ENVIRONMENTAL DEGRADATION, ENVIRONMENTALLY INDUCED MIGRATION AND SUSTAINABLE TOURISM DEVELOPMENT IN RURAL REGIONS OF SERBIA

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ABSTRACT

Environmental degradation and population migration represent important challenges for sustainable rural development, particularly in regions characterized by limited economic opportunities and demographic decline. This study examines the relationships between environmental degradation, environmentally induced migration, and sustainable tourism development in selected rural regions of Serbia. Data were collected through a structured questionnaire administered to 212 respondents. The analysis included descriptive statistics, reliability analysis, exploratory factor analysis, correlation analysis, and multiple linear regression. The results indicate strong associations between perceived environmental degradation, reduced quality of life and socio-economic security, environmentally induced migration, and negative demographic change. Environmental degradation and migration were also strongly associated with perceived constraints on sustainable tourism development. The findings highlight the interconnected nature of environmental, demographic, and economic processes and support the need for integrated rural development policies combining environmental protection, demographic stability, and sustainable tourism development.

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Introduction

Environmental degradation has become one of the most significant challenges to sustainable economic and regional development, particularly in rural and peripheral areas where livelihoods and local economic activities remain strongly dependent on the availability and quality of natural resources. Processes such as soil degradation, water and air pollution, deforestation, biodiversity loss, and the deterioration of ecosystem services can directly affect agricultural production, employment opportunities, human well-being, and the overall quality of life of local populations (FAO, 2018; IPCC, 2022).

Consequently, environmental degradation can no longer be regarded exclusively as an ecological problem, but rather as a multidimensional development challenge with pronounced economic, social, spatial, and demographic consequences. The effects of environmental degradation are particularly important in rural regions, where economic structures are often less diversified and local communities are more dependent on agriculture, natural resources, and ecosystem services. Environmental pressures may therefore intensify existing structural disadvantages, reduce livelihood security, and limit the capacity of local economies to generate stable employment and income. From the perspective of sustainable livelihoods, deterioration of the natural resource base increases household vulnerability and may encourage the adoption of alternative livelihood strategies, including migration (Scoones, 2015).

A growing body of migration research recognizes environmental change as an important factor influencing population mobility. Environmental degradation can operate as a push factor which, in interaction with economic vulnerability, limited employment opportunities, institutional conditions, and individual household characteristics, contributes to migration decisions (Black et al., 2011; McLeman, 2018; Piguet et al., 2011). Environmentally induced migration should not, however, be interpreted as a simple or deterministic response to environmental change. Migration decisions generally emerge from the interaction of environmental, economic, social, and institutional pressures, while the importance of each factor varies according to the vulnerability and adaptive capacity of particular communities (McLeman & Smit, 2006; Hugo, 2014).

Migration can consequently be understood both as a response to environmental and socioeconomic pressures and as an adaptation strategy through which individuals and households attempt to reduce risk and improve livelihood security (Black et al., 2011; Tacoli, 2009). The departure of younger and economically active residents can accelerate population ageing, reduce the available labour force, weaken local entrepreneurship, and diminish the human and social capital necessary for regional development (Castles, 2010; Johnson & Lichter, 2019). These effects are particularly important in rural and peripheral areas already affected by depopulation and limited economic diversification.

Within this context, tourism represents a potentially important mechanism for diversifying rural economies and creating alternative sources of employment and income. Rural areas frequently possess natural landscapes, biodiversity, cultural heritage, traditional production systems, and local identities that can provide a basis

for tourism development. Sustainable tourism may therefore contribute to local economic diversification, support small businesses and entrepreneurship, generate employment opportunities, and strengthen the economic viability of rural communities (Hall & Williams, 2019; Rosalina et al., 2021; López-Sanz et al., 2021). At the same time, however, tourism is strongly dependent on environmental quality, landscape preservation, infrastructure, and the availability and participation of the local population (Hall & Williams, 2019; UNWTO, 2018).

The relationship between environmental conditions and tourism is therefore bidirectional. Tourism development can generate economic opportunities and contribute to the revitalization of local communities, but poorly planned tourism may simultaneously increase pressure on natural resources and contribute to environmental degradation (Hall, 2019; Li et al., 2024). Sustainable tourism requires an appropriate balance between economic benefits, environmental protection, and the social interests of host communities (Hall, 2019). Environmental deterioration may reduce destination attractiveness and negatively influence tourists' perceptions and behavioural intentions, while environmental and natural hazards may significantly affect destination choice and willingness to travel. Evidence from Serbian tourists, for example, indicates that perceived earthquake hazards can influence willingness to visit a destination, demonstrating the broader importance of environmental risk perceptions in tourism decision-making (Blešić et al., 2024).

Population migration adds another dimension to this relationship, as continued outmigration may reduce the local labour force, entrepreneurial capacity, and community participation necessary for sustainable tourism development. Conversely, tourismrelated employment and economic opportunities may contribute to local diversification and potentially reduce some migration pressures, particularly in rural and depopulating areas (López-Sanz et al., 2021; Rosalina et al., 2021).

