred throughout 2023 and 2024, conducted by the lead researcher. Participants consented to the recording of the focus group discussions and interviews, and the transcripts of these recordings were subsequently uploaded onto Atlas.ti, which facilitated the assignment of individual and later group codes to the data. The group codes constituted the key themes, which are discussed below.

RESULTS

INCEPTION OF THE ABNR

The initial inception and development of the ABNR, particularly in relation to the power dynamics, were found to be instrumental to the current challenges and contention amongst the key stakeholders, impacting effective conservation measures in the reserve. The participants were asked to recall the development of the reserve. Abe Bailey Nature Reserve was established by several organisations, including the Far West Rand Dolomite Water Association (FWRDWA) and the Transvaal Branch of the Wildlife Society of South Africa (TBWESSA), also commonly known as WESSA. Certainly, the participants recognised that the government leased the land for the reserve. However, the participants also mentioned that the inception of the reserve as a formally recognised protected area followed the same system as other protected areas in the country, which involved the forceful removal of communities from the designated protected area, with views such as '*They were forced removals; you would find that black people were removed to accommodate the whites*' (community representative). One participant mentioned that the initial lease agreement only sought to conserve a small portion of the land, and a few years later, there was an opportunity to increase the amount of land to be conserved. As the goal to increase the land size continued, the issue of zoning off the land became difficult to maintain. This was largely due to the proximity of communities to the zoned-off areas. This is explained by the quote below:

> But there's always been conflict between the community and the nature reserve. Originally, they fenced it off, put in a 5-metre buffer area open, then put a secondary fence. People from the community broke off the original fence line and moved up to the secondary buffer line. So, when I started working here, we already had people from the community staying on reserve property, and they refuse to move; so, until today, those people are there.

Therefore, there currently reside communities in this protected area, on the outskirts of the boundary of the reserve, as well as in the surrounding townships. The community and the importance of their involvement within the nature reserve were only recognised in 2013, following the inception of the People and Parks programme. The People and Parks programme is a strategy for many protected areas in South Africa to reconcile the relationship between protected area conservation and communities by seeking to re-establish a harmonious relationship geared towards ensuring the survival and management of protected areas and supporting the livelihoods of communities. Many participants alluded to the ineffectiveness of this programme owing to societal challenges, such as low education levels, the need to fast-track economic development, as well as the slow economic return from this programme, which lessened community involvement and support. Sentiments such as *'The programme does nothing' were* shared amongst several community representatives. Further, one went on to add:

> When they spoke to us about the project, it was as if they [were] going to bring in the project to the community to minimise the impacts of unemployment in the community, you see? So what's the use of you giving someone a job on a short-term basis, at least if the project was ongoing. Now they only did it last year and this year they stopped. Now it is June, where are the people? Nowhere.

Moreover, it is important to note that the formalised involvement of the communities was only recognised after 36 years and was found to be one of the reasons for the communities' discontent with the reserve and its governance structures.

Notably, one of the demarcated areas of the reserve is being leveraged for communal uses, with the Nursery group, a small community-based group that plants in the reserve, being noted as one of the more effective community outreach projects. See quote below:

> ….then the concept started pertaining to the Green Zone, to have an area available in the reserve where people can have gardens in the reserve, so then we unofficially let people start using land for gardens but I mean we had the road and we asked them not to go beyond that road from location to the road they can utilise that space. Then the department appointed a programme manager to formalise this process. Mr Peters Madire was

> appointed; he was the first project manager and he then set up this Green Zone. He called the people of the community together with the nursery we had. We had what they called the Bambanani traditional healers group that was established working with the establishment of the nursery regarding the propagation of medicinal plants because in the early 90s, people just used to walk into the reserve and collect bulbous medicinal plants in bags.

CONSERVATION CHALLENGES

The conservation of natural resources in the Abe Bailey Nature Reserve is facing several concerns, with socio-environmental impacts arising from increasing human populations being an issue alluded to frequently. Interestingly, this issue was specifically stressed by park managers, which was exacerbated by the already close proximity of the community settlements to the reserve, as well as the encroachment of the community into the protected areas. To show evidence of the above-mentioned, a biodiversity officer alluded that:

> The location is just getting bigger and bigger and bigger as the years go on. You have more people coming in, which creates a lot of pressure on our resources in the reserve.
>
> The location is right in the middle [of Khutsong]. We are lying 11 kilometres from our boundary against Khutsong – so it does not matter where you are in Khutsong – if you go north, west, or east, as soon as you pass the last house, you are in the reserve.

Khutsong is a growing, underdeveloped township with a nature reserve that has been set aside on mining grounds, with the aim of conserving the environment. However, a sense of urban sprawl, or habitat destruction, occurs as a result of the growing population in the area. This issue is exacerbated by the expansion of the area by the Merafong municipality through the Reconstruction and Development Programme (RDP) houses, which are government-subsidised homes for low-income communities. These houses were expanded in this community to accommodate the growing population in Khutsong. *"The municipality started building RDP houses, people were then moved from this area, so you had less and less people that wanted to be part of the Green Zone anymore"* (representative of the reserve). Unfortunately, this thereby compromises the space that has been reserved for conservation. Indeed, the housing projects would need to expand beyond the reserve's territory or sometimes within a portion of the reserve's territory. A member of the protected area management revealed that:

> As the years progressed, the municipality started building RDP houses, people were then moved from this area [green zone area set aside by the reserve, for the locals], and you had less and less people who wanted to be part of the Green Zone.

The encroachment into reserve land further exacerbates other conservation concerns, particularly illegal hunting and poaching activities carried out by communities. The ABNR's strategic objectives include reducing poverty through employment opportunities for the Khutsong community. However, this goal is complicated by the conservation-poverty paradox, which occurs when a nature reserve is established in an area with pre-existing high poverty and unemployment rates.

> We [park management] must recognise that unemployment in this area is very high and because you have such a high unemployment rate, people do not value nature because they are looking at their own needs; they want to survive today.

A participant representing the reserve's governance revealed that during the initial phases of new management, community members would exploit the reserve's perimeters by releasing wild dogs to hunt food sources within the reserve. In this respect, some participants disclosed that:

> We [park management] had a lot of problems with people from the community hunting with dogs and it's still happening today.
>
> In the early 80s and even 90s, dogs were shot on sight. If you saw a dog in the reserve, it was shot on sight; personnel were equipped with rifles and there are also other ways that people kill dogs, but I won't mention them.

The killing of the community's dogs in that era, and still today, might have created another problem between the management of the reserve and the community. Another park manager stated that:

> The fact that you were killing the dogs of the community members, that in itself created another problem, so now it's becoming like a spiteful thing – you kill my dog, and I'll put a matchstick in your veld.

The practice of hunting within the reserve persists, as community members have recognised the availability of food sources within the reserve and opt to hunt animals for financial gain through illegal black-market sales. Additionally, some residents prioritise stealing animals as a means of providing food for their families, highlighting the complex dynamics of human-wildlife conflict and the exploitation of reserve resources. A community representative revealed that:

> For many years we had people hunting with dogs, but now it's like it is becoming more prevalent as people in the community start realising that there is a food source." [Imitating what a community member would say] "We don't have money; we cannot afford meat, but there is a meat source next door.

The reserve faces significant pressure from poaching activities, which are exacerbated by the limited presence and control of reserve management, who are only stationed in specific areas of the reserve. This lack of comprehensive oversight enables community members to engage in unchecked illegal activities, particularly animal theft, throughout the reserve, except at the entrance, where security is present. The absence of robust security measures throughout the reserve creates an environment conducive to poaching and wildlife exploitation. A representative of the community-based organisations revealed that:

> Now you have people coming in putting snares, you have people coming in hunting with dogs, there are even people driving along the roads and whenever they see animals, they will shoot and take it out – so there is a lot more pressure on the reserve to protect these resources.
>
> At this time at the moment, we do not have the necessary human capacity to protect these resources [animals] effectively.

The reserve's management has observed a concerning trend in the population dynamics of the game species within the ABNR. Despite conducting annual game counts, the data reveal a stagnant population growth rate over the past few years, which deviates from the expected pattern of increase after a couple of years. This anomaly suggests that the reserve's ecosystem may be facing underlying challenges that are impacting the reproduction and survival rates of the game species. A representative of the community-based organisations highlighted that:

> Currently, it [the stagnation of their game population] is not impacting the population negatively, but it does not show any growth and if you continue like this, you are going to eventually have fewer animals available.

Upon discovering that animals have been stolen, reserve management often faces a delayed response, as the discovery typically occurs in the morning, allowing culprits to escape undetected. Moreover, the perpetrators are presumed to be community members, although evidence supporting this assumption is scarce. Following the theft, reserve staff must dedicate resources to repairing damaged fences, diverting attention from conservation efforts.

CONTENTIONS OVER ENVIRONMENTAL IMPACTS

The management of the ABNR has identified numerous challenges encountered during its operational tenure. A long-serving biodiversity officer, with nearly three decades of experience at the reserve, has provided valuable insights as a key informant to this study. According to this officer, the local community has periodically posed a significant threat to the reserve's integrity. The most pressing challenge faced by the reserve is the deliberate tampering with the water system that traverses the protected area, which has been compromised by certain community members. This egregious act has had far-reaching consequences for the reserve's ecological health and biodiversity conservation efforts. However, one park manager opined that:

> We [park management] have an issue with water because foreign nationals punctured the main water supply that supplies water to the reserve.

A key informant's statement contradicts previous assertions, revealing that illegal mining activities conducted by foreign nationals within the community have compromised the water system, thereby depriving the reserve of a functional water supply. This has significantly hindered various activities within the reserve, which boasts an array of facilities, including a 60-person hall, four two-bedroom chalets, four lodges with eight bunk beds each, and administrative infrastructure comprising eight staff houses, main offices, a nursery complex, and propagation units. Notably, the reserve's 2012/13 integrated management plan outlined expansion plans for tourism infrastructure, including family chalets, teacher chalets, and a picnic area. However, the water crisis, exacerbated by the community of Khutsong, has severely impacted these facilities. This raises questions about the responsibility of the funding department and the Merafong municipality in addressing the water scarcity issue, particularly since the municipality is tasked with providing essential services, including water, electricity, and refuse collection. The reserve's management plan highlights the municipality's responsibility, yet the community is often held accountable for the water shortage, rather than seeking redress from the municipality. A community leader highlighted that "the river that runs through here is heavily polluted, which is part of the municipality, and the mines play a big role in that". The river system traversing the reserve is characterised by elevated levels of pollution, which significantly influences the development and adaptation of species within the area. According to the reserve management, the following issues have been identified:

> The fact that you have your top carnivores operating within this river system should indicate as well that, although it is [the river] polluted, the pollution is not that bad because they can still survive from this.

The reserve management has expressed uncertainty regarding the effects of the severely polluted river system on the local fish species, bird species, and game animals that rely on this watercourse. Furthermore, in addition to the pollution issue, which may not be a primary concern for the Merafong municipality, the reserve has also reported instances of environmental degradation resulting from excessive littering by community members residing within the reserve. A community representative of the study divulged that "when I started working here in 1992, we had heaps and heaps of rubbish lying next to the shacks where the reserve area is." Other participants highlight that while the community bears some responsibility for mitigating littering, it is unfair to place sole responsibility on them. Moreover, the community faces service delivery issues with the Merafong municipality, such as refused services, which creates a ripple effect, pressuring the reserve to address issues that the municipality should prioritise. Certainly, one participant highlighted:

> "Currently, if you just go in Khutsong, if you just go drive around and just look at waste management – waste management is still today a big problem in the location. Rubbish lying all over but that is why the people of the community must actually stand up and go to the necessary local authorities saying – hey, you guys are letting us down; you let us live in filthy conditions but it also has two sides to the coin, I mean, what do you do with your rubbish if you don't have a place to dump? Where do you go? The nearest open space.

CONSERVATION VALUES AND ENVIRONMENTAL EDUCATION

Another major contention emanating from the findings relates to the conservation values of the surrounding communities and the related efficacy of environmental education efforts from the ABNR. Unfortunately, many of the participants in both interviews and focus groups were of the opinion that the community didn't hold or display pro-environmental values and behaviours, particularly in relation to the reserve and the importance of its core mandate. In this matter, some participants underscored:

> My personal opinion on this fact is that members of the community, specifically within this Khutsong location, don't value the reserve as it should be. I mean, we are trying to protect a grassland habitat that's under immense transformation within Gauteng, especially

> regarding development and people will only realise what they've lost after they have lost it.

Many participants suggested that this concern is a cause of the lack of economic value placed on these resources: 'so we have an issue of not getting people who want to participate in the reserve for the benefit of the community, but individual gains. We struggle a lot with this' (community representative) or 'Besides the employment, there is no importance attached to ABNR' (community representative). Other provisions for these issues related to the nature and extent of environmental education for the communities, which received mixed responses in the interviews and focus groups. On one hand, many participants recognise the efforts of the reserve in their environmental education programmes, largely targeted at surrounding schools, which allowed school children in the protected area to learn about the diverse resources therein and the importance of conserving such resources and the manner of doing so. Such initiatives were recognised and appreciated by the stakeholders involved in the study. Notably, some participants were unsure of the continuity of these programmes, particularly after the pandemic.

> It was seen as a source of environmental education for communities around Merafong and other areas, as well as for the protection of one grass species, which is very rare. The grass found here has adapted really well to the conditions of the area and the protection of animals such as the wildebeest.
>
> Schoolkids used to come for tours in Abe Bailey. They used to show them the caves.

In terms of environmental education for the broader community, some community representatives were of the view that this has been severely lacking and that the community was made aware of the ABNR, their mandate, activities, and operations, with some participants in the focus groups further adding that this information is often limited to a subjective few members of the community. For instance, see some responses derived from the focus group discussions:

> If there was a certain level of importance to the reserve, they (park managers) would make appointments with the people from the township to explain about this area. You could find that there are many people in the township who do not even know about Abe Bailey.
>
> The thing about Abe Bailey is that they are choosy towards the community; the people who are the nearest to Abe Bailey are the ones who will benefit. When you enter the township, most of the people do not know what the purpose of Abe Bailey is. From my side, I grew up in Khutsong, and I only knew what Abe Bailey is about and which animals are here when I started working here.

