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GEOGRAFSKI ZBORNIK

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Front cover photography: Cultivated terraces enable farming on steep slopes and give the landscape a special character, even if they are overgrown in some places, as the example from the Haloze shows (photograph: Lenart Štaut).
Fotografija na naslovnici: Kulturne terase omogočajo kmetovanje na strmih pobočjih in dajejo poseben pečat pokrajini, tudi če se ponekod deloma zaraščajo, kot kaže tudi primer iz Haloz (fotografija: Lenart Štaut).

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IDENTIFYING CHARACTERISTICS AND TYPOLOGY OF SMALL SHRINKING TOWNS IN SERBIA: THE CASE OF THE REGION OF SOUTHERN AND EASTERN SERBIA

Milica Ljubenović, Ivana Bogdanović Protić, Milena Dinić Branković, Jelena Đekić, Milica Igić

MILICA LJUBENOVIĆ

The Old Bazaar in Knjaževac, small shrinking town in eastern Serbia.

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Milica Ljubenović[1], Ivana Bogdanović Protić[1], Milena Dinić Branković[1], Jelena Đekić[1], Milica Igić[1]

Identifying characteristics and typology of small shrinking towns in Serbia: The case of the Region of Southern and Eastern Serbia

ABSTRACT: Small towns are highly exposed to urban shrinkage, but the attention to them has still been weak in the research, especially in Serbia. Therefore, this study deals with small towns in the Region of Southern and Eastern Serbia, with the goal of elaborating a typology of small towns based on shrinking characteristics. Shrinking small towns were first mapped and then grouped using principal component and cluster analysis. The results indicate that the patterns of shrinking differ and that four clusters of shrinking towns with distinguishable specific characteristics can be identified. This research contributes to understanding of different causes and trajectories of small shrinking towns and suggests a possible application of presented methodology as an urban planning tool.

KEYWORDS: urban shrinkage, small towns, cluster analysis, principal component analysis, Serbia

Ugotavljanje značilnosti in tipologije malih krčečih se mest v Srbiji: primer regije Južne in vzhodne Srbije

POVZETEK: Mala mesta so zelo izpostavljena krčenju, vendar se jim v raziskavah, zlasti v Srbiji, še vedno posveča premalo pozornosti. Zato v tej študiji obravnavamo majhna mesta v statistični regiji Južna in vzhodna Srbija s ciljem oblikovati tipologijo majhnih mest na podlagi značilnosti njihovega krčenja. Majhna mesta, ki se krčijo, smo najprej določili, nato pa združili v skupine z uporabo analize glavnih komponent in metod razvrščanja v skupine. Rezultati so pokazali, da se vzorci krčenja razlikujejo in da je mogoče opredeliti štiri tipe krčečih se mest s svojstvenimi značilnostmi. Pričujoča raziskava prispeva k razumevanju različnih vzrokov in usmeritev krčenja malih mest ter predlaga možnost uporabe predstavljene metodologije kot orodja za urbanistično načrtovanje.

KLJUČNE BESEDE: krčenje mest, mala mesta, razvrščanje v skupine, metoda glavnih komponent, Srbija

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1 Introduction

Shrinking cities have become global phenomenon and a common path of development of many cities since the second half of 20th century. This affected the growth of international research, as well as the development of international discourse about this phenomenon (Großmann et al. 2008; Fol and Cunningham-Sabot 2010; Haase et al. 2017; Mallach 2017). More extensive comparative surveys of shrinking cities give an overview of persistence and spatial extent of this phenomenon in the world (Oswalt and Rieniets 2006) or Europe (Turok and Mykhnenko 2007; Wiechmann and Wolff 2013) and they are based on dynamics of population loss. National context plays an important role in trajectories of urban shrinkage and its tipology, e.g., for United States (Beauregard 2009), France and UK (Cunningham-Sabot and Fol 2009) of Portugal (Alves et al. 2016). These typologies indicate the heterogeneity of the process of urban shrinkage in terms of intensity, dynamics and drivers, as well as the importance of researching this process at different spatial levels (national, regional and local).

Previous studies on shrinking cities have obtained abundant results, but the most of them focus on larger cities. However, the large portion of small towns in Europe has been shrinking (Schlappa and Neill 2013), especially in Central and Eastern Europe (CEE) (Leetmaaa et al. 2015; Ljubenović et al. 2022), where their development was additionally affected by post-socialist transformation. Small towns are mostly considered the losers of the globalization process (Fertner et al. 2015), not relevant to the system (Bernt and Rink 2010), or peripheral in relation to the decision-making process and institutional networks (Cox and Longlands 2016). Compared to larger cities they usually lack resources in the field of education, research and qualified jobs, and have insufficient territorial connectivity (Valtenbergs et al. 2015; Fol and Cunningham-Sabot 2010). In recent years, small towns have received much more research attention in Europe (e.g., Knox and Mayer 2009; Kwiatek-Sołtys and Mainet 2014; Filipović et al. 2016), but there is still a lack of research focusing on urban shrinkage.

In Serbia, the phenomen of shrinking cities has only recently been investigated, while various demographic and economic problems have been pronounced in many cities and towns (Bajić Brković 2010; Penev 2014). Depopulation of urban settlements in Serbia was first registered in the 1991–2002 intercensus period, to become more intensive in the early 21st century. Population loss was most pronounced in small towns, while larger cities stagnated or grew (Ljubenović et al. 2018). The results of the latest Census in 2022 (RZS 2023) indicate the decline in the total population of Serbia of about 7.5% compared to the 2011 Census. The urban system in Serbia is unevenly developed, where the population, functions and economic activity are concentrated in the capital and few major cities (Stojanović and Vojković 2005; Živanović and Gatarić 2017). Due to this centralization, small and medium-sized towns have a weak role in regional and local development (Stojkov and Šećerov 2012). Moreover, the attention to small shrinking towns have been extremely weak in the Serbian national planning policy, which further jeopardize their future development and influence their peripheralization (Kühn 2015). This policy trend is especially pronounced in post-socialist CEE countries, where metropolitan areas and prosperous centres are favoured in regional and national spatial policy (Ehrlich et. al 2012).

Small towns were rarely the focus of research studies in Serbia. Their demographic potential was highlighted (Kanazir 2016), their development characteristics and potential were investigated (Spasić and Petrić 2006; Filipović et al. 2016), but they were not investigated in the context of shrinkage. They were considered only within the overall urban system (Djurkin et. al 2021; Antonić et al. 2020). Considering the diversity and influence of the regional context on the development of small towns (Servillo et al. 2014), it is important to identify the involved factors and their different impacts in the shrinking process.

This research therefore aims to determine the factors that influence the shrinkage of small towns in the Region of Southern and Eastern Serbia (RSES) and establish a typology of small towns based on shrinking characteristics that would enable the shaping of policies for their recovery and future development. RSES was chosen as the most economically underdeveloped region in Serbia, with pronounced problems of depopulation and emigration. The research builds on the previous results achieved in the doctoral dissertation (Ljubenović 2022), conducted for the period 2002–2011. The paper tries to answer the question whether the small towns' shrinkage in RSES forms similar patterns based on which it is possible to group them. At the same time, the goal is to see if it is possible to determine different types of small shrinking towns on a relatively small sample size.

2 Study area, data and methods

2.1 Study area

The research area is the territory of the Region of Southern and Eastern Serbia, which is one of the five statistical regions of Serbia defined by the Law on Regional Development (see the »Official Gazette of RS«, no. 51/2009, 30/2010 and 89/2015 – other law). The region covers 26,249 square kilometres, or approximately one third of the surface area of Serbia. The region's total population was 1.4 million people in 2022, or 21% of the country's population, and the total GDP reached 15.3% of the country's GDP in 2021. The basic criterion for choosing this region, in addition to being the most underdeveloped region in Serbia, is the dominant presence of small towns in the network of settlements with a pronounced process of deindustrialization and economic stagnation (Filipović et al. 2016).

Small towns were defined by combining ESPON's typology of small and medium-sized towns (ESPON 1.4.1. 2006; Servillo et al. 2014), definition of shrinking cities (Wiechmann and Wolff 2013) and the statistical territorial division of Serbia. The lowest threshold for identifying shrinking cities was set by the EU COST Action »Cities Regrowing Smaller« (CIRES), defining shrinking cities as a densely populated urban areas with a minimum of 5,000 inhabitants. In Serbia, settlements are divided into *urban* and *other* according to administrative-legal criteria. Based on the above elements and sources, small towns were defined as urban settlements with a density of more than 300 inhabitants per square kilometre and a population between 5,000 and 25,000 inhabitants. To determine the population density, the size of the urban settlement was used, or, if the urban settlement included large areas of undeveloped land, the size of the construction area defined by the General Regulation Plan was used. According to these criteria, 23 small towns out of 49 urban settlements were defined in the Region of Southern and Eastern Serbia. Due to incomplete statistical data, 4 small towns were excluded from the analysis, due to a lack of data, so that the analytical sample consists of 19 small towns (Figure 1).

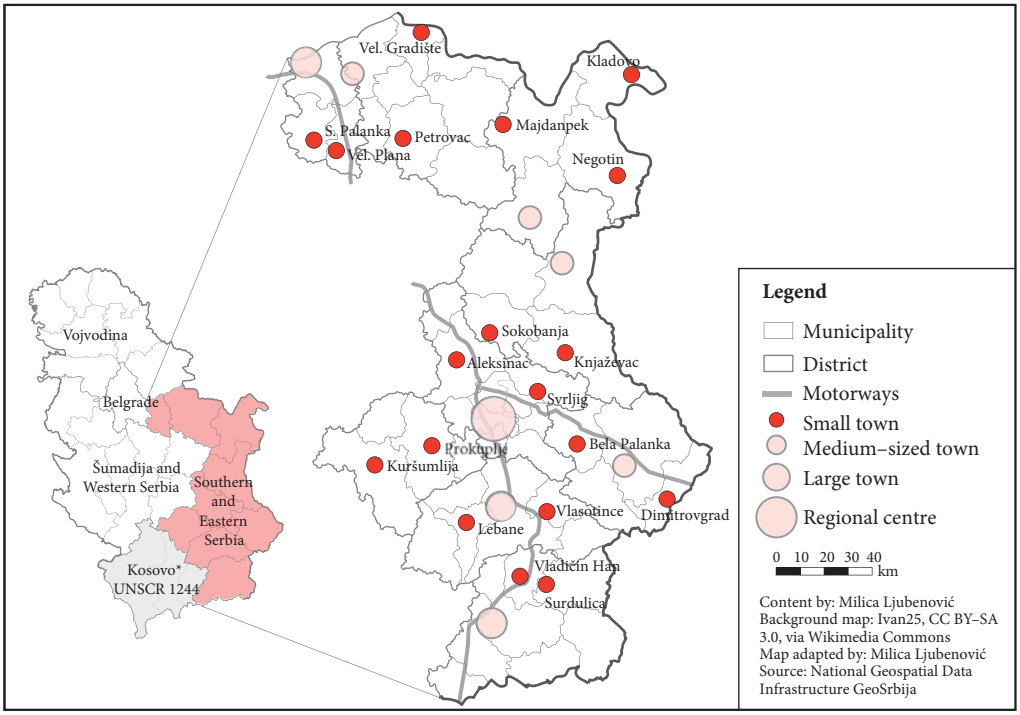

Figure 1: The position of RSES within the territory of the Republic of Serbia and analysed small towns.

2.2 Data source

The identification and analysis of small shrinking towns relies primarily on statistical data from the fields of demography and economics. As a source of demographic data, the Census books of 2002, 2011 and 2022, as well as data from the database of the Statistical Office of the Republic of Serbia (https://www.stat.gov.rs) were taken, while for economic data, the annual publications Municipalities and Regions published by the Statistical Office of the Republic of Serbia were used. The lowest level for which statistical data is collected in Serbia is the settlement level, at which only a small number of indicators are available (number of inhabitants, age of the population and number of abandoned apartments). For other indicators, therefore, data were taken at the municipality level. The population density change was calculated using the maps of the CORINE Land Cover database from 2000, 2012 and 2018 by which the built-up area was determined.

2.3 Identification of urban shrinkage

In order to identify small shrinking towns in RSES, indicators of urban shrinkage were observed within three groups: demographic, economic and spatial indicators. Population loss is considered as the main indicator of urban shrinkage (Turok and Mykhnenko 2007; Haase et al. 2012), and it is most frequently supplemented with additional demographic and economic indicators that are adapted to the goals and scope of analysis, as well as data availability (Gatzweiler et. al 2003; Wolff 2010; Hartt 2018). Indicators related to the spatial manifestation of urban shrinkage are less frequently used, and mainly for mapping housing vacancies and a perforation pattern of shrinking (Kabisch et al. 2006; Haase et al. 2012).

It was necessary to adapt certain indicators to the context of the development of small towns in Serbia, as well as to the available data. A threshold of urban population decline of at least 0.15% per year was adopted in accordance with the recommendations of the CIRES project (Wiechmann and Wolff 2013), and in order to avoid classifying towns that are in temporary stagnation as shrinking towns. Given that the urban shrinkage of small towns is closely related to the shrinkage of rural settlements that surround them (Božić 2017), population change was also observed at the municipal level. Furthermore, other demographic indicators that additionally determine demographic trends and changes in shrinking towns were defined and they are given in Table 1.

Economic indicators were defined based on theoretical recommendations and available data in Serbia (Table 1). The Statistical Office of the Republic of Serbia monitors economic indicators at the municipal level. Due to the great economic decline during the transition period in Serbia, it was more convenient to monitor the economic development of small towns by comparing the indicator values with the national average.

In Serbia, there is no record of most of the spatial indicators used for urban shrinkage research, which makes their monitoring impossible. For these reasons, the available indicators were used: the decline in population density (adjusted data) and the increase in abandoned apartments (data obtained from Census books and CORINE Land Cover database).

Considering that there are no clearly defined thresholds for the criteria, except for the criterion characterized by population decline, their values were adapted to the national and local context, and their comparison was made with the average values at the national level. For the migration balance, the regional average was used because the national average for internal migration is zero. Values were taken for census years at the end of each period. By reviewing the data, the rule was adopted that a small town could be identified as a shrinking town if, in addition to the population decline in the urban settlement, it fulfilled most of the other criteria within its categories, during one inter-census period. The conditions for identifying small shrinking towns can be expressed in the following form: (D_0, min 50% D_{1-6}, min 50% E_{1-5}, min 50% S_{1-2}). The labels are described in the Table 1.

The period for observing urban shrinkage varies between studies and it is usually the period from the moment of population growth reversal. In RSES, as well as in Serbia in general, population decline has first occurred during the 1990s and intensified since 2000. However, the period during the 1990s was characterized by the dissolution of the country, wars on the territory of the former Yugoslav republics, political and economic isolation (Uvalić 2007). These events aggravate the tracking real demographic and economic trends. For these reasons, the period 2002–2022 was chosen as a representative time frame of the research, whereby two intercensal periods 2002–2011 and 2011–2022 are used to identify shrinking towns.

Table 1: Indicators and criteria of urban shrinkage of small towns in RSES (national average was used as critera, except for regional average for migration balance).

Label	Indicator		National / Regional Average		Source
		Criterion	2002–2011	2011–2022	
	Demographic				
D_0	Population change rate (urban settlement)	<–0.15% per year	<0.14%	<–0.32%	Census of population, households and apartments in in the Republic of Serbia (2002, 2011, 2022)
D_1	Population change rate (municipality)	< national average	<–4.15%	<–11.00%	
D_2	Natural increase rate	< national average	<–5.2‰	<–7.0‰	Statistical Office of the Republic of Serbia database
D_3	Fertility rate (children per woman)	< national average	<1.4	<1.6	
D_4	Migration balance (per 1,000 inhabitants)	< regional average	<–1.3	<–1.9	Statistical Office of the Republic of Serbia. Demographic Yearbook (2002-2022)
D_5	Total dependency ratio*	> national average	>43%	>55%	Census of population, households and apartments in in the Republic of Serbia (2002, 2011, 2022)
D_6	Share of elderly population	> national average	>15.6%	>21.0%	
	Economic				
E_1	Average earnings	< national average	<RSD37,976	<RSD65,864	Statistical Office of the Republic of Serbia Municipalities and Regions (2002–2022)
E_2	Budget revenues	< national average	<RSD29,700	<RSD56,521	
E_3	Purchasing power change coefficient	> national average	>0.8	>0.8	
E_4	Employment change coefficient	< national average	<1.0	<1.3	
E_5	Unemployment change coefficient	> national average	>0.8	>0.7	
	Spatial				
S_1	Population density of the built-up area change coefficient	< 1.0	no data available	no data available	Census of population, households and apartments in in the Republic of Serbia (2002, 2011, 2022) CORINE Land Cover database
S_2	Change in the number of abandoned apartments	> national average	>–1.2%	>–1.3%	Census of population, households and apartments in in the Republic of Serbia (2002, 2011, 2022)

* Note: Total dependency ratio = Population (0–14) + Population (65+)) / Population (15–64)

2.4 Typological classification

A quantitative typology was formed based on the grouping of small towns with similar characteristics of shrinkage. With that goal, principal component analysis was first used, which reduced the number of influential factors and removed probable multicollinearity, on the basis of which the cluster analysis was then performed. The data were processed using the IBM SPSS Statistics software.

2.4.1 Principal component analysis

Principal component analysis (PCA) is a statistical technique that is used to reduce a larger number of variables to a small set of factors that explain most of the variance (Mooi and Sarstedt 2011). By defining the basic structure of the data, PCA is an excellent starting point for cluster analysis (Lu et. al 2011). Fifteen variables which characterize the urban shrinkage of small towns in RSES in the period 2002–2022 were selected as input variables for PCA (Table 2).

The application of PCA analysis implies the fulfilment of certain conditions in order to reach reliable and relevant results. Selected variables should be sufficiently correlated which was checked by correlation matrix, The Kaiser–Meyer–Olkin (KMO) statistic and the Bartlett's test of sphericity (Mooi and Sarstedt 2011).

PCA transforms the original set of correlated variables into a smaller number of independent uncorrelated principal components (PC). The first PC explains most of the variance in the data, and each subsequent one accounts for as much of the remaining variability as possible. To determine the number of extracted factors Eigenvalue and Scree plot is usually used (Mooi and Sarstedt 2011). To facilitate the interpretation of the factors varimax rotation was used as the most prominent one. For evaluation of the obtained solution, the correlation matrices' residuals were checked.

2.4.2 Cluster analysis

Factor scores obtained in PCA analysis are used as input variables for cluster analysis (CA), a statistical method for grouping objects within homogeneous or compact groups based on their similarity (Kovačić 1994). Although it is usually used to group a number of objects, there is no generally accepted rule of thumb regarding minimum sample sizes and the number of clustering variables (Mooi and Sarstedt 2011). The procedure is sensitive to low variation of the parameters, which may lead to the building of unrepresentative clusters and affect the credibility of the analysis. Therefore, the selection of data in accordance with the objective of the analysis must be carefully considered.

In this research, hierarchical and non-hierarchical methods were applied, following a recommendation to determine the number of clusters using hierarchical method, which is then used for conducting a non-hierarchical method (Mooi and Sarstedt 2011).

Table 2: Selected variables for PCA analysis.

Label	Variable	Period / Year
	Demographic variables	
PDU	Coefficient of population decline of the urban settlement	2002–2022
PDM	Coefficient of municipal population decline	2002–2022
NI02 NI22	Natural increase (per 1000 inhabitants)	2002 2022
MB02 MB22	Migration balance (per 1000 inhabitants)	2002 2022
EP02 EP22	Share of elderly population	2002 2022
	Economic variables	
S02 S22	Average salary compared to the national average	2002 2022
PP02 PP22	Purchasing power	2002 2022
UR02 UR22	Unemployment rate	2002 2022
	Spatial variable	
DR	Population density of the built-up area change rate	2002–2022

Hierarchical method is based on the process of successive merging of objects in a group (Kovačić, 1994). The object similarity measure was determined using Ward correlation and squared Euclidean distance. The final result of the hierarchical cluster analysis is displayed graphically in the form of a dendogram, and the division into groups can be done by cutting the dendogram at the appropriate height.

The non-hierarchical method implies a predefined number of clusters. K-means procedure was used, according to which the object joins the group that has the closest centroid (Kovačić 1994). The clustering process is repeated by determining new centroids until a homogeneous cluster structure is achieved. The significance of the differences between the clusters was tested using analysis of variance (ANOVA).

3 Results

3.1 Identification of small shrinking towns in the Region of Southern and Eastern Serbia

Small towns have experienced widespread shrinkage in RSES, with 14 out of 19 (74%) shrinking according to the set criteria from 2002 to 2011 and 12 (58%) from 2011 to 2022 (Table 3). Only one town, Prokuplje, did not record a decline in any period and this town was not taken into account for the classification. On the other hand, in the period 2002–2011, there were only two towns that fulfilled all the criteria, while in the following period there was none. It is interesting that in the period 2011–2022, only Kladovo recorded a population growth of the urban settlement but it met all other demographic and economic shrinking criteria. The causes of such changes probably lie in the different values of indicators at the level of settlement and municipality.

Within demographic criteria, the largest number of deviations occur within the aging indicator, which means that aging was not expressed in all towns as at the national level. In addition, the fertility rate is

Table 3: Fulfilment of the criteria of small towns in RSES (values in bold – criteria below 50%).

Town	Fulfilment of the criteria							
	2002–2011				2011–2022			
	D0	D1-6	E1-5	S1-2	D0	D1-6	E1-5	S1-2
Aleksinac	✓	100%	100%	100%	✓	83%	80%	100%
Bela Palanka	✓	50%	80%	100%	✓	83%	**40%**	100%
Dimitrovgrad	✓	67%	60%	100%	✓	83%	**40%**	100%
Kladovo	✓	50%	60%	50%	✗	100%	100%	**0%**
Knjaževac	✓	83%	80%	100%	✓	83%	**40%**	100%
Kuršumlija	✓	83%	100%	50%	✓	50%	60%	100%
Lebane	✓	83%	80%	100%	✓	50%	60%	100%
Majdanpek	✓	67%	60%	100%	✓	67%	**40%**	100%
Negotin	✓	67%	80%	50%	✓	100%	80%	50%
Petrovac	✓	100%	80%	50%	✓	83%	60%	100%
Prokuplje	✗	50%	100%	50%	✓	50%	**40%**	100%
Smederevska Palanka	✓	83%	100%	100%	✓	100%	60%	100%
Sokobanja	✓	100%	100%	100%	✓	67%	80%	100%
Surdulica	✗	67%	100%	0%	✓	67%	80%	50%
Svrljig	✗	67%	80%	50%	✓	83%	60%	100%
Velika Plana	✗	67%	100%	100%	✓	67%	80%	100%
Veliko Gradište	✗	50%	80%	100%	✓	83%	60%	100%
Vladičin Han	✓	67%	80%	100%	✓	67%	**40%**	100%
Vlasotince	✓	67%	80%	100%	✓	50%	60%	100%

higher in most towns compared to the national average. There is greater diversity in the economic criteria, and the only criterion that was met in all municipalities in the period 2002–2011 was the increase in the unemployed. In the following period, there are greater deviations in economic criteria, and even 89% of towns have recorded a greater increase in registered employment compared to the national average. In addition, in 63% of towns, a greater increase in the purchasing power of citizens is noticeable, although the average salary in almost all of them is lower than the national average. These parameters indicate the improvement of the economic position of small towns despite the demographic decline, which confirms the fact that economic factors should also be considered in the process of the shrinking.

3.2 Results of PCA analysis

PCA analysis was performed only for the towns where defined criteria were identified at least in one period, which was 18 small towns. The correlation matrix of the data showed that the variables were sufficiently intercorrelated. Table 4 shows that KMO measure was larger than 0.5 and that the Bartlett's test of sphericity was significant (p=0.000) which indicated that PCA analysis could be further conducted (Mooi and Sarstedt 2011). Communalities were quite high, and ranged from 62.4% to 96.5%.

In this study, out of total l5, four principal components extracted had Eigen value greater than 1, and they contributed 84.7% of the total variability (Table 5), which was in accordance with distinct break in the scree plot (Figure 2).

Table 4: KMO and Bartlett's Test.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.530
Bartlett's Test of Sphericity	Approx. Chi-Square	269.482
	df	105
	Sig.	0.000

Table 5: Total variance explained.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.513	30.087	30.087	4.513	30.087	30.087
2	3.965	26.431	56.517	3.965	26.431	56.517
3	3.031	20.209	76.726	3.031	20.209	76.726
4	1.198	7.987	84.714	1.198	7.987	84.714
5	0.665	4.432	89.146			
6	0.556	3.708	92.854			
7	0.385	2.570	95.424			
8	0.279	1.863	97.286			
9	0.171	1.139	98.426			
10	0.121	0.804	99.230			
11	0.053	0.356	99.586			
12	0.041	0.274	99.860			
13	0.010	0.064	99.924			
14	0.007	0.050	99.974			
15	0.004	0.026	100.000			

Extraction Method: Principal Component Analysis.

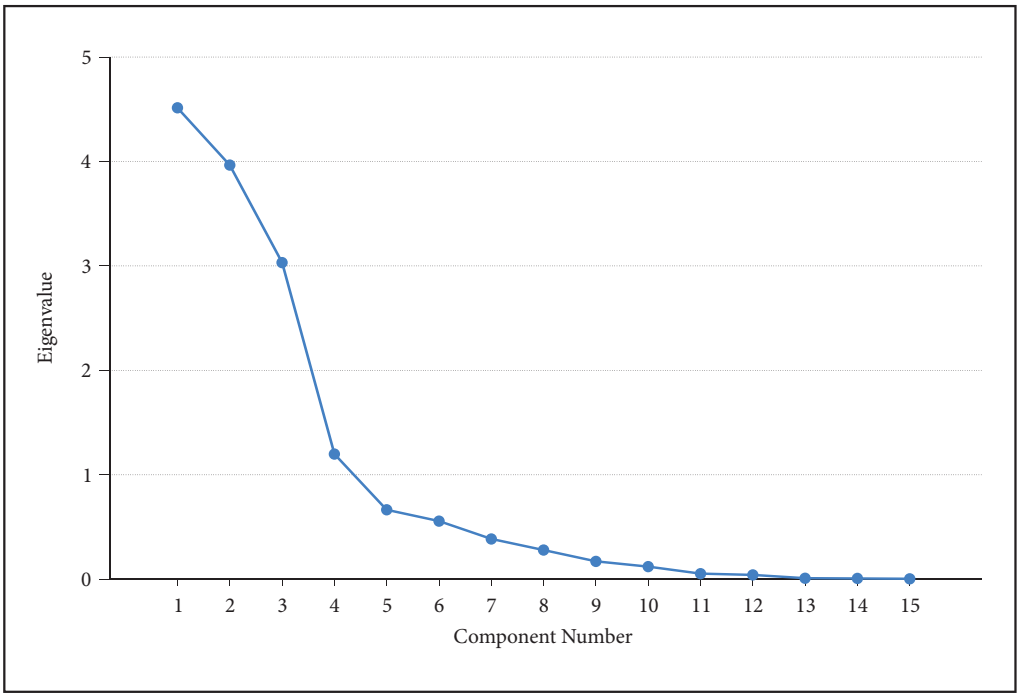

Figure 2: Scree plot.