The concept of sustainable development emphasizes the interdependence of environmental, economic, and social dimensions (WCED, 1987; Sachs, 2015). Applied to rural regions, this perspective requires environmental degradation, population dynamics, and tourism development to be considered as interconnected components of long-term regional sustainability.

The Republic of Serbia provides a relevant context for examining these relationships. Numerous rural and peripheral areas of the country are characterized by demographic decline, population ageing, migration of younger residents, limited economic diversification, and varying forms of environmental pressure. At the same time, many of these areas possess valuable natural landscapes, protected areas, cultural heritage, and other resources suitable for rural, nature-based, and sustainable tourism development. Previous research concerning transitional and rural economies has emphasized the importance of integrating environmental management, economic diversification, and market-oriented development strategies in strengthening regional development capacities (Cvijanović et al., 2013).

Despite the extensive international literature addressing environmental change and migration on the one hand, and sustainable tourism and rural development on the other, these relationships are frequently examined separately. Research on environmentally induced migration primarily focuses on the relationship between environmental stressors, vulnerability, adaptation, and population mobility (Black et al., 2011; McLeman, 2018), whereas sustainable tourism research predominantly examines destination management, environmental protection, economic benefits, and community participation (Hall, 2019; UNWTO, 2018). Considerably less attention has been devoted to empirically examining how local populations perceive the interconnected relationship between environmental degradation, migration processes, demographic change, and sustainable tourism development within a single analytical framework, particularly in the context of rural Serbia.

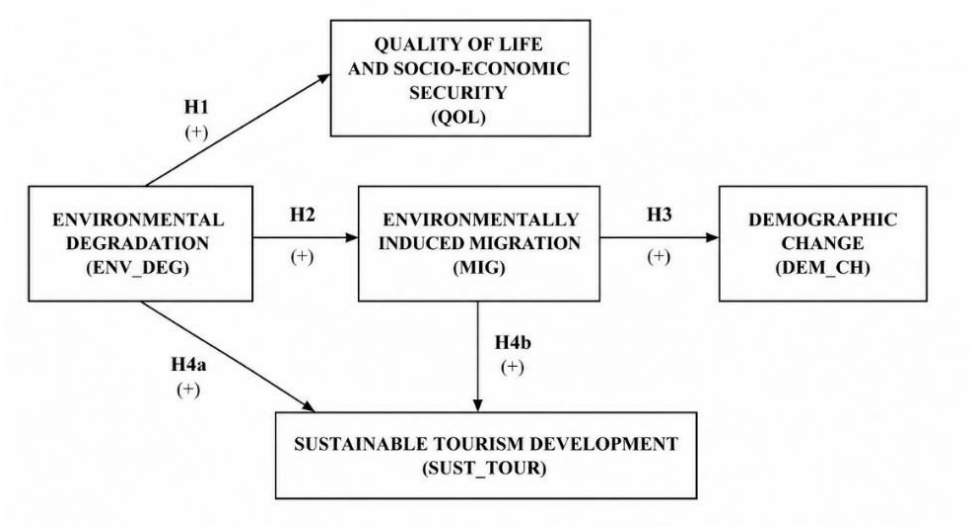
The study therefore adopts an integrated perspective in which environmental pressures may affect quality of life and migration tendencies, while migration processes may alter the demographic and economic capacity of local communities and subsequently influence opportunities for sustainable tourism development. Local residents' perceptions provide insight into how these interconnected changes are experienced and evaluated at the community level.

Accordingly, the aim of this study is to examine the perceived relationships between environmental degradation, environmentally induced migration, demographic and socioeconomic conditions, and sustainable tourism development in selected rural regions of the Republic of Serbia. More specifically, the study investigates whether perceived environmental degradation is associated with deterioration in quality of life and migration tendencies, whether environmentally induced migration is associated with demographic changes, and whether migration processes are related to the perceived sustainability of tourism development.

The novelty of the study lies in integrating environmental, demographic, and tourismdevelopment dimensions within a single empirical framework focused on rural Serbia. This approach contributes to understanding how environmental and demographic pressures may jointly shape local development opportunities and provides a basis for more integrated rural development policies.

Based on the theoretical framework and formulated hypotheses, Figure 1 presents the proposed relationships among environmental degradation, environmentally induced migration, quality of life and socio-economic security, demographic change, and sustainable tourism development.

Figure 1. Conceptual framework of the relationship between environmental degradation, environmentally induced migration, demographic change, quality of life, and sustainable tourism development



Source: Authors' conceptualization based on the research hypotheses.

Materials and methods

The empirical research was conducted among residents of selected environmentally vulnerable rural areas of the Republic of Serbia characterized by environmental pressures, demographic decline, and limited economic diversification, while simultaneously possessing natural and cultural resources relevant for tourism development. The study covered villages and settlements surrounding Potpeć Lake, Kamena Gora and Jabuka, as well as rural and riparian areas within the municipalities of Prijepolje and Priboj. In Eastern Serbia, respondents were drawn from the villages of Krivelj, Slatina, Oštrelj, Metovnica and Bučje in the surroundings of Bor, as well as rural settlements surrounding Majdanpek. The research also included peripheral villages in the Zlatibor area, including Sirogojno, Gostilje and Ljubiš, and villages surrounding Vlasina Lake in the municipality of Surdulica.