Other members in the focus groups argued that the onus should also be on the community itself, stating that there is some information sharing and the contributions of the community groups are evident, but the community must be willing to recognise the importance of conservation values and the ABNR regardless of its economic importance. A response exemplifying this includes:

> We are ignorant of the fact that there is an Abe Bailey and what is happening inside; we do not want to be involved, so I put the blame on us.

DISCUSSION

This study sought to explore nature conservation through the examination of the relationship between protected areas and the surrounding communities. The four key themes elucidating the protected area-community relationship are interrelated and reflect how historical legacies, economic conditions, and social realities can affect current conservation practices and challenges. Population pressures impacting conservation activities are nuanced, rendering this issue complex and multifaceted. The increase in human populations exerts detrimental impacts on the environment, such as the destruction of natural habitats, overexploitation of natural resources, and loss of biodiversity (Basu, & Savarimuthu, 2015). According to Ceballos and Ehrlich (2023) and Verma et al. (2020), the expansion of urban areas, which results from population growth, has heightened the demand for natural resources, often disrupting wildlife patterns and fragile ecosystems. Furthermore, the expansion of the human population in urban areas has led to an increased need for appropriate

housing, which in this case has been supported by the RPD programme. However, this expansion of residential areas straddles the borders of the reserve, complicating the long-term challenges of expanding, maintaining, and protecting its boundaries. This situation bears further consequences, particularly in light of global initiatives such as the Global Biodiversity Framework's 30 × 30 Target and the Aichi Biodiversity Target 11, which advocate for the expansion of protected areas (Di Marzo, & Espinosa, 2025).

Beyond housing, the growing urban population raises questions regarding the availability and diversity of livelihood options. South Africa exhibits one of the highest levels of unemployment, with Mbokazi and Maharaj (2025) noting that the number of individuals employed in the formal sector is alarmingly low. The lack of economic activities has been identified as one of the factors driving illegal hunting and poaching within the reserve. Such developments may have serious implications for the reserve's environmental priorities and broader social impacts (Kamil et al., 2020). This situation illustrates a human-nature value gap, in which residents near the reserve hold values that diverge from those of the reserve's management. Kubo et al. (2019) explain that a value mismatch can occur when various stakeholder groups, including the community, reserve management, municipality, and policymakers, ascribe different values, beliefs, and attitudes to the environment. This issue presents a significant challenge within the study site, affecting the relationship among stakeholders as well as the effectiveness of reserve management activities. While this conflict is not unprecedented in conservation contexts, the peri-urban nature and structure arguably exacerbate these issues due to overlapping land-use demands, high population pressures, and competing development priorities that intensify tensions between conservation objectives and community needs.

An additional layer of complexity arises in the form of conservation-development conflict, which occurs when the reserve's management fails to address the local community's needs and priorities. This results in a value mismatch between residents and the reserve (Kimengsi et al., 2023). In the case of the Abe Bailey Nature Reserve (ABNR) and the Khutsong community, this paradox is evident. While the ABNR contributes to local economic development through job creation, its impact is constrained by the tension between conservation and tourism objectives and the community's expectations. When communities perceive the reserve as not significantly contributing to their well-being, resentment and conflict may arise, creating additional challenges for preserving critical habitats such as the Carletonville Dolomite Grassland. This issue is further compounded by the local government's inability to address societal needs, resulting in increased anti-environmental behaviours. This challenge was observed when the administrative department overseeing the reserve lacked support from complementary government bodies, such as the Merafong Local Municipality. The absence of coordination can lead to tangible consequences, such as the municipality's neglect of refuse collection in surrounding areas, which has resulted in parts of the reserve being used as an unauthorised dumping ground. This undermines the reserve's ability to promote more environmentally sustainable values.

CONCLUSION

Overall, this study illustrates the complex relationship between the ABNR and the surrounding communities and its implications for conservation practices. The concerns related to population growth, land-use pressures, limited livelihood opportunities, and stakeholder value mismatches underscore that conservation cannot be understood in isolation from broader political and economic processes. By foregrounding these dynamics, political ecology provides a critical lens for examining how power relations, governance failures, and uneven development influence conservation outcomes. These factors also highlight the difficulties faced by the reserve in expanding its tourism operations, as its facilities and efforts are hindered by these challenges. The challenges encountered at the reserve are not merely ecological but are deeply embedded in broader structures of inequality, marginalisation, and competing claims to land and resources. As protected areas continue to develop and expand in both rural and urban contexts, this study demonstrates the

necessity for designing inclusive, context-sensitive strategies that balance conservation goals with community needs. Furthermore, while not emerging as a major finding, the role of community structure and social capital is arguably influential in disseminating critical information concerning the reserve and how to sustainably utilise and leverage natural resources for societal needs.

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WHY DOES THE DEMOGRAPHIC CRISIS PERSIST IN JAPAN?

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Abstract: Global demographic shifts, marked by below-replacement fertility rates in numerous nations, are significantly influencing economies and cultures, especially in countries like Italy, Japan, and Germany. This study examines the circumstances in Japan, where the fertility rate reached a historic low of 1.20 in 2023, resulting in immediate implications for the demographic composition and workforce. This study examines the fundamental causes of this trend, emphasising work culture, the correlation between marriage and fertility, and current initiatives aimed at addressing demographic and socioeconomic issues.

Key words: Japan; demographic changes; fertility; marriage; work culture; loneliness, measures

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INTRODUCTION

The world is experiencing significant demographic changes. Approximately two-thirds of the global population has fertility rates below the replacement level of 2.1 children per woman. The demographic transition has significant implications in countries like Italy, Japan, and Germany, characterized by low fertility rates and a rising population of individuals aged 65 and older, attributable to increased life expectancy. The main effect of this phenomenon is the decline in the

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working population, which mainly affects the economic and social systems (Stanley, 2024). Accordingly, this paper is aimed at examining the factors contributing to the demographic crisis in Japan. After the second baby boom from 1971 to 1974, the number of annual births in Japan steadily declined as the second baby-boom generation reached the age of having children of their own. In 2007, it was the first time that the number of births fell below the number of deaths, reaching a record low fertility rate of 1.20 in 2023 (Nippon.com, 2024) (among the lowest in the G7, although still higher than other Asian countries like South Korea, Hong Kong, Singapore) (Asao, Smirnov, & Xu, 2024).

How did Japan arrive at the precipice of this crisis? This paper aims to address this question and highlight Japan's demographic situation by analysing contributing factors, emphasizing work culture and its impacts, the Japanese perspective on marriage and family formation, and recent regulations intended to tackle demographic and social issues. Moreover, the authors argue in favour of the existence of a causal nexus between the Japanese perception of marriage, the feelings of loneliness, the work culture and the persistently low fertility rate in the country.

METHODS

From a methodological point of view, we used both quantitative and qualitative research methods, so as to delimit the basic concepts of our research, the specific theories, and to better highlight the social policy at the level of Japan, analysing in comparison to other models of social policies in the EU (Norway, Sweden, Germany), with the aim of highlighting some of the major causes of the demographic problems faced by Japan, in particular, and developed countries, in general. The research methods used are as presented bellow.

Analysis of social documents – we conducted a comprehensive analysis of official documents and reports, statistical data and specialized studies developed by national and international institutions such as the National Population and Social Security Research Institute, the Gender Equality Bureau, the OECD and the Pew Research Centre. These sources provided important demographic, social and economic data, used to track the evolution of the population and social policies in Japan and selected European countries.

Specialized literature – for the theoretical basis of the work and for the correlation of specific concepts and theories with empirical data, we turned to works of reference authors, such as Chihiro Iwawaki, Noreena Hertz, Tomas Sobotka, Anna Matysiak & Zuzanna Brzozowska.

Ex-post evaluation – analysing public policies, rules and regulations in Japan and selected European countries, we have highlighted positive and negative elements of Japanese social policy in order to propose improvements in this direction.

RESULTS AND DISCUSSION

THE NEXUS BETWEEN MARRIAGE, LONELINESS AND FERTILITY RATE IN JAPAN

As highlighted by the National Population and Social Security Research Institute, by 2070, Japan's population (approx. 126 million in 2020) is anticipated to decrease by 30% (to 87 million), and the elderly population 65+ is expected to account for almost 40% of the total (National Institute of Population and Social Security Research, 2023). One of the main causes is the low fertility rate. Japanese society is against children out of wedlock. Therefore, marriage is a prerequisite for having children, but the number of marriages is decreasing. Moreover, contemporary society is characterized by smaller family units, thus fertility rates are declining. But why are there fewer marriages in Japan? This happens for several reasons.

First, young people choose work over family life. Men tend to make this choice because of job instability. According to a survey undertaken by the Japan Institute for Labor Policy and Training in 2019, young men tend to quit within the first 3 years of employment citing the following reasons (Iwawaki, 2024):

- long working hours
- low wages
- disparity between the actual working conditions and the information they were provided prior to their employment
- unpaid overtime
- harassment
- lack of communication
- insufficient financial resources
- the desire to maintain their financial autonomy.

Added to this is the desire to consume which is on the rise. Surveys, such as the one conducted by PEW Research Centre in 2006, show that young people are very sensitive to the influence of advertising. The advertising industry promotes the consumption of products, especially expensive brands, which young people may see as the only way to self-esteem and happiness. Consumption aspirations are growing strongly, but the purchasing power of younger workers is, in a good case, growing modestly, making personal satisfaction with the level of consumption hard to achieve. (Skirbekk, Matsukura, & Naohiro, 2014) As a consequence, if the job is insecure, many young people lack the security of a stable income. Given the necessary expenses (housing, food, transportation), the prospect of marriage and raising a child, which entails more expenses, is postponed until later years or even cancelled.

Women make this choice because of gender inequality. They are reluctant when it comes to starting a family because (1) men offer too little support with housework and parenting - because of the work culture, which discourages taking time off, and men's tendency to engage in very little unpaid work. Then, (2) because the work culture, being strict, offers inflexible working hours, which makes women choose more flexible jobs (part-time, seasonal, etc.), but which prevents them from pursuing their desired career and excelling (Asao, Smirnov, & Xu, 2024). Also, (3) because the traditional idea that the husband should provide for the family, and the wife should take care of the household duties is still ingrained in Japanese society (CNA Insider, 2024). The statement of a Showa University student describes the whole situation very well: "When you have a child in Japan, the husband continues to work, but the mother is expected to quit her job and take care of the children. I feel it is hard to raise children, financially, mentally and physically" (McCurry, 2022).

As a result, the prospects of starting a family are pushed to the back burner, postponed or, in some cases, even rejected. A 2023 survey of unmarried people aged between 20 and 49, which included valid responses from 1,200 people, found that 34.1% of them had never been in a relationship. Also, only 49.3% of women and 43.5% of men said they wanted to get married at some point of their life. The most common reasons young people gave for rejecting the idea of marriage were that "imposes limits on my activities and life" (among women) and "loss of financial freedom" (among men). Others included "see no benefit", "don't want to lose my freedom", "burden of responsibility to support the family", "don't feel the need" (Nippon.com, 2024).

Second, the balance between work and personal life is increasingly tipping towards the former, as work occupies an increasingly significant part of an individual's life. This is visible at global level as well, because contemporary society is characterized by the values of neoliberal capitalism, which emphasizes productivity, efficiency and personal success, and the individual is in a constant competition to perform, to exceed their limits and to achieve as much as possible financially and materially (Han, 2024). Such values are emphasized in a society such as Japan, where extreme dedication to work is considered a sign of loyalty and respect for the company, and employees are expected to work overtime, often without pay. This behaviour has been normalized in Japanese culture, and a lack of work-life balance leads to extreme burnout and even fatal situations. For example, in 2013, the journalist Miwa Sado died of cardiac arrest after logging 159 hours of overtime and only two days off in the month before her death. Another notable case is that of a 24-year-old woman, Matsuri Takahashi, who had logged more than 100 hours of overtime in a

month and committed suicide. A few weeks before, she had written on a social media platform, "I want to die" and "I am physically and mentally destroyed" (McCurry, 2017). The cases stated are not unique. In fact, the phenomenon is quite widespread, and the Japanese have a specific term for it: "karoshi" (meaning "death caused by overwork") (NowThis, 2017).

These cases illustrate the harmful effects of a toxic work culture, of which main interests are productivity and profit, and less the well-being of employees. This disposition has significant repercussions not only for the individual's mental well-being but also for societal cohesion. People, being trapped in their egocentric loop, become individualistic and tend to isolate themselves from others. As a result, they are lonelier, and sadly this has become a global trend. In 2023, the World Health Organization declared loneliness a "global health threat" (BJC HealthCare, 2024).

Third, the Japanese society is confronting with the challenge of loneliness. According to a national survey from 2022, out of the total respondents, 4.5% said they felt lonely "often/always", 14.5% "sometimes", 17.4% "occasionally", 38.9% "hardly ever" and 23.7% "never" (Office for Policy on Loneliness and Isolation, 2025). Generalizing to the entire population of Japan, it would mean that about 5.6 million citizens feel lonely often or always, 18 million feel lonely sometimes and 21.5 million feel lonely occasionally. These statistics are worrying because the effects of loneliness can have a significant negative impact on individuals and society. Firstly, loneliness and social isolation affect health. People in this situation are more prone to both simple illnesses, such as colds or flu, and serious ones: the risk of heart disease, stroke, clinical dementia and premature death is 29%, 32%, 64%, respectively 30% higher (Hertz, 2021). Studies also show that due to the stress caused, individuals who experience loneliness are more vulnerable to mental health affections, including anxiety, depression, cognitive impairment and feelings of hopelessness, as well as self-harm or suicide (Klein, et al., 2021). The reverse scenario is also true - poor health exacerbates loneliness and social isolation tendencies - so a vicious cycle is created in which the two phenomena are both causes and symptoms. Suicide is another problem in Japanese society, where more than 20 000 people take their own lives each year (Japan Suicide Countermeasures Promotion Center, 2021).