Table 6: Rotated component matrix (coefficient below 0.3 are suppressed; values with cumulative variances over 50% are bold).

	Component			
	1	2	3	4
PDU		0.901		
PDM				0.793
NI02				0.732
NI22				0.953
MB02		0.770		
MB22			0.691	
EP02			0.933	
EP22			0.642	–0.668
S02	–0.880			
S22	–0.542	–0.696		
PP02	0.885			
PP22	0.605	0.662		
UR02	0.732			
UR22	0.838			
DD		0.780		

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 5 iterations.

Varimax factor rotation was applied to simplify the interpretation of the discovered factors (Table 6):

- PC1 showed high positive and negative factor loadings on all economic variables, and it was labelled as »Economy«.
- On PC2, high loadings had PDU, MB02 and DD, but also S2 and PP2 which also highly contribute to PC1. This component was labelled as »Urban settlement population and density decline«.
- PC3 had high loadings on MB22, ER02 and ER22 and was labelled as »Age and migration«. – Variables PDM, NI02, NI22 and ER22 showed high loadings on PC4, labelled as »Natural increase and municipality population decline«.

The resulting principal components represent the main dimensions of the shrinkage of small towns in the RSES.

Residuals are computed between observed and reproduced correlations. There are 28 (26.0%) nonredundant residuals with absolute values greater than 0.05, which is less than the required maximum of 50% (Mooi and Sarstedt 2011).

3.3 Results of cluster analysis

The obtained results from a hierarchical analysis indicated that two to four clusters could be distinguished, whereby Majdanpek stood out as an outlier (Figure 3). These results made it possible to implement a k-means by assigning a different number of clusters. Using ANOVA, statistical significance was compared for two, three and four clusters. The means between groups differed from each other the most for the solution with four clusters. Cluster membership and their basic characteristics are given in Figure 4 and Table 7. Majdanpek

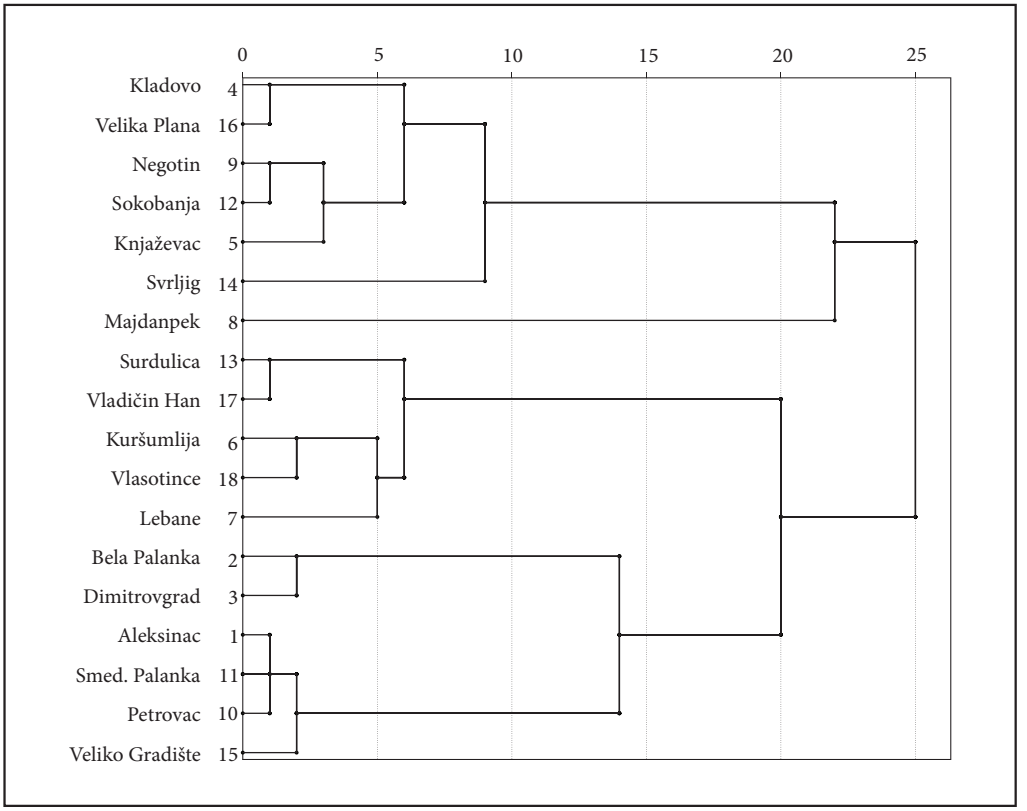

Figure 3: Dendrogram obtained by hierarchical analysis.

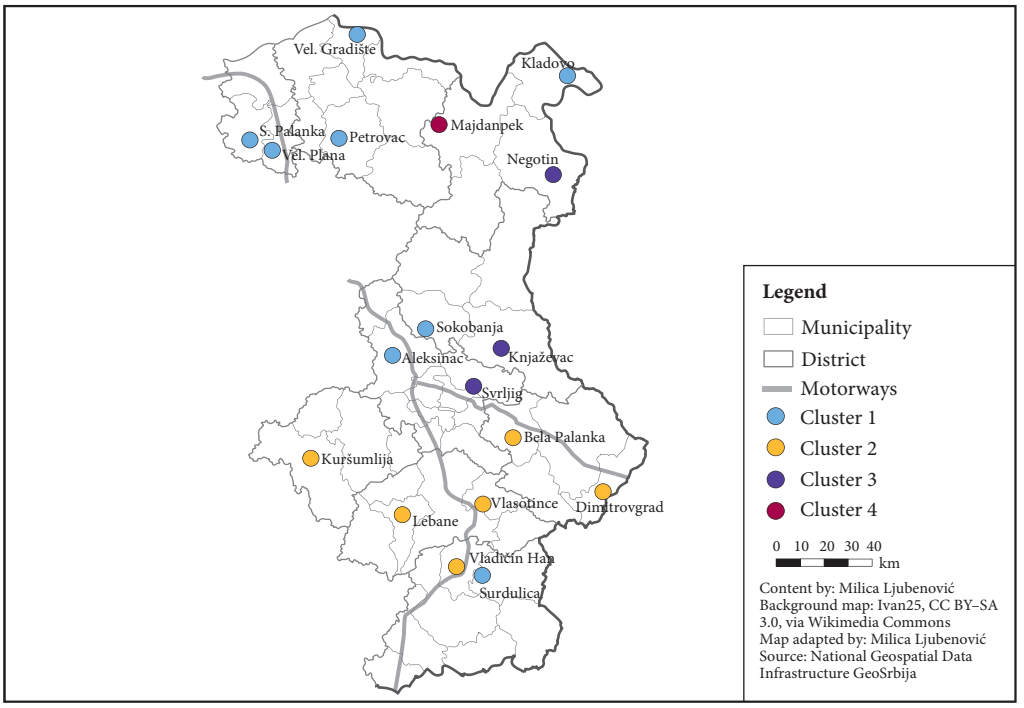

Figure 4: Clusters of small shrinking towns in RSES.

Table 7: Identified clusters and their characteristics.

Cluster			
Custer 1 The most stable economy	Cluster 2 Emigration and unemployment	Cluster 3 Extremely negative natural increase and aging	Cluster 4 Pronounced population decline and emigration
Towns			
Aleksinac Kladovo Petrovac Smederevska Palanka Sokobanja Surdulica Veliko Gradište Velika Plana	Bela Palanka Dimitrovgrad Kuršumlija Lebane Vladičin Han Vlasotince	Knjaževac Negotin Svrljig	Majdanpek
Characteristics			
Lower population decline in urban settlement and municipality Average earnings 75–100% of the national average The highest purchasing power Smallest changes in purchasing power The lowest percentage of unemployed	Pronounced population decline in urban settlement and municipality Pronounced negative migration balance A lower proportion of the elderly The lowest average earnings Low purchasing power with the highest increase The highest unemployment rate The highest density decline	The most pronounced population decline in municipality The most pronounced negative natural increase The largest share of elderly Low average earnings The lowest purchasing power with the highest increase	The most pronounced population decline (urban settlement and municipality >35%) The most pronounced negative migration balance The lowest proportion of old people in both periods The average salary in 2022 is above the national average Highest purchasing power The largest employment rate

stood out again as a separate cluster, which was a consequence of the large differences in the values of the variables compared to other towns.

Clusters are quite heterogeneous in terms of settlement size and economic functions. However, some similarities, by which they differ from each other can be observed (Figure 4 and Table 7).

Cluster 1 is mainly located in the northern part of the region. Six towns belonging to this cluster are located in the vicinity of a high-way, and two towns are situated on the right bank of the Danube River. This position along transport routes (road and water) influenced more favourable economic change and lower population decline.

Towns grouped in cluster 2 are positioned in the southern part of RSES. One of the cause for pronounced emigration and unemployment in these towns is the change in their territorial position regarding transport connectivity. Naimely, transit roads used to pass through these towns, but with the construction of the highway in the 21st century, they remained in its hinterland.

Cluster 3 contains two border towns and one town (Svrljig) which developed in a shadow of a regional center. They are all characterized by a peripheralization, caused in the first two towns by remote location, and in the third by unequal power relations between regional center and small town. As a consequence, these towns face extremely negative natural increase and aging.

Cluster 4 contains only one town that is a typical example of a small monofunctional town, unique in RSES. The decline of the most developed economic branch coused a drastic population decline.

4 Discussion

4.1 Characteristics of urban shrinkage of small towns and cluster analysis

The results of the analysis of the development trends of small towns in Serbia indicate that the phenomenon of urban shrinkage is present to a large extent, but that the trends differ according to individual parameters. The population decline is widely present and increasingly intense in almost all towns. In terms of demographic parameters, the biggest deviation occurs in the age structure because the aging process has not yet affected all towns significantly similar to findings of Bański et al. (2023). However, the change in the demographic structure towards aging is more noticeable in the previous decade and bearing in mind the ubiquitous decline of natural increase, this process will be more pronounced in the future. There are greater variations and deviations in economic criteria, especially in terms of registered employment and purchasing power of citizens. On the one hand, this can be interpreted as a slight economic recovery of certain towns, but it should be noted that formal employment and unemployment do not fully reflect the labour market. In all towns, there is a decrease in population density, which indicates that there is no spatial expansion of towns opposite of process occurring in medium-sized and larger cities (Miljanović et al. 2023). The increase in abandoned apartments is evident in almost all towns, but it does not follow the dynamics of the population change, which confirms that this phenomenon also depends on other factors such as the number and structure of households and the real estate market (Haase et al. 2016). The results of the analysis in this research confirm previous claims that small towns in Serbia are heterogeneous ensemble (Spasić and Petrić 2006; Filipović et. al 2016; Grčić et al. 2024), which is also the case in other countries (Stoica et al. 2020). There are different causes and trajectories of shrinkage of small towns in RSES, affected by the combined effects of national and local factors. However, the possibility of forming different clusters confirms that they could be grouped by similar characteristics of shrinkage. The clusters obtained in this work are almost identical to the clusters in the previous research on the small shrinking towns in the same region for the period 2002–2011 (Ljubenović 2022). Such results indicate that similar development tendencies continued in the towns in the next decade, as well as that this classification procedure can be used for long-term planning of the strategic development of small shrinking towns.

The formed clusters show that the shrinkage is not related to the size of the small town, as suggested also by Pirisi and Trócsányi (2014). On the other hand, the patterns of urban shrinkage are closely related to the territorial position and traffic connectivity (ESPON 1.4.1. 2006; Domhardt and Troeger-Weiß 2009; Cox and Longlands 2016). However, proximity to main transport axis shows two varieties. On the one hand, towns that developed along the highway over a longer period of time show more stable economic development, while the others were negatively affected by the recent construction of the highway.

Small towns at a shorter distance from others, especially larger towns, should have more favorable preconditions for development (ESPON 1.4.1. 2006; Restrepo Cadavid et al. 2017). Cluster analysis showed that this factor did not have a major impact on cluster formation, which can be explained by the fact that even larger cities in RSES are stagnating or shrinking. Border towns show also diversity and belong to different clusters, which is similar to findings of Avdić et. al (2022).

The intensity of population change, used in many studies as the base for the typology of shrinking cities (Turok and Mykhnenko 2007; Hill et al. 2012; Wiechmann and Wolff 2013) did not have a major impact on cluster formation and was of a similar scale in different clusters, except in the case of cluster 4, which consists of one town with the most pronounced decline.

4.2 Recommendations for guiding cluster development

The governance and planning system in Serbia did not have a positive impact on the development of small shrinking towns (Ljubenović 2022). Issues of urban development are mostly left to the local level and considered within general urban plans or lower planning levels (Bajić Brković 2010). Certain demographic and economic problems of small towns have been treated to some extent in national and regional documents, however, urban policy in Serbia has so far failed to achieve visible effects and improve the quality of life in small towns. The approach to small towns cannot be unique (Knox and Mayer 2009; Servillo et al. 2014; Stoica et al. 2020), as confirmed by the results of the cluster analysis. A special approach and program measures for directing the development of the clusters of shrinking small towns in RSES should be formed, addressing the dominant factors of shrinking. Cluster 1 consists of economically relatively stable towns, which actually did not go through large dynamics of economic changes. Given the better prerequisites for development compared to other clusters, possible measures could be aimed at improving and promotion of an alternative living environment compared to big cities, an approach that, for example, in France has become a tool of local actors for the development of small towns (Kwiatek-Sołtys and Mainet 2014).

The economic dimension of urban shrinkage should be influenced the most in towns of Cluster 2, thus strategies should be directed towards building local economic resilience and designing new economic directions for the town development (Cox and Longlands 2016). Inter-municipal cooperation is also important for stimulating the economy of small towns and ensuring better quality and efficiency of services (Siljanoska et al. 2012; Servillo et al. 2014).

Due to the unfavourable demographic structure of Cluster 3, it is necessary to develop policies for the integration of the elderly population into society (Hospers 2014). Urban-rural partnerships can expand the capabilities of small towns in the production of public goods, achieve economies of scale by improving the provision of public services, or develop entirely new economic opportunities (Valtenbergs et al. 2015; Igić et al. 2023).

A major limitation of future development of town in Cluster 4 is the monostructural economy, as well as the distance from other settlements. For such towns, a wider regional context and cross-border cooperation are recommended in order to become important centres independent of their location (Servillo et al. 2014), as well as the development of a specific specialization of the local economy (Leetmaaa et al. 2015).

5 Conclusion

The identification of small shrinking towns in Serbia required certain adaptations of criteria of shrinkage to national and local context. A major limitation for the identification and comparison of individual indicators in Serbia is the insufficiently developed statistical system and the lack of data, as well as their incompleteness for the lowest spatial units.

PCA and CA singled out four groups of towns according to pronounced characteristics of shrinkage in RSES, which showed that in addition to the same global and national conditions, urban shrinkage had recognizable local specificities. Specific characteristics could be distinguished in each cluster, i.e. a group of shrinking towns differed from others. The results of the cluster analysis also indicate that the tendencies of the development of small shrinking towns correspond to earlier research (Ljubenović 2022). This classification procedure can be used for long-term planning of the strategic development of small shrinking towns.

In addition to the data and indicators used in the analysis, a difference between the clusters is recognized in territorial position and connectivity. This indicated that additional spatial determinants such as accessibility, traffic connectivity and the location of the town in relation to other settlements should be included in the further analysis of small shrinking towns, and especially in the process of shaping development policies.

The application of this methodology is also possible for other regions in Serbia, as well as outside Serbia. In order to implement this method of classification, it is necessary to have variations in parameters, and if they were not expressed, it would be necessary to introduce additional quantitative determinants in relation to which the classification could be carried out. Lack of accurate data for some key variables could also affect the formation of clusters.

Considering the prevalence of urban shrinkage in small towns in Serbia, planning their future development requires more attention in the Serbian national planning policy. Accordingly, the formulation of a special national policy for the development of small towns would be necessary in order to achieve a more balanced territorial and urban development of the country. Such a document could contain special program measures coordinated according to the typology of small shrinking towns. This would identify priority strategies depending on the key characteristics of urban shrinkage.

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PHYTOTOPONYMS IN ALBANIA

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RINOR BRAKAJ

The botanical oikonym Shkozë in Vlorë district, Albania.

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Mariglen Sherifaj[1], Valbona Duri[1]

Phytotoponyms in Albania

ABSTRACT: This paper deals with oikonyms in Albania, named after plants. It aims to identify the phytotoponyms, their geographical distribution and influencing factors. The review of geographical, linguistic, botanical and historical sources helped to highlight 175 phytotoponyms, derived from 39 phytonyms. They were analyzed in geospatial terms using qualitative and comparative methods. The phytotoponyms named after walnut, apple and pear have a high frequency, while those named after olive, plum, cypress are rarer. Most of phytotoponyms are located in the lowlands of western Albania, while in the mountainous territories in the south and north their number decreases significantly. This work could inspire toponymy research, inform policy, reveal dialects, and document phytonyms.

KEYWORDS: oikonym, phytotoponym, phytonym, territory, hypsometric level, Albania

Fitotoponimi v Albaniji

POVZETEK: Članek proučuje imena naselij v Albaniji, nastala iz poimenovanj rastlin (t. i. fitotoponime). Njegov namen je opredeliti fitotoponime ter njihovo geografsko razširjenost in dejavnike, ki so vplivali na njihovo poimenovanje. Na podlagi pregleda geografskih, jezikoslovnih, botaničnih in zgodovinskih virov je bilo določenih 175 fitotoponimov, nastalih iz 39 imen rastlin (fitonimov), ki so bili nato geoprostorsko analizirani s kvalitativnimi in primerjalnimi metodami. Naselja, poimenovana po orehu, jabolku in hruški, so zelo pogosta, medtem ko so tista, poimenovana po oljki, slivi in cipresi, redkejša. Fitotoponimi prevladujejo v nižinskem svetu zahodne Albanije, na gorskih območjih na jugu in severu pa je njihovo število precej manjše. Ugotovitve so potencialno koristne za nadaljnje raziskave toponimov, informiranje politike, preučevanje narečij in dokumentiranje fitonimov.

KLJUČNE BESEDE: ime naselja, fitotoponim, fitonim, ozemlje, hipsometrična raven, Albanija

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1 Introduction

Toponymy is the taxonomic study of place names. It divides them into two broad categories: habitation names (homestead, village, or town) and feature names (hydronyms, oronyms, and places of natural vegetation growth) (Abella et al. 2025).

Toponyms generally receive a single typology tag; however, they may have more than one (Blair and Tent 2021). Such are oikonyms associated with the names of plants. This type of toponyms called botanical oikonyms (Encyclopædia Britannica … 2017) or phytotoponyms are interpreted as names of natural objects and names of manmade objects (Abdikhalikovna 2020).

Plants, as a universal toponymic source (Lim and Cacciafoco 2020), were among the primary elements that humans in ancient times noticed and were vitally dependent upon. Unlike animals, plants, serve as fixed points in a landscape, making them useful for immediate place identification (Pinna et al. 2017). Knowing how to read and understand the language of geographical names can provide deeper insights into original names, allowing a seemingly silent and mute landscape to reveal its broader significance in many aspects (Kladnik et al. 2020).

Trees provide humans with food, building materials, various raw resources, and medicines. Besides their material role, they hold symbolic significance, serving as a form of expression of folk customs, beliefs, and mythology (Cargonja et al. 2008). Throughout history, plant names, have penetrated toponymy and been used to name oikonyms.

»Phytonym« is the scientific or botanical name of a plant (Bil 2018). Phytonyms are nominative-onomastic units formed based on the plants connection to the world within their conceptual meaning (Pazlitdinova 2017).

Whereas a »phytotoponym« is a place name that refers to a plant or vegetation. Phytotoponyms (place names containing a plant element) can illuminate the relationship between humans and nature over a long time span through their historical context (Oxford University Press 2012).

Almost every country has toponyms derived from plant names, such as the United States, Croatia, Romania, South Africa, India, China, and Singapore (Lim and Cacciafoco 2020). In Great Britain, some phytotoponyms are related to plant names; oak, apple, ash (Smatova et al. 2020) and pear (see the http://kepn.nottingham.ac.uk provided by The Institute for Name-Studies).

The names of plants are widely used in all categories of toponyms in Albania, including oikonyms, oronyms, hydronyms, and drymonyms. Oikonyms of phytonymic origin are common in Albania. Examples are: comonyms *Mollas* from *mollë* (apple in Albanian), *Frashër* from *frashër* (ash tree in Albanian) (Lafe and Cikuli 2002), astionyms *Gramsh* from *gram* (Bermuda grass in Albanian) (Koçi 2021) and *Fier* from *fier* (fern in Albanian) (Gjika 2004).

This paper focuses on oikonyms related to plant names in Albania. It aims to identify phytotoponyms and analyse their vertical extent in comparison with plant species used as phytonyms.

Only standard Albanian plant names, as well as their vernacular variants used in naming phytotoponyms, were considered. These names are lexicographically Albanian, and we do not claim that they are of Albanian etymological origin. However, the scientific names of plants in Latin are not the focus of our study.

It is important to note that the Albanian language's inherited fund has been enriched over the time by both internal and external sources. Many additions have penetrated toponymy, leading to changes that can be explained by predictable patterns in the development of the phonetic system and morphological structure of the Albanian language (Demiraj 1998).

This work combines qualitative and quantitative methods to acquire a more profound understanding of each phytotoponym and analyze them in geospatial terms. The phytonym-phytotoponymy relationship was studied through descriptive scientific analysis interpreting data from multiple linguistic, historical, and botanical sources.

The theoretical and practical significance of phytotoponyms motivated us to undertake and realize this multidisciplinary research, where phytotoponyms are studied both semantically and geographically.

2 Study Area

Albania is a Mediterranean country located within coordinates 39°38′–42°39′N and 19°16′–21°04′E. Its geographical extent in direction from south to north (3°01′ or 340 km) and east to west (1°48′ or 148 km)

indicates that the horizontal extent has minimal impact on the surrounding environment. Although topography is the primary influencing factor in the vertical direction, an elevation range of –8 m to 2751 m (Qiriazi 2019), dictates a significant diversity of natural conditions.

Albania is a highly mountainous country: 61.2% of the territory lies above 600 m, 25.5% in 300–599 m, and only 13.3% in 0–299 m altitude (Habili et al. 1997). The impact of vertical zoning is evident on the climate and consequently on the flora.

The presence of a primarily Mediterranean flora, comprising approximately 3250 species, is influenced by the various topographic, petrographic, and soil types as well as a Mediterranean climate. This flora includes 330 species and varieties of forest trees, of which 85% grow and develop naturally while the remaining 15% have been introduced for aesthetic and commercial purposes (Habili et al. 1997).

The horizontal distribution divides Albania's flora into two major groups: the Mediterranean vegetation, which includes the Adriatic and Greek vegetation and contains 35% of the country's plant species, and the Meso-European vegetation, which makes up roughly 65% of the country's flora, divided along the Koplik–Leskovik line (Qiriazi 2018), which runs in a NW–SE direction.

According to the vertical distribution, there are four zones of vegetation (Qiriazi 2018; Figure 1): Mediterranean shrubs and forests (up to 600–800 m), Oaks (*Quercetum*) (from 600–800 m to 1000–1200 m), Beech forests (*Fagetum*) and conifers (1000–1200 m to 1600–1800 m), Alpine pastures (above 1600–1800 m).

The zones of vegetation are 200 meters higher in the south of Albania due to the country's warmer climate than in the north. Their minimum borders are those of northern Albania. In this study, the following zonation was used:

- Mediterranean shrubs and forests, up to 600 m altitude (I),
- Oaks (*Quercetum*), 600–1000 m (II),
- Beech forests (*Fagetum*) and conifers, 1000–1600 m altitude (III),
- Alpine pastures, above 1600 m (IV).

In 2017, Albania had 1,051,871 hectares of wooded land, with 14% consisting of conifers, 50% of oak trees, and 36% of shrubs. The forest coverage is distributed as follows: 31% in the Northern Region, 19% in the Central Region, 31% in the South-East Region, and 19% in the South-West Region (Ministry of Tourism and Environment 2018). The distribution of forests across Albania's landscape is highly uneven, with some areas, particularly in the west and south, lacking significant forest cover (Shqahu 2007).

3 Study materials and methods

The purpose of this research entails the set of oikonyms in Albania related to plant names. It aims to identify and collect phytotoponyms, address their spatial distribution, and evaluate the relationship that exists between phytotoponyms and phytonyms based on altitude. Several steps were followed to conduct this study.

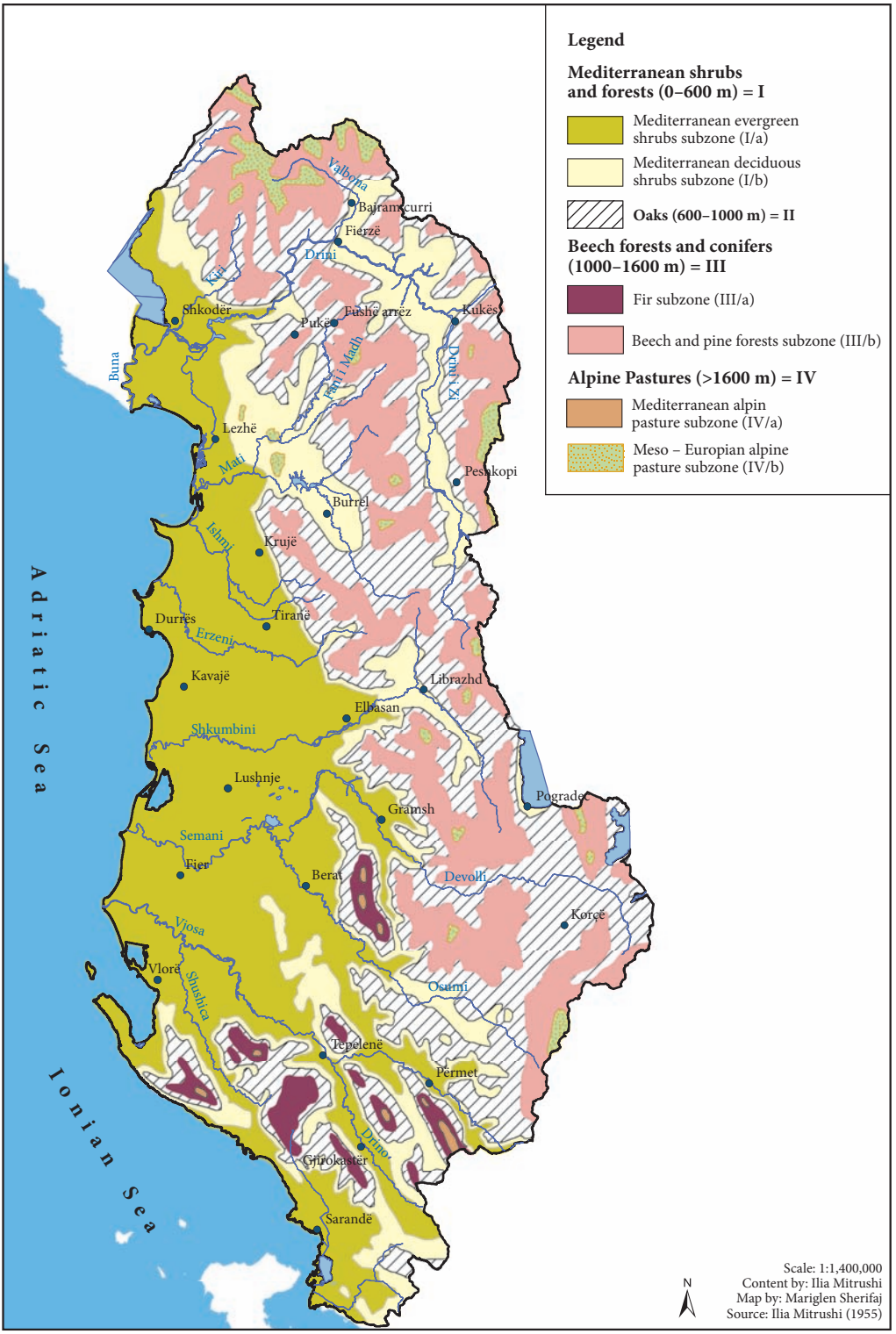
Firstly, a list of 3036 Albanian settlements (consisting of 2962 villages and 74 cities) (Ziu 2009) had been georeferenced. They were compared based on their semantic meaning to the name of plants growing in Albania and divided into three groups:

a) Settlements whose names are the same as the phytonyms, with no change in structure.
b) Settlements named after plants that have undergone phonetic and structural changes. This includes phytotoponyms accompanied by prefixes, and suffixes, noun phrases, compound or agglutinated words.
c) Settlement names that have no relation to plant names (this group was not included in the analysis). This includes oikonyms for which we cannot provide a semantic explanation, are part of a foreign lexicon, or may be of plant origin, but we do not know the specific plant name.