The study employed a non-probability sampling approach. The questionnaire was primarily distributed online to residents of the selected rural areas, while part of the data collection in the Zlatibor area was additionally conducted through direct field administration. The combined approach facilitated access to respondents from geographically dispersed rural communities while enabling direct participation in selected settlements. Participation was voluntary and anonymous, and respondents were informed about the purpose of the research and the use of the collected data prior to completing the questionnaire. The final sample consisted of 212 respondents of different gender, age groups and educational levels. The socio-demographic heterogeneity of

the sample enabled the examination of perceptions across different groups; however, the non-probability sampling procedure should be considered when interpreting and generalizing the findings beyond the surveyed population.

The research instrument consisted of 20 statements measuring respondents' perceptions of environmental degradation, environmentally induced migration, demographic change, quality of life and socio-economic security, and sustainable tourism development. All items were measured using a Likert-type scale. The complete questionnaire items and their theoretical foundations are presented in Table 1.

Table 1. Questionnaire items, thematic dimensions, and theoretical foundations

Item	Questionnaire statement	Thematic dimension	Supporting literature
Q1	Environmental degradation in my local area has increased in the past 5 years.	Environmental degradation	IPCC, 2022; FAO, 2018
Q2	The increase in environmental degradation affects tourism negatively in my region.	Environmental degradation / tourism	Gössling et al., 2015; Hall, 2019
Q3	I have considered migrating due to worsening environmental conditions.	Environmentally induced migration	Black et al., 2011; McLeman, 2018
Q4	Tourism development in my area has contributed to environmental degradation.	Environmental degradation / tourism impacts	Hall, 2019; UNWTO, 2018
Q5	Sustainable tourism practices are adequately implemented in my community	Sustainable tourism development	Hall, 2019; UNWTO, 2018
Q6	Population migrations are influenced by environmental changes in Serbia.	Environmentally induced migration	Black et al., 2011; Hugo, 2014
Q7	The government effectively manages environmental impacts related to tourism.	Sustainable tourism governance	UNWTO, 2018; Hall, 2019
Q8	Job opportunities in tourism influence population movements in my region.	Migration / tourism development	Hall & Williams, 2019
Q9	Environmental degradation has reduced the quality of life in my area.	Environmental degradation / quality of life	IPCC, 2022; FAO, 2018
Q10	Local communities support measures for sustainable tourism development.	Sustainable tourism / community participation	UNWTO, 2018; Hall, 2019
Q11	Migration decisions consider both economic and environmental factors.	Environmentally induced migration	Black et al., 2011; McLeman, 2018
Q12	Awareness about environmental issues and migration is widespread in my community.	Environmental awareness / migration	McLeman, 2018
Q13	Tourism industry stakeholders prioritize sustainability in their practices.	Sustainable tourism development	UNWTO, 2018; Hall, 2019
Q14	I feel tourism brings more benefits than harm to the environment locally.	Tourism impacts / sustainability	Hall, 2019
Q15	Environmental degradation causes more out-migration than other social factors.	Environmentally induced migration	Black et al., 2011; Hugo, 2014

Item	Questionnaire statement	Thematic dimension	Supporting literature
Q16	Public infrastructure supports sustainable development and environmental protection.	Sustainable development	Sachs, 2015; UNWTO, 2018
Q17	Tourism has created new economic opportunities for residents concerned about migration.	Tourism / local economic development	Hall & Williams, 2019
Q18	Population movements due to environmental reasons affect local demographics.	Demographic change	Castles, 2010; Black et al., 2011
Q19	Environmental education programs influence attitudes towards migration and tourism.	Environmental awareness	IPCC, 2022; UNWTO, 2018
Q20	There is sufficient cooperation between tourism and environmental sectors in Serbia.	Sustainable tourism governance	UNWTO, 2018; Hall, 2019

Source: Authors' elaboration based on the literature cited in the table

The questionnaire items were developed specifically for the purposes of the present study, drawing on theoretical and empirical literature concerning environmental degradation, environmentally induced migration, demographic change, quality of life, and sustainable tourism development. The cited sources in Table 1 therefore represent the theoretical foundations supporting the conceptualization of individual items rather than previously validated scales from which the statements were directly adopted. The 20 items address interconnected dimensions of environmental degradation, environmentally induced migration, demographic change, quality of life and socioeconomic conditions, and sustainable tourism development. Certain items intentionally address the intersections between these dimensions, reflecting the integrative conceptual framework of the study.

For hypothesis testing, selected questionnaire items were grouped into composite variables corresponding to the theoretical constructs examined in the study. The operationalization of the principal research constructs used for hypothesis testing is presented in Table 2.

Table 2. Operationalization of the research constructs

Research construct	Operational meaning
Environmental degradation (ENV_DEG)	Perceived deterioration of environmental conditions and natural resources and its consequences for local communities
Quality of life and socioeconomic security	Perceived effects of environmental pressures on quality of life and socioeconomic conditions
Environmentally induced migration (MIG)	Perceptions of environmental factors as drivers of migration

Research construct	Operational meaning
Demographic change	Perceived demographic consequences associated with environmentally induced migration
Sustainable tourism development (SUST_TOUR)	Perceptions of environmental and demographic influences on tourism sustainability

Source: Authors' elaboration based on the research questionnaire.