In addition, the loneliness is often closely linked to another widespread phenomenon in Japan, namely the "hikikomori" phenomenon. According to the Japanese Ministry of Health, Labour and Welfare, this is a condition in which an individual refrains from engaging in social activities, such as school, employment, or socializing outside of the home, for a duration exceeding six months (Ministry of Health Labour and Welfare of Japan, 2020). The phenomenon usually occurs following events that cause excessive stress or negative feelings and can impel the individual to no longer want to interact with society because they feel overwhelmed, and isolation becomes a refuge or escape from reality rather than a rational choice. For example, in the 1990s, when Japan was hit by the economic crisis, the number of jobs was reduced and competition in academia intensified, which put immense pressure on individuals because the risk of not getting a job was very high. Many young people were also left without jobs. In Japan, there is an efficient school-work system that helps graduates to get a job immediately after graduation, but it is vulnerable to periods of economic distress, hence the close link between reduced job vacancies and increased competitiveness in school (Iwawaki, 2024). In response to stressors, an increasing number of young people have isolated themselves, avoiding interaction with society.

Hikikomori persons can return to society and, despite the stigma that they are just lazy and don't want to contribute to society or that they are mentally ill, many of them manage to come back. Solutions exist (e.g. home visits, community outreach, hospitalization and psychotherapy), however these take time (Teo, 2010).

The correlation between marriage and fertility is directly proportional, as the Japanese culture disapproves of children born out of wedlock; hence, both marriage and fertility rates are dropping due to a significant number of individuals opting for or ultimately leading a solitary lifestyle. As a result, the number of marriages is declining - in 2023, there were 474,717 marriages (it was the first time in the post-war era that the number of marriages fell below 500,000) (Nippon.com, 2024). In

the same way, the number of elderly people who have no one by their side is also increasing. According to a study by the Ministry of Health, Labor and Welfare, as of June 2023, there were 54,452,000 households, of which 34% (18,495,000) were inhabited by single persons (only one person); 24.8% (13,516,000) by married couples with unmarried children; 24.6% (13,395,000) by married couples. Also, of all one-person households, 46.2% were inhabited by people over 65, of whom 64.4% were women and 35.6% were men (Nippon.com, 2024). The increasing number of lonely elderly is leading to another phenomenon, called "kodokushi". This is when a person dies alone, with no one to care for him/her, the body being found after a longer period of time (weeks, months; often found because of the smell) (Byard, 2025).

Thus, the demographic crisis extends beyond mere population decline. It is linked to many other problems that are both causes and consequences. Constantly feeding on each other, they worsen the demographic, economic and social situation, with repercussions for the individual's health and also for social cohesion (Jones, 2024). In these circumstances, it is reasonable to inquire about the measures the Japanese government is implementing to ameliorate the situation, and what interventions might help. The following part of the study will focus on the government's initiatives and their effectiveness concerning various issues - family and birth rate, work culture, loneliness and migration.

GOVERNMENT POLICIES AND MEASURES MEANT TO TACKLE THE DEMOGRAPHIC CRISIS

Government initiatives to promote family establishment and childbirth

The Nippon government has generally focused on social assistance measures to encourage family formation and childbirth - a prime example is the "New Dimension" policy of former Prime Minister Fumio Kishida's cabinet, which proposed measures such as monthly payments for families with young children, a reduction in the costs for higher education, an increase in the percentage of men who take paternity leave, etc (Prime Minister's Office of Japan, 2024). The last mentioned regulation related to paternity leave deserves more attention as a measure of this type has been effective in other countries such as Norway and Sweden. In 1993 and 1995 respectively, they introduced the "daddy quota" scheme, whereby the family loses paid parental leave if the father does not take leave. This provides a strong financial incentive for fathers to take paternity leave. Following implementation, the take-up rate has increased from 4% (1995) to over 90% (2003) in Norway and almost 90% in Sweden. Germany also adopted a model similar to the Nordic one in 2007, and in 2015 they introduced a flexible leave system whereby parents can take part-time leave for up to 36 months (Asao, Smirnov, & Xu, 2024). According to researchers like Sobotka, Matysiak, and Brzozowska (2020), fertility rates among highly educated women have increased due to this type of policy reform.

Such a policy could also pay off in Japanese society, given that Japan has a generous parental leave scheme: about a year of paid paternity leave, at 61% of salary for the first 180 days, with a limit of about 305 000 yen (€1903) per month, and 50% of salary after 180 days, with a limit of about 228 000 yen (€1422) per month (Kimoto, 2025). The issue is that few fathers take paternity leave in 2022, the average duration was less than 6 weeks (Asao, Smirnov, & Xu, 2024). A "daddy quota" policy could change this, helping to reduce the work-life imbalance by primarily supporting mothers because the burden of raising a child, in addition to other household chores, would be eased by fathers' presence and involvement. This could also mean a more positive outlook for women towards starting a family. Moreover, there are benefits for fathers too, such as improving their relation with their wives and children, which can boost their confidence and become more satisfied (Jackson, 2015). Initially, this may indicate a greater reluctance among men, as they tend to be less inclined to participate in unpaid work, such as childcare, compared to women (Varela & Moridi, 2024), who do such work 5 times more (Asao, Smirnov, & Xu, 2024). However, this kind of measures should be taken in consideration because welfare-only regulations have limited

effectiveness (Sobotka, Matysiak, & Brzozowska, 2020) and the work-life gap has not changed positively, let alone demographic issues.

Government regulations designed to mitigate workplace pressures and improve work conditions

With regard to the work culture, the stressors caused by high performance conditions and their consequences emphasize the significance of regulations, and the Japanese government has undertaken such measures. These include: introducing a stress screening program, conducted by firms with at least 50 employees, to examine the mental health of employees (Ogawa, Kishida, & Takeda, 2021). Limiting overtime to 45 hours per month and 360 hours per year, but with the caveat that under certain conditions this limit can be raised to 100 hours per month and 720 hours per year - for example, an agreement between the employer and the employee. Increasing the additional pay from 25% to 50% for overtime over 60 hours per month. Incentivize companies to contribute positively to workers' health by recognizing them as a "Certified Outstanding Organization" (Saito, 2024). However, it is imperative to acknowledge the limitations of these measures. In the case of the amendment on the limitation of overtime, those conditions for changing the limit, such as the agreement between employer and employee, can be relatively easily met by unethical methods such as blackmail or the threat of losing one's job, making it almost impossible for the worker to refuse. Also, by increasing overtime pay exclusively for employees who works over 60 hours of overtime per month is more likely to encourage the employee to work more than the legal limit in order to earn additional income. The demographic decline will also put more pressure on both bosses and workers to increase the working overtime to fill the gap of the missing working population (Lewis, 2024). Considering this, the measures are rather inefficient. They may even have an adverse impact, contributing to a worsening in the individual's well-being.

Government initiatives meant to combat the loneliness "hikikomori" phenomenon

Regarding loneliness and the "hikikomori" phenomenon, in 2021, a Ministry of Loneliness was created (an initiative also adopted by the UK in 2018), which aims to combat loneliness and social isolation, focusing on three main directions: social media use, identifying lonely and/or socially isolated people, and supporting collaboration between organizations, academic experts, government entities and other assistance organizations addressing the concerns of loneliness and social isolation (Office for Policy on Loneliness and Isolation, 2025). It is very important that these social problems receive more attention and that initiatives are sought to combat them as they have a huge impact at both an individual and societal level. According to Noreena Hertz (2021), loneliness and social isolation lead to more distrustful and less empathetic attitudes towards others, which can negatively affect social cohesion. In Japan in particular, this can be an obstacle to integrating foreigners into the country, given that Japan is open to a limited extent to immigrants.

Therefore, initiatives to combat loneliness and social isolation should be encouraged as they can have a significant positive effect given the huge consequences these phenomena have. At the same time, fewer individuals in such situations can be potential citizens who can form families, helping to alleviate the demographic crisis.

Immigration as a solution for the demographic crisis?!

From a migration perspective, migration is not a solution to demographic problems, nor even to social problems such as the "kodokushi" phenomenon. While in other countries immigrants help to alleviate these problems (for example, in Italy, there are many Romanians caring for Italian elderly), in Japan this is not as possible at the moment. First, because Japan welcomes relatively few foreigners into the country - compared to OECD countries, it has one of the smallest immigrant populations: 2.2% compared to 10.4% of the OECD (in 2021) (OECD, 2024). Then, because most foreigners are staying only temporarily in Japan, due to the conditions for receiving citizenship.

Japan applies the principle of *jus sanguinis*, whereby citizenship is granted according to the "right of blood" or according to the citizenship of the parents, regardless of place of birth (Green, 2017).

For other people who wish to obtain a permanent residence permit, they usually need to live in the country for a minimum of 10 years (OECD, 2024), and this can be difficult for several reasons. The first one is represented by the fact that the Japanese language proficiency is required as English is not a strong suit of the locals, according to the English Language Proficiency Index, in 2024, Japan ranked 92 out of 116 (Signum International AG, 2024). The second one explains that the Japanese society places great importance on social obligations, and people adopt politeness as a tool for interacting with others. Through it, the Japanese traditionally separate "real intentions" (honne) and "appearances" (tatemae) in communicating with others (Skirbekk, Matsukura, & Naohiro, 2014). Therefore, for a person from a country where it is normal to express one's true thoughts and feelings much more freely, it might be hard to understand this approach, and locals might consider them rude or view them in a more negative light if they behave in the same way as in their home country. The third reason deas with discrimination: according to a 2017 government survey on discrimination, nearly 40% of foreigners have been refused housing, 25% have been turned down by employers, and around 30% have experienced racist or discriminatory remarks (Burgess, 2024). As a result, people who decide to settle in Japan are in quite small numbers. In 2022, about 3 million foreigners were living in Japan, a a significant percentage of whom were immigrants coming to work, interns and international students. Of these, only half were permanent residents (OECD, 2024).

The concept of a homogenous nation, which defines Japan's national identity, makes it very difficult for foreigners to genuinely integrate in the Japanese society. However, there are also supportive trends. For example, in Tokyo, a special manual has been created for foreign residents to understand Japanese manners and rules (Tokyo Metropolitan Government, 2024). Also, the government has implemented a point system to attract highly skilled foreigners. Through this, those recognized as "highly skilled foreigners" gain several privileges, such as facilitating the process for obtaining permanent residency and the chance of obtaining it after only 5 years of living in the country (Ministry of Justice in Japan, 2012). This is important because the welfare of a state and the opportunities offered by migration increase the faster the integration of immigrants is (Polgár, 2019). Thus, initiatives to facilitate the integration of foreigners in Japan can have a major positive effect. However, the demographic and social challenges were not adequately addressed by the number of immigrants. According to 2001 UN estimates, Japan required an average influx of 343 000 net immigrants per year from 2000 to 2050 in order to maintain the population size in 2050 equal to that of 2000. Respectively, an annual influx of 650 000 immigrants in the same time frame, for the working age population in 2050 to be equal to that of 2000 (Tsuya, 2014). If in Europe, immigrants contribute massively to the labour market (Micle, et al., 2022), this is almost impossible to achieve in Japan. Firstly, because of the "us vs. them" mentality whereby foreigners are tolerated but not truly integrated into society. Secondly, due to the exhausting conditions in the workplace. Thus, initiatives such as the acceptance of dual citizenship, alternative ways to obtain citizenship, or the promotion of a multicultural system, at least with other East Asians, could make Japan a more tolerant and welcoming country for foreigners (Castillo, 2020).

Finally, the main obstacle in solving demographic problems is the traditional mindset. Although the number of people with this outlook is decreasing, this mentality is still held by many older voters and politicians with a conservative outlook. It is also important not to forget that today's Japan's national identity was formed during the Meiji period, when the goal was to create national unity in the context of a divided population and the fear of being colonized by an outside power (Hollifield & Sharpe, 2017). That is why, even though the world is changing, a good part of the population and the leading members of Japan still see the strenuous work culture and the gender division in household chores and labour as normal, and immigrants as those people who are preferably not to remain in the country for extended periods unless they possess advanced skills and

can significantly enhance the nation's economy and reputation (Yamashige, 2014). If this trend continues, there is a good chance that the only major demographic policies the government will take in the coming years will continue to be limited to financial assistance and limited openness to foreign nationals.

CONCLUSIONS

There are also positive aspects to a smaller population, such as reduced environmental damage (Götmark, Cafaro, & O'Sullivan, 2018). But even so, the shrinking population will have a major impact on the social and economic systems because it also means a shrinking workforce. This, and the ageing population will make it more difficult to sustain the per capita income level and the system of social and health spending (OECD, 2024). While in 2020, social spending was about 136 trillion yen (€ 863 million) (National Institute of Population and Social Security Research, 2022), this, together with health spendings, is expected to increase to 17 trillion yen (€ 107.1 billion) between 2025 – 2040 (OECD, 2024).

The elderly dependency ratio also contributes to the current situation, which is also expected to increase: from 48% in 2020 (2.1 working persons per elderly) to 74.2% in 2070 (1.3 working persons per elderly) (National Institute of Population and Social Security Research, 2023). Some European countries, including Greece, Italy, and Portugal, also face the same problem, as their dependency ratio exceeds 54%. This creates a significant vulnerability in the social and health care systems, necessitating the implementation of imperative reforms (Brie, 2019). Therefore, in order to avert numerous forms of decline, Japan and its leadership must concentrate on the underlying causes of the issue, including gender inequality, a rigid and inflexible work environment, low wages for young people, and restricted access of foreigners.

In conclusion, the causes of Japan's demographic crisis are deeply rooted in Japanese mentality and culture. They take the form of a traditional, homogenous society and, as evidenced in the research of the Gender Equality Bureau of Japan, the form of gender inequality (Gender Equality Bureau, Cabinet Office, 2024). Thus, foreigners avoid possible living in Japan, the Japanese government only acts on surface issues, and in the context of a world dominated by the values of neoliberal capitalism, young people choose careers and a solitary lifestyle over family life, which causes a decline in marriages and newborns. Consequently, as demonstrated by studies conducted by the National Institute for Population and Social Security Research (2023), fertility rates are declining, while the number of elderly is increasing, thereby exacerbating the ongoing demographic crisis.

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THE DYNAMICS OF ACCOMODATION FORMS IN ROMANIA AND THEIR OCCUPANCY RATE IN THE PERIOD 2021-2024

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Abstract: The development of tourism is a necessity for any country, both due to its role in the national economy and in covering customer requirements. This can be achieved by ensuring a solid infrastructure, which can guarantee quality services. In this sense, through our research, the article presents a picture of the situation of various accommodation units, the arrival of tourists in different reception structures as well as the analysis of the net utilization index of accommodation capacity. These have expanded and diversified greatly during the analyzed period, creating the conditions for increased comfort.