After distinguishing phytotoponyms from phytonyms, we grouped phytotoponyms according to the plant names from which they originated.

The identification and comparison of plant names and phytotoponyms required a detailed examination of Albanian literature across several disciplines; linguistics, history, botany, and geography. In analogy, we reviewed researches conducted by international authors who have led similar studies related to this theme.

Figure 1: Phytoclimatic map of Albania (Mitrushi 1955). ➤ p. 29


Legend
Mediterranean shrubs and forests (0–600 m) = I
Mediterranean evergreen shrubs subzone (I/a)
Mediterranean deciduous shrubs subzone (I/b)
Oaks (600–1000 m) = II
Beech forests and conifers (1000–1600 m) = III
Fir subzone (III/a)
Beech and pine forests subzone (III/b)
Alpine Pastures (>1600 m) = IV
Mediterranean alpin pasture subzone (IV/a)
Meso – Europian alpine pasture subzone (IV/b)
Adriatic Sea
Ionian Sea
Vlorë
Bajram Curri
Fier
Shkodër
Pukë
Fushë Arrëz
Kukës
Lezhë
Peshkopi
Burrel
Krujë
Durrës
Tiranë
Kavajë
Librazhd
Elbasan
Lushnje
Gramsh
Pogradec
Berat
Devoll
Korçë
Tepelenë
Përmet
Gjirokastër
Sarandë
Vjosa
Shushica
Osumi
Drino
Semani
Shkumbini
Ishmi
Erzeni
Mati
Buna
Drini i Zi
Fani i Madh
Valbona
Kir
Drini
N
Scale: 1:1,400,000
Content by: Ilia Mitrushi
Map by: Mariglen Sherifaj
Source: Ilia Mitrushi (1955)

Another valuable source of information was interviews with elderly residents, representatives of local institutions, regional development agencies, researchers and others. The questions of *what*, *where*, *who*, *when, and why* (Blair and Tent 2021) were addressed through 34 direct interviews with semi-structured questions (Osmani 2015). These questions covered the meaning of the settlement's name: who named it, where it was named, when it was named, and why it was named after a plant, without delving into the specifics of history and linguistics.

Secondly, we aimed to clarify the meaning of oikonyms that were ambiguously derived from plant names. This stage involved examining phytonyms and phytotoponyms appearing in dialectal forms distinct from standard Albanian language. For example, phytotoponyms like *Gjoricë e Sipërme* and *Gjoricë e Poshtme* (Lafe and Cikuli 2002) as well as *Arn i Epërm* and *Arn i Poshtëm* are derived from the vernacular names *gjoricë* (European wild pear in Albanian) (Shkurtaj 2001) and *arn* (Balkan pine in Albanian) (Çabej 1982) and the antonyms that reveal a contradiction relation between *e Sipërme/i Epërm* and *e Poshtme* (upper/above and lower in Albanian), which differentiate settlements according to hypsometry (Clayer 2008).

Thirdly, a list (Table 1) was compiled containing information about plants used as phytonyms and their corresponding vegetation zones (0–600 m, 600–1000 m, 1000–1600 m, and >1600 m; see Chapter 2 for more details). Then we found the altitude of each phytotoponym and compared it to the altitude band of homonymous plant growth where matching and mismatching cases were extracted (Table 3). The phytotoponyms' altitude was calculated using the ArcGIS software, superimposing the spatial layer of phytotoponyms on the vector file representing the altitude zones. These layers were provided by The State Authority for Geospatial Information (ASIG).

Finally, we investigated the influencing factors for the inconsistency cases between the altitude of phytotoponyms and the altitude band where plants with phytonymic use grow.

This study examines phytotoponyms at a micro level, employing both qualitative and quantitative methods, although the latter have yielded inconclusive results (Zhong et al. 2020). The quantitative data on phytotoponyms and their spatial distribution were valuable for macro-level analysis. To achieve the best results, it is important to analyse all toponyms in a country rather than studying individual ones (Shkurtaj 2001). This necessitates combining both intensive and extensive approaches (Tent 2015).

4 Results

Albania offers an interesting panorama of a sizable variety of phytonyms and phytotoponyms. Despite the country's rich flora, our analysis of settlement names revealed 39 distinct plant species employed as phytonyms (Table 1). Most phytonyms are found in the zones of Mediterranean shrubs and forests, and Oaks, while their number declines as one moves further into the zones of Beech forests and conifers, and Alpine pastures.

In Albania, there are approximately 175 phytotoponyms, accounting for 5.76% of the total 3036 settlements. These are associated with 39 different plant species, four appellations of vegetation, one name related to vegetation, *kashtë* (straw in Albanian), and *dushk* (oak in Albanian) that refers to the oak genus (*Quercus L.*) or is used as a substitute for specific plants within this genus.

Out of these phytotoponyms, 151 are phytotoponyms, 10 settlements of oak, 3 settlements consist of two plant names (walnut and apple, willow and tamarisk, pine and alder), while 11 settlements are not genuine phytotoponyms. The latter ones have been formed from appellations of vegetation, such as *vresht* (vineyard in Albanian), *livadh* (meadow in Albanian), *drith* (grain in Albanian), *bar* (grass in Albanian), and *kashtë* (straw in Albanian) (Table 2).

It should be noted that the names of the 151 phytotoponyms are not identical to those of the phytonyms, as they have undergone linguistic and semantic changes over the years, resulting in changes in form, spelling, pronunciation, and oral transmission (Shi et al. 2015; Imoh and Dansabo 2022).

Often phytotoponyms are presented in different linguistic forms such as:

a) Phytotoponym with prefix; *lë-, kë-, tej-;*
   - *Lamollë* (*lë-/la-* and *mollë*),
   - *Kalis* (*kë-/ka-* and *lis*),
   - *Tejmollë* (*tej-* and *mollë*), *tej-* shows a place which is found across (Xhuvani and Çabej 1980);

Table 1: Phytonyms in Albania.

Genus (English/Latin)*	Species (English/Latin)	Phytonym (Albanian)	Zone of vegetation**
Pine (*Pinus L.*)	Balkan pine (*Pinus peuce*)	Arnen	II–IV
	Pine (*Pinus sp.*)	Pishë	I–III
Juniper (*Juniperus L.*)	Juniper (*Juniperus sp.*)	Dëllinjë	I–II
Cypress (*Cupressus L.*)	Cypress (*Cupressus sempervirens*)	Selvi	I
Plane trees (*Platanus L.*)	Plane tree (*Platanus orientalis*)	Rrap	I–II
Pomegranate (*Punica L.*)	Pomegranate (*Punica sp.*)	Shegë	I–II
Buckthorn (*Paliurus Mill.*)	Buckthorn (*Paliurus aculeatus*)	Drizë	I–II
Grapevine (*Vitis L.*)	Grapevine (*Vitis sp.*)	Hardhi	I
Cornel (*Cornus L.*)	Cornel (*Cornus sp.*)	Thanë	I–III
Walnut (*Juglans L.*)	Walnut (*Juglans regia*)	Arrë	I–III
Hawthorn (*Crataegus L.*)	Hawthorn (*Crataegus sp.*)	Murriz	I–III
Pear (*Pyrus L.*)	European wild pear (*Pyrus amygdaliformis*)	Goricë	I
	Pear (*Pyrus sp.*)	Dardhë	I–II
Apple (*Malus L.*)	Apple (*Malus sp.*)	Mollë	I–III
Bramble (*Rubus L.*)	Bramble (*Rubus sp.*)	Ferrë	I–II
Plum tree (*Prunus L.*)	Blackthorn (*Prunus spinosa*)	Kulumbri	I–II
	Plum tree (*Prunus sp.*)	Kumbull	I–III
Cherry tree (*Cerasus Juss.*)	Cherry tree (*Cerasus sp.*)	Qershi	I–III
Hornbeam (*Carpinus L.*)	Hornbeam (*Carpinus sp.*)	Shkozë	I–III
Hazelnut (*Corylus L*)	Hazelnut (*Corylus sp.*)	Lajthi	I–III
Alder (*Alnus L.*)	Alder (*Alnus sp.*)	Vërri	I–III
Chestnut (*Castanea Mill.*)	Chestnut (*Castanea sp.*)	Gështenjë	I–II
Oak (*Quercus L.*)	Turkey oak (*Quercus cerris*)	Qarr	I–III
	Downy oak (*Quercus pubescens*)	Lis	I–III
Ash tree (*Fraxinus L.*)	Ash tree (*Fraxinus sp.*)	Frashër	I–III
Olive (*Olea L.*)	Olive (*Olea sp.*)	Ulli	I
Tamarisk (*Tamarix L.*)	Tamarisk (*Tamarix sp.*)	Marinë	I
Fig (*Fikus L.*)	Fig (*Ficus sp.*)	Fik	I
Elm tree (*Ulmus L.*)	Elm (*Ulmus campestris*)	Vidh	I–III
Willow (*Salix L.*)	Willow, white willow (*Salix sp.*)	Shelg, sheq	I–IV
Populus (*Populus L.*)	Poplar (*Populus sp.*)	Plep	I–III
Arundo (*Arundo L.*)	Arundo (*Arundo donax*)	Kallëm, Kallm	I
Fern Pteridium (*Pteridium L.*)	Fern (*Pteridium aquilina*)	Fier	I–III
Bermuda grass (*Cynodon L.*)	Bermuda grass (*Cynodon dactylon*)	Gram	I
Rye (*Secale L.*)	Rye (*Secale cereale*)	Thekërr	I–III
Rice (*Oryza L.*)	Rice (*Oryza sativa*)	Oriz	I
Vetches (*Vicia L.*)	Vetches (*Vicia faba*)	Bath	I
Tea (*Sideritis L.*)	Tea (*Sideritis roesseri*)	Çaj	I–III
Tobacco (*Nicotiana L.*)	Tobacco (*Nicotiana tabacum*)	Duhan	I

*Sources: Mitrushi 1955; Demiri 1979; Nano 1987; Miçi 1988; Paparisto 1988; Vangjeli et al. 1995; Shqahu 2007; Akademia e Shkencave e Shqipërisë 2008; Kashta et al. 2010; Qiriazi 2018.
L. = Linnaeus, Mill. = Miller, Juss. = Jussieu, sp. = species.
**The zones of vegetation are shown with numbers: Mediterranean shrubs and forests (0–600 m) = I, Oaks (600–1000 m) = II, Beech forests and conifers (1000–1600 m) = III, Alpine pastures (>1600 m) = IV.

Table 2: Phytotoponyms in Albania and their distribution according to the zones of vegetation.

Composition of phytotoponyms		Zones of vegetation*			Total
		I	II	III and IV	
Phytonyms	1 Phytonym	105	30	16	151
	2 Phytonyms	2	1	0	3
Plant or zone of vegetation	Oak	10	0	0	10
Other	Grain	1	1	0	2
	Vineyard	2	2	0	4
	Hay meadow	1	1	0	2
	Grass	0	2	0	2
	Straw	1	0	0	1
	Total	**122**	**37**	**16**	**175**

*The zones of vegetation are shown with numbers: Mediterranean shrubs and forests (0–600 m) = I, Oaks (600–1000 m) = II, Beech forests and conifers (1000–1600 m) = III, Alpine pastures (>1600 m) = IV.

b) Phytotoponym with suffix: *-isht (-ishtë) -aj, -et, -ës, -ëz (-zë), -ore, -th* etc. (Shkurtaj 2001):
   - *Qarrishtë* (*qarr* and *-ishtë*), *-ishtë* refers to a group of trees (Luka 2019), *Sheqishtë* (Çabej 1982),
   - *Lisaj (lis and -aj), -aj* is the same as the suffix *-ishte* (Agalliu et al. 2002),
   - *Shkozet (shkozë and -et), -et* indicates the place where there are many plants (Xhuvani and Çabej 1980),
   - *Arrëz (arrë and -ëz), -ëz* is a plural suffix, in this case, means walnut forest (Topalli 2017),
   - *Bathore (bath and -ore), -ore* indicates the place where a plant is planted (Agalliu et al. 2002),
   - *Arrth (arrë and -th), -th* is a diminutive suffix (Doçi 2006) etc.

c) Antonymous phytotoponyms: *Kallm i Madh* and *Kallm i Vogël* have been formed from the phytonym *kallëm/kallm* (Arundo in Albanian), and adjectives *i madh – i vogël* (big–small in Albanian) which are in antonymic relationship with each other (Shkurtaj 2001).

d) Phytotoponym carrying geographical concept. The incorporation of toponymic determinants such as pass, field, hill, and shingle into settlement names contributes to their desemantization and subsequent reinterpretation as instruments for word formation. For instance, the phytotoponym *Qafëdardhë* consists of two names: *Qafë* (pass in Albanian) and *Dardhë* (pear in Albanian) (Bidollari 1990). Similar phytotoponyms are *Zall-Dardhë* and *Fushë-Arrëz* (Luka 2019).

e) Compound or agglutinated phytotoponyms. They consist of a noun phrase where one member is phytonym or a phytonym root (Shkurtaj 2001). Binomial oikonyms such as *Murriz-Kozar*, *Vadardhë* (*Va* and *dardhë*) (Luka 2019), and *Pishëporo* have been formed by the merger or the administrative merger of two or more settlements (Bidollari 1990).

What often stands out in phytotoponyms is that they are associated with well-defined species, although they can also refer to a genus (Spampinato et al. 2022). When it comes to the names of plant species, which consist of a noun and an adjective, only the name of the plant is used as phytonym (Cargonja et al. 2008). Furthermore, people tend to avoid using Latin plant names in phytotoponyms because they are difficult to remember and pronounce.

Phytotoponyms with high frequency in Albania, are those deriving from plant names such as walnut (16 cases), apple (10 cases), pear (9 cases), and willow (8 cases). While phytonyms used only once are plum, tea, rice (Figure 2).

Phytotoponyms in Albania are irregularly distributed according to horizontal and vertical zoning. A large number of phytotoponyms are located in central and western Albania, but their number decreases significantly in the south and north. We think that this phenomenon is not related to the large areas of these plants.

On the contrary, vegetation is considered a reference object and receives toponymic use when it occupies small areas and is dominated by one type of plant, or solitary plants and distinct from others. So what is scarce, rare, and different from the others is taken as a reference to label places and settlements.

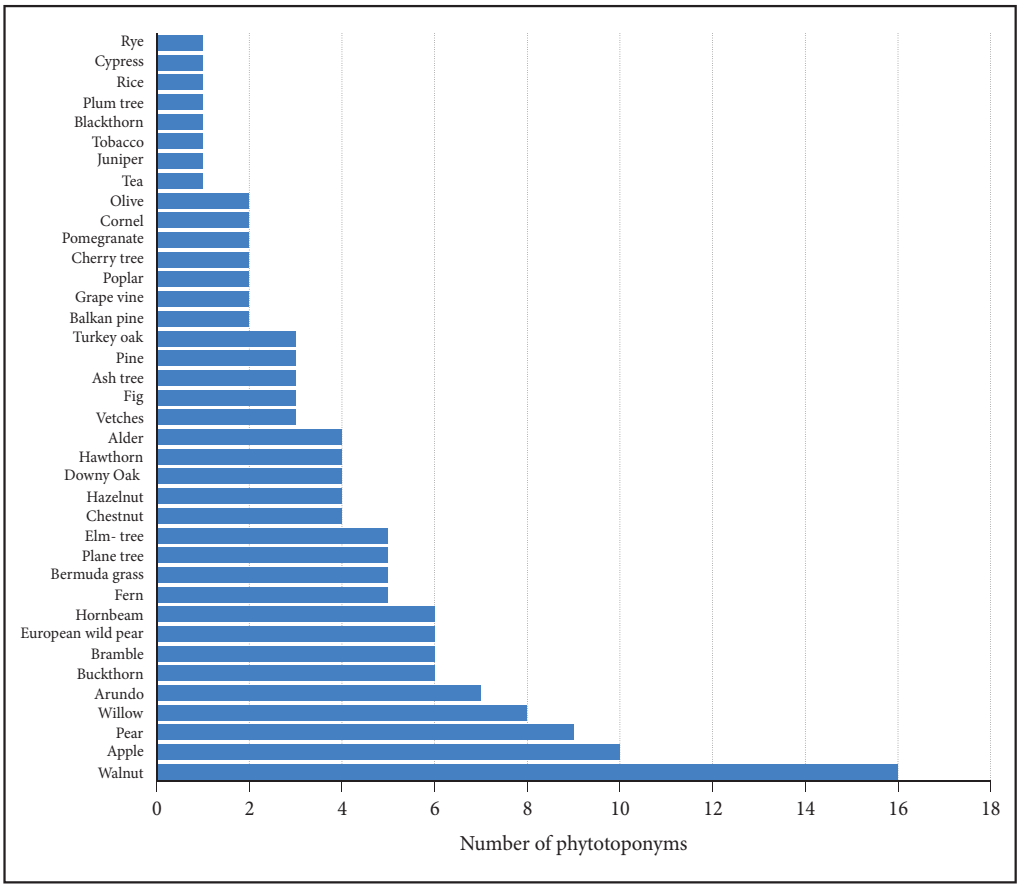


Figure 2: Phytotoponyms per taxon in Albania.

According to this argument, there are few phytotoponyms in mountainous districts with significant forested areas, such as Pukë, Tropojë, Malësi e Madhe, Dibër, Kukës, and Mat. In contrast, there are a lot more phytotoponyms in the lowland districts like Lushnjë, Fier, Kavajë, and Durrës that have tiny forested areas (Habili et al. 1997).

Depending on the types of terrain in Albania, the ratio of phytotoponyms to non-phytotoponyms (settlements not based on plant names) is as follows: there are 86 phytotoponyms and 930 non-phytotoponyms in the lowlands between 0 and 200 m; 73 phytotoponyms and 1666 non-phytotoponyms in the hilly terrain between 200 and 1000 m; and 16 phytotoponyms and 265 non-phytotoponyms in the mountainous terrain above 1000 m. Non-phytotoponyms are located up to 1700 meters in altitude, while phytotoponyms demonstrate a limited extent from 10 to 1340 meters.

According to the zones of vegetation, we find that most of the phytotoponyms belong to the zone of Mediterranean shrubs and forests from 0–600 m altitude with 122 phytotoponyms, decreasing to the Oaks with 37 phytotoponyms and Beech forests and conifers with 16 phytotoponyms. While at the zone of the Alpine pastures, there are no phytotoponyms (Table 3).

We have identified two types of matching based on the phytonymic-phytotoponymic relationship according to altitude: 1) complete and 2) partial matching.

Firstly, complete matching occurs when the altitude of the phytotoponyms exactly corresponds to the altitude band where the plants, which have received phytonymic use, grow. As shown in Table 3, out of the

151 pure phytotoponyms, only 140 match the altitude of the phytonyms, whereas 11 do not. Specifically, 140 phytotoponyms are names derived from 38 phytonyms (Tamarix was not included in Table 3 since it forms a compound phytotoponym together with Willow).This high degree of matching between phytotoponyms and phytonyms according to vertical distribution is not surprising, because phytotoponyms reflect vegetative peculiarities of the area and »give a hint« as to which useful plants can grow in the specific region (Atasoy and Yeginbayeva 2017).

Secondly, partial matching occurs when there is not a complete alignment between the phytotoponyms' altitude and the altitude band where the plants, which have received phytonymic use, grow. As can be seen in Table 3, 11 phytotoponyms named after the pear (*dardhë*), European wild pear (*goricë*), arundo (*kallëmb*), chestnut (*gështenjë*), ash tree (*frashër*) do not match the altitude of phytonyms. On the other hand, 17 other phytotoponyms labeled with the aforementioned phytonyms are found in the altitude where these plants grow (Table 3).

A case of matching is the phytotoponym *Gështenjas* (in the Pogradec district) located at an altitude of 750 m, adjacent to a chestnut plantation (Qiriazi 2018). It is worth noting that this plant typically grows within altitudes ranging from 400 to 800 m (Shqahu 2007).

Conversely, the phytotoponym Dardhë (in the Korçë district), situated at 1340 m, may have been named after the European wild pear tree, which thrives at altitudes exceeding 1000 m (Qiriazi 2018), whereas the common pear tree, can be found below 800 m.

In conclusion, out of the pure 151 phytotoponyms, altitudes of 11 phytotoponyms derived from 5 phytonyms do not match with growth altitudes of phytonyms, while 123 phytotoponyms derived from 33 plants completely match with corresponding phytonym. Growth altitudes of 33 phytonyms match with altitudes of all the corresponding phytotoponyms and 5 phytonyms exhibit partial matching. So there are cases of matching and partial matching, while there are no cases of complete non-matching.

It is important to note that the remaining 24 settlements are categorized as follows: 11 phytotoponyms originated from terms such as grass, hay meadow, vineyard, and grain; 10 phytotoponyms named after oak were not examined as they do not represent phytonyms. Additionally, 3 phytotoponyms, whose names comprise two phytonyms each, cannot be defined because the plants they are named after grow at different altitudes.

5 Discussion

This work offers a geographical perspective on phytotoponyms. We faced many challenges such as the subject not being thoroughly studied in Albania, incomplete information on phytotoponyms, and lack of data to conduct thorough analyses of the relationship between phytotoponym and phytonym.

Another issue is the categorization of toponyms that satisfy multiple criteria (so they are oikonyms and phytotoponyms) as currently there is no unique worldwide classification (Abbasov and Valiyeva 2023).

The impact of topography, history, culture, population shifts, vegetation, and other factors on settlement nomenclature will encourage researchers to conduct in-depth studies and sensitize the people about the fact that the names of settlements are not coincidental but rather the product of local heritage, developed over many years. Thus, toponyms act as a lens or filter through which people, individuals, groups, and societies, view and engage with biodiversity (Shackleton 2018; Zhong et al. 2020). A good example is the phytotoponym *Kalis*, located nearby several old oaks at 1200 m, designated as natural monuments (Qiriazi 2018).

A limited number of natural or cultivated plants, 39 in total, have been used to name phytotoponyms in Albania. They are typical of the Mediterranean climate, as are the phytonyms; bamboo, papaya (Shi et al. 2015), jackfruit, coffee tree (Setyo et al. 2022), mango, tamarind, in tropical countries (Lim and Cacciafoco 2020).

Compared to Croatia, which has the highest number of phytotoponyms in continental and lowland areas and the fewest in the Mediterranean phytogeographic region (Cargonja et al. 2008), Albania exhibits a different pattern. In the coastal plain, there are many phytotoponyms, while in the high coastal line, their number is comparatively lower. However, in the interior of Albania, there is not a clear evidence in the distribution of phytotoponyms, as there are territories in the north and south where phytotoponyms are almost absent.

Table 3: Phytonyms and phytotoponyms in Albania according to altitude.

Phytonym	Phytoclimatic region*	Phytotoponyms		Phytotoponyms according to the zone of vegetation**			Phytonym-phytotoponym hypsometric relationship		
	Elevation (m)	No	Elevation (m)	I	II	III	Match	No match	Result
Walnut	0–1200	16	40–1150	8	4	4	16	0	Complete
Apple	0–1800	10	90–980	5	5	0	10	0	Complete
Pear	0–800	9	40–1340	4	3	2	5	4	Partial
Willow	0–1800	8	20–740	7	1	0	8	0	Complete
Arundo	0–400	7	25–1010	6	0	1	6	1	Partial
Buckthorn	0–700	6	60–210	6	0	0	6	0	Complete
Bramble	0–1000	6	10–210	6	0	0	6	0	Complete
European wild pear	0–500	6	340–950	4	2	0	3	3	Partial
Hornbeam	0–1500	6	30–1050	4	1	1	6	0	Complete
Fern	0–1200	5	40–80	5	0	0	5	0	Complete
Bermuda grass	0–800	5	15–230	5	0	0	5	0	Complete
Plane tree	0–900	5	20–800	3	2	0	5	0	Complete
Elm tree	0–1300	5	40–720	4	1	0	5	0	Complete
Downy Oak	0–1400	5	170–600	5	0	0	5	0	Complete
Hazelnut	0–1600	4	660–1220	2	2	0	4	0	Complete
Hawthorn	0–1600	4	30–870	3	1	0	4	0	Complete
Alder	0–1600	4	30–720	3	1	0	4	0	Complete
Chestnut	400–800	3	670–1180	0	2	1	2	1	Partial
Vetches	0–400	3	70–210	3	0	0	3	0	Complete
Fig	0–400	3	90–230	3	0	0	3	0	Complete
Ash tree	100–1700	3	40–1020	2	0	1	1	2	Partial
Pine	0–1600	3	10–870	2	1	0	3	0	Complete
Turkey oak	0–1400	3	10–1020	2	0	1	3	0	Complete
Balkan pine	600–2200	2	600–680	0	1	1	2	0	Complete
Grapevine	0–400	2	30–130	2	0	0	2	0	Complete
Poplar	0–1700	2	30–580	2	0	0	2	0	Complete
Cherry tree	400–1450	2	1140–1160	0	0	2	2	0	Complete
Pomegranate	0–700	2	80–170	2	0	0	2	0	Complete
Cornel	0–1300	2	30–70	2	0	0	2	0	Complete
Olive	0–700	2	130–140	2	0	0	2	0	Complete
Tea	0–1700	1	1320	0	0	1	1	0	Complete
Juniper	0–1100	1	10	1	0	0	1	0	Complete
Tobacco	0–400	1	140	1	0	0	1	0	Complete
Blackthorn	0–800	1	600	1	0	0	1	0	Complete
Plum tree	0–1400	1	1040	0	0	1	1	0	Complete
Cypress	0–400	1	120	1	0	0	1	0	Complete
Rye	400–1600	1	960	0	1	0	1	0	Complete
Rice	0–600	1	50	1	0	0	1	0	Complete
Total		**151**		**107**	**28**	**16**	**140**	**11**	

*Sources:Mitrushi 1955; Nano 1987; Miçi 1988; Paparisto 1988; Vangjeli et al. 1995; Shqahu 2007; Akademia e Shkencave e Shqipërisë 2008; Kashta et al. 2010; Qiriazi 2018.