Composite indicators were constructed from conceptually related questionnaire items and subsequently used in the statistical analyses. The complete wording and theoretical basis of all 20 questionnaire items are presented in Table 1.

The internal consistency of the research instrument was assessed using Cronbach's alpha. Reliability analysis showed exceptionally high internal consistency for the complete 20-item questionnaire ($\alpha = 0.991$) and for the reduced 10-item set used in hypothesis testing ($\alpha = 0.981$). These values indicate a high degree of consistency among the questionnaire items and support their use in subsequent statistical analyses.

To examine the underlying dimensional structure of the questionnaire and obtain evidence regarding construct validity, an exploratory factor analysis (EFA) was performed using principal axis factoring (PAF). Sampling adequacy was evaluated using the Kaiser–Meyer–Olkin (KMO) measure, while Bartlett's test of sphericity was used to determine whether the correlation matrix was suitable for factor analysis. Factor retention was initially evaluated using eigenvalues greater than 1 and inspection of the scree plot. Given the theoretical expectation that the examined dimensions may be interrelated, an additional theoretically specified five-factor solution was examined using Promax oblique rotation. This procedure enabled comparison between the empirically derived factor structure and the five conceptually defined dimensions used in the study.

Statistical analysis was performed using SPSS. Descriptive statistics were used to summarize sample characteristics and response distributions. Pearson's correlation coefficient was applied to examine relationships between the main constructs, while Spearman's rank correlation coefficient was additionally calculated as a robustness check given the ordinal origin of the Likert-scale data (Field, 2018). Multiple linear regression was subsequently employed to examine the joint association of environmental degradation (ENV_DEG) and environmentally induced migration (MIG) with sustainable tourism development (SUST_TOUR). Statistical significance was evaluated at conventional significance levels.

As the study is based on respondents' perceptions and a cross-sectional design, the identified relationships represent perceived associations and should not be interpreted as direct causal effects.

Results

Socio-demographic profile of respondents

The socio-demographic characteristics of the sample are presented in Table 3. The sample was predominantly male (64.6%), while the largest age groups were 26–35 (34.4%) and 36–45 years (34.0%). Regarding education, most respondents had completed secondary (42.0%) or higher education (35.8%).

Table 3 Socio-demographic characteristics of respondents

Characteristics	Category	Frequency	Percentage (%)
Gender	Male	137	64.6
	Female	75	35.4
	Total	**212**	**100.0**
Age (years)	18–25	22	10.4
	26–35	73	34.4
	36–45	72	34.0
	46–55	43	20.3
	56–65	2	0.9
	Total	**212**	**100.0**
Education level	Primary education	6	2.8
	Secondary education	89	42.0
	Higher education	76	35.8
	Master's degree	36	17.0
	Doctoral degree	5	2.4
	Total	**212**	**100.0**

Source: Authors' calculations

Descriptive analysis of key research constructs

Descriptive statistics for the principal composite variables are presented in Table 4.

Mean scores were 1.99 (SD = 0.88) for environmental degradation (ENV_DEG), 2.41 (SD = 1.07) for environmentally induced migration (MIG), and 1.81 (SD = 0.71) for sustainable tourism development (SUST_TOUR). Among the three constructs, MIG showed the highest mean score and the greatest variability in respondents' perceptions.

Table 4. Descriptive statistics of composite variables

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Environmental degradation (ENV_DEG)	212	1.00	5.00	1.99	0.88
Environmentally induced migration (MIG)	212	1.00	5.00	2.41	1.07
Sustainable tourism development (SUST_TOUR)	212	1.00	4.50	1.81	0.71

Source: Authors' calculations

Reliability and consistency of measurement

Reliability analysis indicated exceptionally high internal consistency for both the complete 20-item questionnaire (α = 0.991) and the reduced 10-item set used for hypothesis testing (α = 0.981) (Table 5). Given the magnitude of these coefficients, possible conceptual overlap among the measured dimensions was further examined through exploratory factor analysis.

Table 5. Reliability and consistency of measurement

Scale	Number of items	Cronbach's alpha
Full scale	20	0.991
Reduced scale (hypotheses testing)	10	0.981

Source: Authors' calculations

Exploratory Factor Analysis and Construct Structure

Exploratory factor analysis was conducted to examine the dimensional structure of the

20-item questionnaire. The data were highly suitable for factor analysis, with a Kaiser–Meyer–Olkin value of 0.952 and a statistically significant Bartlett's test of sphericity ($p < 0.001$). Principal axis factoring initially identified one dominant factor with an eigenvalue of 17.710, explaining 88.552% of the total variance. Factor loadings were uniformly high, ranging from 0.868 to 0.966, indicating a strong common underlying dimension across the questionnaire items (Table 6).