Key words: research, tourism market, customer needs, infrastructure, accommodation units.

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INTRODUCTION

The tourist phenomenon has amplified, expanded and diversified greatly during the long period of peace and economic development worldwide that followed after 1945 until the present. The tourist market can be summarized as three main elements that can come into contact with each other: tourists, tourist attractions and the facilities offered (Hall & Page, 2006).

Tourist attractions are made up of natural and anthropogenic territorial components that represent the tourist potential of the place (geological substrate, relief, waters, climate and weather, vegetation, fauna, soil, population and its traditional and economic activities, localities, archaeological sites, fortresses, palaces, castles, administrative and cultural buildings, factories of tourist interest (beer, wine, sweets, etc.), agricultural crops, specific local cuisine, old or modern educational institutions, sports and leisure centers, access infrastructure, accommodation and dining,

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etc.). These give life to the tourist phenomenon. Without them, the discussion about tourism and recreational activities would be meaningless (Cocean, Moisescu & Toader, 2014). The variety of the country's relief, the large number of historical monuments and, especially, their historical significance, together with the existence of mountain resorts, some with a spa profile or for practicing sports, constitute elements of attraction for Romanian tourism, both domestically and internationally (Manole, Diaconu, Popovici, Sfetcu, 2016). Accommodation units have multiplied considerably; services have increased greatly in terms of number and quality. The number of tourists has increased in all countries of the globe as well as in Romania. The material base for accommodation is classified according to comfort (number of stars - from one to five and above, daisies etc). This is one of the most important issues related to current tourism (functionality, appearance, design, hygiene, warmth, air conditioning, tranquility, organic food, location, surrounding view, accessibility, unpolluted environment, diverse and quality service, friendliness of staff, offer for fun, leisure etc).

Tourist reception structures with tourist accommodation functions include: hotels, apartment hotels, motels, tourist villas, chalets, bungalows, holiday villages, campsites, rooms for rent in family homes, river and sea vessels, tourist guesthouses and agro-tourism guesthouses and other units with tourist accommodation functions (Romanian Government, 1998). Tourist hotels and guesthouses sometimes exceed the role of accommodation, through the facilities they have and the activities they organize, constituting themselves as true attractive objectives. The first of these can become brands known on the world map, presenting themselves as hotel chains that go beyond the borders of countries. Such established names can also have some inns that have old traditions, sometimes even with historical and cultural connotations. Hotels may also have additional facilities for business or cultural-scientific activities “symposiums, seminars, festivals, exhibitions” and leisure (Cocean & Dezsi, 2009, 165). They are equipped with the most modern and sophisticated dining facilities. Motels, villas and cabins have a lower accommodation capacity and are linked either to transport routes or to the presence of special objectives in the immediate vicinity. Pensions are more specific to the rural environment and have the advantage of the presence of special local traditions, especially in terms of cuisine. Apartments and accommodation rooms are characteristic especially of the urban environment and ensure immediate access to objectives in the central areas of cities. Campsites, shelters and refuges are often non-permanent accommodation structures, are often peripheral or isolated and less expensive. Accessibility and transport facilities are a fundamental problem in tourism. Nowadays, airports are gaining overwhelming importance, the existence of quality highways and roads is an essential condition for this important human activity that is tourism. Communication infrastructure (telephone signal, internet) and other modern facilities (including the banal payment by card) are mandatory in today's tourism. Medical, banking and niche services complete the needs of the modern traveler.

Tourism infrastructure “sums up the totality of goods and means that facilitate the valorization and tourist exploitation of the attractive resources of a territory” (Cocean, Dezsi, 2009, 162). It includes a series of elements starting from reception units (structures with accommodation functions - hotels, motels, guesthouses, villas etc), restaurants, bars, transport provision (roads, highways, airports etc), services, utilities communication facilities etc.

When we talk about tourism and the development of tourism activity, we cannot fail to consider marketing activity. Modern marketing presents characteristics such as: responsiveness to the society’s requirements, respectively the market; rigorous knowledge of market requirements, systematic monitoring and anticipation of them through a scientific approach to the socio-economic environment, through the use of appropriate work tools; flexibility in the functioning mechanism of tourism companies; inventiveness, creative spirit, permanent concerns for renewal and modernization; unitary vision of the whole and the activity that make up the economic cycle of goods and services from the moment of conception to the moment of their effective entry into consumption;

maximum good efficiency as a result of the effective orientation of tourism activities towards market requirements (Zaharia, 2016).

Tourism products must be as attractive as possible to sell. They will be designed in such a way that they can withstand competition. The way they are presented is very important to ensure success. Therefore, advertising plays an important role. Proper advertising can lead to the desired results. "*The growth of competition on a global, but also national level, forces those who offer tourism products and services to take decisive readaptation measures in order to maintain themselves on the market, by diversifying and correlating the quality with the price of the tourism product*" (Butnaru, 2012, 26). Broadly defined, the tourism market represents the economic sphere of interference of supply, materialized through tourism production, with demand, materialized through consumption (Stanciu, 2016). The consumer of tourism products is increasingly informed and demanding in terms of the offer, the attractiveness of the environment and landscape, accommodation conditions, the quality and variety of food etc.

In accordance with the general understanding, the tourist market is represented by the totality of sales-purchase acts whose object is tourist products, viewed in connection with the relationships they generate, the geographical space and the moment in which the action takes place (Minciu, 2004). In the context of market development, there is a permanent need for companies to adapt to customer needs. In this regard, tourism companies develop a wide range of offers, providing products and services that cover requirements, as well as an infrastructure that ensures quality conditions.

The level of development of a country is largely determined by the level of development of the sphere of services offered to the population, among which tourism services stand out (Cristache, 2008). The services that give content to the tourism product (called tourism services) are a conglomerate or a combination of at least four basic types, transportation, accommodation, food and leisure services (Gherasim, Gherasim, 1999). The level of provision of each type of service influences market demand, namely the occupancy rate of various forms of accommodation, as well as the exploitation of tourism potential. The development of tourism depends directly on the existing facilities in a given country. Upgrading hotel accommodations, restaurants and tourist attractions to meet international standards will improve the tourist experience and promote longer stays (Cozac, 2024). The most effective advertising is done by customers, who often return to their favorite places and, often, recommend these tourism products to different people who will become new visitors.

"The degree of qualitative and quantitative diversification of tourism infrastructure is closely related to the attractiveness of tourist attractions and the number of tourists. Thus, infrastructure and tourism demand are in a relationship of interconditioning, each stimulating and conditioning the appearance, development and evolution of the other. The quality and diversity of the tourist offer is reflected directly in the tourist circulation, in the shaping of the tourist flows, the emitter areas, and respectively the tourist destination. In this background, this study aims to identify, analyze and hierarchize Romanian tourist emitter and reception areas and of the relationships between the two spatial entities" (Herman, et al., 2020, 122).

Modernizing infrastructure facilitates access to tourist areas, multiplies the degree of comfort and, ultimately, generates profit. Investments in this sector recover quickly. The classification of tourist accommodation facilities has as its primary purpose the protection of tourists, constituting a codified form of synthetic presentation of the level of comfort and the services offer (Ministry of Economy, National Authority for Tourism, 2013).

METHODOLOGICAL ASPECTS

The paper represents a research based on official data obtained from the National Institute of Statistics of Romania (for the period 2021-2024). Within it, a series of indicators were analyzed such as tourist accommodation capacity, tourist arrivals in reception structures (number of tourists) and their net utilization index. The analysis is quantitative and reflects a real image of an important part of tourism activity in Romania.

ACCOMMODATION CAPACITY

During the period 2021-2024, Romania's accommodation capacity multiplied and was modernized, being served by various units. There was an evolution from 11736 structures in 2021 to 13538 in 2024, representing an increase of 15.35% (Fig. 1).

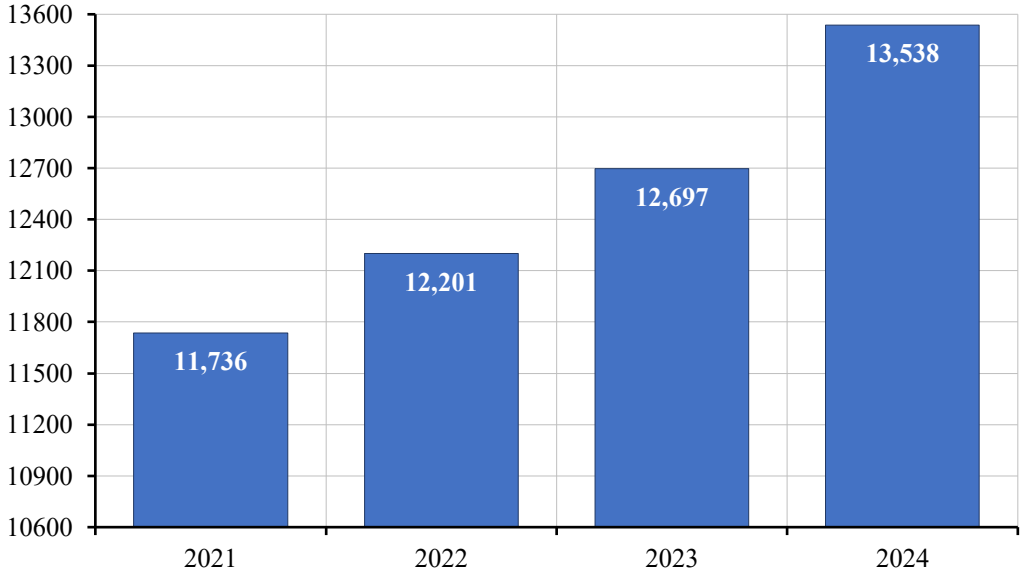

Figure 1. Trend in the number of tourist accommodation establishments in Romania.
(Data Source: INS, http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table)

Among the units with tourist accommodation functions, we can mention hotels, motels, tourist guesthouses, tourist villas, agro-tourism guesthouses, bungalows, tourist cabins and others. Regarding the shares of tourist reception structures, the largest were recorded in 2021 by agro-tourism guesthouses with 30% of the total in the entire country, followed by apartments and rooms for rent with 22% and hotels with 13.48%. Tourist villas were also appreciated by tourists, which in 2021 recorded 6.40%, followed by bungalows with 4.28%. Other tourist accommodation structures presented lower values, such as hostels 3%, tourist cabins 2%, motels 2%. Campsites, tourist stops and tourist cottages held less than 1% in 2021. By 2024, the share in total accommodation units had recorded several important changes. Thus, tourist guesthouses followed a slight decrease reaching 26.42%, while apartments and rooms for rent ranked first with 32.58% (Fig. 2).

Hotels maintain their third position in 2024 with 11.87%. The other tourist accommodation units remain at the same values or register a slight decrease at the end of the analyzed period. We can appreciate that there is a great preference for agro-touristic guesthouses, appreciated by tourists for their relaxation possibilities and as a result of the newly created conditions in rural areas where tradition combines with nature. Considering the analysis of the evolution over the period 2021-2024, the data shows a significant increase in the number of apartments and rooms for rent from 2590 units in 2021 to 4411 in 2024, representing an increase of 70.30% in 2024 compared to 2021, followed by agro-touristic guesthouses which recorded an increase of 3.41% in 2024 compared to 2021, from 3460 in 2021 to 3578 in 2024 and by hotels which slightly evolved by 1.57%, from 1583 structures in 2021 to 1608 in 2024. A significant change was also recorded in campsites of 59.70% in 2024 compared to 2021, from 67 in 2021 to 107 in 2024.

The other forms of accommodation suffered numerical decreases during the analyzed period as follows: tourist stops – 13.63%, motels -9.76%, tourist villas – 6.51%, tourist cabins – 1.80%, hostels – 0.90%.

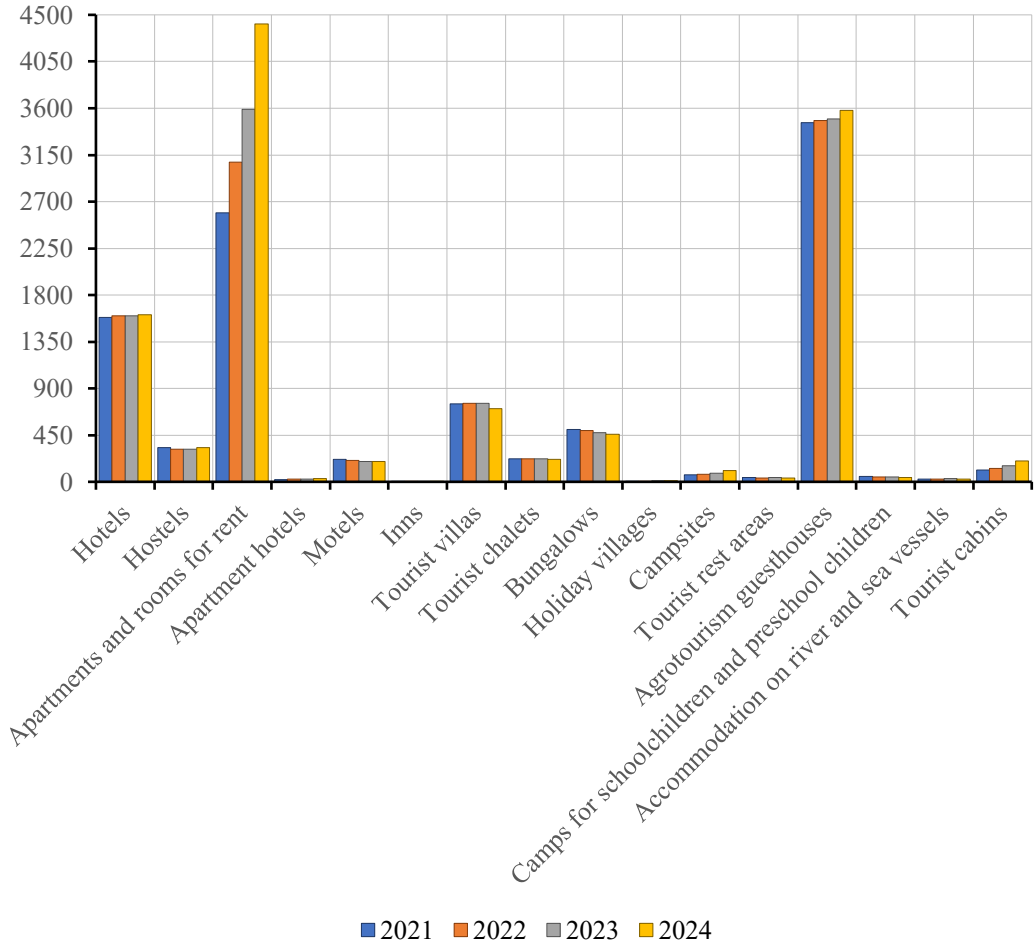

Figure 2. Trend in the number of tourist accommodation establishments with lodging functions in Romania during the period 2021-2024
(Data Source: INS, http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table)

The analysis of reception structures with tourist accommodation functions by tourist destinations shows that in 2021 most units are found in the category of other localities and tourist routes, representing a 32% share in total, followed by mountain resorts with 29%, Bucharest and the county capitals, excluding Tulcea, with 17%, resorts in the coastal area, excluding the city of Constanța with 10%, spa resorts with 7% and the Danube Delta area, including Tulcea by 5%.