**The zones of vegetation are shown with numbers: Mediterranean shrubs and forests (0–600 m) = I, Oaks (600–1000 m) = II, Beech forests and conifers (1000–1600 m) = III, Alpine pastures (>1600 m) = IV.

A distinct case from Albania is the province of Western Hubei, China, where phytotoponym frequency is low in lowlands and hilly terrain and the majority of them are found at significantly higher altitudes (Shi et al. 2015).

Analyzing the relationship between phytotoponyms and phytonyms, according to a vertical distribution, we notice a high degree of matching (123 of 151), while partial matching occurs in 28 phytotoponyms. These oddities have been conditioned by weak relationship between the phytotoponym and the plant name, as well as the areal of the plant used as phytonym is close, but not exactly at the same location as the phytotoponym.

There are some factors which have influenced the naming of phytotoponyms.

a) Migration

In Albania, it is common to come across settlements with identical names (Sherifaj and Duri 2023). A few settlements that sprang from population migration are still known by their original names. These types of toponyms, known as migration names, are carried from one location to another through population migration (Mahmudovna and Gulomovich 2023).

One such case is the phytotoponym *Darzezë* (Gramsh), originally called *Dardas* in the 15th century (Inalxhik 1954). The construction of a hydroelectric dam on the Devoll's river led to the displacement of the village's inhabitants, who then relocated to a new settlement in Fier. The new settlement, Darzezë, retains the original botanical oikonym but is defined by its connection to the previous name rather than the pear plant (Bidollari 1991).

b) Historical factors

The nomenclature of settlements after plant names in Albania may be an early practice. Further research is required to determine whether phytotoponyms have retained their original names throughout history. There are cases where newer settlement names have gradually replaced older ones. As a result, the current name of the settlement is not a true reflection of its age (Laansalu 2015).

A prime example is the phytotoponym *Frashër* (in the Përmet district) which dates back to the 2nd century BC (Qiriazi 2018). Although Frashëri appears under the name Firaçil (Bayir 2005) in the Ottoman register of 1519, we believe this to be the phytonym *frashër* (ash tree).

It appears that the phytonym *dardhë* (pear in Albanian) is an old Illyrian-Balkan term that denotes Kingdom of Dardania (Kocillari 2019). Toponyms containing the root »*pear*« or noun phrases containing this word are common wherever pears are cultivated, particularly in the northeast of Albania (Shkurtaj 2001).

In ancient times, oak was thought to be the center of the Pelasgian cradle. The Celtic term »wood« is said to signify »oak« and »wise« (Hysi 2010), also supposed to be a symbol of fortitude, age, and resistance.

Oak gave rise to several of the phytotoponyms that are still in use today, albeit some have changed structurally.

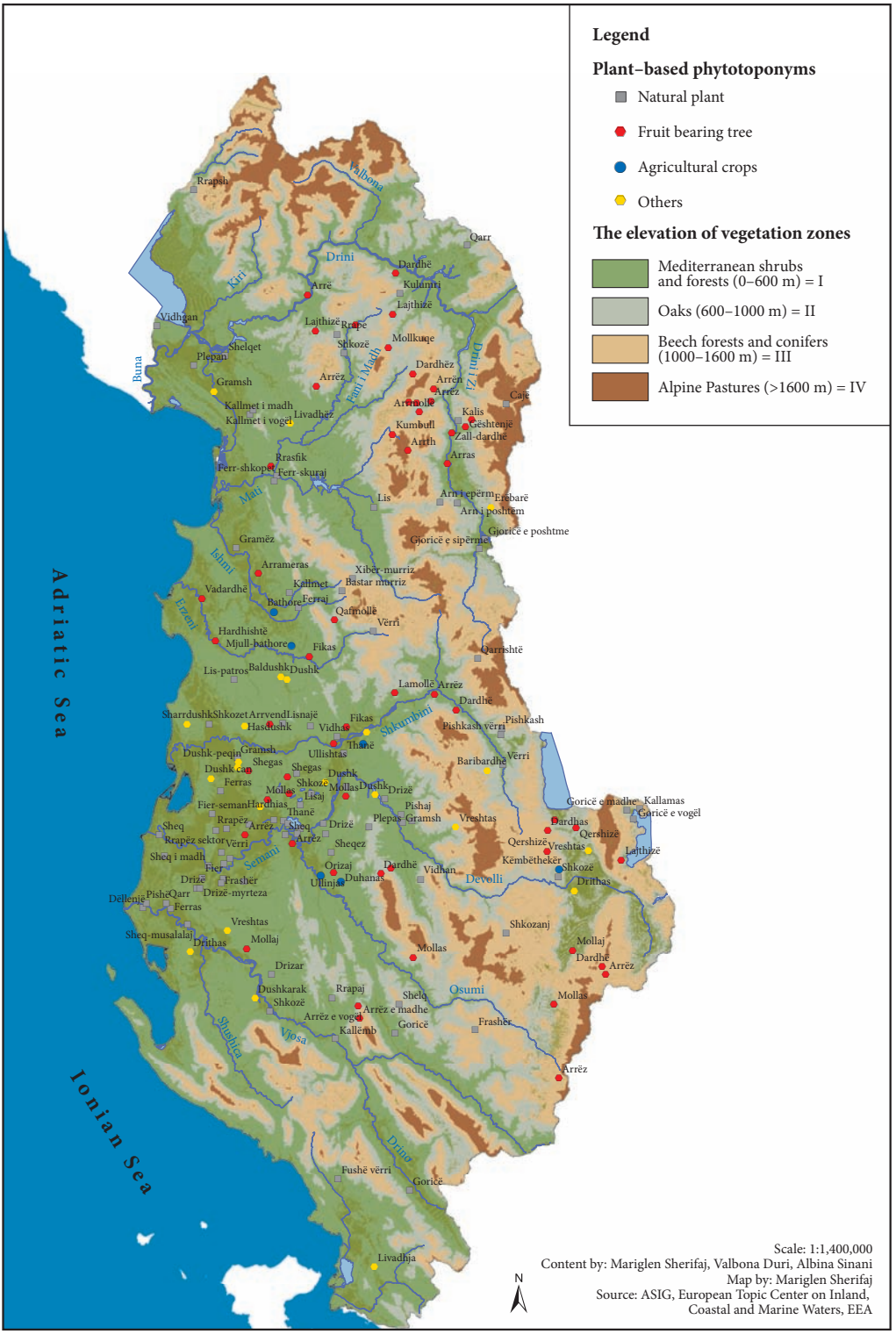
Previous names of the city of Lezha respectively Lissus and Akrolis in the 4th century BC (Prendi and Zheku 1972), and Elis in the 9th and 10th century (Prendi and Zheku 1983) resemble to be of fitonymyc origin. We think that they derive from the word *lis* (Downy oak in Albanian), but the linguists disagree with this opinion. According to them, the name of this settlement has undergone this path of transformation: in ancient times, to the Greeks with the name Lissos (*λισσός*) meaning »flat, bare, high,« then to the Romans as Lissus. From the Middle Ages to the 18th century, it was known as Alesio and Leshë, and currently as Lezhë (Demiraj 2015). This matter requires exhaustive research.

c) Incorrect use of plant names by inhabitants

The term »dushk« (oak in Albanian) may have derived from the root; *du- dru- drushk* (Topalli 2017; Çabej 1982). It has a broad use in the Albanian language:

- As the name of a genus of plants which is referred to the oak genus (*Quercus L.*). In Albania, the term *dushk* (oak in Albanian) is also employed as a synonym or substitute for the plant names belonging to the oak genus, such as Downy oak (*Quercus pubescens*), Valonia oak (*Quercus aegilops*) (Mitrushi 1955) and Kermes oak (*Quercus coccifera*) (Demiri 1979), functioning both as a hyperonym and a hyponym. This usage is also observed in Croatia (Cargonja et al. 2008).

Figure 3: Phytotoponyms in Albania according to phytonyms typology. ► p. 37


Legend
Plant–based phytotoponyms
Natural plant
Fruit bearing tree
Agricultural crops
Others
The elevation of vegetation zones
Mediterranean shrubs and forests (0–600 m) = I
Oaks (600–1000 m) = II
Beech forests and conifers (1000–1600 m) = III
Alpine Pastures (>1600 m) = IV
Adriatic Sea
Ionian Sea
Buna
Drini
Valbona
Kiri
Mati
Ishmi
Erzeni
Shkumbini
Semani
Vjosa
Shushica
Osumi
Devolli
Dhuna
Rrapsh
Qarr
Dardhë
Kulumri
Arrë
Lajthizë
Vidhgan
Rrapë
Shkozë
Mollkuqe
Shelqet
Plepan
Dardhëz
Gramsh
Arrëz
Kallmet i madh
Livadhëz
Kallmet i vogël
Kumbull
Geshtenjë
Zall-dardhë
Arras
Rrasfik
Ferr-shkopë
Ferr-skuraj
Lis
Arrë i epërm
Arrë i poshtëm
Ersbarë
Gjoricë e poshtme
Gjoricë e sipërme
Gramës
Arrameras
Xibër-murriz
Bastar murriz
Kallmet
Vadardhë
Ferraj
Bathore
Qafmollë
Vërri
Hardhishtë
Mjull-bathore
Fikas
Qarrishtë
Lis-patros
Baldushk
Dushk
Lamollë Arrëz
Dardhë
Sharrdushk
Shkozet
Arrvend
Lisnajë
Hasdushk
Vidhas
Pishkash vërri
Pishkash
Thanë
Dushk-peqin
Gramsh
Ullishtas
Shegas
Baribardhë
Vërri
Dushk can
Ferras
Mollas
Lisaj
Drizë
Fier-seman
Hardhias
Pishaj
Goricë e madhe
Kallamas
Goricë e vogël
Rrapës
Plepas
Gramsh
Vreshtas
Dardhas
Sheq
Qershizë
Rrapës sektor
Vërri
Sheqez
Kërnbëthekër
Sheq i madh
Orizaj
Duhanas
Vidhan
Dhrithas
Dërlenjë
Pishë
Drizë-myrteza
Shkozanj
Vreshtas
Sheq-musalalaj
Mollaj
Dhrithas
Drizar
Dushkarak
Rrapaj
Shkozë
Shelq
Arrëz e madhe
Arrëz e vogël
Goricë
Kallëmb
Frashër
Livadhja
Fushë vërri
N
Scale: 1:1,400,000
Content by: Mariglen Sherifaj, Valbona Duri, Albina Sinani
Map by: Mariglen Sherifaj
Source: ASIG, European Topic Center on Inland, Coastal and Marine Waters, EEA

- As the name of a vegetation zone known as Oaks which ranges from 600 to 1000 m.
- As the label of oikonyms. The location of all ten phytotoponyms, at altitudes ranging from 35 to 210 meters (in the Mediterranean shrubs and forests, rather than the Oaks zone), indicates a misperception among the inhabitants regarding the meaning of the word oak.

d) The economic importance of phytonyms

In Albania, fruit farming has practiced since the Neolithic period. Due to the significance of this sector, which produces apples, grapes, figs, and olives, among other fruits, people in the farming villages named the settlements after them like *Mollas, Vreshtas* (a collective noun related to the vineyard) and *Fikas* (Shqahu 2007).

Moreover, due to their economic value, even agricultural plants like tobacco, grain, and rice have received phytonymic use (Figure 3). Once these agricultural toponyms are named, they continue to carry the name of the plant, regardless of whether it is still being cultivated or not in that territory. One such case is the phytotoponym *Orizaj* (Berat district) related to the cultivation of rice since the 17th century, and no longer cultivated nowadays (Kashta et al. 2010).

e) Government decisions

Another aspect of naming toponyms is decision-making. Individually and collectively, people are not and have never been, in equal positions to name locations (Kladnik et al. 2020). Some settlements have had previous names, changed arbitrarily by the governmental decision without taking into consideration their importance and reasons for labelling.

An example is Shkoza, one of Fier City's quarters, which is today known as 1 Maji. When Kahraman Pashë Vrioni founded the city of Fier in 1864, Shkoza was originally a village named after the nearby hornbeam woodland (Gjika 2004). It was included as a quarter of Fier with the same name in the 1927 census (Selenica 1928). The nearby Shkoza Hill is also noted (Gjika 2004).

6 Conclusion

The study of the oikonyms derived from the phytonyms is an important aspect of the toponymy of Albania as it offers a basic viewpoint for the relationship between the names of the settlements with the natural environment, economy, history, and culture of the country. The varied plant-related place names in Albania reflect a rich and ancient history, shaped by decisions, invasions, migration, and other pivotal occurrences.

Understanding why certain plant names are used for naming settlements, requires a scientific analysis of historical, geographical, and linguistic sources. The geographical component is crucial to identify and argue the relationship between phytotoponyms and phytonyms. Complete results need an in-depth analysis of vegetation, topography, proximity to the sea, and the conditions under which settlements are created.

Our study showed that there is an uneven distribution of phytotoponyms along the horizontal and vertical distribution. Most of them are found in the lowlands in the west of Albania, whereas they reduce significantly in the country's north and south, where mountains predominate.

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PREDICTORS FOR RESIDENTIAL MOBILITY IN LATER LIFE: EMPIRICAL FINDINGS FOR THE YOUNG-OLD LIVING IN AN AUSTRIAN SMALL TOWN

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TATJANA FISCHER

The main square of Bruck an der Mur.

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Predictors for residential mobility in later life: Empirical findings for the young-old living in an Austrian small town

ABSTRACT: The article addresses residential mobility in later life from the perspective of the young-old, an under-explored topic in Austria. Data originating from a written survey conducted as part of a cross-sectional case study on people aged 60 to 74 years living in an Austrian small town are used to estimate prospective behaviour using logistic regression. The results show that women and people with a higher educational attainment are more likely to leave their current urban residential municipality, while men are more likely to relocate to a nursing home. Moreover, a duration of residence of 20 or more years decreases the probability of relocation. The findings confirm previous studies and highlight, that more spatially disaggregated data is needed to improve decision-making in town planning.

KEYWORDS: spatial research, cross-sectional study, aging in place, residential mobility, attitudes, Austria

Prediktorji stanovanjske mobilnosti v poznejšem življenjskem obdobju: empirični izsledki o mlajših starejših v manjšem avstrijskem mestu

POVZETEK: Članek obravnava stanovanjsko mobilnost v poznejšem obdobju življenja z vidika mlajših starejših, kar je v Avstriji slabo raziskano področje. Na podlagi podatkov, pridobljenih s pisno anketo med prebivalci manjšega avstrijskega mesta, starimi od 60 do 74 let, v okviru presečne študije primera, je z logistično regresijo ocenjeno njihovo prihodnje vedenje. Rezultati kažejo, da je za ženske in osebe z višjo izobrazbo bolj verjetno, da bodo zapustile mestno občino, v kateri živijo, medtem ko je za moške bolj verjetno, da se bodo preselili v dom za ostarele. Poleg tega se verjetnost preselitve zmanjša, če posamezniki v kraju prebivajo 20 let in več. Izsledki potrjujejo ugotovitve prejšnjih raziskav in poudarjajo potrebo po prostorsko bolj razpršenih podatkih za izboljšanje odločanja pri načrtovanju mest.

KLJUČNE BESEDE: prostorske raziskave, presečna študija, staranje na mestu, stanovanjska mobilnost, stališča, Avstrija

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1 Introduction

Demographic transition is evident globally in all spatial archetypes of areas in terms of a shift in the age structure of the population in favour of a growing number of people in later life (United Nations 2023) – including small towns (Steinführer et al. 2016). Consequently, older adults are receiving heightened political attention as a key target group. This is also true for urban planning (Grey et al. 2023). In the latter context, a central concern is to create age-friendly environments in order to support an active and healthy life for as long as possible. For this purpose it is essential to utilise the practical knowledge of people in later life (van Hoof and Marston 2021; Wood et al. 2022). From a spatial planning perspective old adults are considered relevant because of their heterogeneity in terms of (spatial) perception as well as expression of needs and ability to fulfil them autonomously. The heterogeneity of people in later life refers to the chronological age, state of health, caregiving obligations, social inclusion and spatial mobility – and thus varying capabilities to live independently –, socio-cultural background, the socio-economic status and lifestyle as well as the living and household arrangement (see Jaul and Barron 2021; Mauritz 2022; Stadelbacher and Schneider 2022). Whether and to what extent they feel comfortable in their current place of residence and (wish to or are able to) stay there may be influenced by various factors. These include:

- satisfaction with housing and housing conditions (size of the flat/house and garden), location and accessibility of the flat in the building, construction and technical equipment) and maintenance costs (Coleman et al. 2016; Bigonnesse and Chaudhury 2019),
- the location of the dwelling in the district/town, the perceived quality of the built and social environment and access to services (Schorra and Khalailab 2018), and place attachment (Jiaxuan et al. 2024),
- the availability of additional places of residence as well as the implications of life-changing private events such as changes of private affairs and living arrangements (Gillespie and Fokkema 2024; Wanka et al. 2024).

Lewis and Buffel (2020) found a positive correlation of duration of residence and emotional attachment to one's home. Moving to an institutional long-term care facility is a sensitive topic, as leaving one's private home is a pivotal incident in life which cannot be compared to a regular relocation (Haumann 2020).

Residential mobility or loyalty to current place of residence of people in later life is a well-established international research topic (Seo and Lee 2023). This refers both to the behaviour of staying in terms of aging-in-place and the (temporary/permanent) move to another municipality. The term aging-in-place is not clearly defined and comprises both staying in the current dwelling/house, the (temporary) relocation to another dwelling or changing the residence – e.g., from a private homes to a senior nursing home – within the current municipality of residence (Forsyth and Molinsky 2020).

1.1 More recent empirical findings on residential mobility of people in later life focussing on urban contexts

The literature review shows a focus on predicting residential mobility, in other words doing research on the aspirations and intentions to leave or stay. These studies (Table 1) reveal a number of factors that may have an influence both on the readiness to leave/relocate and the sedentariness – above all residential mobility experiences (Kramer and Pfaffenbach 2016), the duration of stay (Beyer et al. 2017; Kolland et al. 2018), the satisfaction with current housing conditions (Kramer and Pfaffenbach 2016; Kolland et al. 2018) and ownership (Matsumoto et al. 2016; Beyer et al. 2017), place attachment (Kramer and Pfaffenbach 2016; Matsumoto et al. 2016; Beyer et al. 2017; Kolland et al. 2018) as well as the ability to adapt to changes of the residential environment (Lewis and Buffel 2020). According to the empirical findings, women are more likely to move than men (Kramer and Pfaffenbach 2016; Matsumoto et al. 2016; Kolland et al. 2018); the young-old are more likely to move than older adults (Beyer et al. 2017; Kolland et al. 2018). Basically, a good state of health correlates with a higher likelihood to have any relocation plans (Beyer et al. 2017). Relocation to a residential long-term care facility in the case of need of care is more likely to occur for those old adults who (1.) have a negative perception of old age, but a positive attitude towards institutional care and nursing facilities, or (2.) live in a flat/house with reduced accessibility, but do not plan for any refurbishment (Kolland et al. 2018).

1.2 Significance of topic, purpose of the paper and research questions

Given the rising number of people in later life residing in urban areas and the increasing probability of being in need of care with age (Haß et al. 2023), particularly for evidence-informed political decision-making on housing issues, several questions remain unanswered: e.g., the time of significant occurence of vacancies in residential buildings (Nam et al. 2016) and the capacity planning of stationary long-term care facilities (Spangenberg et al. 2013). The topic of residential mobility is particularly relevant for small towns because they constitute a hybrid of urban and rural areas in terms of settlement structure, infrastructural facilities and development paths (Steinführer et al. 2016; Stöglehner 2019). This spatial archetype refers to municipalities with a population ranging from 5,000 up to 20,000 inhabitants (Stöglehner 2019).

As there is a lack of knowledge regarding spatial archetype contextualised residential mobility in later life in Austria, this article aims to identify predictors that are suitable for analysing the relevance of aging-in-place, respectively the willingness to relocate in later life using data originating from 2017 on the young-old (people aged 60 to 74 years) living in an Austrian small town. For this purpose, the following two research questions will help to address this issue:

- Research question 1: Which factors are decisive for old adults considering to leave their current municipality of residence?
- Research question 2: Who is considering to relocate to a stationary long-term care facility in case care is needed, and what are the factors that influence this consideration?

2 Material and methods

Original data from a standardised written survey conducted in 2017 of people aged 60 to 74 years living in Bruck an der Mur was used. The methodological approach of the secondary data analysis is presented below.

2.1 Case-study context and original data

Bruck an der Mur is the capital of the eponymous political district, located in Styria, a federal province of Austria (Figure 1).

As part of the Styrian territorial reform in 2015, the small town Bruck an der Mur was consolidated with the hitherto independent rural market town Oberaich. The new municipality Bruck an der Mur is characterised by a variety of settlement structures and housing types (Figure 2). At the beginning of 2017, Bruck had a population of 15,850 inhabitants (Statistik Austria 2018), approximately a quarter of the residents were aged 65 years plus (Fischer 2018). Against this backdrop, it is a key concern of the municipal authority to ensure that Bruck maintains its position as a feel-good town (Fischer 2018).

Subsequently, the municipal authority of Bruck an der Mur and the Mariazellerland-Mürztal LEADER region (for explanation: LEADER is a funding programme of the European Union to support the development of rural areas) jointly commissioned a study in 2017 in order to gain insights into the opinions of the young-old on the quality of life Bruck an der Mur and their aspirations to stay in or to leave Bruck (Fischer 2018) in later life. As part of this study, a postal survey was conducted in the first half of 2017 among 500 residents aged 60 to 74.

The sampling was carried out randomly and was stratified in proportion to the number of inhabitants of the two consolidated municipalities Bruck an der Mur and Oberaich. 110 people were selected for Oberaich and 390 people for Bruck an der Mur. The sample was drawn on a random basis in order to avoid errors due to the frequency of individual attributes such as the first name, surname or the year of birth. The questionnaire was developed in accordance with representatives of the municipal authority of Bruck an der

Figure 1: Location of Bruck an der Mur. ► p. 46
Figure 2: Impressions of Bruck an der Mur. ► p. 47

Table 1: Overview of more recent studies on residential mobility of old adults (2014–2024).

	Geographical context and spatial archetypes	Target group(s) and scientific interest with reference to this paper	Methods and data
Study 1 (Kramer and Pfaffenbach 2016)	Germany nine big or medium-sized cities, the latter located in and outside metropolitan areas	• residents aged 50 to 60 years, living in private homes • identification of parameters influencing the probability to stay in the current dwelling/in the current municipality of residence or to move to another municipality	prospective and retrospective cross-sectional, mixed-methods 5,500 questionnaires and 140 qualitative interviews statistical analysis using logistic regressions
Study 2 (Matsumoto et al. 2016)	Japan one big city	• residents aged 40 to 64 years, living in private homes • identification of relevant parameters for staying or relocation (to a nursing home, alternative residential setting, the children's home) in case of being unable to leave one's home or being bedridden	prospective cross-sectional postal survey with 616 valid responses statistical analysis using bivariate und multivariate regressions
Study 3 (Beyer et al. 2017)	Germany one market town, comparable to small towns in terms of population	• residents aged 50 and over, living in private homes • identification of relevant parameters regarding preferences, needs and actual plans for one's own old age	prospective cross-sectional postal survey with 2,156 valid responses
Study 4 (Lewis and Buffel 2020)	England, UK two areas located in north Manchester; both comparable to small towns in terms of population	• residents aged 50 and over, living in private homes • understanding trajectories of staying and/or moving from a life-course perspective in considering changes in in the physical (built), demographic and social (neighbourhood) environment.	prospective and retrospective mixed-methods, secondary data analysis using data from 24 qualitative longitudinal interviews plus a cross-sectional interview study with four participants of the previous referred study
Study 5 (Kolland et al. 2018)	Austria nationwide	• residents aged 60 and over, living in private homes • identification of relevant parameters regarding intentions to move (= change of place of residence) and understanding housing preferences	prospective cross-sectional telephone interviews with 1,001 people from all nine federal provinces (1/3 living in urban municipalities) statistical analysis using logistic regressions

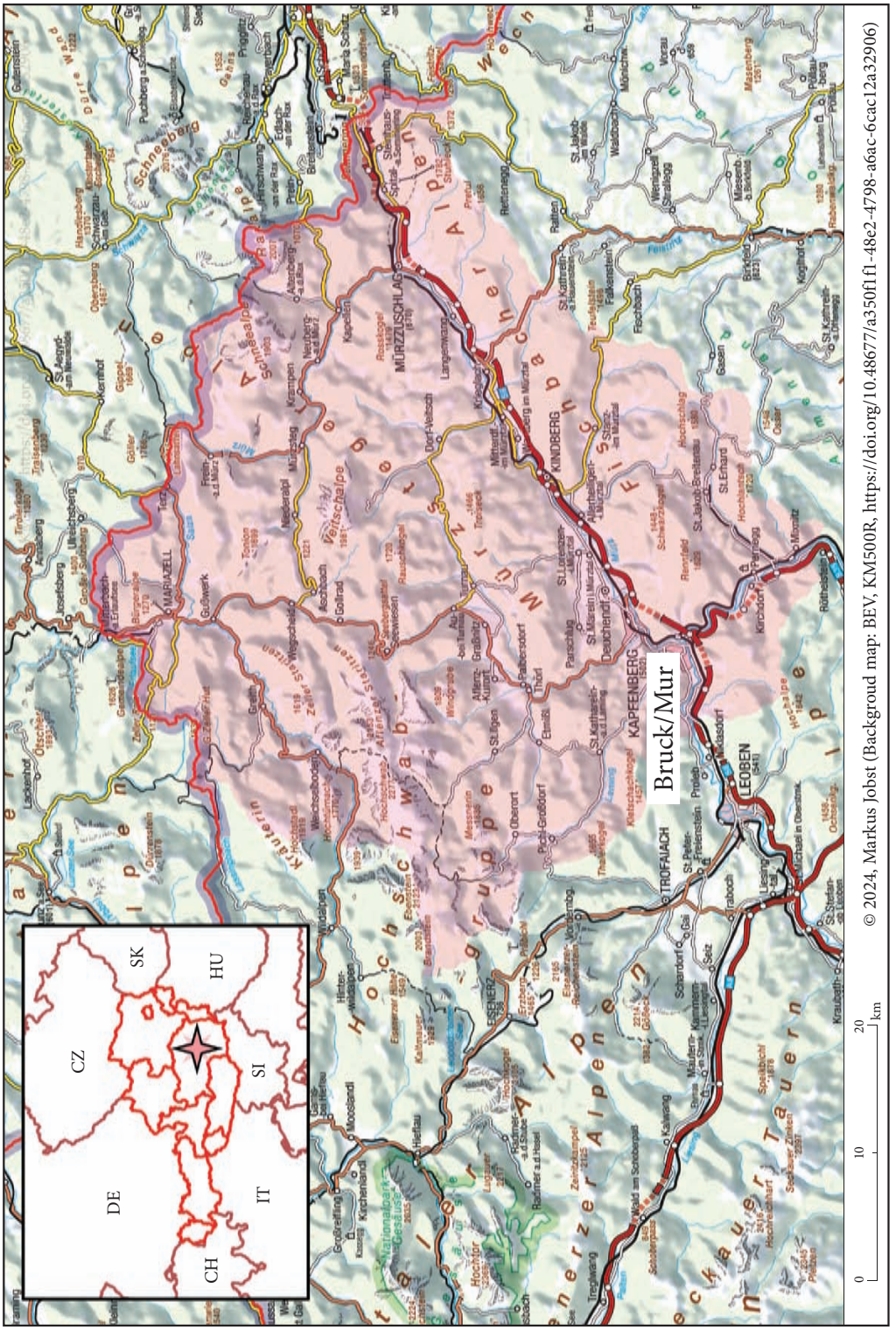
Bruck/Mur
CZ
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Table 2: Original dataset, data modification and modified dataset.