Table 6 Exploratory factor analysis of the 20-item questionnaire*****

Item	Factor loading	Communality
Q1	0.960	0.921
Q2	0.951	0.905
Q3	0.942	0.887
Q4	0.908	0.824
Q5	0.928	0.861
Q6	0.966	0.932
Q7	0.953	0.909
Q8	0.933	0.870
Q9	0.919	0.844
Q10	0.868	0.754
Q11	0.940	0.884
Q12	0.924	0.854
Q13	0.928	0.861
Q14	0.963	0.928
Q15	0.959	0.919
Q16	0.954	0.910
Q17	0.927	0.859
Q18	0.964	0.929
Q19	0.945	0.894
Q20	0.922	0.850

* KMO = 0.952; Bartlett's test: $\chi^2(190) = 10{,}168.288$, $p < 0.001$; eigenvalue of the first factor = 17.710; variance explained = 88.552%. Extraction method: Principal Axis Factoring.
Source: Authors' calculations

Given the theoretically defined multidimensional structure of the study, a five-factor solution was additionally examined using Promax oblique rotation. Although the rotated solution provided some differentiation among the theoretically proposed dimensions, substantial cross-loadings and strong factor interrelationships remained. Together with the exceptionally high Cronbach's alpha coefficients, these findings suggest considerable empirical overlap among the constructs and indicate that respondents may perceive environmental degradation, environmentally induced migration, demographic change, quality of life, and sustainable tourism development as interconnected dimensions of a broader rural vulnerability framework. The factor structure should therefore be interpreted with caution rather than as evidence of fully distinct latent constructs.

Testing hypothesis H1

Hypothesis H1 proposed that higher perceived environmental degradation is associated with lower perceived quality of life and greater socio-economic insecurity. Pearson's correlation showed an exceptionally strong and statistically significant association between the constructs ($r = 0.953$, $p < 0.001$), while Spearman's coefficient confirmed a similarly strong relationship ($\rho = 0.962$, $p < 0.001$) (Table 7). The consistency of the two coefficients indicates a robust association between perceived environmental degradation and adverse perceptions of living conditions and socio-economic security. Therefore, H1 was supported.

Table 7. Relationship between environmental degradation and quality of life (H1)

Variables	Pearson r	Spearman ρ	Significance (p)
ENV_DEG – Quality of life / security	0.953	0.962	< 0.001

Source: Authors' calculations

Testing hypothesis H2

Hypothesis H2 proposed that higher perceived environmental degradation is associated with stronger perceptions of environmentally induced migration. The results revealed an exceptionally strong and statistically significant association between ENV_DEG and MIG (Pearson $r = 0.953$, $p < 0.001$; Spearman $\rho = 0.962$, $p < 0.001$) (Table 8). Thus, respondents who perceived environmental degradation as more severe also tended to perceive stronger environmentally induced migration pressures. The consistency of the Pearson and Spearman coefficients supports the robustness of this relationship, and H2 was therefore supported. It should be noted that the coefficients reported for H2 differ slightly from those presented later within the general hypothesis (H0), as the hypothesis-specific analysis was based on the composite indicators constructed from the selected questionnaire items corresponding specifically to H2, whereas H0 was assessed using the broader composite constructs employed in the general conceptual model.

Table 8. Relationship between environmental degradation and environmentally induced migration (H2)

Variables	Pearson r	Spearman ρ	Significance (p)
ENV_DEG – MIG	0.953	0.962	< 0.001

Source: Authors' calculations

Testing hypothesis H3

Hypothesis H3 proposed that stronger perceptions of environmentally induced migration are associated with stronger perceptions of negative demographic change in rural communities. The relationship was exceptionally strong and statistically significant according to both Pearson's ($r = 0.974$, $p < 0.001$) and Spearman's ($\rho = 0.970$, $p < 0.001$) coefficients (Table 9). These findings indicate that stronger perceived migration pressures are closely associated with perceptions of population decline, ageing, and weakening demographic capacity in the surveyed rural communities.

Therefore, H3 was supported.

Table 9. Relationship between environmentally induced migration and demographic changes (H3)

Variables	Pearson r	Spearman ρ	Significance (p)
MIG – Demographic change	0.974	0.970	< 0.001

Source: Authors' calculations

Testing hypothesis H4

Hypothesis H4 proposed that environmental degradation and environmentally induced migration are associated with stronger perceptions of negative impacts on tourism development and its long-term sustainability. The correlation analysis showed a strong and statistically significant association between MIG and SUST_TOUR (Pearson $r = 0.866$, $p < 0.001$; Spearman $\rho = 0.917$, $p < 0.001$) (Table 10). This finding indicates that stronger perceived migration pressures are closely associated with greater perceived constraints on sustainable tourism development. The migration-related component of H4 was therefore supported, while the joint contribution of environmental degradation and migration was subsequently examined through multiple regression analysis.

Table 10. Relationship between environmentally induced migration and tourism sustainability (H4)

Variables	Pearson r	Spearman ρ	Significance (p)
MIG – SUST_TOUR	0.866	0.917	< 0.001

Source: Authors' calculations

Testing the general hypothesis (H0)

The general hypothesis H0 proposed that perceived environmental degradation is positively associated with environmentally induced migration and with perceived negative impacts on sustainable tourism development. As shown in Table 11, all three relationships were exceptionally strong and statistically significant. Pearson's coefficients ranged from 0.946 to 0.963, while Spearman's coefficients ranged from 0.947 to 0.959 (all $p < 0.001$). Specifically, ENV_DEG was strongly associated with MIG ($r = 0.946$; $\rho = 0.959$) and SUST_TOUR ($r = 0.956$; $\rho = 0.947$), while MIG was strongly associated with SUST_TOUR ($r = 0.963$; $\rho = 0.958$). These findings support H0 and indicate that respondents perceive environmental degradation, environmentally induced migration, and sustainable tourism development as closely interconnected dimensions of rural development.