For the year 2024, there are no significant changes, we only mention an increase of 1% in the spa resorts and in the category of other localities and tourist routes and a reduction of 1% in Bucharest and the county capitals, excluding Tulcea and in the Danube Delta area, including the city of Tulcea.

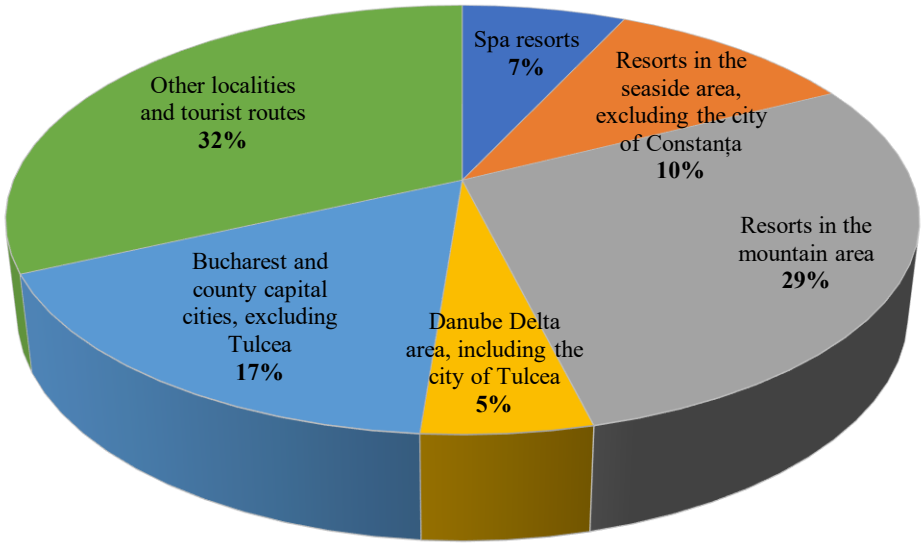

Figure 3. Share of tourist accommodation establishments by tourist destination in Romania in 2021
(Data Source: INS, http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table)

It is interesting to note that spa resorts only account for 7% in 2024 of the total number of tourist accommodation units, in the context in which Romania has a large area of forests, many mineral springs that allow the treatment of numerous ailments, with a biodiversity rarely found in Europe and the world. At the same time, the Danube Delta Area, a masterpiece of nature, only accounts for 4% in 2024, the Romanian coastline, 11% in 2024, which shows us that there is room for development in this area as well.

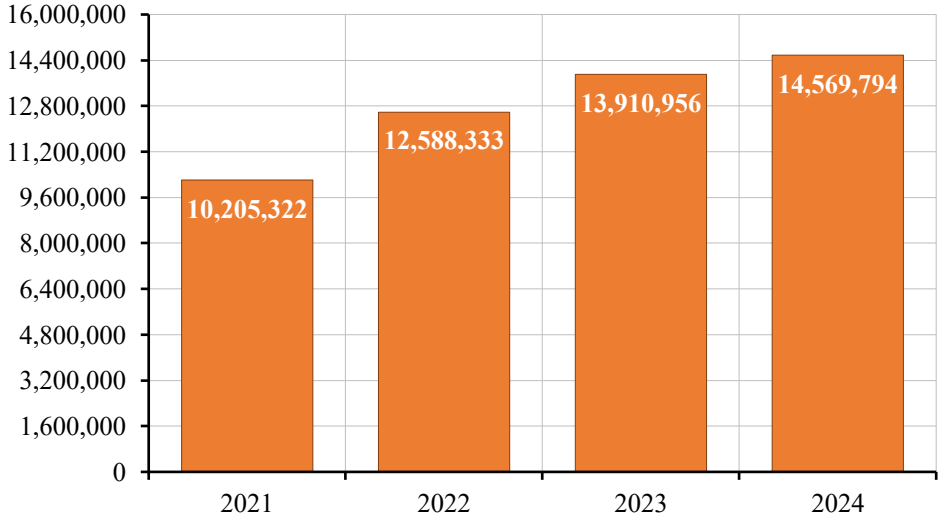

Figure 4. Trend in the number of persons accommodated in establishments in Romania
(Data Source: INS, http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table)

NUMBER OF TOURISTS

In 2024, according to a MinistrRomania was visited by almost 2.4 million foreign tourists, up 13.5% compared to 2023. The increase is explained by the promotion made by the relevant ministry due to Romania's accession to the Schengen area (https://economie.gov.ro/in-2024-romania-a-fost-vizitata-de-aproape-24-milioane-de-turisti-straini-in-crestere-cu-135-fata-de-anul-2023) by improving services, road transport networks etc.

It is also relevant to follow the evolution of the number of tourists coming to the various tourist areas, as the data shows us that there was an increase throughout the analyzed period. Thus, from 10,205,322 people in 2021, it reached 14,569,794 in 2024, representing 42.76% in 2024 compared to 2021.

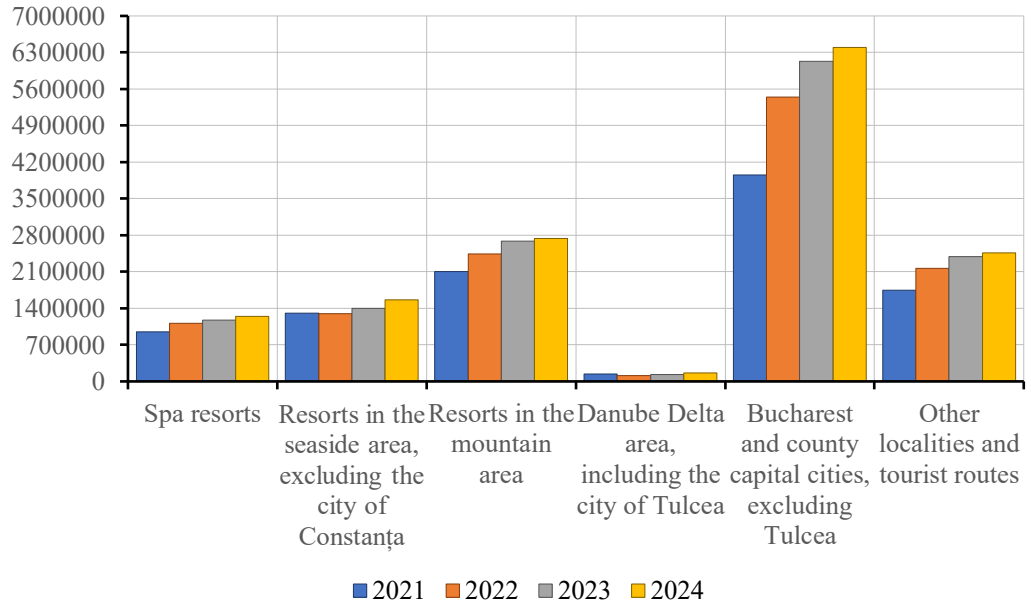

Figure 5. Number of tourists accommodated in tourist accommodation establishments, by destination (Data Source: INS, http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table)

The analysis by destination shows that most tourists arrived in various reception units in Bucharest and the county capital cities, excluding Tulcea, followed by mountain resorts and those in the category of other localities and tourist routes. If we analyze the share of the number of tourists arriving in different forms of accommodation in 2021, we can see that Bucharest and the county capitals, excluding Tulcea, account for 39% of the total, mountain resorts 21%, other localities and tourist routes 17%, seaside resorts 13%, and spa resorts 9%. The Danube Delta area, including the city of Tulcea, records only 1% in 2021.

In 2024, the situation improved in the number of arrivals in various accommodation structures in Bucharest and the county capital cities, excluding Tulcea, reaching 44%, an increase of 5% compared to 2021. In contrast, decreases were recorded in mountain resorts reaching 19%, with a decrease of 2% compared to 2021, and on the coast also with a decrease of 2% compared to 2021.

NET UTILIZATION INDICES OF TOURIST ACCOMMODATION CAPACITY

The net utilization index of tourist accommodation capacity by type of structure is relevant to know how used the various reception structures are. This indicator is calculated by reporting the number of overnight stays, to the tourist accommodation capacity in operation, in the respective period. The data analysis highlights that the net occupancy rate of accommodation capacity in terms

of types of tourist reception structures was the highest for rental apartments with 40.2% in 2021, increasing slightly to 41.4% in 2024, followed by hotels with 32% in 2021 and 39.5% in 2024. These recorded an increase in the net occupancy rate of accommodation capacity, reaching from 23.8% in 2021 to 25.1% in 2024. Over 20% throughout the analyzed period were also recorded by tourist villas, bungalows, campsites, accommodation spaces on river and sea ships, and tourist cottages are also approaching these values. The lowest figures for this indicator are recorded by inns with 6.6% in 2021, increasing to 8.4% in 2024.

CONCLUSIONS

Romania has a wide variety of reception structures with tourist reception functions, units that can cover a wide variety of tourist accommodation needs. These differ not only in location, but also in offers for different market segments. They are in line with the diversified need for accommodation, but also with the financial possibilities of existing and potential clients. They are becoming increasingly demanding, their requests are diversifying, causing tourism companies to constantly adapt to market requirements.

Thus, in addition to hotels, apartments and rooms for rent have also developed, which, as data analysis shows, are in demand and appreciated. They registered an increase of 70.30% in 2024 compared to 2021, recording a share of 32.58% of the total accommodation units in 2024. The analysis of reception and accommodation structures by tourist destinations shows us an agglomeration of forms, especially in localities and in Bucharest, with mountain resorts holding approximately 29% in 2021, while the seaside 10%, spa resorts 7% and the Danube Delta area 5%.

The situation did not change much in 2024 either. Following the destination of tourists through the number of arrivals in different accommodation structures, it is observed that Bucharest and the county capital cities, excluding Tulcea, have the largest number of tourists, followed by mountain resorts of the category and other localities and tourist routes, while the seaside has only 13%, and spa resorts only 9%, in 2021. In 2024, the trend was maintained, Bucharest and the county capital cities recorded increases, while spa resorts and the seaside, a slight decrease.

The net utilization index of tourist accommodation capacity shows us that tourists largely prefer apartment hotels, hotels, apartments and rooms for rent. If we analyze the reasons for these preferences, we will find that these forms of accommodation offer larger spaces, much greater flexibility and freedom during the stay, more affordable prices especially for families, etc. Of course, other forms of accommodation are also used, such as tourist villas, bungalows, campsites, accommodation spaces on river and sea ships, tourist cottages depending on the customers' objectives, preferences and their sensitivity to the price of services.

The increase in the number of tourists is also due to the exit from the isolation period during the pandemic, customers being eager to go to resorts after a long period of prohibition.

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GEOGRAPHICAL CONSIDERATIONS REGARDING SMALL VILLAGES IN BIHOR COUNTY

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Abstract: The depopulation of small villages is a major problem facing today's society in the context of the migration of young people to the urban environment, which offers numerous opportunities for a better life. Given that a sustainable alternative to stop this phenomenon is the development of technical-urban and social facilities, this study aims to identify and establish the relationships between the specifics of rural localities in Bihor County, Romania, and the related technical-urban and social infrastructure. In this regard, the multi-criteria method was used. The results highlighted the existence of strong relationships in the case of 238 of the analyzed localities (90.3%), which confirms the importance of identifying solutions adapted to the local specifics for the revitalization of the rural environment.

Key words: small settlements, depopulation, technical-urban and social facilities, Bihor County

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INTRODUCTION

Small settlements represent a spatial reality specific to Bihor County in Romania, with origins and traditions dating back to the 13th century. They are an expression of the sustainable valorization of space in the context of the subsistence economy of previous centuries. The economic, social and political mutations that define today's society require serious efforts to adapt these communities to the new realities specific to globalization (Castles, 2002; Herman et al., 2016; McMichael, 1996).

One form of adaptation is to equip localities with urban and social infrastructure, including road, electrical, drinking water supply, wastewater collection, sewage, educational, power supply networks, etc. However, the process of depopulation and abandonment of small localities by the young population through migration to the city is increasingly intense and specific to our days (Bilsborrow, 2002; Johnson & Lichter, 2019; Pinilla et al., 2008; Viñas, 2019).

Small rural localities represent a defining presence for the Romanian geographical space, but in recent years they have faced numerous socio-economic and demographic challenges (Iancu et al., 2022; Muntele et al., 2021; Nancu et al., 2010; Stașac et al., 2010).

In the specialized literature, studies have been carried out that targeted the spatio-temporal evolution (Chen et al., 2024; Mao et al., 2025), influencing factors (Lou et al., 2020; Preotesi, 2013; Wang et al., 2023), land use (Cao et al., 2017; Yang et al., 2015), village identity (Herman and Benchiș, 2017; Patratanu, 2013), the possibility of adaptation to new challenges (Ropa, 2020), problems related to depopulation, migration and unemployment (Bajmócy and Balogh, 2012; Filimon and Filimon, 2011; Filimon, 2012, 2014; Ilcsikné Makra et al., 2018; Lung and Gligor, 2018; Lung, 2019; Stasac et al., 2016), land use (Herman et al., 2019; Pop and Benedek, 1996); mining activities and the impact on small rural settlements (Morar, 2012), demographic risk (Surd et al., 2007; Mureșan, 2014).