Variable abbreviation	Variable (full name according to the original dataset)	Data modification (creation of new categories / (re-)labelling)	Variable labels (modified dataset)
Var2	district (= name of independent municipality prior to territorial reform) (excluded from modelling)	Yes. The information on the postal address was assigned to the two formerly independent municipalities.	0 = Oberaich, 1 = Bruck an der Mur
Var3	gender	No.	0 = male, 1 = female
Var4	age	Yes. The nominally scaled data were re-categorised.	0 = 60 to 69 years 1 = 70 to 74 years
Var7	educational attainment	Yes. In a first step, three categories were defined following Beyer et al. (2017). As category 1 (no education / compulsory school) contains only two observations, these two observations were emoved from the dataset and two categories were defined afterwards.	1 = intermediate school / other 2 = high school or higher
Var9	caregiving experiences (excluded from modelling)	Yes. The caregiving experience was queried indirectly by asking about the challenges of being a caregiving relative.	0 = no, 1 = yes
Var10	marital status	Yes. There were five categories for this variable in the original dataset: being single/living alone, living in a partnership, being married, divorced and widowed. The values *living in a partnership* and *married* were merged to the new category *living in a partnership or being married*. People who are widowed but living in a partnership were also assigned to this category. Due to the small number of observations and their implications for the confidence intervals, the five widowed people who are widowed but not living in a partnership were removed from the dataset.	1 = being single / living alone 2 = living in a partnership or being married 4 = divorced
Var11	duration of residence in Bruck	Yes. The original dataset contains numerical information on the year since which the individual has been living in Bruck (again). The information was converted into the duration of stay (= number of years) and assigned to two categories.	0 = less than 20 years 1 = 20 or more years
Var12	household structure	Yes. The original dataset contains information on the number of people living in the same household. Following Matsumoto et al. 2016, the data were assigned to three categories.	1 = living alone 2 = living together with one family member 3 = living together with more than one family member
Var13	housing type	Yes. In the original dataset, the following categories were assigned: 1 = rental flat, 2 = co-operative flat, 3 = owner-occupied property (flat/house), 4 = single-family or multi-family house. Rental flats, co-operative flats and owner-occupied property (flat/house) were merged to the *new category flat*.	0 = flat 1 = single-family or multi-family house
Var14	tenure (property)	Yes. In the original dataset, four categories were assigned: 1 = rental flat, 2 = co-operative flat, 3 = owner-occupied flat, 4 = single-family or multi-family-house Rental and co-operative flats were merged to the new category *rental flat*; owner-occupied, single-family and multi-family houses were merged to the new category »owner-occupied flat/house«	0 = rental flat 1 = owner-occupied flat/house

Variable abbreviation	Variable (full name according to the original dataset)	Data modification (creation of new categories / (re-)labelling)	Variable labels (modified dataset)
Var15	monthly net household income	Yes. The ordinal-scaled data were grouped into four categories.	1 = less than 1,000 Euros, 2 = 1,000 up to 1,999 Euros, 3 = 2,000 up to 2,9999 Euros, 4 = 3,000 Euros and more
Var16	migration type	No.	1 = loyal to location (Bruck/Mur) 2 = moved to Bruck/Mur 3 = returned to Bruck/Mur
Var17	aspiration to be able to live in one's home for as long as possible	No.	0 = no, 1 = yes
Var18	self-rated suitability of the current flat / house for old age	Yes. The original dataset contains three values: 1 = yes, 12 = yes and no, 2 = no. The two values *yes* and *yes and no* were merged to the new category yes.	0 = no, 1 = yes
Var19	**sometimes thinking about leaving Bruck = predicted variable (research question 1)**	**No.**	**0 = no, 1 = yes**
Var20	being emotionally attached to the community	Yes. The newly generated variable comprises all positive answers related to the question concerning the emotional aspects of place attachment. These include: being born and growing up in Bruck, childhood memories, bonds to close family and friends, neighbours. If one of these aspects was true, the respondent was ascribed an emotional attachment to the community.	0 = no, 1 = yes
Var21	emotional attachment to flat / house (and garden)	No.	0 = no, 1 = yes
Var22	**nursing homes as a conceivable option for a comfortable life in the case of being in need of care = predicted variable (research question 2)**	**No.**	**0 = no, 1 = yes**

Mur and comprised a total of 47 predominantly open-ended questions organised in seven thematic sections, namely:

- place of residence,
- housing situation and number of additional residences,
- quality of life in Bruck,
- quality of the historical town centre,
- residential mobility intentions and scenarios regarding care arrangements,
- socio-demographics and caregiving experiences (Fischer 2018).

In order to achieve a high response rate, the survey was publicly announced using various information channels. It was not scheduled to carry out a pre-survey. 121 questionnaires, which corresponds to a response rate of 24.2% were returned.

2.2 Modelling

2.2.1 Screening of original data and methodological pre-considerations

Both the pseudonymised original dataset and the code book were provided in xls-format. It was found that a) dataset with one exception, the data are nominally-scaled and b) there is a number of missing values.

It was decided to chose Variable 19 »sometimes thinking about leaving Bruck« as predicted variable for answering research question 1 and Variable 22 »nursing homes as a conceivable option for a comfortable life in the case of being in need of care« for answering research question 2 (Table 2). As the predicted variables only have two levels, a logistic regression (Agresti 2007) was chosen to analyse the data. With regard to the selection of the independent variables, attention was paid to the statistical basic principle as following: »inclusion of as many independent variables as necessary – inclusion of as few independent variables as possible«. Consequently, only variables that are assumed to influence the predicted variables should be included in the model. For that purpose more recent international gerontological literature (Table 1) was consulted.

Due to the fact that the original dataset includes information on the »residential history« for 116 out of the 121 respondents, it was decided to include this information in the modelling. According to the information provided, one in two respondents had moved to Bruck in the course of life, 12% (14 respondents) had returned to Bruck in the course of life and 38% of the respondents have never lived anywhere else than in Bruck and can thus be described as »loyal to location«.

In order to make appropriate decisions and carry out the modelling, the original dataset was reduced to the (independent) variables considered relevant (Table 2). For two of them, the number of categories was reduced in order to obtain an appropriate number of observations per category – following Agresti (2007) a minimum of approximately 10 observations is needed. Then the modified dataset was analysed using the statistical software SAS (version 9.4).

As informal caregiving for one's parent(s) is widespread in Austria (Nagl-Cupal et al. 2018), including (former) caregiver experiences (Table 2, Var9) seemed to be an interesting and novel independent variable for modelling mobility (aspirations) in later life. However, this parameter could not be included, because 97 of the 121 respondents did not provide any information or crossed the corresponding question out. So it was not possible to deduce whether the »missing values« related explicitly to a lack of caregiving experiences or a reluctance to answer the question.

Furthermore, for this article it was intended to reveal any intra-urban-specific differences (Table 2, Var2) regarding aging and place and relocation aspirations. This had to be set aside due to the lack of information.

2.2.2 The models in detail

Model 1 aims to address the research question 1 and estimate the probability of leaving Bruck an der Mur (Var19 = 1) using the following eight independent variables (parameters): district, gender, educational attainment, marital status, household structure, tenure (property), migration type and emotional attachment

to flat/house and garden. The parameters were selected following the more recent related literature listed in Table 1.

In order to answer research question 2, which aims to estimate the probability to consider to relocate to a nursing home in case care is needed (Var22 = 1), three models – referred to below as **Model 2a**, **Model 2b** and **Model 2c** – were developed in order to comprise the variety of potential influencing variables.

Model 2a adopts a rational-materialistic perspective and includes the following six variables, partly with reference to Kramer and Pfaffenbach (2016), Matsumoto et al. (2016) as well as Kolland et al. (2018): gender, educational attainment, housing type, tenure (property), net monthly household income and self-rated suitability of the apartment/house for old age.

Model 2b focusses on age-related emotional attachment to one's home and living arrangements and includes the following seven independent variables partly following Matsumoto et al. (2016) as well as Beyer et al. (2017): age, educational attainment, duration of residence in Bruck an der Mur, household structure, housing type, tenure (property) and emotional attachment to flat/house (and garden).

Model 2c focusses on the age-related appraisal of housing conditions and includes the following seven independent variables mainly in accordance with Matsumoto et al. (2016): age, gender, educational attainment, type of housing, tenure (property), monthly net household income and self-rated suitability of the flat/house for old age.

2.3 Statistical analysis

Due to missing values, it was necessary to remove seven records from the original dataset. The dataset used for further statistical analysis now comprised 114 observations. In logistic regression data records must be complete. For this reason, only 82 observations for **Model 1**, 90 observations for **Model 2a**, 84 observations for **Model 2b** and 83 observations for **Model 2c** could be included. The predicted variables were modelled using the selected independent variables and the influence of these independent variables on the predicted variables was estimated. The parametric estimates were interpreted with reference to the significance of the respective independent variable.

3 The sample at a glance

Table 3 provides an overview of the socio-demographic profile, socio-economic status, living arrangements and duration of residence in Bruck an der Mur and the respondents' thoughts regarding their life in later life. The sample comprises mainly respondents currently living in Bruck (70%). The mean age of the 114 respondents is approximately 68 years. Women have a share of about 55% of the respondents. Slightly more than a quarter of the respondents have an educational attainment that is high school or higher. The majority of respondents (82.5%) live in a partnership or is married. 57% are living in a flat, 42% in a single-family or a multi-family house. About two in three respondents live in an owner-occupied property (flat/house) (69.3%). Approximately 15% of the respondents have a monthly net household income of less than 1,000 Euros, 19.3% have an income of more than 3,000 Euros and around one in three has an income of between 2,000 and 3,000 Euros. About half of the respondents (48.2%) had moved to Bruck an der Mur during their course of life, whereas about 38% had never lived in any other place than Bruck an der Mur. Furthermore, approximately one in ten have returned to Bruck. The average duration of residence in Bruck is 46 years, about 80% have been living in Bruck an der Mur for at least 20 years. 82 respondents (about 72%) feel emotionally attached to their home. Respondents expressed the following thoughts on their (future) residential mobility and the option of relocating to a nursing home in case of need as follows: 11 respondents (9.6%) stated that they sometimes think about leaving Bruck an der Mur. 106 respondents (93.0%) would prefer to live in their home for as long as possible, 79 respondents (69.3%) rated their home suitable for old age and 36 respondents (31.6%) indicated they would consider to relocate to a nursing home in case care is needed.

Table 3: Characteristics of the sample (N = 114).

mean age, years (SD)	67.8 (4.4)
female	63 (55.3%)
male	51 (44.7%)
60 up to 69 years old	65 (57.0%)
70 up to 74 years old	39 (34.2%)
intermediate school / other	75 (65.8%)
high school or higher	27 (23.7%)
loyal to location (Bruck/Mur)	43 (37.7%)
moved to Bruck/Mur	55 (48.2%)
returned to Bruck/Mur	12 (10.5%)
single	10 (8.8%)
living in a partnership / being married	94 (82.5%)
divorced	9 (7.9%)
living alone	20 (17.5%)
living together with one family member	79 (69.3%)
living together with more than one family member	14 (12.3%)
monthly net household income less than 1,000 Euros	17 (14.9%)
monthly net household income 1,000 up to 1,999 Euros	31 (27.2%)
monthly net household income 2,000 up to 2,999 Euros	37 (32.5%)
monthly net household income 3,000 Euros and more	22 (19.3%)
living in the former independent municipality »Bruck an der Mur«	80 (70.2%)
living in the former independent municipality »Oberaich«	23 (20.2%)
average duration of residence (in Bruck an der Mur)	46 years
living in Bruck an der Mur for less than 20 years	16 (14.0%)
living in Bruck an der Mur for 20 or more years	91 (79.8%)
living in a flat	65 (57.0%)
living in a single-family or multi-family house	48 (42.1%)
rental flat	34 (29.8%)
ownership-occupied property (flat/house)	79 (69.3%)
sometimes thinking about leaving Bruck an der Mur	11 (9.6%)
not thinking about leaving Bruck an der Mur	97 (85.1%)
emotional attachment to flat/house and garden given	82 (71.9%)
emotional attachment to flat/house and garden not given	29 (25.4%)
living in one's home for as long as possible is a key concern	106 (93.0%)
living in one's home for as long as possible as is not a key concern	1 (0.9%)
suitability of the current flat/house for old age given	79 (69.3%)
suitability of the current flat/house for old age not given	26 (22.8%)
nursing homes are a conceivable option for a comfortable life in the case care is needed	36 (31.6%)
nursing homes are not a conceivable option for a comfortable life in the case care is needed	76 (66.7%)

4 Results

In this section, the results of the statistical analyses are presented separately for each research question in both text and tables. The main reason to provide the estimated values and the results of the significance tests in tables is to recognise the magnitude of any deviations in the data. That is why the confidence intervals of the odds ratios are also listed. In order to avoid over-interpretation, only the results for those independent variables that have a significant influence on the predicted variables are described.

4.1 Considering to leave Bruck an der Mur

The statistical analysis shows that two variables have a significant influence on the probability to leave: gender (p = 0.0482) and educational attainment (p = 0.0311) (Table 4).

If the label of the variable »gender« is equal to 0 (men), the probability for leaving drops to 0.3394 compared to the men who prefer to stay (Table 5). A total of five male respondents favour the idea of leaving.

Table 4: Results of significance tests for the independent variables (parameters) – model 1.

Independent variable (parameter)	Degrees of Freedom	Wald Chi-Square	Chi-Square p	Assessment
district	1	0.1979	0.6564	not significant
gender	**1**	**3.9021**	**0.0482**	**significant**
educational attainment	**1**	**4.6478**	**0.0311**	**significant**
marital status	2	0.7604	0.6837	not significant
household structure	2	0.9210	0.6310	not significant
tenure (property)	1	0.6556	0.4181	not significant
migration type	2	0.1049	0.9489	not significant
emotional attachment to flat/ house and garden	1	0.2625	0.6084	not significant

Note: significance level alpha = 0.05.

Table 5: Estimated values for respondents with identical attributes – model 1.

Independent variable (parameter)	Degrees of Freedom	Maximum-Likelihood--estimated value	Odds ratio
district Oberaich	1	–0.2304	0.7942
men	**1**	**–1.0806**	**0.3394**
educational attainment lower than high school	**1**	**–1.1414**	**0.3195**
single	1	–0.9791	0.3756
living in a partnership, being married	1	0.8474	2.3336
living alone	1	0.9084	2.4804
living together with one family member	1	–0.2107	0.8173
living in a rental flat	1	–0.5466	0.5789
being loyal to location (Bruck an der Mur)	1	0.1053	1.1110
moved to Bruck an der Mur	1	0.1657	1.1802
being not emotionally attached to flat/house and garden	1	–0.3586	0.6986

Note: significance level alpha = 0.05. Significant attributes are in bold.

If the label of the variable educational attainment is equal to 1 (educational attainment less than high school), the probability of leaving drops to 0.3195 compared to people with an educational attainment lower than high school who want to stay (Table 5).

With regard to the idea to leave, no district-related differences can be identified (Table 6). For the two significantly relevant parameters gender and educational attainment, the probabilities for leaving Bruck an der Mur can be described as follows: the proportion of men who are considering to leave in comparison to the proportion of women who are considering to do so is 0.115 (Table 6).

The proportion of respondents with an educational attainment lower than high school considering to leave Bruck compared to those with an educational attainment of high school or higher is 0.102 (Table 6).

4.2 Considering relocation to nursing homes in case of need

Regarding the consideration to relocate to a nursing home in the case of being in need of care the statistical analyses (Table 7) show for **Model 2a** that none of the six parameters has a significant relevance. **Model 2b** indicates a significant relevance for parameter duration of residence ($p = 0.0204$) and **Model 2c** for parameter gender ($p = 0.0469$). Regarding model 2b: If the duration of residence is less than 20 years, the estimated probability to consider a nursing home as an option is 2.3 times higher compared to those respondents who do not consider to relocate to a nursing in case care is needed (Table 8). Furthermore, it was calculated that respondents who have been living in Bruck an der Mur for less than 20 years are approximately 5.5 times more likely to consider to relocate to a nursing home than those who have been living in Bruck for 20 or more years (Table 9).

Regarding **Model 2c**: If the parameter gender is equal to 0 (men), the estimated probability to consider relocating to a nursing home is 1.8 times higher compared to men who don't (Table 8). Furthermore, it was calculated that men are three times more likely to consider relocating to a nursing home than women (Table 9).

Table 6: Estimated values for respondents with different attributes – Model 1.

Independent variable (parameter)	Odds ratio
district Oberaich (ref. Bruck)	0.631
men (ref. women)	**0.115**
educational attainment lower than high school (ref. high school or higher)	**0.102**
single (ref. not being single)	0.329
living in a partnership/married (ref. not living in a partnership)	2.046
living alone (ref. living together with more than one family member)	4.983
living together with one family member (ref. living together with more than one family member)	1.627
rental flat (ref. owner-occupied property)	0.335
loyal to locality (ref. returned to Bruck an der Mur)	1.457
moved to Bruck an der Mur (ref. returned to Bruck an der Mur)	1.548
not being emotionally attached to flat/house (and garden) (ref. being emotionally attached to flat/house and garden	0.488

Note: significance level alpha = 0.05. Significant attributes are in bold.

Table 7: Results of significance tests for the independent variables (parameters) – Model 2a, Model 2b and Model 2c.

Independent variable (parameter)	Model 2a				Model 2b			Model 2c		
	Degrees of Freedom	Wald Chi-Square	Chi-Square p	Assessment	Wald Chi-Square	Chi-Square p	Assessment	Wald Chi-Square	Chi-Square p	Assessment
age	1	–	–	–	0.5422	0.4615	not significant	0.0007	0.9792	not significant
gender	1	2.6511	0.1035	not significant	–	–	–	3.9472	0.0469	**significant**
educational attainment	1	0.8806	0.3480	not significant	1.7135	0.1905	not significant	1.7215	0.1895	not significant
household structure	2	–	–	–	0.2802	0.8693	not significant	–	–	–
housing type	1	2.6562	0.1031	not significant	2.9425	0.0863	not significant	2.6780	0.1017	not significant
tenure (property)	1	1.2643	0.2608	not significant	2.6085	0.1063	not significant	2.0904	0.1482	not significant
monthly net household income	3	0.5606	0.9054	not significant	–	–	–	0.1251	0.9887	not significant
suitability of the current flat / house for old age	1	3.3509	0.0672	not significant	–	–	–	1.4333	0.2312	not significant
duration of residence (in Bruck an der Mur)	1	–	–	–	5.3747	0.0204	**significant**	–	–	–
emotional attachment to flat / house and garden	1	–	–	–	0.0004	0.9837	not significant	–	–	–

Note: significance level alpha = 0.05

Table 8: Estimated values for respondents with identical attributes – Model 2a, Model 2b und Model 2c.

Independent variable (parameter)	Model 2a			Model 2b		Model 2c	
	Degrees of Freedom	Maximum--Likelihood--estimated value	Odds ratio	Maximum--Likelihood--estimated value	Odds ratio	Maximum--Likelihood--estimated value	Odds ratio
60 to 69 years old	1	–	–	–0.1943	0.447	–0.00689	0.993
men	1	0.4316	1.5397	–	–	**0.5657**	**1.761**
educational attainment lower than high school	1	0.2767	1.319	0.4555	1.57696	0.4284	1.535
living alone	1	–	–	0.2732	1.314	–	–
living with one family member	1	–	–	–0.0465	0.9546	–	–
living in a flat	1	0.4670	1.595	0.5519	1.7365	0.4842	1.623
living in a rental flat	1	–0.3688	0.692	–0.5804	0.55967	–0.5113	0.599
monthly net household income less than 1,000 Euros	1	–0.3023	0.739	–	–	0.0711	1.074
monthly net household income 1,000 up to 2,000 Euros	1	–0.0489	0.952	–	–	–0.0590	0.943
monthly net household income 2,000 up to 3,000 Euros	1	0.00109	1.001	–	–	–0.1226	0.882
suitability of the current flat / house for old age	1	0.5244	1.689	–	–	0.3707	1.449
residing in Bruck an der Mur for less than 20 years	1	–	–	**0.8532**	**2.347**	–	–
not being emotionally attached to flat / house and garden	1	–	–	–0.00721	0.9928	–	–

Note: significance level alpha = 0.05. Significant attributes are in bold.

Table 9: Estimated values for respondents with different attributes – Model 2a, Model 2b und Model 2c.

	Odds ratio		
Independent variables (parameter)	Model 2a	Model 2b	Model 2c
aged 60 to 69 years (ref. 70 to 74 years)	–	0.678	0.986
men (ref. women)	2.371	–	**3.100**
educational attainment lower than high school (ref. high school or higher)	1.739	2.487	2.356
living alone (ref. together with more than one family member)	–	1.648	–
living together with one family member (ref. living together with more than one family member)	–	1.197	–
flat (ref. house)	2.544	3.015	2.634
rental flat (ref. owner–occupied property)	0.478	0.313	0.360
monthly net household income less than 1,000 Euros (ref. 3,000 Euros and more)	0.521	–	0.961
monthly net household income 1,000 up to 2,000 Euros (ref. 3,000 Euros and more)	0.671	–	0.844
monthly net household income 2,000 up to 3,000 Euros (ref. 3,000 Euros and more)	0.705	–	0.792
suitability of the current flat / house for old age not given (ref. suitability given)	2.854	–	2.099
residing in Bruck an der Mur for less than 20 years (ref. 20 or more years)	–	**5.510**	–
not being emotionally attached to flat / house and garden (ref. being emotionally attached)	–	0.986	–

Note: significance level alpha = 0.05. Significant attributes are in bold.

5 Discussion

To discuss the empirical findings, related studies, both international and national (Table 1) are referred to. At this point, it should be noted that these studies explore the (predicted) residential mobility for differing age groups, which means that the surveyed target groups are either younger or older than the surveyed population of Bruck an der Mur. It should also be noted that the research questions in the studies differ.

5.1 Content-related discussion of the results

5.1.1 To stay or to leave Bruck?

The sample shows a strong preference for aging in place (85.1% of respondents) – here defined as the intention to stay in Bruck an der Mur – and the aspiration to live in one's home for as long as possible (93.0% of respondents) (Table 3). Factors such as where respondents live in Bruck, their marital status, migration history, and residential loyalty – indicating that one in three respondents has lived in the same place for an average of 46 years – as well as whether they own their home or are emotionally attached to it and its garden, do not significantly influence their consideration of leaving Bruck. The results thereby differ from those from Kramer and Pfaffenbach (2016), Matsumoto et al. (2016) and Kolland et al. (2018). Since the number of previous moves (including relocations within the town) was not investigated, the influence of the previous residential mobility on sedentariness as well as the significance of the preference to live in one's own walls for as long as possible could not be appraised from a life-course perspective.

The results of the modelling indicate that gender and educational attainment have a significant influence on the consideration to leave; as a result, men are more likely to stay than women. Matsumoto et al. (2016) found similar results for residents aged 40 to 64 years of a large Japanese city, as did Kolland et al. (2018) in the telephone survey of around 1,000 people aged 60 plus in Austria, which was carried out at the same time as the data collection in Bruck. However, Kolland et al.'s (2018) findings do not support our result that respondents with a higher educational attainment were more likely to consider to relocate than those with a lower educational attainment. It is not clear to what extent the socio-cultural profile of older adults is relevant for the sedentary behaviour, due to the fact that neither place of birth nor citizenship were surveyed. Additionally, due to missing information regarding the number and spatial information of any further places of residence, residential mobility against the backdrop of multilocality cannot be discussed in the context of spatial archetypes (Fischer 2022).

5.1.2 Nursing homes as an option in case care is needed?

Engaging with the topic of living and housing at old(er) age, respectively in need of care might be perceived to be unpleasant (Franco et al. 2021). This is also *true* for the respondents: about 60% of the 121 respondents stated that they do not consider elder care and nursing in a sincere manner (Fischer 2018). Against this background, the findings from the logistic regression models need to be interpreted with caution.

If one focusses on the duration of residence – a parameter identified as significant in model 2b – and the self-ratings regarding the suitability of the (current) flat or house for old age, it becomes apparent that the longer the duration of residence, the higher the suitability is rated. The ratio of respondents who rate their current home suitable compared to those who don't is 2.25:1 for those living in Bruck less than 20 years, and 3.5:1 for those living in Bruck for 20 years or longer. This finding is in line with those of Kolland et al. (2018) for Austria.

However, it cannot be inferred from the available information to what extent these differences are actually related to the district where the flat/house is located. This also applies for the location of the flat in the residential building and its accessibility or other (individual) reasons. Nonetheless, the findings suggest that housing satisfaction correlates positively with the duration of residence, regardless of the spatial archetype of the residential municipality. By contrast, in model 2c the parameter gender is identified as significant. This indicates that men are more open to a (future) relocation to a nursing home compared to women of the same age. This finding is in line with that of Matsumoto et al. (2016) and Kolland et al. (2018).

5.2 Strength and limitations of the study

In contrast to related works (Table 1), this article focuses on a comparatively narrowly defined age cohort, namely people aged 60 to 74 years. With regard to modelling, due to the richness of content of the original data it was possible to base the choice of parameters on previous (international) research on predictors for leaving Bruck in the (near) future on the one hand and relocation to a nursing home in case of need of case on the other hand and furthermore, to develop several models for answering the latter research question. The validity of the models was tested using the ROC curve, which compares the estimated to the observed value. The AUC (Area Under the Curve) value for **Model 1** is 0.87, for **Model 2a** 0.68, for **Model 2b** 0.71 and for **Model 2c** 0.70. As a reference value, an AUC of 0.70 to 0.90 corresponds to a moderate and an AUC greater than 0.90 to a high diagnostic quality of a test (Hosmer Jr. et al. 2013). This means that the diagnostic quality of **Model 1** may be considered good and the quality of **Model 2a**, **Model 2b** and **Model 2c** may be considered moderate.

No relevant correlations were found between the independent variables, which has a positive effect on the stability of the analysis. Moreover, there are no outliers in the statistical sense nor any anomalies in the diagnosis of influence. So, nothing particularly conspicuous in terms of statistics could be detected.