Table 11. Correlations among environmental degradation, migration, and sustainable tourism development (H0)

Variables	Pearson r	Spearman ρ	Significance (p)
ENV_DEG – MIG	0.946	0.959	< 0.001
ENV_DEG – SUST_TOUR	0.956	0.947	< 0.001
MIG – SUST_TOUR	0.963	0.958	< 0.001

Source: Authors' calculations

Multiple Regression Analysis of the Proposed Conceptual Model

To complement the correlation-based hypothesis testing, multiple linear regression analysis was performed to examine the joint association of perceived environmental degradation (ENV_DEG) and environmentally induced migration (MIG) with sustainable tourism development (SUST_TOUR). SUST_TOUR was specified as the dependent variable, while ENV_DEG and MIG were entered simultaneously as predictors.

Table 12. Model Summary for the Multiple Regression Analysis*

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate
1	0.973	0.946	0.946	0.16510

**Predictors: (Constant), MIG, ENV_DEG.*

Source: Authors' calculations

The model showed a very strong overall relationship ($R = 0.973$) and explained 94.6% of the variance in SUST_TOUR ($R^2 = 0.946$; adjusted $R^2 = 0.946$).

Table 13. ANOVA for the Multiple Regression Model*

Model	Sum of Squares	Df	Mean Square	F	p
Regression	100.714	2	50.357	1847.363	<0.001
Residual	5.697	209	0.027		
Total	106.411	211			

*Dependent variable: SUST_TOUR. Predictors: (Constant), MIG, ENV_DEG.
Source: Authors' calculations

The regression model was statistically significant, $F(2, 209) = 1847.363$, $p < 0.001$, indicating that ENV_DEG and MIG jointly provided significant prediction of SUST_TOUR.

Table 14. Regression Coefficients Predicting SUST_TOUR*

Predictor	B	Std. Error	β	t	p	Tolerance	VIF
Constant	0.227	0.028	-	7.992	<0.001	-	-
ENV_DEG	0.343	0.040	0.425	8.599	<0.001	0.105	9.525
MIG	0.371	0.033	0.561	11.362	<0.001	0.105	9.525

*Dependent variable: SUST_TOUR.

Source: Authors' calculations

Both ENV_DEG ($B = 0.343$, $\beta = 0.425$, $p < 0.001$) and MIG ($B = 0.371$, $\beta = 0.561$, $p < 0.001$) were statistically significant predictors of SUST_TOUR, with MIG showing the larger standardized coefficient. However, tolerance values of 0.105 and VIF values of 9.525 indicate substantial multicollinearity between the predictors. Together with the EFA findings and exceptionally high internal consistency, this suggests considerable empirical overlap between ENV_DEG and MIG. The individual regression coefficients should therefore be interpreted cautiously, with the model primarily demonstrating their strong joint association with sustainable tourism development rather than independent causal effects.

Table 15. Collinearity Diagnostics for the Regression Model*

Dimension	Eigenvalue	Condition Index	Constant	ENV_DEG	MIG
1	2.881	1.000	0.02	0.00	0.00
2	0.111	5.105	0.98	0.02	0.03
3	0.009	18.067	0.00	0.97	0.97

**Dependent variable: SUST_TOUR.*

Source: Authors' calculations

Collinearity diagnostics revealed a highest condition index of 18.067, which, together with the VIF values of 9.525, indicates substantial overlap between the predictors and warrants cautious interpretation of their individual regression coefficients.

Discussion

The results of this study provide strong empirical evidence that environmental degradation, environmentally induced migration, demographic change, and sustainable tourism development are perceived as closely interconnected processes in the selected rural regions of Serbia. The exceptionally strong relationships identified between the analyzed constructs suggest that local residents do not perceive environmental, demographic, and economic challenges as isolated phenomena, but rather as mutually reinforcing dimensions of a broader rural development problem. This interpretation is particularly relevant in environmentally vulnerable rural areas, where ecological pressures coexist with population decline, ageing, limited employment opportunities, and restricted economic diversification.

One of the key findings concerns the relationship between perceived environmental degradation and quality of life and socio-economic security. The strong association between these dimensions indicates that respondents relate deteriorating environmental conditions to broader concerns regarding living standards, livelihood security, and future economic opportunities. This finding is consistent with the sustainable livelihoods perspective, according to which environmental resources constitute an important component of the asset base upon which rural households depend (Scoones, 2015). In rural areas where agriculture, natural resources, and place-based economic activities remain important, environmental deterioration may therefore have consequences extending beyond ecosystem quality to household income and employment opportunities. In this sense, the present findings support the broader argument that environmental degradation should not be treated exclusively as an ecological issue, but as a development constraint affecting multiple dimensions of rural well-being.