Moreover, the issue of the European rural environment, even if it does not strictly refer to small settlements, has been on the European Union agenda for some time. Thus, in April 2017, the "EU Action Initiative for Smart Villages" program was launched at European level, which aims to revitalize the rural environment and, at the same time, defines the smart village as that village oriented towards its inhabitants, using all the possibilities offered by the present (Sytnyk et al., 2022). Another important element highlighted in the document is the emphasis placed on the use of all endogenous resources of identity elements and which, associated with local heritage, can confer specific territorial resources, different from general ones (Pecqueur, 2000).

The settlement network in Bihor County is structured by 458 localities, with a population of 551,297 inhabitants, of which 250 are small localities (54.6%), which concentrate a population of 67,618 inhabitants, representing 12.3% of the total population of the county.

Their importance within the rural settlement system does not derive from the concentration of population, but rather from their historical past, the degree of coverage of the territory with settlements and the influences they exert in the process of humanization and urban development of the county.

In this context, the purpose of the present study is to identify and explore the relationships between the specificity indices of small rural settlements and the related technical-urban and social facilities. The specificity indices of small rural settlements are represented by the factors that have determined and continue to determine the continuity of the population in the analyzed settlements. Among them, the defining characteristics of the population (number, sex, age structure, level of education, etc.), the customs and traditions of the population, the motivation, perception and satisfaction of the population living in the analyzed spaces, the size of the settlement, the population evolution trend, the degree of isolation, etc. Knowing all these elements that give specificity to small rural settlements has proven to be an extremely difficult objective to achieve, requiring time and in-depth research at the level of each locality.

The research hypothesis of this study aims at the fact that, at the level of small villages, there are strong relationships between specificity indices and technical-urban and social facilities, so that

the research questions were: Are there relationships between specific indices of small rural settlements and technical-urban and social facilities? What kind of relationships are there?

The novelty of the study is given by the approach of small localities on the verge of depopulation and disappearance through the multi-criteria method to identify the possible relationships that have been established between specificity indices and technical-urban and social facilities. Knowledge of these aspects can represent an informational support for decision-makers regarding integrated spatial planning of the territory.

RESEARCH METHODOLOGY

The data and information necessary for the present study were taken from the National Institute of Statistics, the Bihor Public Health Directorate, the Bihor County School Inspectorate and the National Road Infrastructure Management Company. Thus, to capture the specifics of small rural settlements, the indicators used were: X1. Population; X2. Type of settlement, X3. Type of road; X4. Road condition; X5. Distance between the analyzed localities and the commune centers to which they belong; X6. Evolution trend, while calculating the specificity index of the technical-urban and social infrastructure the following indicators were used: Y1. Electricity supply network; Y2. Drinking water supply network; Y3. Sewage network; Y4. Medical offices; Y5. Schools, Y6. Churches; Y7. Grocery stores.

The identification and exploration of the relationships between the specifics of small rural settlements and their related technical-urban and social facilities was carried out using the multi-criteria method [Herman et al., 2023, 2024a, b, 2025a,b; Boc et al., 2022; Deac et al., 2023], which involved: normalizing the values (between 0 and 1) specifics of small rural settlements and their related technical-urban and social facilities; calculating the aggregate values for specifics of small rural settlements and their related technical-urban and social facilities; evaluating the criterion through the synthesis value; calculating the relationship index; graphical and cartographic rendering of the results obtained through the ranking and classification methods using the Excel (Microsoft Office 365) and ArcgisPro software programs.

RESULTS AND DISCUSSION

The documentary attestation of localities highlights the humanization process and the moment when they appear mentioned in official documents, so that, over time, the number of small settlements fluctuated, being influenced mainly by socio-economic factors.

From the analysis of the evolution of small rural settlements after the date of documentary attestation, it can be observed that the largest number of settlements dates from the 16th century, followed by settlements attested in the 20th, 13th, 15th and 14th centuries, with relatively close values (Figure 1).

A special situation was recorded in the Păcălești locality (Drăgănești commune), which was part of the Țigănești de Beiuș locality until 2008, when following a referendum it became a village (Ropa, 2020). The large number of localities dating from the 13th-17th centuries highlights the fact that small villages in Bihor County are the result of the population's adaptation to the constraints generated by natural factors (relief, soil, hydrography, vegetation and fauna), while the influence of demographic behavior is noticeable in the 20th and 21st centuries.

Analyzing the demographic dimension in the census of 1977, 1992, 2002, 2011, 2021, we observe that of the total number of current small rural settlements, a number of 125 villages (50.2%), fall into the same category. Since 1977, the transition of some villages from the large and medium category to the small category, as a result of demographic behavior, coupled with socio-economic changes (closure of mining operations, industrial units) is best reflected by the example of the localities of Pădurea Neagră, Băița, Damiș, Munteni, Dernișoare, etc., which, from a population exceeding over 1000 inhabitants at that time, currently have under 500 inhabitants (Figure 1).

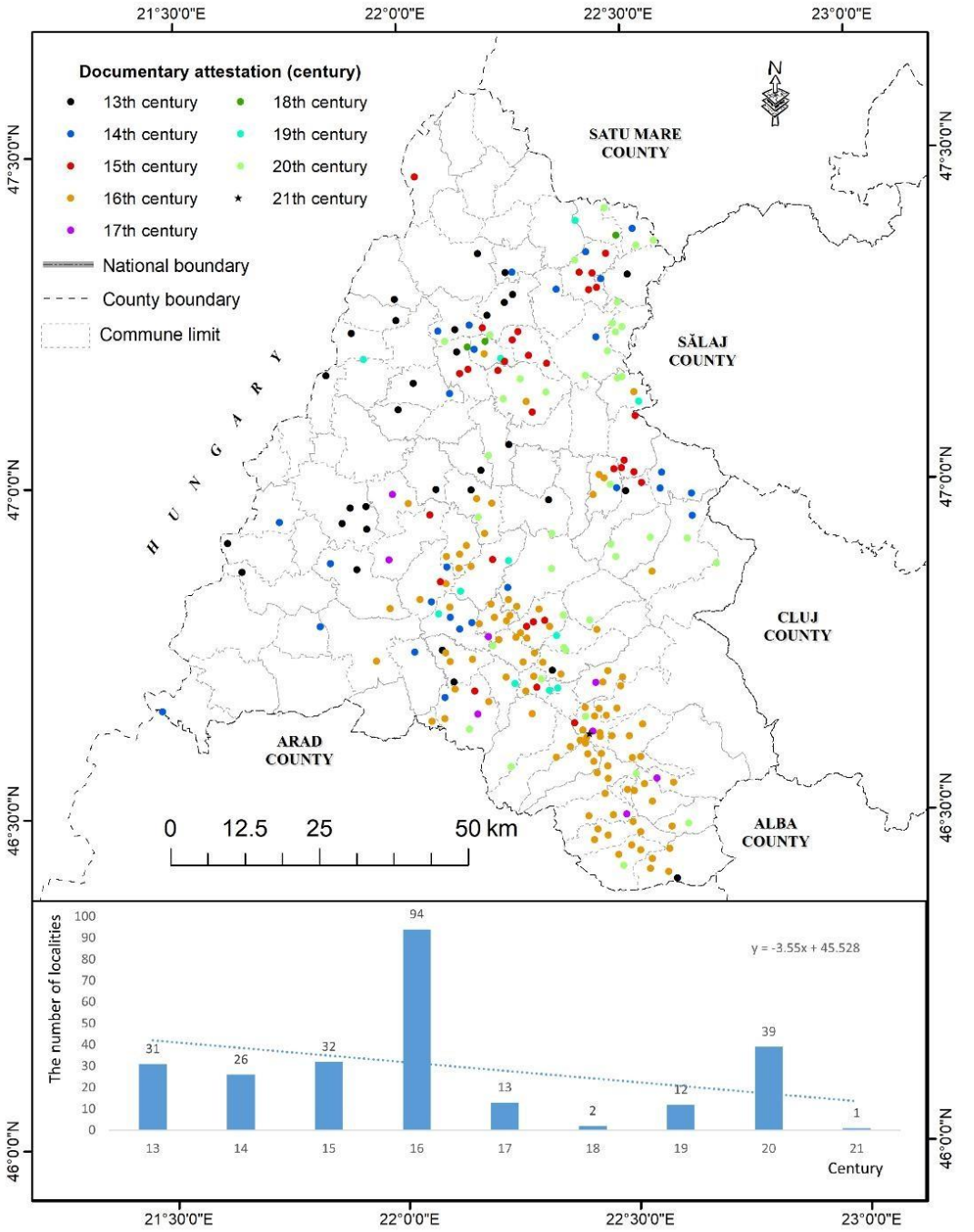

Figure 1. Spatio-temporal distribution of small rural settlements according to the year of documentary attestation

The spatial distribution of small settlements reflects the expression of the favorability of the natural environment in terms of their genesis and evolution in the analyzed space. Thus, a higher

concentration of small settlements can be observed in mountainous areas characterized by more limited opportunities to support larger communities, while in depressional, hilly and plain areas the demographic size of human settlements increases. Thus, three areas with a high concentration of small rural settlements can be highlighted, namely: Țara Beiusului, Valea Barcăului and Valea Crișului Repede (Figure 2).

Beiuș Country is the most representative area of concentration of small settlements, holding over 40% of their total number. The high share of these settlements is generated by the configuration of the relief and its housing potential. Their concentration, especially in the center of the Beiuș Depression, is also the result of the administrative policies carried out by the Austrian authorities in the 18th century, namely the drawing of villages in a line (Filimon, 2012).

The second area of concentration, with 30% of the number of small settlements, is represented by the northeastern part of the county, namely the Barcăului Valley, both the plain and the hilly one. And in this case, the relief, together with the hydrography, are the factors that conditioned the possibilities of the development of the settlements. It should be noted that in this area the small rural settlements are either Romanian or Hungarian.

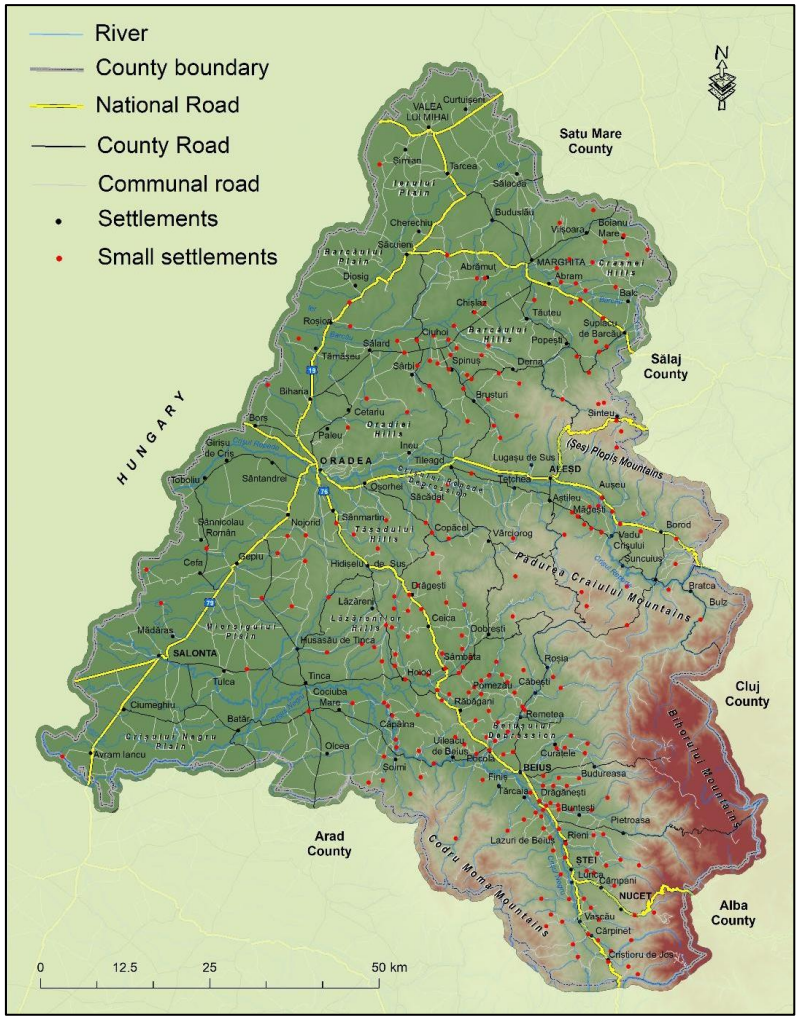

Figura 2. Spatial distribution of small rural settlements in Bihor County

A third, less extensive area is in the eastern part of the county, largely overlapping the Crișului Repede Valley and with a small extension in the Plopiș Mountains and the Craiului Forest. Like the other areas, here too the configuration of the relief and the other components of the natural setting have contributed decisively to the evolution of the settlements. In the case of the Plopiș Mountains, a defining element for the small settlements is the Slovak communities that populate these settlements. In addition to these areas of concentration of small settlements, they also appear in the western part, in the plain area and which generates an imaginary line that connects the northern and southern parts of the county in the vicinity of the border with Hungary (Figure 2).

Analysis of synthetic specifics of small rural settlements

To identify and explore the synthetic specifics of small rural settlements, information was collected on population, type of settlement, type and condition of the road, distance between the analyzed localities and the commune centers to which they belong, and the evolution trend.

At the last census, in December 2021, out of the total of 458 settlements in Bihor County, 250 small settlements (54.6%) were registered. This high percentage highlights the special role they play in the structure of rural settlements in Bihor County.

From a demographic point of view, small rural settlements can be classified into three categories: settlements in a critical stage (under 100 inhabitants), small settlements (between 100 and 249 inhabitants) and small settlements (between 251 and 500 inhabitants). Settlements in a critical stage represent a percentage of 20.4% (51 localities), most of which are in the mountainous area of the county. Among these settlements with an imminent risk of depopulation due to their high degree of isolation, Codrișoru, Huta, Băița Plai, Brusturi, Bilc, Socet, etc. stand out. The category of small settlements with a population between 100 and 249 inhabitants includes 69 settlements (27.6%), relatively evenly distributed throughout the county, some of which have a privileged position with respect to some communication routes and the commune center. Among these, we mention Păcălești, Cacuciu Vechi, Satu Nou, Dumbrăvani, Tororeni etc. Small settlements, with a population between 250 and 500 inhabitants, number 130 units, or 52% of the total. They are present throughout the county and benefit from a high degree of connectivity. From this category we mention Sudrigiu, Păușa, Chisirid, Delani, Sighiștel, Berechiu etc.