With regard to modelling, in contrast to related studies, neither the health status nor the (number of) adult children were taken into account. This can be explained as follows: For this study people were only asked to self-rate whether they felt »active and physically fit« (94 respondents) or »physically disabled« (17 respondents) (Fischer 2018). Therefore, it cannot be precluded that there is a certain sample bias with regard to the health status of the respondents.

Furthermore, having adult children was not included because approximately 90% of the respondents who have children stated that (in case care is needed) they would choose not to move in with their children, giving the following reasons: not wanting to become a burden to the child(ren) (Fischer 2018; Kolland et al. 2018), not willing to leave the familiar housing environment, maintaining one's independent lifestyle, lack of space in the adult child(ren)'s housing environment, cohabitation of the old and young does not do any good, the adult child(ren) live(s) nearby anyway or rather (still) in the respondent´s house(hold) (Fischer 2018).

The subject of multilocality or the relevance of having more than one place of residence could not be taken into account due to the number of missing values. This was because about 45% of the respondents did not provide any information on additional places of residence and another 47% of the respondents stated that they definitely do not have any second homes.

Furthermore, the »emotional attachment to the community« could not be included in the modelling, because this would have led to a very unstable estimation and some confidence intervals that would have ranged from 0 to infinity. This is particularly unfortunate, considering that 118 out of 121 respondents commented on this issue and emphasised its importance with regard to the choice of place of residence and subjective quality of life (Fischer 2018).

6 Conclusions

Firstly, it should be noted that predicting human behaviour is a (methodological) challenge *per se* (Sutton 1998) and the empirical results reported in this article should be understood as an attempt to identify relevant factors influencing residential mobility in later life. Given the data situation, this article presents a rare dataset on the predictors of residential migration in later life illustrated by the example of the Austrian small town Bruck an der Mur. Despite all methodological limitations, this study provides empirical insights into the intentions of the young-old in Bruck in the year 2017.

In terms of content, the findings align with those of previous related research, suggesting that gender and educational attainment are relevant factors for prospective residential mobility, particularly regarding changes in the municipality of residence. Surprisingly, in this sample neither the district nor the emotional attachment to the flat or house and garden seem to be relevant to the idea of leaving Bruck. Regarding ageing-in-place within one's home, or considering relocation in case care is needed, the modelling results indicate that the statistical significance of influencing factors (such as gender) depends on the choice of independent variables. Therefore, it is not possible to determine whether women or men have different attitudes towards relocating to a nursing home in the future, nor to what extent gender and duration of residence will influence residential mobility in later life.

Given the sample size, the number of observations included in the models and the lack of previous studies on the topic for small towns in Austria in general and particularly for Bruck, it is difficult to state whether the results are representative for the entire population aged 60 to 74 living in the case-study municipality.

However, these results provide a valuable starting point for further investigations on the factors influencing the residential mobility in later life and aging-in-place. Future studies could use quantitative cross-sectional or longitudinal exploratory pro- or retrospective research designs. This could involve conducting repeat surveys of people aged 60 to 74 and/or people aged 67 to 81 living in their home or in nursing homes in Bruck, or through panel studies. A more differentiated look should focus on individuals living alone and those with multiple residences.

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PROJECTIONS OF FUTURE SOIL TEMPERATURE IN THE WESTERN PART OF THE SOUTHEASTERN ANATOLIA PROJECT REGION, TÜRKİYE

İlyas Sadık Tekkanat

MEHMET EMİN TUDUN

Planting green beans with a planter at a soil depth of 5 cm in the village of Şekerli, Siverek, Türkiye, in June, when sufficient soil temperatures are reached.

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UDC: 631.4:551.525.2(560.8)

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Projections of future soil temperature in the western part of the Southeastern Anatolia Project region, Türkiye

ABSTRACT: Soil temperature (Ts) is crucial for land use and soil management. It has gained importance in climate change research as it reflects the interactions between the atmosphere and biosphere. This study evaluates Ts changes at depths of 5, 10, 20, 50, and 100 cm in the western part of the Southeastern Anatolia Project (W-SAP) region of Türkiye, which has a Mediterranean and hot semi-arid climate, for the period 2030–2090 compared to 1981–2010. The Soil Temperature and Moisture Model (STM^2) is used to generate Ts estimates. A temperature increase of 0.7–3.0 °C (RCP4.5) and 0.9–5.5 °C (RCP8.5) is predicted for the 21st century. Extreme Ts values in late-century summers may hinder crop planning. The research provides the first future Ts projections in W-SAP and offers important agro-climatic insights.

KEYWORDS: soil temperature, projection, STM^2, Southeastern Anatolia Project, Türkiye

Projekcije prihodnjih temperatur prsti v zahodnem delu območja projekta jugovzhodne Anatolije v Turčiji

POVZETEK: Temperatura prsti je ključna za rabo zemljišč in upravljanje tal. V raziskavah podnebnih sprememb postaja čedalje pomembnejša, saj odraža interakcije med ozračjem in biosfero. V članku so proučene spremembe v temperaturi tal v globinah 5, 10, 20, 50 in 100 cm v zahodnem delu območja projekta jugovzhodne Anatolije v Turčiji, ki ima sredozemsko in vroče polsuho podnebje, in sicer za obdobje 2030–2090 v primerjavi z obdobjem 1981–2010. Za oceno temperatur prsti je uporabljen model temperature in vlage prsti (STM^2). Za 21. stoletje je napovedano zvišanje temperature za 0,7–3,0 °C (RCP4.5) in 0,9–5,5 °C (RCP8.5). Ekstremne temperature prsti v poletnih mesecih proti koncu stoletja bi lahko otežile načrtovanje pridelkov. Predstavljena raziskava podaja prve projekcije prihodnjih temperatur prsti na proučevanem območju in pomembna agroklimatska spoznanja.

KLJUČNE BESEDE: temperatura prsti, projekcija, STM^2, projekt jugovzhodne Anatolije, Turčija

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1 Introduction

Soil temperature (Ts) is an important agronomic, agrometeorological and ecological parameter for soil classification, soil use and sustainability of ecosystem health (Araghi et al. 2017; Bradford et al. 2019). Moreover, Ts is an integrative indicator that best reflects the impact of climate change on the biosphere (Chang 1957). Ts is directly affected by climate change and land cover/land use changes and may even change its regime. This interaction may increase soil vulnerability to extreme soil temperatures and has negative impacts on natural and social systems (Sviličić et al. 2016; Tekkanat and Öztürk 2022a; Tekkanat and Öztürk 2022b).

In the 19th century, Ts measurements were conducted worldwide, particularly in the USA, China, Russia, and England. Short-term records were used to derive descriptive statistics and analyze annual changes in Ts with respect to depth (Rambaut 1901; Abbe 1905; Bouyoucos 1916). Subsequently, the warming process in the climate, driven by increasing human-induced greenhouse gas emissions from the industrial revolution, increased the need for research on air temperature (Ta) changes. However, studies on Ts have typically been insufficient in both quality and quantity. The primary reasons for this are as follows: firstly, a general lack of Ts observations and insufficient Ts proxies; secondly, Ts decreases exponentially with increasing depth and exhibits greater resistance to change than the atmosphere due to the time lag in its response to Ta; thirdly, Ts can be controlled locally, especially in agricultural areas. Finally, the spatio-temporal uncertainty and complexity of interactions between rhizosphere and plant development complicate the understanding of soil temperature dynamics.

While research on Ts estimation based on Ta observations, soil temperature trends, and soil temperature regimes has gained weight after the 2000s, ecosystem-based Ts studies and projections of future soil temperatures are more recent and scarce. So far, results on projections of soil temperature have been reported for Asia (Araghi et al. 2019; Tekkanat 2023), Europe (Oni et al. 2017; Górniak 2023), and various regions of North America (Houle et al. 2012), but there is a gap in knowledge about other regions. Ts are increasing due to global warming, and it is becoming increasingly important to analyze how soils have responded in the past and how they will respond in the future under changing climate conditions (Qian et al. 2011; Houle et al. 2012; Araghi et al. 2017; Oni et al. 2017; Araghi et al. 2019; Górniak 2023; Tekkanat 2023). For example, under the A1B emission scenario and 15 regional climate models (RCMs), Ts increases of 1.7 °C, 1.5 °C, and 1.3 °C are projected on average for the upper (10 cm), middle (20 cm), and bottom (60 cm) layers in the riparian zone in Svartberget, northern Sweden for the period 2061–2090, respectively. These projected Ts increases were 1.3 °C, 1.3 °C, and 1.1 °C in the highlands, respectively. Another region in northern latitudes (Canada, southern Québec, three forested areas) exhibits higher projected temperature increases in the 70 cm soil layer, especially during 2070–2099. Compared to the 1971–2000 reference period, the projected increase in Ts in the 2040–2069 period ranged from 1.1 to 1.9 °C, while this range was calculated as 1.9 to 3.3 °C in the 2070–2099 period. In a study conducted with three weather stations in northeastern Iran, characterized by an arid and semi-arid climate, it was found that Ts is projected to increase by 0.8 to 1.5 °C and 2.4 to 4.4 °C under the RCP4.5 and RCP8.5 scenarios, respectively (Araghi et al. 2019). Similarly, a Ts projection study in the northwestern region of Türkiye, specifically in the Meriç-Ergene River Basin (MERB), analyzed 17 sets of Global Climate Models (GCMs) at depths ranging from 5 to 100 cm (Tekkanat 2023). This study indicated temperature changes between –0.6 °C to 3.0 °C and –0.5 °C to 5.6 °C under the RCP4.5 and RCP8.5 scenarios, respectively. Furthermore, it has been suggested that the Ts regime in northeastern Poland is also changing due to global warming, with anticipated increases of over 2 °C and approximately 1.5 °C by the end of the 21st century in the 0–20 cm and 50 cm layers, respectively, according to the RCP8.5 scenario (Górniak 2023).

The projections of future Ts in Türkiye were first conducted by Tekkanat (2023) in the MERB, with no studies having been carried out on Ts changes in other regions. This study presents, for the first time, the short-term (2030), medium-term (2050), and long-term (2070 and 2090) future Ts changes in the western part of the Southeastern Anatolia Project (W-SAP) region of Türkiye. The agrometeorological and agroclimatological data provide valuable information for planning and may alter our understanding of local climate change, water management, agriculture, and food security, particularly in regions like the Southeastern Anatolian Project and the Euphrates Basin. This study provides important and useful information for other regions with similar Mediterranean and hot semi-arid (steppe) climates, such as Southern Europe, North Africa, and the Middle East, where agricultural practices and water resources management are critical under climate change scenarios.

2 Study area, data and methods

2.1 Study area

The study area is situated in the western part of the Southeastern Anatolia Project (W-SAP) region. For this research, two stations were selected in the plains of Siverek and Birecik, as shown in Figure 1. These stations are primarily located within the Euphrates River basin and represent the W-SAP. The region spans an area of 34,835.25 km². According to Koç (2013), the elevation in this area ranges from 0 to 1,000 meters, with extensive agricultural land predominantly found at elevations between 0 and 250 meters. The average slope of the terrain is 4%, consisting of flat, hilly, and gently sloping plains. The cities of Şanlıurfa, Siverek, and Birecik are the major urban centers in the W-SAP.

The W-SAP is characterized by a Mediterranean climate (Csa) and a hot semi-arid climate (Bsh). Influenced by the migratory Cyprus low, which can cause thunderstorms (Kadioğlu 2000), the area experiences a transitional precipitation regime, with rainfall occurring both frontally and convectively. The climate displays traits of a modified Mediterranean climate, featuring a precipitation peak in December and moderate precipitation levels overall (Sariş et al. 2010). Additional geographical information about the meteorological stations can be found in Table 1.

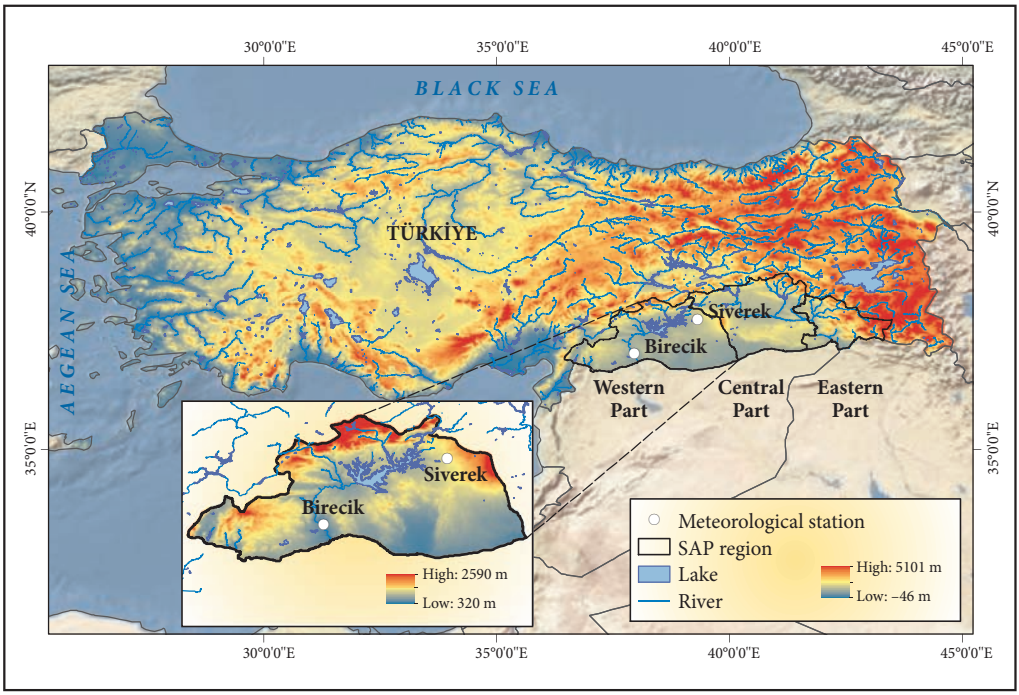

Figure 1: Locations of meteorological stations and the study area.

Table 1: Geographical information of meteorological stations used in this study.

Basin	Station	Lat(°)	Lon(°)	Elevation (m)	Annual precipitation (mm)	Mean annual air temperature (°C)	Beaufort wind scale
Euphrates Basin	Siverek	37.7522	39.3291	801	570	16.63	Light breeze
	Birecik	37.3103	37.9638	347	360	17.94	Light air

In the W-SAP, the soil characteristics in Siverek are as follows. In the topsoil (0–30 cm), the organic carbon content is 1.22% by weight and the pH is 6.3. In the subsoil (30–100 cm), the organic carbon content decreases to 0.58%, while the pH increases slightly to 6.4. Based on the FAO74 soil classification, the dominant soil type in this area is Chromic Luvisols. The proportions of clay, silt and sand in Siverek are 22.5%, 51.9%, and 25.6% respectively, indicating a dominant clay texture.

In contrast, the soil properties in Birecik differ considerably. In the topsoil (0–30 cm), the organic carbon content is 0.6% with a pH of 8.0. In the subsoil (30–100 cm), the organic carbon content decreases further to 0.4%, while the pH increases to 8.1. According to the FAO74 classification, the dominant soil type in Birecik is Eutric Fluvisols. The clay, silt, and sand proportions in Birecik are 36.4%, 18.0%, and 45.6% respectively, resulting in a loamy texture.

2.2 Data

Ts and Ta observations for the period 1981–2010 were obtained from the General Directorate of Meteorology. Daily Ts data from 2003–2006 at different depths were used to correct biases in the Soil Temperature and Moisture Model (STM^2) outputs and to detect future Ts increases or decreases. Additionally, daily average precipitation (mm), and daily maximum and minimum air temperature data, which are the meteorological input parameters required to run STM^2, were obtained from the MarkSim daily weather generator. MarkSim is a third-order Markov precipitation generator that utilizes methods developed by Richardson (1981) to produce weather data for potential future climatology (Jones and Thornton 2013).

The Harmonized World Soil Database (HWSD) is a raster database with a horizontal resolution of 30 arc seconds (approximately 1 km), where each raster grid represents the predominant soil type. The source databases for HWSD include the European Soil Database (ESDB), the Soil Map of China at a scale of 1:1 million, the SOTWIS database, and the Soil Map of the World. Organic matter and soil texture data used in the model were obtained from the HWSD version 1.21 Imager.

2.3 Methods

In this study, the methodology used by Araghi et al. (2019) was applied to predict future Ts changes in the W-SAP. In the first stage, daily stochastic time series of minimum air temperature, maximum air temperature and precipitation were generated for the years 2030, 2050, 2070 and 2090 with 99 replications for the stations to be used in the soil microclimate prediction model – STM^2. These time series were obtained by running 17 Global Circulation Models (GCMs) under the RCP4.5 and RCP8.5 scenarios using the MarkSimGCM tool.

In the second stage, the organic matter and texture information to be used in STM^2 were extracted from the HWSD version 1.21 Imager based on expert opinion. Both texture and organic matter values included in the model represented the average of topsoil (0–30 cm) and subsoil (30–100 cm). Texture was defined according to the USDA Texture Classification, and organic matter was calculated based on organic carbon (% weight) values (Pribyl 2010).

After the data preparation phase, the STM^2 model was run for the years 2030, 2050, 2070, and 2090, as well as for the 2003–2006 period to be used for bias correction.

STM^2 is a one-dimensional model written in Java that predicts soil microclimate conditions using limited inputs along with empirical and physical models (Spokas and Forcella 2009). This model was developed by the U.S. Department of Agriculture Agricultural Research Service (USDA ARS) and serves as a tool for simulating soil temperature and moisture, often used in agrometeorological studies (Spokas and Forcella 2009; Masin et al. 2012; Perreault et al. 2013; Araghi et al. 2019).

Following the STM^2 model run, it was necessary to calibrate the raw Ts model outputs with bias correction (BC) methods to make accurate predictions. Previous studies have reported that linear scaling performs very well at all depths in calibrating STM^2 Ts model outputs (Araghi et al. 2019). Therefore, in this study, the linear scaling method, which is frequently used in the temperature variable, was preferred to eliminate uncertainties and systematic errors in model outputs (Teutschbein and Seibert 2012; Shrestha et al. 2016). Linear scaling is a correction method that addresses bias by adjusting simulated data through

a correction factor. This factor is determined by the ratio of observed monthly averages to those simulated by the model (Lenderink et al. 2007; Teutschbein and Seibert 2012).

Bias corrections were applied to the air and soil temperature data using Equation 1 proposed by Shrestha et al. (2016):

$$T_f^* = T_f(d) + \mu_m(T_{obs}(d)) - \mu_m(T_{his}(d)) \quad (1)$$

where *T, his, obs, f, μ, m,* and *d* represent the temperature, historical run, observational data, model future run, average, month, and day, and the symbol * denotes the bias-corrected data sets.

In the final stage of the methodology, a performance evaluation of the STM^2 model at all depths for 2008 was also conducted. In this sense, Root Mean Square Error (RMSE), Mean Absolute Error (MAE), Mean Absolute Percentage Error (MAPE), index of agreement (d), and R-squared correlation (R^2) performance measures were utilized.

3 Results

3.1 Performance of STM^2 model

2008 was chosen as a test year to evaluate the performance of the STM^2 model. We significantly reduced the uncertainties by applying linear scaling to the daily temperature values (Ts) of the model for that year. The RMSE values for the raw outputs of the model (no bias correction) ranged from 2.30 to 3.99 °C, while the RMSE values after applying linear scaling for bias correction ranged from 0.76 to 2.41 °C (Tables 2 and 3).

The error rate at the Birecik station was higher than at the Siverek station, particularly at a depth of 5 cm (Tables 2 and 3). In the post-linear scaling model outputs, the average RMSE values were 1.3 °C across all depths at both stations. It is worth noting that the average RMSE values in the 20–100 cm soil layer were below 1 °C.

Additionally, we observed a 60% decrease in mean absolute error (MAE) values after bias correction, compared to the values before bias correction. The reductions were 47.80%, 75.62%, and 80.78% in the shallow (0–20 cm), medium (50 cm), and deep (100 cm) soil layers, respectively. After applying bias correction at all stations and depths, the mean absolute percentage error (MAPE) values ranged from 3% to 22%, with the average MAPE value decreasing by approximately 50%. Following the linear scaling bias correction applied to the STM^2 model outputs, we achieved accurate predictions based on the d and R^2 criteria (Tables 2 and 3).

Table 2: Performance evaluation of the STM^2 model at Siverek station in 2008 using the linear scaling (LS) bias correction (BC) method.

Depth (cm)	Bias Correction (BC)	index of agreement – d (°C)	Root Mean Square Error (°C)	Mean Absolute Error (°C)	Mean Absolute Percentage Error (%)	R^2
5	no BC	0.99	2.77	2.31	infinity	0.97
	LS	0.99	1.84	1.41	22.4	0.98
10	no BC	0.99	2.64	2.25	18.5	0.98
	LS	1.00	1.56	1.27	14.6	0.99
20	no BC	0.99	2.30	1.94	15.8	0.98
	LS	1.00	1.04	0.81	8.1	0.99
50	no BC	0.97	2.76	2.40	15.2	0.95
	LS	1.00	0.79	0.60	4.5	0.99
100	no BC	0.92	3.17	2.74	15.1	0.88
	LS	1.00	0.77	0.62	4.0	0.99

Table 3: Performance evaluation of the STM^2 model at Birecik station in 2008 using the linear scaling (LS) Bias Correction (BC) method.

Depth (cm)	Bias Correction (BC)	index of agreement – d (°C)	Root Mean Square Error (°C)	Mean Absolute Error (°C)	Mean Absolute Percentage Error (%)	R^2
5	no BC	0.98	3.58	3.06	19.3	0.97
	LS	0.99	2.41	1.96	17.9	0.97
10	no BC	0.98	3.24	2.65	17.9	0.98
	LS	0.99	1.73	1.39	11.6	0.98
20	no BC	0.98	2.63	2.25	24.7	0.99
	LS	1.00	1.08	0.78	6.6	0.99
50	no BC	0.95	3.49	3.05	20.7	0.94
	LS	1.00	0.98	0.75	5.2	0.99
100	no BC	0.89	3.99	3.35	15.9	0.84
	LS	1.00	0.76	0.59	3.4	0.99

3.2 Projections of future soil temperature

The projections of future changes in soil temperature (Ts) for the period 2030–2090 based on RCP4.5 and RCP8.5 scenarios for stations representing the W-SAP are shown in Figures 4–7. Under the RCP4.5 scenario, soil warming between 0.7 °C and 3.0 °C is projected in the geographical section, with Ts ranging between 0.8–3.0 °C and 0.7–2.6 °C in Siverek and Birecik, respectively. The projected increase in soil temperature in Birecik is about 3% higher than in Siverek. The projected average increase in soil temperature in the W-SAP corresponds to about 1.7 °C, with increases of 1.0 °C, 1.6 °C, and 2.1 °C in the short (2030), medium (2050), and long-term (2070 and 2090), respectively. When RCP8.5 simulation results are analyzed, the projected average increase in Ts in the W-SAP during the 2030–2090 period is 2.8 °C, with soil warming between 0.9 °C and 5.5 °C detected. In 2030, 2050, 2070, and 2090, the projected increases in Ts at 5–100 cm depth vary between 0.9–1.6 °C, 1.6–2.8 °C, 2.4–4.1 °C, and 3.2–5.5 °C. According to the model results, the projected average in the short-, medium-, and long-term Ts increases within the geographical area are 1.2 °C, 2.2 °C, and 3.9 °C, respectively.

In the future, soil temperature at a depth of 5 cm is predicted to be higher than air temperature (Ta) for both scenarios in Siverek, but this change is not observed at other depths. Moreover, the rate of increase in Ts decreases as the depth increases. Conversely, in Birecik, the future trend pattern of Ts is higher than Ta at all depths and under both scenarios, with this trend pattern being more pronounced in the RCP8.5 scenario. However, unlike Siverek, in Birecik, the projected trends of Ts and Ta in the shallow depth layer (5–20 cm) coincide, i.e., they exhibit similar behavior (Figures 2 and 3).

According to the RCP4.5 scenario, the future changes in Ts and Ta in the W-SAP exhibit stronger rates of increase in the medium term, while these increases relatively decrease in the long term. This change observed in Ts and Ta under the RCP4.5 scenario is not reflected in the results under the RCP8.5 scenario, and both Ts and Ta increases exhibit a more linear behavior in the RCP8.5 scenario. Moreover, according to the RCP8.5 scenario, the range of temperature change between depths in the geographical section shows an increasing trend (Figures 2 and 3).

In the RCP4.5 scenario, the simulations in the W-SAP region project an increasing trend in soil temperatures at all depths for this century. The strongest soil warming is expected for September and August at a depth of 50 cm and for October and September at 100 cm. According to the RCP4.5 scenario, a significant increase in the near-surface soil layer (Ts 5 cm) is expected at the Birecik station in September and November. At the Siverek station, the strongest rise in soil temperatures at a depth of 5 cm is projected in July and September of this century. This increase is expected to be more pronounced at higher extreme soil temperatures (≥30 °C and ≥35 °C) at 5 cm, especially from June to September. Slight differences can also be observed on a spatial and temporal level. According to the RCP4.5 scenario, the most significant

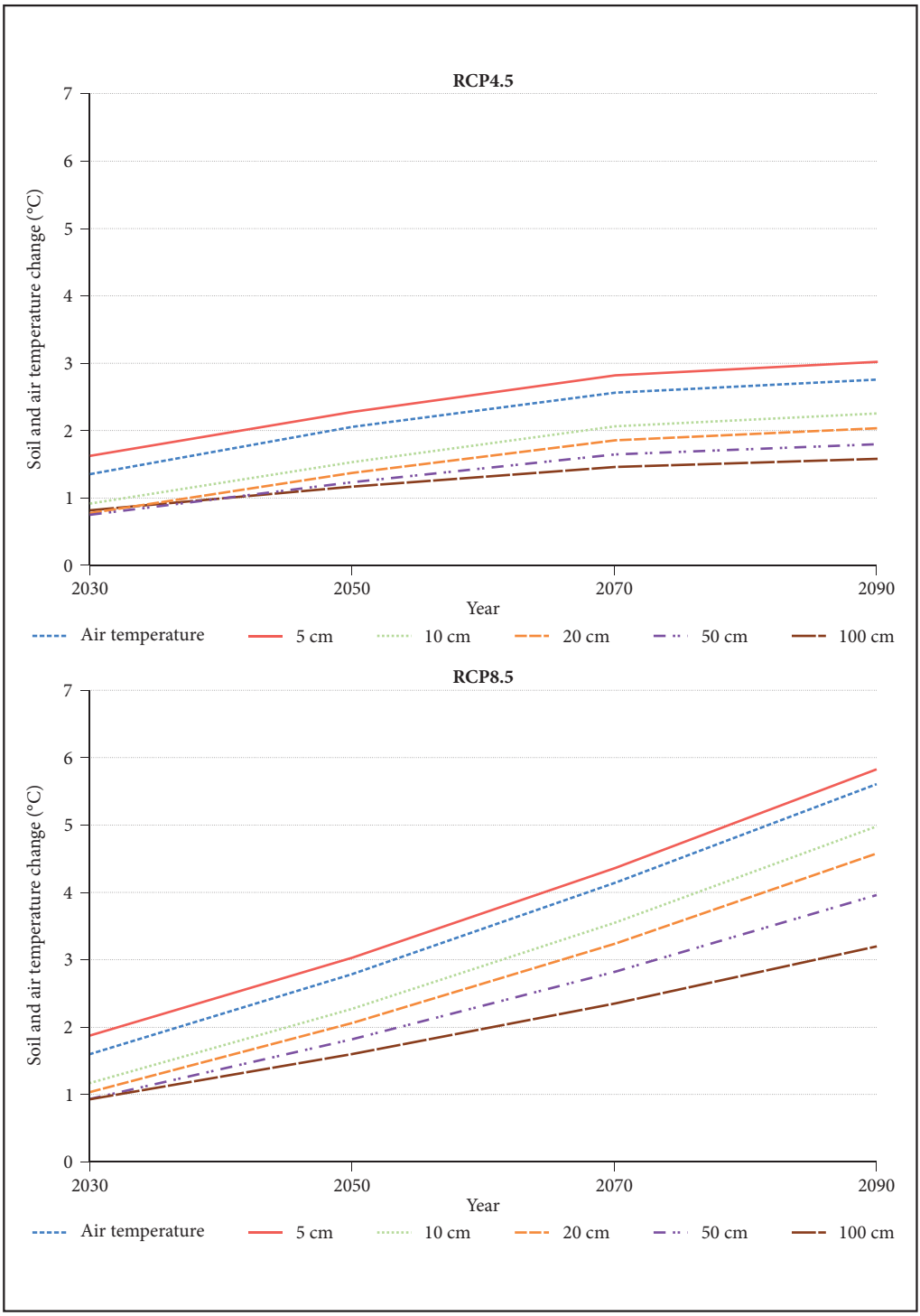

Figure 2: Change of future soil temperature and air temperature projections at Siverek station based on the 1981–2010 standard reference period.