The strong relationship between environmental degradation and environmentally induced migration further supports the growing body of literature that treats environmental change as one component of a multi-causal migration process. Previous studies have emphasized that environmental pressures rarely operate as independent determinants of migration; rather, they interact with economic conditions, employment opportunities, household resources, institutional settings, and existing social vulnerabilities (Black et al., 2011; McLeman, 2018). This interpretation is consistent with Castles (2002), who cautioned against environmentally deterministic explanations of migration, and Foresight (2011), which conceptualized environmental change as interacting with economic, social, political, and demographic drivers of mobility. From a broader migration-theory perspective, migration decisions depend not only on external pressures but also on the aspirations, resources, and capabilities of individuals and households (de Haas, 2010, 2021).

At the same time, the results should not be interpreted as evidence that environmental degradation directly causes migration. The cross-sectional and perception-based design does not allow causal inference, and migration decisions remain inherently multidimensional. Rather, the findings indicate that residents perceive environmental deterioration as closely connected with conditions that may encourage population mobility. This distinction is particularly important in Serbia, where rural migration and depopulation predate many contemporary environmental concerns and are also shaped by long-term economic restructuring, regional inequalities, employment opportunities, and population ageing. Previous research has identified structural and profitability constraints within Serbian rural and agri-food sectors that may further limit local development capacity and interact with environmental and demographic pressures (Domanović et al., 2018). Environmental degradation should therefore be interpreted as an additional and potentially reinforcing pressure rather than as a single explanation for rural out-migration.

The relationship between environmentally induced migration and negative demographic change represents another important dimension of the findings. Respondents strongly

associated migration with population ageing, labour shortages, and declining local development capacity. This pattern corresponds with broader research on rural depopulation showing that persistent out-migration, particularly among younger and economically active populations, can accelerate demographic ageing and weaken the human-capital base of rural communities (Johnson & Lichter, 2019). A declining working-age population can also reduce entrepreneurial activity, weaken local markets and services, and diminish the capacity of communities to initiate new development activities. Migration can therefore be understood not only as an outcome of unfavourable local conditions, but also as a mechanism through which existing environmental and socio-economic vulnerabilities may be reproduced over time. This interpretation is consistent with migration theories emphasizing that migration can reshape areas of origin through selective population loss and changes in the composition of the remaining population (Massey et al., 1993; King, 2012), affecting labour availability, human capital, social networks, and the long-term economic capacity of rural communities.

These demographic effects are particularly important when considering sustainable tourism development. The results indicate strong associations between environmental degradation, environmentally induced migration, and perceived constraints on tourism sustainability. This finding is consistent with the broader sustainable tourism literature, which emphasizes that tourism development depends not only on attractive natural resources but also on their long-term preservation and effective management (Hall, 2019; UNWTO, 2018). Environmental degradation may reduce landscape quality, ecosystem services, and the overall attractiveness of rural destinations, thereby weakening the natural-resource base on which many forms of rural and nature-based tourism depend.

However, the results also point to a second mechanism that is sometimes less explicitly considered: tourism sustainability depends on demographic capacity as well as environmental quality. Continued migration can reduce the availability of local labour, potential entrepreneurs, service providers, and community members capable of participating in destination development. It may also weaken the preservation of local traditions, knowledge, and cultural practices that contribute to the authenticity of rural tourism. This interpretation corresponds with studies emphasizing the role of local communities, human resources, and participation in successful rural and sustainable tourism development (Rosalina et al., 2021; López-Sanz et al., 2021). From this perspective, environmental degradation and migration may affect tourism through different but mutually reinforcing pathways.

The relationship is nevertheless not necessarily unidirectional. Sustainable tourism can itself represent a potential mechanism for rural economic diversification and local revitalization. Previous research has shown that appropriately planned rural tourism may generate employment, support small businesses, valorize local products and cultural resources, and create supplementary sources of household income (Rosalina et al., 2021; López-Sanz et al., 2021). These effects may be particularly relevant in depopulating areas with limited alternative economic opportunities. The findings

therefore suggest a potentially important development dynamic: environmental degradation and migration may constrain tourism development, while well-managed sustainable tourism may contribute to improving local economic opportunities and reducing some socio-economic pressures associated with out-migration. Such benefits, however, should not be assumed automatically, since poorly managed tourism may itself generate environmental pressures and undermine the resources on which destination competitiveness depends (Hall, 2019).

Although sustainable tourism may provide opportunities for economic diversification, its capacity to reverse rural decline should not be overstated. Tourism development can generate employment and supplementary income, but its benefits depend on effective planning, local participation, appropriate governance, and the protection of the environmental resources on which tourism relies (Weaver, 2006; Hall & Lew, 2009). This supports the view of sustainable tourism as an adaptive and context-dependent development approach rather than a universally applicable solution (Hunter, 1997; Saarinen, 2006).

An important aspect of the results concerns the exceptionally strong statistical relationships among the analyzed constructs. The high internal consistency of the questionnaire, the dominant general factor identified by exploratory factor analysis, and the high correlations and regression coefficients collectively indicate considerable empirical overlap among perceptions of environmental degradation, environmentally induced migration, demographic change, and tourism-related consequences. The substantial multicollinearity observed between ENV_DEG and MIG further supports the need for cautious interpretation of their individual effects. These findings suggest that respondents may perceive the analyzed issues as components of a broader underlying dimension of rural environmental and socio-economic vulnerability rather than as entirely separate processes.