The distance from the commune center highlights the degree of isolation of the village from the administrative center, this index being conditioned by the configuration of the relief and, last but not least, by the quality of the communication routes.

Regarding the distance between the small component villages and the corresponding commune center, within Bihor County the distances vary between 0.1 km (in the case of 19 localities) and 34 km between Codrișoru and the center of Auseu commune. In the case of Codrișoru village the distance is generated by the configuration of the relief, the commune center being in the Crișului Repede meadow, and the village is in the Plopiș Mountains. Except for this situation, most villages, 121 units (48.4%), are located at distances of maximum 5 km from the corresponding commune center. 88 localities (35.2%), are located at a distance between 5.1 and 10 km. For 41 villages, 16.4%, the distance exceeds 10 km, greater isolation and raises problems regarding the degree of connectivity and urban endowment of these villages. In this situation are villages such as Codrișoru, Vărzării de Sus, Vărzării de Jos, Sohodol, Josani, Goila, Răcaș, etc.

Closely related to the distance from the village center to the degree of isolation, an important role is played by the communication routes that serve the localities. Considering that in recent years, road transport has had a defining role, at least in Bihor County, in terms of the movement of the population for various purposes (services, school, health, various purchases: food, clothing, etc.), we analyzed the type of road that connects small villages and their condition. Thus, 46 villages are served by road by county roads with asphalt surface, 32 localities have communal roads also with asphalt surface, 9 are crossed by national roads, the rest of the localities being served by a combination of the three types of road arteries. In terms of quality, except for the communal roads connecting the villages of Huta (Boianu Mare commune), Cristioru de Sus (Cristioru de Jos

commune) to the commune center or to a major artery and which are not asphalted, all the others benefit from asphalt surfacing. We can appreciate the fact that, in terms of connectivity, with few exceptions, small villages are not isolated from the commune centers or nearby cities.

Following the ranking of the localities analyzed based on the specifics of small rural settlements, it was found that its highest values were found in Poclusa de Barcău (0.693, with a population of 378 inhabitants in 2021, located at a distance of 7.2 km from the commune center, with a population growth trend, with access to the national road), Pocola (0.687, with a population of 464 inhabitants in 2021, located at a distance of 0.1 km from the commune center, with a population growth trend, with access to the national road), Drăgesti (0.660, with a population of 397 inhabitants in 2021, located at a distance of 0.1 km from the commune center, with a population growth trend, with access to the national road) and Marțihaz (0.647, with a population of 269 inhabitants in 2021, located at a distance of 24 km from the commune center, with a population growth trend, with access to the national road), while the lowest values were recorded for the localities of Criștioru de Sus (0.048, with a population of 49 inhabitants in 2021, located at a distance of 5 km from the commune center, with a depopulation trend, with access to an unpaved communal road) and Reghea (0.014, with a population of 36 inhabitants in 2021, located at a distance of 4.5 km from the commune center, with a depopulation trend, with access to an asphalted communal road) (Figure 3).

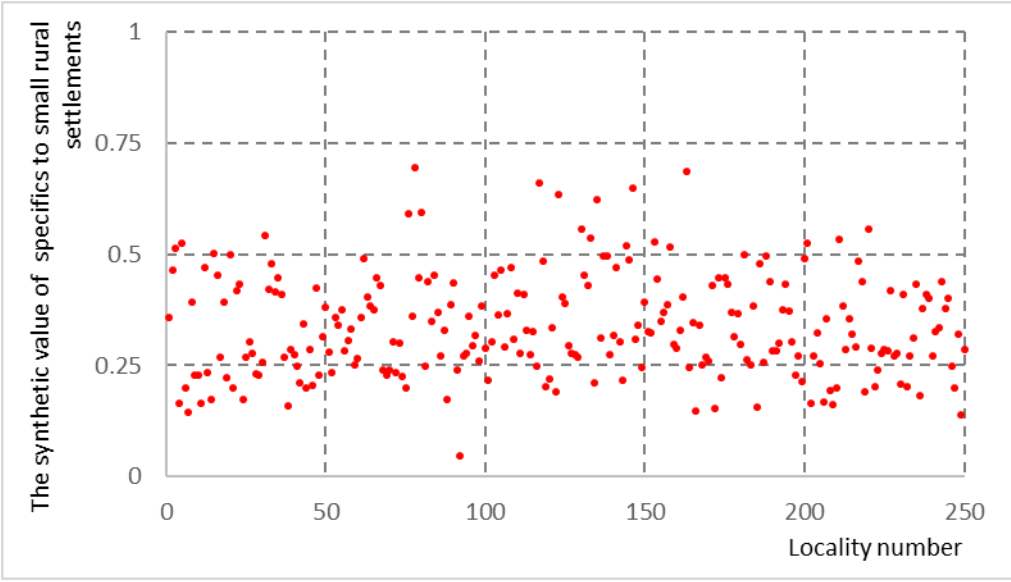

Figure 3. The distribution of the synthetic value of specifics of small rural settlements

Following the classification of small rural settlements according to the value of the specificity index, the existence of the following types of localities was highlighted: with a high value (21 units, 8.4%), with a low value (169 units, 67.6%) and with a very low value (60 units, 24.0%) (Figure 4).

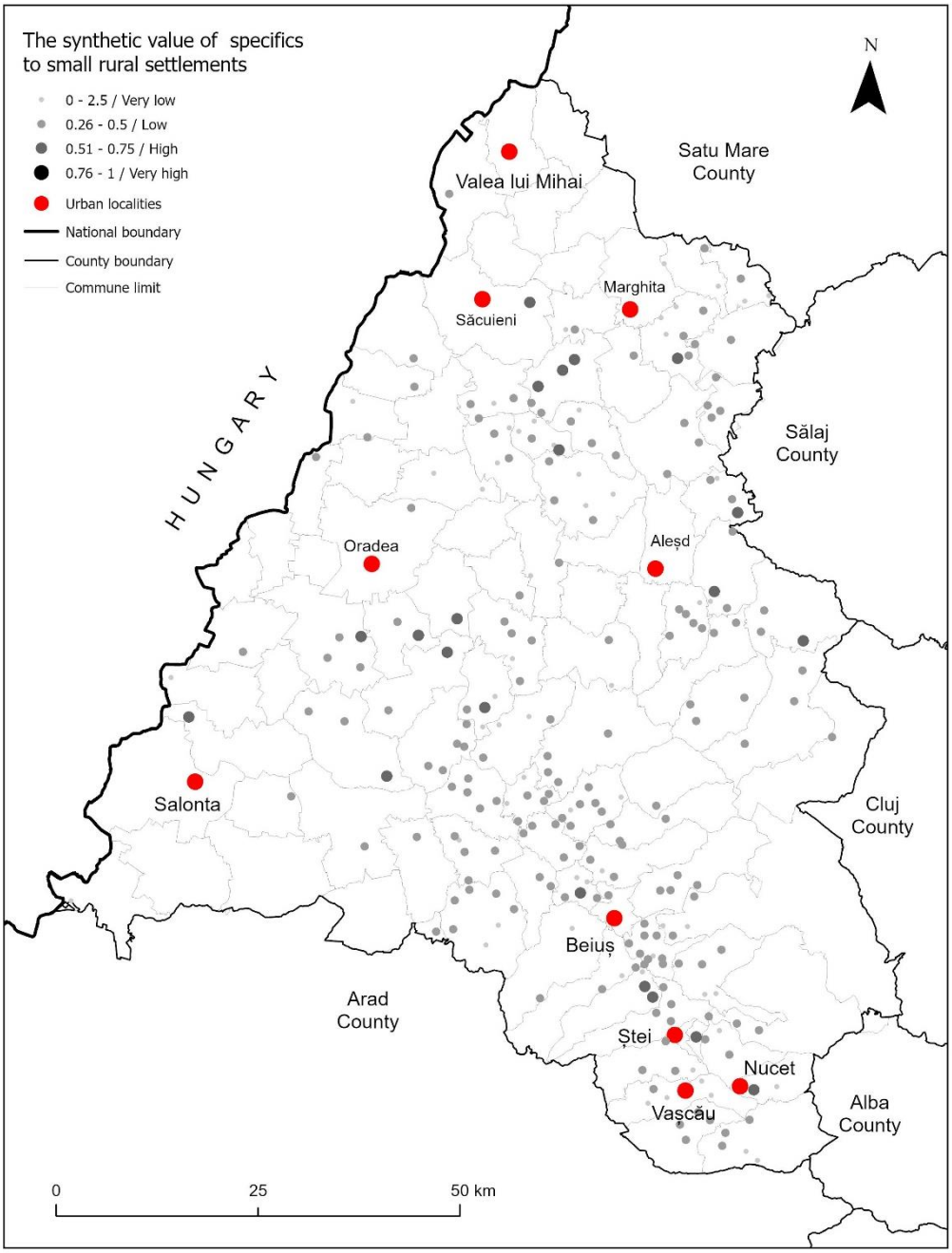

Figure 4. Spatial distribution of the synthetic value of specifics of small rural settlements

Analysis of synthetic indices specific to technical-urban and social facilities in small villages

To identify and explore the synthetic index specific to the technical-urban and social facilities in small villages, information was collected on the electricity, water and sewage supply network, the existence of schools, medical offices, churches and grocery stores. All these elements ensure the comfort and standard of living of the population determine the degree of attractiveness or repulsion of a locality. Naturally, these facilities are influenced by the degree of isolation, the distance from

the administrative center, and not least by the home-based spirit of the mayor's office representative, the local council and the locals. If during the socialist period, Romanian villages, and especially small ones, were neglected, through the policy pursued by the Romanian state (Filimon, 2012), after 1989, from government, own, and then European funds, the level of municipal facilities increased. Before 1989, the Romanian state did not invest in infrastructure works (water, sewage, asphalting of roads, health facilities, schools) precisely to make villages unattractive for the population and thus determine the population to move to the city or, at best, to the center of the commune. The effect expected by the state, the abandonment of the village followed by the demolition of buildings and the transformation into agricultural land.

The connection to the electricity network was made in all villages, except for a few isolated households in the mountainous area belonging to the village of Brusturi (Finis commune). It is worth mentioning that the extension of the electricity network was largely completed by 1989.

The water and sewage network, the gas network is a general problem specific to the rural area in Romania. Thus, currently, out of all the small villages, a relatively small number have these facilities. Thus, in only 21 villages (8.4%), the water and sewage network is present and functional, in some of them, introduction works are underway. The situation is explained either by the degree of isolation of some villages from the commune center, or by the disinterest of the local administration, and last but not least, we must take into account the locals, their mentalities, and the fact that for many, water was provided from their own wells, considered cheap, and for sewage they use either septic tanks or a network of ditches for household water.

As for the gas network, the existing one does not serve small settlements, this year the Bihor County Council is starting a large-scale project aimed at expanding the gas network in over 30 UATs by 2030, thus increasing the number to 80 communes and cities (Bihor County Council, 2025).

An equally critical situation is regarding the provision of health services. Out of all the small settlements, only 20 localities have family medical offices that offer a minimum package of medical services. The lack of such facilities creates problems for the local population, forced to resort to medical services, either in the commune centers, if such services exist there, or in the nearby city. Given the aging population, such services would be necessary at least in the commune centers, but the lack of money for investments, the lack of medical personnel, make this objective a weak point for these communities, at least for now.

Unfortunately for small villages, the degree of coverage with educational units is not in a better situation either. If in the past, with few exceptions, there was at least one primary school in each locality, currently, due to the reduction of the preschool and school population, the lack of teaching staff and policies to merge educational units, the number of school units has decreased drastically. Thus, in only 16 small villages, representing 6.4% of the total, there is an educational unit up to grade 8. Most of them also have preschool groups in the same unit.

Regarding their provision with public catering units (shops), things are much better. The possibility of manifesting the entrepreneurial spirit, especially in the field of trade, means that almost all small settlements, except for the Bîlc locality (Cristioru de Jos commune), have shops. They are mixed types of shops (food and non-food products), adapted to meet the needs of the locals.

A landmark of local identity (size, construction materials), a place of socialization, hope for the community and, at the same time, an element of continuity, churches are also present in small villages (Herman et al., 2020). Like shops, they are present in the rest of the villages, except for Bilc, and are often a place of community cohesion.

Following the classification of small rural settlements according to the value of the technical-urban and social facilities index, the existence of the following types of localities was highlighted: with a very high value (23 units, 9.2%), localities with a high value (86 units, 34.4%), localities with a low value (140 units, 56.0%) and localities with a very low value (1 unit, 0.04%) (Figure 5).