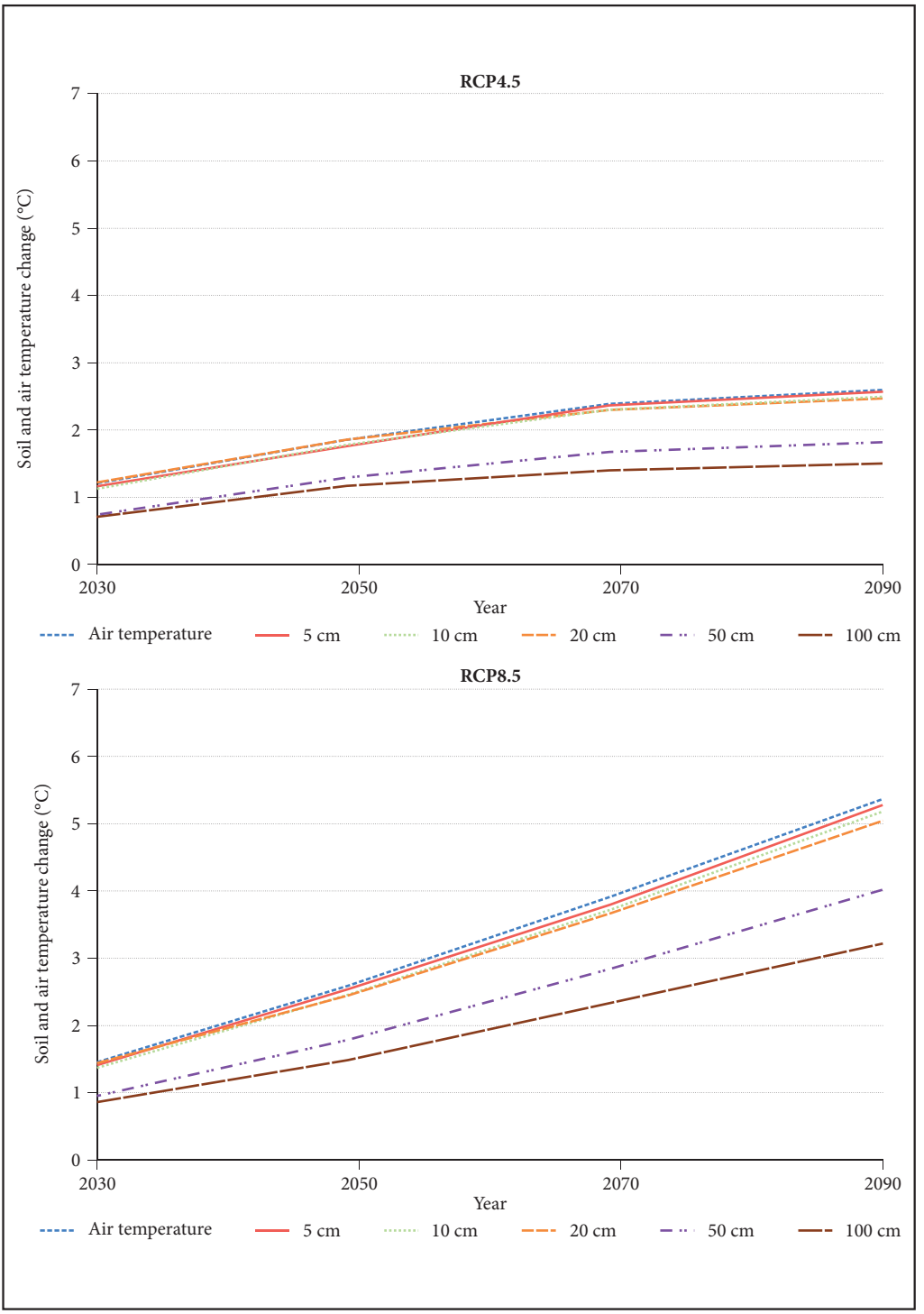

Figure 3: Change of future soil temperature and air temperature projections at Birecik station based on the 1981–2010 standard reference period.

change in soil temperatures at 5 cm depth is the projected increase in the frequency of temperatures above 30 °C in Birecik in the second half of this century. In particular, the frequency of days with soil temperatures of 30°C and above in May is expected to increase significantly in Birecik in the second half of the 21st century. These extreme temperature days will double by 2050 and even quadruple by 2090. In addition, according to the RCP8.5 scenario, a significant increase in extreme soil temperatures is expected in May in both Siverek and Birecik, which will be more pronounced in Birecik in the second half of this century and in Siverek towards the end of the century. At the Birecik station, the frequency of days with extreme soil temperature (≥30°C) in May will double compared to the historical period and will last for one to two weeks in the second half of this century.

4 Discussion

Many researchers have indicated that soil temperatures (Ts) in the 1-meter soil layer in different climate zones will continue to increase in the 21st century (Houle et al. 2012; Araghi et al. 2019; Górniak 2023; Tekkanat 2023). In our research, the western part of the Southeastern Anatolia Project (W-SAP) region, which has a semi-arid climate dominated by irrigation conditions, showed a similar trend. Although the predicted increases in Ts in some areas of the region are lower than air temperature (Ta) increases (Araghi et al. 2019; Tekkanat 2023), the increases in Ts at a depth of 5 cm in some areas, such as Siverek, are relatively higher than Ta. In this sense, the future soil-atmosphere interaction in Siverek is similar to the Edirne station located in the Meriç-Ergene River Basin (MERB), which is situated at the intersection of different climate zones and is characterized by a Mediterranean transitional climate (Tekkanat 2023).

The W-SAP is an area dominated by the Aridisols soil order, and it has been reported that soil temperatures in this region will never fall below 0°C by the end of the 21st century, as predicted for the global Aridisols order (Soong et al. 2022). According to their results, there is a significant difference between soil temperatures near the surface (5 cm) and in the deep soil layer (100 cm) in the W-SAP, despite the expected uniform warming of all soil patterns on a global scale. The difference between the soil temperatures at the surface and the temperature increase at 100 cm depth is significantly lower than the global estimates. In the region, according to the RCP4.5 scenario, the expected increase in soil temperature at a depth of 5 cm in the 21st century corresponds to the global average values and the projected temperature increase at a depth of 1 cm in the Aridisols. In contrast, soil warming at 100 cm depth is slightly below the global average but within the standard deviation range of projected temperature change. These results indicate that surface temperatures in the W-SAP are above the global average, while a smaller temperature increase is observed in deeper soil layers. Projections based on the RCP8.5 scenario show that the temperature increase in deep soil layers is within the standard deviation of the global averages or the projected increase in the Aridisols. These differences illustrate how local climate and soil conditions deviate from global trends and that regional climate change modeling requires a more sensitive analysis at the local level.

In the Northern Hemisphere, warming in the northern latitudes is considerably higher than in the southern latitudes, with warming in the Arctic being four times faster than in other parts of the world over the period 1971–2021 (43 years) (Rantanen et al. 2022). In this context, Post et al. (2019) have argued that the world has warmed by about 0.8 °C since the late 19th century, while warming in the Arctic has been 2.5 to 4 times this rate. This historical and current situation is also evident in other cross-regional correlations between future Ts and Ta simulations, including the results of the present study (Araghi et al. 2019; Soong et al. 2020; Sahoo 2022; Tekkanat 2023). The projected increases in Ts and Ta in the short, medium, and long term in the W-SAP, dominated by a semi-arid climate, are lower than in northern latitudes and higher than in southern latitudes. The increases in Ts and Ta determined in the research are lower than the outer limit of the subtropical belt, i.e. lower than in the areas with a continental climate in northern latitudes (Jungqvist et al. 2014; Górniak 2023). The fact that the projected increases in Ts and Ta in W-SAP are larger than in MERB, which has a semi-humid climate in northwestern Türkiye, and in northeastern Iran, which has an arid and semi-arid climate under the RCP4.5 scenario (Araghi et al. 2019; Tekkanat 2023), supports the above conclusion.

The variability of projected Ts increases in the W-SAP follows a pattern higher than in northeastern Iran but lower than in the MERB of Türkiye (Araghi et al. 2019; Tekkanat 2023). The increased soil mois-

ture due to irrigation may have a significant impact on the lower Ts variability in the study area compared to the more humid MERB. This is because 19 of the 29 irrigation unions established in the last 30 years under the Southeastern Anatolia Regional Development Plan are located within the W-SAP region. This development is further supported by the opening of 130 thousand hectares of land for irrigation in the Şanlıurfa-Harran Plains as of 2001 (Republic of Türkiye … 2002). GCMs predict that precipitation will increase in the Eastern Anatolia Region in the future. Therefore, the water level of the dams built on the Euphrates and Tigris Rivers is expected to rise. Essentially, these conditions mean that the increase in irrigation unions and the opening of land for irrigation will be encouraged. In conclusion, the combined results of Ts, Ta, and precipitation projections, along with land use/land cover changes in the W-SAP, indicate that Ts variability will decrease further compared to regions with more humid climates. This suggests a shift in the agroclimatology of the region and positive developments in agricultural activities.

It is expected that between 1981 and 2120 the mesic and thermal zones between 45°N–60°N and 45°S–60°S will expand due to global warming. This expansion may lead to a shift in agricultural areas from mesic to thermic and from thermic to hyperthermic areas (Grillakis et al. 2016). In particular, the expansion of the thermal regime zones can also be observed at lower latitudes. In the last ten years, significant changes in soil temperature regimes have been observed in Türkiye due to rising air temperatures. In addition, thermic and hyperthermic zones are expanding significantly and shifting northwards compared to other regimes (Tekkanat and Öztürk 2022a). According to the RCP4.5 and RCP8.5 scenarios, similar changes are expected in the W-SAP in the short, medium, and long term.

The margin of error for the Ts estimated in W-SAP for the 20–100 cm soil layer is smaller and more reliable than at the 5 and 10 cm depths. When considering the average Ts at the 1-meter soil layer, the performance of STM^2 remains within acceptable limits. This result is consistent with the work of Araghi et al. (2019) and Tekkanat (2023), who found that the linear scaling method is the most accurate for correcting biases in Ts model outputs. However, the accuracy of predicted Ts in W-SAP is somewhat lower than in MERB and its immediate vicinity, but better than in the northeast of Iran. Thus, the consistency of STM^2 tends to decrease as continentality increases and the climate becomes drier.

According to the models, the surface air temperature is expected to change by 1.5–4.5 °C by the end of this century compared to the pre-industrial period, with a high probability of global warming of more than 2 °C (Mozaffari 2022). Although we do not have Ts data for the pre-industrial period in the W-SAP, the general warming trend and soil temperature increases over the 1981–2010 standard climate period indicate a similar warming trend in the shallow soil layer. Projections suggest that the 2 °C threshold at a 5 cm depth will be exceeded in the second half of the 21st century according to the RCP4.5 scenario. This finding suggests a regional warming trend, which has previously been observed in MERB and its immediate vicinity (Tekkanat 2023).

The increase in soil temperatures observed in recent years is due to the rise in temperature, especially in summer (Yeşilırmak 2014; Tekkanat 2023). It is expected that this trend will largely continue in the W-SAP in the future. However, in Birecik, a stronger increase in soil temperatures at 5 cm and 10 cm depth was observed in fall compared to summer. In Siverek, soil temperatures are expected to increase significantly in the fall compared to the summer. Although this changes the general trends somewhat, similar changes are predicted for the W-SAP. A higher increase in soil temperatures is expected for the fall compared to the summer, especially at a depth of 5 cm.

In Türkiye, air temperature has the strongest correlation with soil temperature when compared to other factors (Tonkaz et al. 2007; İçel and Ataol 2013; Yeşilırmak 2014). However, a weak relationship between air temperature and soil temperature at 50 cm depth is observed in the southwestern part of Türkiye and the Şanlıurfa/Birecik region. In the Southeast Anatolia region, the relationship pattern between soil and air temperature is more variable than in the other areas where strong and weak relationships are observed (Tekkanat 2023). This relationship pattern shows high variability in the W-SAP compared to the other areas, as not only air temperature but also vegetation cover and soil moisture have a combined effect on soil temperature changes. Therefore, it can be said that factors such as the construction of irrigation canals and dams as part of the Southeast Anatolia Project and the rise in air temperature will play an important role in future changes in soil temperature in the W-SAP. In addition, the expansion of irrigable land towards steppe areas will also have an impact on soil temperature.

According to the model results, there is no risk of a frost event in the winter months in both the short and medium term, and in the long term, primarily due to soil and air warming. However, according to

the RCP4.5 scenario, soil temperatures of 30 °C and above start to be more effective in Siverek starting from June at a depth of 5 cm. These extreme temperatures are predicted to be effective in Birecik in May in the short term and in June in the medium and long term. In the RCP8.5 scenario, these extreme temperatures shift two months earlier in the 21st century and become effective from April. In both scenarios, the time difference decreases in the months in which the soil temperatures reach 35 °C or more. In addition, the occurrence of extreme soil temperatures increases between June and September. These results indicate that the Southeastern Anatolia Region (Tekkanat and Öztürk 2022b), which shows moderate to very high vulnerability to soil temperatures of 35 °C and above at a depth of 5 cm, will reach very high vulnerability in the second half of the 21st century.

The predicted soil and air temperatures contain important phenological information and indicate that a change in the agricultural cropping pattern of the W-SAP will occur. The trend of increasing Ts and Ta widens the sowing window for wheat and favors rapid root development and deep root crowns. Under the RCP4.5 scenario, the earliest planting date for cotton corresponds to the first half of April, shifting about one month earlier than the optimal conditions. However, under the RCP8.5 scenario, the earliest cotton planting in Siverek in the long term (2070 and 2090) shifts about 1.5 months earlier than the optimal date range. For maize, which is sown after the wheat harvest, optimum germination conditions occur halfway through the year at a depth of 5 cm, and increased Ts are projected to support rapid emergence. On the other hand, extreme soil temperatures (≥35 °C) at a depth of 5 cm between the last week of June and the third week of September may threaten crop development. However, the combination of increasing wetlands (natural and artificial lakes) and expanding irrigation activities with the SAP also suggests that the climate will soften in the region. Therefore, it is unlikely that this risk of extreme soil temperatures will negatively affect agricultural development in the future.

5 Conclusion

This study analyzes the projections of future soil temperatures in the western part of the Southeastern Anatolia Project (W-SAP) region under two scenarios: RCP4.5 and RCP8.5. The analysis covers short-term (2030), medium-term (2050), and long-term (2070 and 2090) forecasts. According to the ensemble models based on these scenarios, both Siverek and Birecik exhibit a notable warming trend in the 1-meter soil layer, consistent with global warming. On average, the projected increase in soil temperature for the 21st century is about 1.7 °C for the RCP4.5 scenario and around 2.8 °C for the RCP8.5 scenario. The projected rise in soil temperature (Ts) varies from 0.7 °C to 3.0 °C under RCP4.5 and from 0.9 °C to 5.5 °C under RCP8.5. Consequently, most models indicate that the goal of limiting global warming to below 2 °C will be surpassed in the shallow soil layer by both the medium and long-term forecasts.

These findings can serve as a basis for strategies to adapt to future climate change, particularly for agricultural planning, water resource management, and ecosystem health. A phenological calendar based on soil temperature and moisture could help determine minimum germination temperatures, optimal sowing times, ideal growing seasons, and appropriate crop rotation systems. It could also help create agricultural maps to mitigate the effects of climate change. To improve planning efforts, trend analysis methods such as the Mann-Kendall trend test and Sen's innovative trend test could be used alongside agro-climatological analyses. Extending the methodology to additional meteorological stations in larger river basins would allow the identification of microclimates and provide more accurate data for land use and agricultural crop planning. This approach has great potential for future research and could contribute significantly to developing spatial strategic information for agricultural planning.

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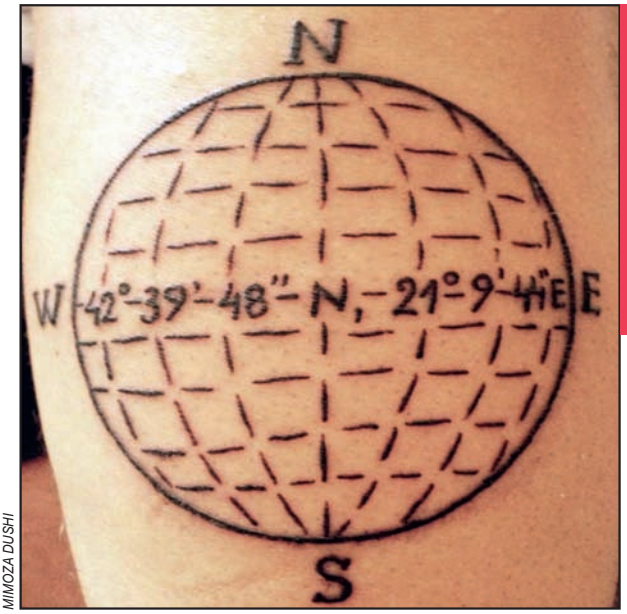
DIASPORA'S ROLE IN THEIR HOME COUNTRY'S ECONOMIC DEVELOPMENT: THE CASE OF KOSOVO

Mimoza Dushi, Albert Berila



MIMOZA DUSHI

Geographical roots in ink: Prishtina's coordinates as a symbol of belonging for second-generation migrants.

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Mimoza Dushi[1], Albert Berila[1]

Diaspora's role in their home country's economic development: The case of Kosovo

ABSTRACT: This study critically examines the challenges faced by the Kosovo Albanian diaspora in investing in their home country. Despite being a significant economic asset, particularly through substantial remittances that contribute to the national GDP, the diaspora encounters various barriers to effective investment. Based on 53 biographical interviews (2014–2016) with migrants in Switzerland and Germany, as well as 23 interviews with key informants, including officials, trade union representatives, and civil society actors, the study highlights the absence of adequate incentive packages to support diaspora driven investments in Kosovo. The research addresses both individual and policy levels, offering recommendations aimed at enhancing the impact of diaspora financial initiatives.

KEYWORDS: diaspora investments, Kosovo Albanian, remittances, economic development, policy recommendations, qualitative research, Kosovo

Vloga diaspore pri gospodarskem razvoju matične države: primer Kosova

POVZETEK: V članku so kritično proučeni izzivi albanske diaspore na Kosovu pri naložbah v matično državo. Čeprav je diaspora pomemben gospodarski vir zlasti zaradi obsežnih nakazil, ki pomembno prispevajo k nacionalnemu BDP, se spopada s številnimi ovirami, ki vplivajo na učinkovitost njenih naložb. Na podlagi 53 biografskih intervjujev (2014–2016) z migranti v Švici in Nemčiji ter 23 intervjujev s ključnimi deležniki, kot so uradniki, predstavniki sindikatov in akterji civilne družbe, je izpostavljeno pomanjkanje ustreznih paketov spodbud za podporo naložb diaspore na Kosovu. V članku sta obravnavani tako individualna kot politična raven, podana pa so tudi priporočila za povečanje učinka finančnih pobud diaspore.

KLJUČNE BESEDE: naložbe diaspore, kosovski Albanci, denarna nakazila, gospodarski razvoj, priporočila politiki, kvalitativna raziskava, Kosovo

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1 Introduction

Migration of Kosovo Albanians to Western Europe began in the 1960s, primarily involving low-skilled workers seeking temporary employment opportunities (Remiddi et al. 2019). In the following decades, especially during the 1980s, family reunification allowed many to secure residency in host countries. Political instability and economic hardship in Yugoslavia led to a significant outflow of migrants in 1989, including many educated young men from both rural and urban areas (Iseni 2013; United Nations … 2014; Gashi 2021). The 1998–99 war in Kosovo triggered a large-scale humanitarian crisis, resulting in a sharp increase in emigration, particularly of asylum seekers and refugees (Schwander-Sievers 2005; United Nations … 2014). After 2000, migration continued, driven by the pursuit of better employment, education, and living standards, with both highly educated and less-skilled individuals leaving the country (Meyer et al. 2012; King and Gëdeshi 2024).

Despite this long history and large scale of migration, accurate data on the Kosovo Albanian diaspora remains limited. The diaspora is relatively new and less institutionalised, and Kosovo's changing political status has complicated its statistical visibility. Before independence in 2008, Kosovo Albanians were recorded in host country alongside with other ethnic groups from the former Yugoslavia, making it difficult to isolate data specific to them. The first migration report by the Kosovo Agency of Statistics (2014) in 2014 relied on data from other countries, which often failed to distinguish between Albanians from Kosovo, Albania, North Macedonia, or Montenegro. As a result, reliable demographic and socio-economic profiles, such as age, gender, and reasons for migration, are still lacking. Estimates suggest that between 885,000 (Ministry of … 2021) and one million Kosovo Albanians live abroad (Gashi 2021; King and Gëdeshi 2024), accounting for roughly one-third to one-half of the population born in Kosovo (United Nations … 2014). Most reside in Germany and Switzerland (58.1%), followed by Italy, Slovenia, and Austria (20%), with around 4% living in the United States (Kosovo Agency … 2014; Ministry … 2019).

While the economic contributions of the diaspora, particularly through remittances, have been widely acknowledged (Mustafa et al. 2007), their potential to contribute more broadly to Kosovo's development remains underutilized. In many countries, diasporas are actively engaged as investors, entrepreneurs, and sources of knowledge transfer (Brinkerhoff 2008). However, in Kosovo, this potential has not been effectively tapped (Gashi et al. 2013). While remittances continue to play an important role in household consumption, only 3.9% are directed toward business investment, considerably below the regional average of 7.93%. In comparison, Montenegro leads with 18.26%, while Albania and Serbia report 7.9% and 7.2%, respectively (United Nations … 2012a; Topxhiu and Krasniqi 2017). These differences are largely attributed to more robust diaspora investment policies, including legal incentives and institutional outreach programs, which are largely absent in Kosovo.

Although the Government of Kosovo has adopted three National Migration Strategies between 2013 and 2025, they have not resulted in significant engagement of the diaspora, particularly in economic development. Unlike its regional neighbors, Kosovo does not provide a specific legal or policy framework to facilitate diaspora investment, classifying diaspora as the same as any foreign investor. This lack of targeted measures, combined with weak institutional coordination and limited communication, continues to discourage diaspora members from investing or sharing their expertise (Lee et al. 2011; Zhu et al. 2012). This article addresses these gaps by asking: how Kosovo can improve its migration policies to better attract and support diaspora investments? Through an analysis of migration policy documents and biographical interviews with members of the diaspora and key informants, the article identifies key challenges and offers policy recommendations to better connect Kosovo with its global population and unlock its diaspora's full potential in national development.

1.1 Diaspora financial, social and human capital

The Kosovo Albanian diaspora has played an important role in the country's development, especially through financial, social, and human capital. One of the most visible forms of support is through remittances. According to the Central Bank of the Republic of Kosovo (Figure 1), migrants have sent over 500 million euros every year since 2007, and in 2021, this amount exceeded one billion euros (Central Bank … 2024). Between 2013 and 2023, remittances made up around 14–19% of Kosovo's GDP, placing the country among the top 15 recipients of remittances in the world relative to its economic size (Remiddi et al. 2019; World

Bank 2023). This financial support is mainly driven by strong emotional and family ties that migrants maintain with their home country. According to United Nations Development Programme (2012a), about 40% of remittances directly support the total household income of families in Kosovo.

A key concern surrounding remittances is their utilisation. Rather than being directed toward productive investment, remittances in Kosovo have primarily served to alleviate poverty and support household welfare. A survey by the Mustafa et al. (2007) found that 47% of remittances are spent on daily consumption, 18% on building or repairing houses, 17% on healthcare, 15% on education, and only 3% are used for business activities. These patterns were later confirmed by the World Bank (2011) and United Nations Development Programme (2012b), underscoring that most remittances serve short-term household needs rather than long-term economic growth. More recent studies reaffirm this trend, noting that remittances continue to be channeled mainly into consumption, housing repairs, healthcare, and education, with limited contribution to productive investments (United Nations … 2014; Gashi 2021). In terms of origin, the largest share of remittances comes from Germany (39.2%), followed by Switzerland (18.9%), the United States (7.2%), Austria (4.4%), Italy (4.2%), and France (3.9%) (Ministry of … 2021).

Besides remittances, the diaspora has contributed through charitable donations and collective support, especially during difficult periods. In the 1990s, Albanian communities in Europe and the United States worked hard to raise awareness about human rights violations in Kosovo (Koinova 2010; Koinova 2017; Remiddi et al. 2019). Many migrants donated 3% of their monthly income to Kosovo-related causes, a system that began in Switzerland. As the situation worsened in 1998–1999, their efforts shifted toward international lobbying and advocacy. One example is the creation of the »Homeland Calling« (alb. *Vendlindja Thërret*) initiative, which opened an office in New York (U.S.) to support international cooperation and attention for Kosovo (Ragaru and Dymi 2004; Hockenos 2018). These actions showed the diaspora's strong and lasting dedication to their homeland.