This overlap is theoretically meaningful because environmental, demographic, and economic pressures frequently occur simultaneously in vulnerable rural areas. Nevertheless, it also requires methodological caution. The very high correlations should not be interpreted as evidence that the constructs are identical or that one necessarily causes another. Instead, they may partly reflect the interconnected nature of the phenomena, the perceptual character of the measurement instrument, and similarities in respondents' evaluations of related statements. Future studies should therefore examine the discriminant validity of these dimensions using larger and more diverse samples and, where appropriate, confirmatory factor analysis or structural equation modeling. Combining perceptual measures with objective environmental, demographic, and tourism indicators would enable a more rigorous examination of these relationships.

The multiple regression analysis provides additional support for the proposed conceptual framework beyond the bivariate correlations. ENV_DEG and MIG jointly explained a very high proportion of variance in SUST_TOUR ($R^2 = 0.946$), while both predictors were statistically significant. However, the substantial multicollinearity between the

predictors (VIF = 9.525) requires cautious interpretation of their individual coefficients. Rather than demonstrating independent causal effects, the regression results indicate that environmental degradation and environmentally induced migration are closely related and jointly associated with sustainable tourism outcomes.

Taken together, the findings support an integrated interpretation of rural development in which environmental quality, population dynamics, and tourism development are interconnected. This perspective challenges sectoral approaches that address environmental protection, demographic decline, or tourism development independently. In environmentally vulnerable rural regions of Serbia, tourism policies may have limited long-term effectiveness if environmental degradation continues or demographic decline reduces the human resources necessary for local development. Conversely, environmental protection measures may generate broader development benefits when combined with initiatives supporting employment, local entrepreneurship, community participation, and sustainable tourism.

The findings therefore point to the need for place-sensitive and integrated rural development strategies. Such strategies should combine environmental rehabilitation and resource protection with measures aimed at strengthening local economic opportunities, supporting younger and economically active residents, encouraging entrepreneurship, and developing tourism based on the sustainable use of natural and cultural resources. Sustainable tourism should therefore not be viewed as an isolated solution to rural depopulation, but as one component of a broader development framework linking environmental protection, economic diversification, and community resilience.

Conclusions

The findings of this study demonstrate that environmental degradation, environmentally induced migration, demographic change, and sustainable tourism development are strongly interconnected in the selected rural regions of Serbia. Based on the perceptions of local residents, environmental pressures are closely associated with reduced quality of life and socio-economic security and with stronger perceptions of environmentally induced migration. Migration, in turn, is associated with negative demographic changes and perceived constraints on the long-term sustainability of tourism development. These findings support an integrated understanding of rural vulnerability in which environmental, demographic, and economic processes should not be considered in isolation.

From a theoretical perspective, the study contributes to the literature by integrating environmental degradation, environmentally induced migration, demographic change, quality of life, and sustainable tourism within a common analytical framework. While previous research has frequently examined these processes separately, the present study demonstrates how local residents perceive them as closely interconnected dimensions of rural development. In particular, the findings extend the discussion of environmentally induced migration by highlighting its perceived relationship not only with environmental and socio-economic pressures, but also with demographic capacity

and the conditions necessary for sustainable tourism development. This integrated perspective represents the principal theoretical contribution of the study.

The findings also have important policy implications. Environmental protection should be treated as an integral component of rural development policy rather than as a separate environmental agenda. Measures aimed at improving environmental quality and protecting natural resources may simultaneously strengthen the conditions for rural livelihoods and tourism development. Likewise, policies addressing migration and demographic decline should be coordinated with local economic development strategies supporting employment, entrepreneurship, infrastructure, and economic diversification in vulnerable rural communities.

Sustainable tourism may represent an important component of such diversification, particularly in regions with valuable natural and cultural resources, but should not be regarded as an automatic solution to rural depopulation. Its long-term contribution depends on environmental quality, local participation, appropriate infrastructure, and effective destination management. Sustainable tourism policies should therefore be integrated with broader environmental, demographic, and regional development strategies.

Several limitations should be acknowledged. The study is based on respondents' perceptions and a cross-sectional research design; consequently, the identified relationships should not be interpreted as direct causal effects. The exceptionally strong correlations and the substantial overlap identified through exploratory factor and regression analyses indicate that respondents may perceive these processes as dimensions of a broader rural vulnerability. Future studies should examine these relationships using larger and more geographically diverse samples, objective environmental and demographic indicators, longitudinal and spatial data, and confirmatory approaches such as CFA or structural equation modeling.

Overall, the study provides empirical support for approaching environmentally vulnerable rural regions as integrated socio-environmental systems in which environmental quality, population dynamics, and economic development interact. By connecting environmentally induced migration with demographic change and sustainable tourism development, the research contributes to further theoretical development and provides a framework for more integrated rural development policies in Serbia.

Conflict of interests

The authors declare no conflict of interest.

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