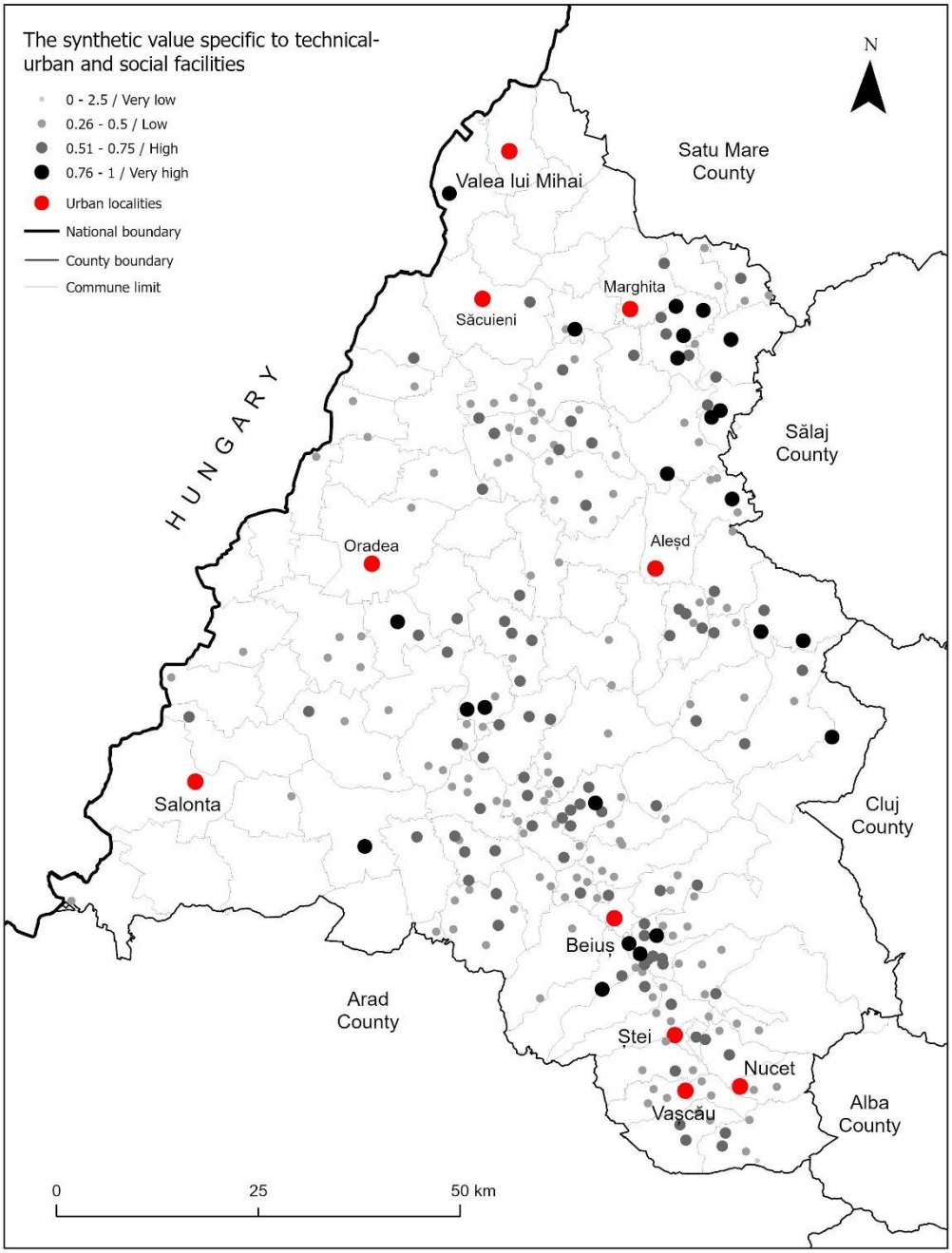

Figure 5. Spatial distribution of the synthetic value of the index of technical-urban and social facilities

Following the ranking of the analyzed localities based on the synthetic index specific to technical and municipal facilities, it was found that the highest values were found in Abrămuț, Drăgănești, Drăgești (1, with access to the electricity network, drinking water and sewage, benefits from a medical office, school, church and grocery store), while the lowest values were recorded in the locality of Bâlc (1, with access to the electricity network, without access to the drinking water and sewage network, without a medical office, school, church and grocery store) (Figure 6).

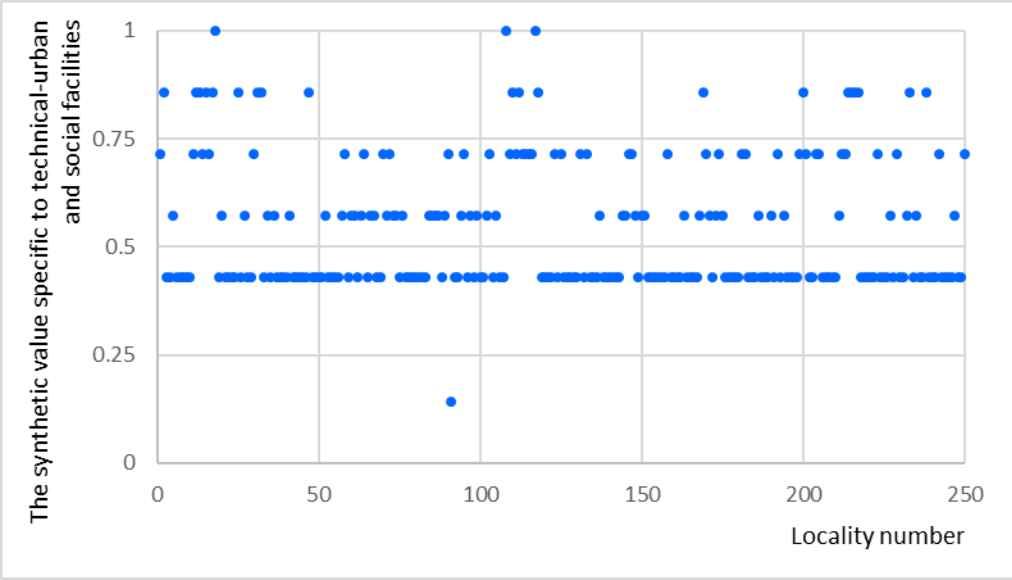

Figure 6. Distribution of the synthetic value of the index of technical-urban and social facilities

Analysis of the relationship index between the specifics of small rural settlements and technical-urban and social facilities

The following types of relationships were found:

(1) Weak negative relationships, characterized by relationship index values between -1 and -0.5, were established at the level of 12 localities (8.3%). This type of relationship is defined by values of the specifics of small rural settlements equal to 0 or lower than those specific to the technical-urban and social facilities index. Thus, the value of the relationship index for the localities of Cohani and Cristioru de Sus was -0.625 and -0.799, being given by the synthetic values of the indices specific to small rural settlements (0.165 and 0.048) and of the technical-urban endowments index (0.714 and 0.429) (Figures 7 and 8).

(2) Strong negative relationships with relationship index values between -0.51 and 0 were identified in 213 localities (61.1%). This type of relationship is defined by values of the specifics of small rural settlements lower than those specific to the technical-urban and social facilities index. Thus, the value of the relationship index for the localities of Codrișoru and Satu Nou was -0.012 and -0.023, being given by the synthetic values of the indices specific to small rural settlements (0.419 and 0.409) and of the technical-urban and social endowments index (0.429 and 0.429) (Figures 7 and 8).

(3) Strong positive relationships with relationship index values between 0 and 0.5 were identified in 25 localities (29.2%). This type of relationship is defined by values of the specifics of small rural settlements higher than those specific to the technical-urban and social facilities index. Thus, the value of the relationship index for the localities of Poclușa de Barcău and Bâlc was -0.263 and -0.256, being given by the synthetic values of the indices specific to small rural settlements (0.693 and 0.241) and of the technical-urban and social endowments index (0.429 and 0.143) (Figures 7 and 8).

(4) Weak positive relationships, with relationship index values between 0.51 and 1, were not identified. This type of relationship is defined by values of specifics of small rural settlements higher than those specific to the technical-urban and social facilities index (Figures 7 and 8).

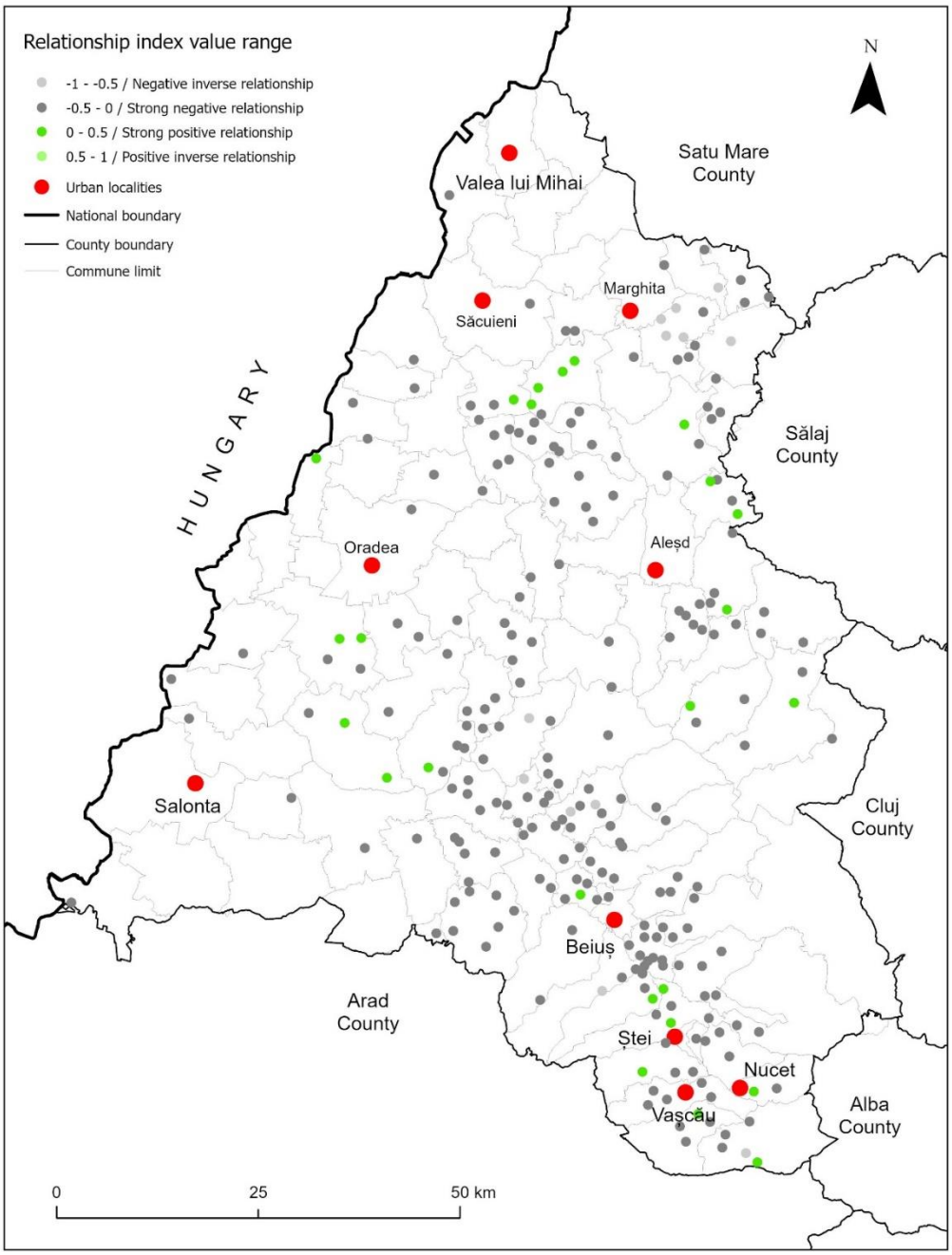

Figure 7. Spatial distribution of types of relationships between indices specifics of small rural settlements and those of technical-urban and social facilities

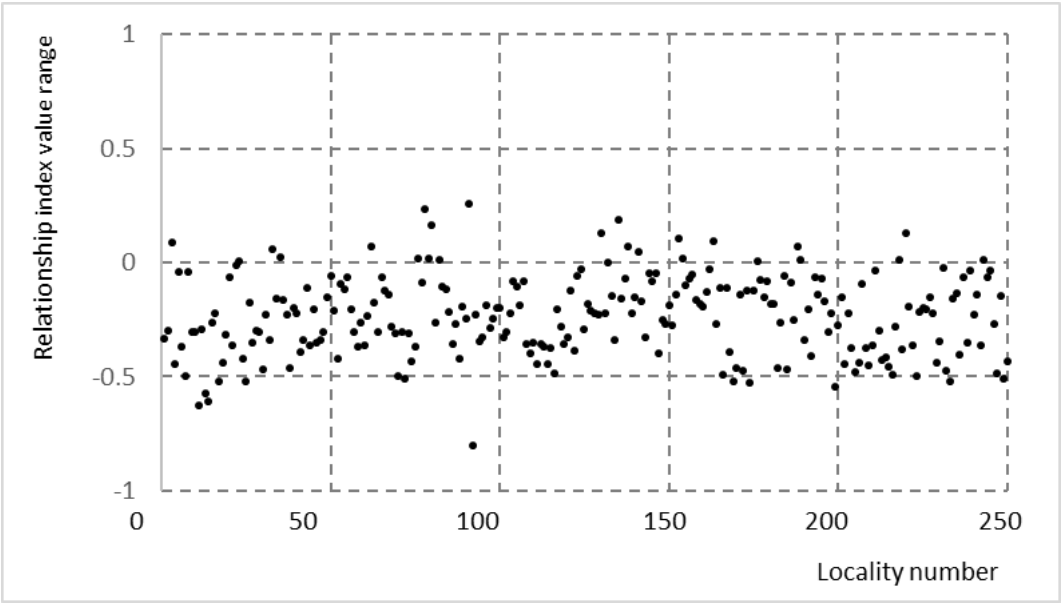

Figure 8. Distribution of types of relationships between indices specifics of small rural settlements and those of technical-urban and social facilities

CONCLUSIONS

Given the age of attestation and the high share of small villages in Bihor County (54.6%), we can say that they are one of the main elements in the process of humanization of the territory. Although they have been attested since the 13th century, the largest number of settlements was attested in the 16th century (94 settlements). The analysis of the spatial distribution highlights the existence of three concentrations of small rural settlements, namely Țara Beiușului, Valea Crișului Repede and Valea Barcăului.

From a demographic point of view, three categories of settlements can be highlighted: critical settlements, with a population of under 100 inhabitants and a higher degree of isolation, especially in mountainous and depressional areas, very small settlements (100-249 inhabitants) present throughout the county and small settlements (250-500 inhabitants) with a much higher degree of connectivity.

The distance from the center of the commune highlights the fact that the most numerous settlements (121 units) are those located at a maximum distance of 5 km from the center of the commune, at the opposite pole being 19 settlements whose degree of isolation is much higher, over 10 km from the center of the commune. Regarding the technical and municipal facilities in the small settlements, major deficiencies were found in terms of drinking water supply, sewage, gas, educational institutions, health, because of the effect of the historical past, the restrictions imposed by the relief, isolation, but also because of the human factor (local population and public administration). Although small villages are characterized by a pronounced depopulation process, it is currently quite difficult to specify what the socio-demographic evolution of these spatial entities, which represent a true backbone of the rural system of Bihor, will be.

For this reason, in this study an attempt was made to establish relationships between the specificity indices of small rural settlements and those of technical-urban and social facilities. The results highlighted the existence of strong relationships in the case of 90.3% of the analyzed localities, which tests the research hypothesis confirming that the phenomenon of depopulation of small settlements can be counteracted by investments in technical-urban and social infrastructure.

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