In recent years, the diaspora has become more active in foreign direct investment (FDI). While total FDI accounts for about 6.64% of Kosovo's GDP (Topxhiu and Krasniqi 2017), only part of it comes from the diaspora. Estimates suggest that 26% originates from Germany, 24% from Switzerland, and 12.5% from

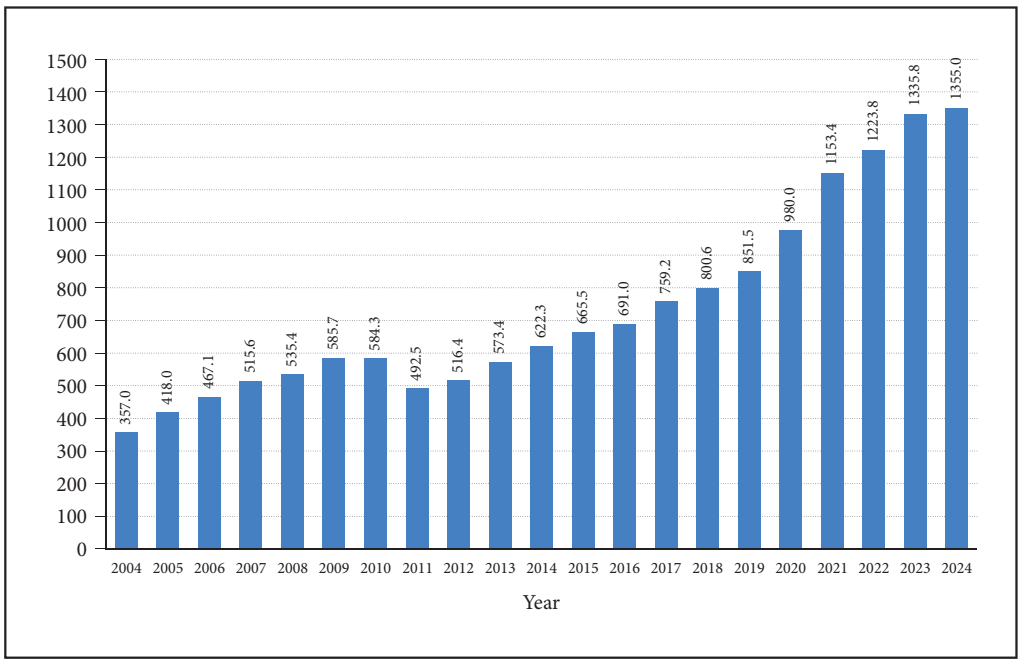


Figure 1: Remittances in Kosovo 2004–2024 (in millions) (Central Bank . . . 2024).

the U.S., countries with large Kosovo Albanian communities (Germin 2023). Although diaspora-led FDI represents just a share of the total, it plays an important role in creating jobs, improving infrastructure, and linking Kosovo to international markets. With their global experience and networks, diaspora investors are well placed to bring in new knowledge and attract further investment.

Members of the diaspora are often more willing to take financial risks than domestic investors. This pattern is often explained by the idea of »home bias,« where decisions are based on emotional ties and personal attachment to Kosovo, rather than financial advice or expert analysis (Terrazas 2010). In addition to their money, diaspora members bring modern important skills, experiences, and networks, which can support economic development, knowledge exchange, and long-term cooperation between Kosovo and the countries where its diaspora lives (Dwyer 2010; Grabowska et al. 2017).

In short, the Kosovo diaspora contributes in many ways, through remittances, donations, and investments, and remains a key partner for Kosovo's future (Germin 2023). However, to better use this potential, Kosovo needs to create a more supportive environment. Clearer policies, greater incentives, and stronger institutions are necessary to encourage the diaspora to stay involved and to invest in the long-term development of the country (Krasniqi 2022).

1.2 Kosovo's policies on migration

Kosovo has made efforts to engage its diaspora through strategic and institutional initiatives. The first major step was the Strategy for Diaspora and Migration 2013–2018**,** seen as a continuation of the Law on Diaspora**,** aiming to protect diaspora rights, preserve cultural identity, and strengthen partnerships. Following this, two more strategies were adopted: the 2019–2023 Strategy for Diaspora and Migration and the 2021–2025 Strategy for Migration**,** reflecting the continued importance of the diaspora to Kosovo's development.

Institutionally, the Ministry of Diaspora**,** established in 2011, was a unique initiative among neighboring countries (Williams 2018). However, after government restructuring in 2019, it was merged into the Ministry of Foreign Affairs, a move that was widely criticized for weakening diaspora representation (Gashi 2021). Within this ministry, the Department for Diaspora operates across communication, culture, youth, sports, and education. Additionally, the Kosovo Investment and Enterprise Support Agency (KIESA) under the Ministry of Industry, Entrepreneurship, and Trade was created to attract investments, including from diaspora.

Despite these efforts, major gaps remain. Policies still treat diaspora investors the same as foreign investors, with no special incentives or support mechanisms effectively implemented. Much of the literature on migration and labor migration confirm that Kosovo lacks a dedicated registry for diaspora investments and possesses limited data on migrant profiles or labor market needs (Gashi 2021; King and Gëdeshi 2024). Earlier attempts by the Ministry of Diaspora to register the diaspora were incomplete, limiting the government's ability to connect with its expatriate talent and address brain drain.

Moreover, diaspora investors face many challenges**:** lack of trust in institutions, corruption, complex bureaucracy, unclear legislation, infrastructure problems, and financial insecurity (Hoxha 2009; Gashi et al. 2013). While the need for a »stimulus package« for diaspora investors has been acknowledged, it has not been implemented. Without stronger, more targeted policies and reliable information systems, Kosovo will continue to struggle to fully benefit from the diaspora's economic potential (Brinkerhoff 2012).

2 Research methodology

To empirically examine the challenges and opportunities related to diaspora engagement and investment, the study draws on 53 in-depth interviews conducted between 2014 and 2016 with Kosovo Albanian migrants: 27 in Germany and 26 in Switzerland (Figure 2). These interviews focused on their migration experiences, integration into the host countries, and ongoing connections with Kosovo. Fieldwork was conducted in three main locations: Kosovo (during migrants' return visits in winter and summer), Munich (Germany), and Zurich (Switzerland), which all host significant Kosovo Albanian communities.

To gain deeper insight into national policies and institutional frameworks shaping migration and diaspora engagement, we also carried out 23 interviews with key informants, 14 with policymakers and nine with representatives from trade unions, civil society organizations, NGOs, and academic institutions.

19 interviews were conducted in Kosovo with officials from government institutions, the International Organization for Migration (IOM), and organizations facilitating student employment in Germany. The remaining four interviews were conducted in Germany and Switzerland with Kosovar diplomatic staff and representatives from local trade unions and civil society. These key informant perspectives helped us better understand policy gaps, implementation challenges, and institutional efforts related to diaspora engagement.

Our research used a biographical approach (Iosifides and Sporton 2009) and semi-structured interviews (Bogataj and Krč 2023), which are well-suited for exploring complex migration experiences. This method allowed us to reconstruct individual migration trajectories and connect them to broader socio-economic and political contexts.

The interviews were structured into three parts. First, participants shared their life stories, focusing on key personal experiences. Second, they reflected on their migration and settlement in the host countries, with particular emphasis on labor market integration. Lastly, we explored the impact of their legal status, well-being, and opportunities abroad on their ties to Kosovo and future plans. While many participants discussed their transnational connections unprompted, we also asked specific questions about family responsibilities, financial support, and their views on investing in Kosovo.

To build trust and ensure that participants felt comfortable sharing their stories (Knox and Burkard 2009), each interview began with an informal discussion about the study's purpose. All interviews were conducted in Albanian, the participants' native language, to support clearer and more emotionally accurate communication. Ethical standards were strictly followed, including informed consent, full anonymity, and confidentiality. Interview settings were chosen by participants and included homes, offices, or quiet cafés to ensure a relaxed atmosphere. We used snowball sampling (Mack et al. 2005; Erdal and Ezzati 2014; Uršič and Tamano 2019), which proved effective in reaching a diverse sample of migrants in both countries. Participants were assured that their information would remain confidential, as outlined in the signed consent forms. Therefore, participants are identified by codes, as shown in Table 1.

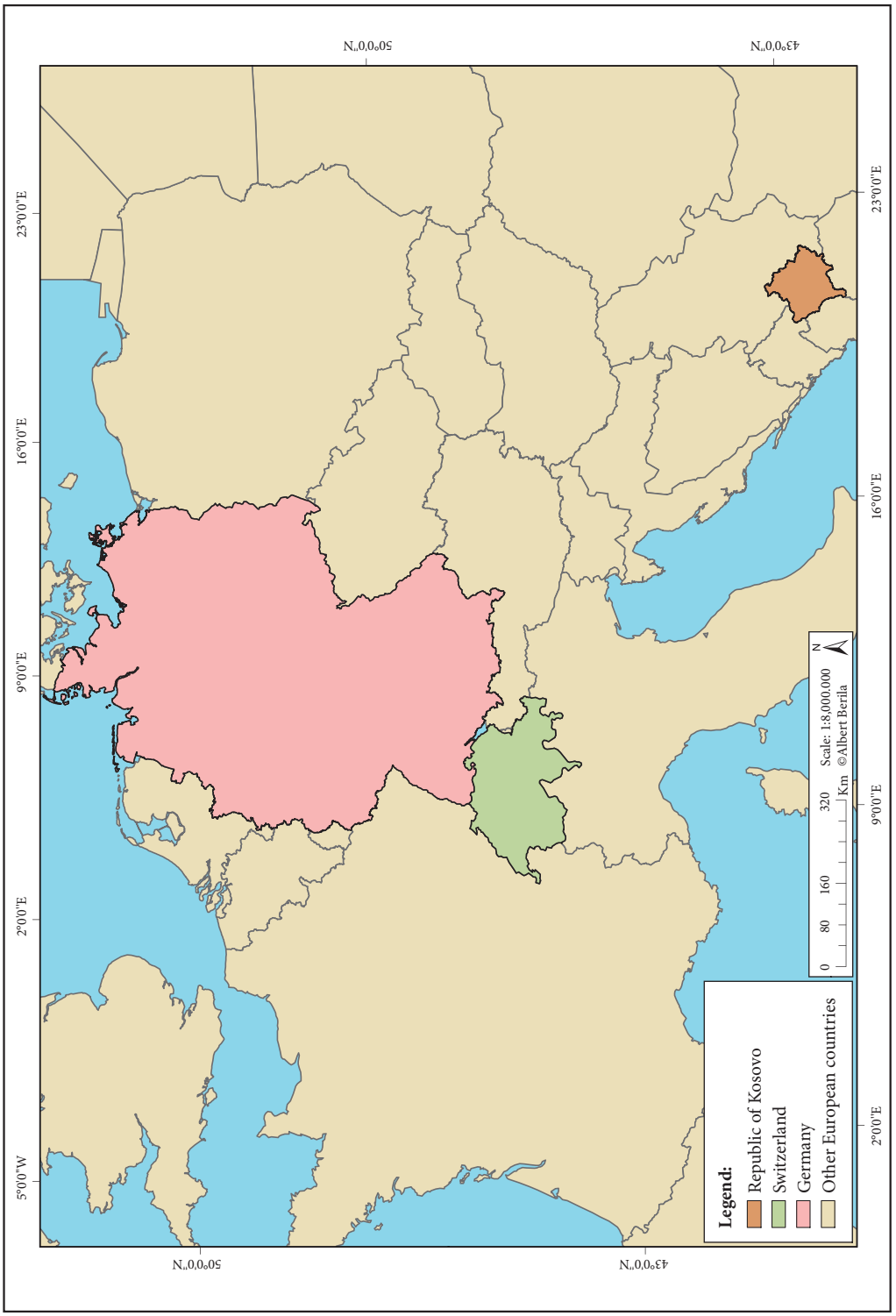
The interviews ranged from one to three hours and were recorded (with permission) and transcribed in their original language. We analyzed the transcripts using the qualitative data analysis software MAXQDA, starting with version 14 and later using version 24. Thematic analysis was applied, guided by grounded theory (Birks and Mills 2015). The coding process followed three stages: first, descriptive coding to identify general themes; second, initial coding to refine and expand these themes; and third, focused coding to organize findings and deepen interpretation (Jacques 2021).

Participants included individuals who had entered their host countries through different channels, mainly tourist visas, family reunification, or irregular entry, followed by asylum claims. By the time of the interviews, all participants had clarified their legal status. 15.1% had completed primary education, 45.3% secondary education, and the rest held associate or university degrees. Employment was distributed across different sectors: 35.8% worked in services and administration, 22.6% in manufacturing, 11.3% in construction, and 28% in other professions. The majority of respondents were men (79.2%), reflecting a gendered pattern in Kosovo's labor migration, while women (20.8%) had primarily migrated through family reunification.

Table 1: List of interviewees.

Type	Codes (number of interviewees)
Migrant in Germany Migrant in Switzerland	MG1-MG27 MS1-MS26
Policy maker (Kosovo and Switzerland) (Ministries of: Internal Affairs, Foreign Affairs, Diaspora, Labour, Trade and Industry, Community and returnees, Kosovo Police)	PMK1-PMK12; PMS1-PMS2
Trade Union (BSPK Kosovo, DGB Germany and UNIA Switzerland)	TUK, TUG, TUS
Civil society (Kosovo and Germany)	CSK1, CSG1
NGO and researchers	N1-N4

Figure 2: Map of the study area. ► p. 83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N

3 Results and discussion

This section presents the key findings from interviews with Kosovo Albanian migrants and key informants, highlighting their contributions to their homeland and the structural barriers they face when translating interest into meaningful investment. While the diaspora demonstrates strong emotional and financial commitment to Kosovo, institutional gaps continue to limit their engagement within national development.

3.1 Unrealized potential: Barriers to diaspora investment

Despite their strong willingness and financial capacity to contribute, many members of the Kosovo diaspora encounter serious barriers to meaningful economic engagement. The interview data reveal a recurring frustration: that institutional shortcomings, lack of transparency, and weak coordination continue to hinder investment efforts.

One informant from Switzerland (MS12) noted that institutional support is a major obstacle. His comments reflect a broader concern: that even when diaspora members have the capital and willingness to invest, a lack of streamlined procedures and effective communication discourages them from doing so. In many cases, these frustrations lead to mistrust in Kosovo's public institutions.

A major issue is the diaspora's limited awareness of the investment environment in Kosovo. Despite genuine interest, many potential investors lack access to clear information about opportunities, procedures, and regulations. A study by Gashi et al. (2013) found that 56% of surveyed diaspora members did not know where or how to invest. Nevertheless, 42% expressed strong interest, and 52% said they would consider investing – only 6% were not interested.

Frustrations with this lack of institutional support are strongly reflected in the words of diaspora members. One migrant (MS15) noted: »*It must be the investments of migrants in Kosovo. We don't feel just an obligation. We have the desire and obligation to build our country. These are things that remain*.«

Another (MG6) expressed disappointment after returning to Kosovo with the goal of contributing: »*We went to Germany to make money fast and to return and invest in Kosovo. To do something in Kosovo... When I decided to return to Kosovo, after graduating there with German investment from the neurology hospital (migrant workplace), I thought I would attract attention, that doctors from Germany have invested in Kosovo. This is how we started, but in the first months, we went through a lot of difficulties. We did not have any work at all... I mean, Kosovo is a rough market because we do not find support as foreign investors. I am Kosovar, but I do not find the support of the locals. They do not see us as collaborators but as competitors.*«

These concerns were echoed by another informant (MG22) who emphasized three core concerns:

1) the financial capacity of the diaspora:
   »*Do you know how much remittance money is sent to Kosovo? Officially, it's over 700 million euros a year. But in reality, it's closer to 3 billion. That's nearly double Kosovo's national budget. And yet, the government doesn't take it seriously.*«
2) the need for supportive policies: »*Everything we asked for, they (referring to potential German investors) have been able to fulfil us. Look, we cannot help the Germans much; they can help us more. Although I still do not understand why the economy of Kosovo or the people, for example, did not tell me what we should do to make the most of that opportunity? What can we do to attract investors? But a very bad game has been played; we are too late with different policies …*«
3) the urgency to act before interest fades: »*There must be a reform in Kosovo for things to change and for the diaspora to have greater opportunities to contribute. This spirit (readiness) must be used, which will last for a maximum of 20 years. The diaspora, which today is very interested in investing in Kosovo, will lose interest in the future. Look, my child will not have the same feeling for Kosovo.*«

Institutional shortcomings were further emphasized by interviewees, such as MG7 and MS12, who pointed to the lack of institutional support as a critical obstacle. Both described how complex procedures, limited facilitation services, and bureaucratic inefficiencies made investing in Kosovo less attractive. Their experiences reflect a broader issue of weak coordination, inadequate information flow, and a lack of trust in public institutions, all of which discourage sustained diaspora engagement.

These individual accounts highlight a broader dynamic. Kosovo's diaspora contributes far more than just remittances. In addition to monetary transfers, they offer valuable knowledge, including human capital, innovative ideas, business models, technological skills, and entrepreneurial spirit, all of which are vital

for Kosovo's development. In other words, the diaspora's impact extends beyond remittances and plays a key role in national development (Wei and Balasubramanyam 2006; Riddle et al. 2010; Grabowska et al. 2017).

Members of the diaspora often possess deep knowledge of local markets and maintain strong cultural and social ties with their communities. At the same time, they have experience and networks in international business environments. This dual expertise makes them well-positioned to promote entrepreneurship by blending global and local perspectives (Vaaler 2011; Xavier et al. 2013). Their contributions also support peacekeeping, knowledge transfer, and democratic empowerment (Bush 2008; Gibson and McKenzie 2012). Previous studies confirm a positive link between return migration and business ownership, although many diaspora-owned business remain small and informal (Nicholson 2001; Kilic et al. 2009).

Without stronger, more targeted policies and reliable information systems, Kosovo will continue to struggle fully benefit from the diaspora's economic potential (Brinkerhoff 2008; Riddle et al. 2010). The government must act to remove barriers and enable conditions that turn this potential into a lasting force for national development.

3.2 Institutional challenges and the need for reform

Key informants from government institutions echoed the concerns raised by migrants. Although Kosovo has adopted several strategic documents and established relevant agencies like KIESA and the Department for Diaspora, implementation has been weak. A policymaker (PMK4) confirmed that, while a »stimulus package« for diaspora investment has been identified as a policy priority, no such measure has been implemented to date.

Kosovo also lacks a centralized database of diaspora investors. Previous attempts to register the diaspora have failed to produce comprehensive or usable data (Gashi 2021). Key informants from the Ministry of Labor (PMK7), KIESA (PMK9) and NGO (N3) all highlighted the absence of accurate statistics on diaspora investments, noting that institutional coordination is poor and information-sharing between agencies is limited. As a result, strategic planning and targeted outreach efforts are significantly hindered. The actual scale of diaspora investment remains unclear but is widely believed to fall short of its full potential.

One major issue is that diaspora investors are treated the same as any foreign investor. There are no tailored incentives, advisory services, or streamlined procedures to reflect their unique position. This approach is a missed opportunity, particularly given the diaspora's emotional, cultural, and often long-term commitment to Kosovo.

Beyond these policy gaps, broader structural challenges persist. Civil society organisations and international reports highlight broader challenges in the investment climate. Corruption, weak infrastructure, legal uncertainties, and a lack of trust in public institutions continue to deter engagement. As one NGO representative (N3) noted: »*The diaspora has both expertise and capital, but without a supportive environment, they won't invest. What's needed are policies that actively encourage and facilitate their involvement.*«

This sentiment was mentioned by a key informant from the Institute for Management and Development (SKC1) explained: »*There are no government policies oriented toward diaspora needs, and there is a lack of statistics on how many businessmen from the diaspora have invested in Kosovo. Despite some investments from the diaspora resulting in disappointment due to the lack of formal information channels, the state does not provide any facilities for such initiatives.*«

While institutions like the RiInvest Institute and KIESA have made efforts to promote investment, they face similar obstacles. According to key informants (PMK9), there is still no dedicated registry of diaspora investors or a clear strategy for attracting and supporting them.

Although the diaspora shows strong interest and capacity to contribute, Kosovo's institutional weaknesses and lack of focused policy measures continue to limit meaningful investment. Without reforms, the potential of the diaspora will remain largely unrealized.

3.3 Moving forward: What can the government do?

Kosovo must implement targeted reforms to better leverage diaspora investment and engagement. Interview findings (e.g., PMK4, SKC1) confirm strong interest among diaspora members in contributing to national development, yet this willingness is undermined by weak institutional support, administrative barriers,

and limited access to information. A transparent and supportive environment is essential to transform this interest into long-term development partnerships.

These challenges are not unique to Kosovo. Similar obstacles are observed in other countries. Sinatti and Horst (2015) highlight that many governments engage diasporas symbolically, without offering meaningful support. Likewise, Page and Mercer (2012) argue that diaspora policies often fail when structural constraints, such as institutional inefficiencies and low trust, are overlooked. These examples underscore the importance of inclusive policymaking and comprehensive institutional reform.

Kosovo should move beyond a remittance-focused approach and view the diaspora as a strategic development partner. This requires clear legal frameworks, targeted incentives, streamlined procedures, and improved inter-institutional coordination. Establishing a reliable monitoring system and actively involving diaspora representatives in policymaking could help Kosovo align with international best practices and fully harness its diaspora's potential for sustainable development.

4 Conclusion

This study highlights the valuable yet underutilized role of the Kosovo Albanian diaspora in national development. Migrants from Kosovo, particularly in Western Europe, express a strong willingness to invest in their home country, not only financially, but also through the transfer of knowledge, networks, and skills. Their motivations are driven not only by economic opportunity but also by deep emotional and cultural ties. Despite this enthusiasm, their engagement is hindered by institutional and structural challenges, including the absence of dedicated incentive schemes, fragmented coordination among state actors, limited access to reliable information, and a general mistrust in government institutions. These barriers make it difficult for diaspora members to contribute effectively and sustainably, often leaving their potential untapped.

The findings of this study underscore that diaspora investment should not be treated merely as foreign capital but as a form of socio-economic partnership with long-term national benefits. Migrants' demands are clear: their contributions must be acknowledged as part of the national development agenda, and they should be offered tailored support mechanisms such as tax incentives, simplified procedures, and access to advisory services. Policymakers must recognize the urgency of creating a more enabling environment, as the current generation of diaspora members retains a strong sense of identity and desire to contribute, while future generations, more deeply rooted in host societies, may not maintain the same level of attachment.

Government institutions must respond with coherent and integrated reforms, including improved data collection on diaspora engagement, streamlined communication across agencies, and structured dialogue with diaspora representatives. A long-term strategy should focus on building trust, reducing administrative and legal hurdles, and creating clear pathways for investment and knowledge transfer. Institutions such as the Ministry of Foreign Affairs and Diaspora, must take a more proactive role in coordinating efforts, promoting successful diaspora-led projects, and offering consistent support throughout the investment process.

Diaspora engagement offers more than capital: it could serve a bridge between global expertise and local development, bringing innovation, job creation, and broader international networks to Kosovo. By addressing the gaps identified in this study and committing to concrete policy action, Kosovo can transform its engagement with its diaspora from a symbolic relationship into active partnership in its economic and social advancement. Failing to act risks losing not only financial resources but also the trust and goodwill of a highly motivated and capable global community.

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- **Results:** follow the research questions as presented in the introduction and briefly present the results.
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All references in the reference list must be cited in the text. Arrange references alphabetically and then chronologically if necessary. Identify more than one reference by the same author(s) in the same year with the letters a, b, c, etc., added to the year of publication: (1999a, 1999b). In case there are more than seven authors, list the first seven followed by et al.

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- Kladnik, D., Kruse, A., Komac, B. 2017a: Terraced landscapes: An increasingly prominent cultural landscape type. *Acta geographica Slovenica* 57-2. https://doi.org/10.3986/AGS.4770
- Kladnik, D., Šmid Hribar, M., Geršič, M. 2017b: Terraced landscapes as protected cultural heritage sites. *Acta geographica Slovenica* 57-2. https://doi.org/10.3986/AGS.4628
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4.2 Books

Last Name1, A. B., Last Name2, C. D. Year: Book title. *Book Series Title* with Number. Publisher. https://doi.org/…

If the book is edited by editors, add '(eds.)' before the year of publication.

- Achino, K. F., Velušček, A. 2022: The lake-dwelling phenomenon. *E-Monographiae Instituti Archaeologici Sloveniae* 13. Založba ZRC. https://doi.org/10.3986/9789610506560
- Gams, I. 2004: Kras v Sloveniji v prostoru in času. Založba ZRC.
- Hall, T., Barrett, H. 2018: Urban geography. Routledge. https://doi.org/10.4324/9781315652597
- Knox, P., Marston, S. 2015: Human geography: Places and regions in global context. Pearson.
- Luc, M., Somorowska, U., Szmańda, J. B. (eds.) 2015: Landscape analysis and planning. *Springer Geography*. Springer. https://doi.org/10.1007/978-3-319-13527-4
- Marshall, T. 2016: Prisoners of geography: Ten maps that explain everything about the World. *Politics of Place*. Scribner.
- Mihelič Pulsipher, L., Pulsipher, A., Johansson, O. 2019: World regional geography: Global patterns, local lives. W. H. Freeman.

4.3 Chapters of books or proceedings

Last Name1, A. B., Last Name2, C. D. Year: Chapter title. In: Book Title. *Book Series Title* with Number. Publisher. https://doi.org/…

- Griffin, A. L. 2018: Cartography, visual perception and cognitive psychology. In: The Routledge Handbook of Mapping and Cartography. Routledge. https://doi.org/10.4324/9781315736822
- Solem, M., Boehm, R. 2015: A research coordination network for geography education. In: EUGEO Budapest 2015: Congress Programme and Abstracts. Hungarian Geographical Society.
- Stethem, C. 2013: Avalanches. In: Encyclopedia of Natural Hazards. Springer. https://doi.org/10.1007/978-1-4020-4399-4_7
- Zorn, M., Ferk, M., Lipar, M., Komac, B., Tičar, J., Hrvatin, M. 2020: Landforms of Slovenia. In: The Geography of Slovenia: Small But Diverse. *World Regional Geography Book Series*. Springer. https://doi.org/10.1007/978-3-030-14066-3_3

4.4 Reports, theses, dissertations, and other materials with authors

Last Name1, A. B., Last Name2, C. D. Year: Title. *Type of document*. Publisher. https://doi.org/…

- Davies, G. 2017: The place of data papers: Producing data for geography and the geography of data production. *Blog post*. Geo: Geography and Environment.
- Easterbrook, D. J. 1976: Geologic map of western Whatcom County, Washington (1-854-B). *1:62,500 map*. United States Geological Survey.
- Fležar, U., Hočevar, L., Sindičić, M., Gomerčić, T., Konec, M., Slijepčević, V., Bartol, M. et al. 2022: Surveillance of the reinforcement process of the Dinaric - SE Alpine lynx population in the lynx-monitoring year 2020–2021. *Technical report*. LIFE Lynx.
- Hawking, S. 1966: Properties of expanding universes. *Ph.D. thesis*. University of Cambridge. https://doi.org/10.17863/CAM.11283
- Hrvatin, M. 2016: Morfometrične značilnosti površja na različnih kamninah v Sloveniji. *Ph.D. thesis*. Univerza na Primorskem.
- Šifrer, M. 1997: Površje v Sloveniji. *Technical report*. Geografski inštitut Antona Melika ZRC SAZU.

4.5 Sources without authors

Use in-text citations (see Chapter 3). If sources need to be listed in the references use the following style: Publisher Year: Title. *Type of document*. https://doi.org/…

- European Commission, Eurostat 2023: Quality report on national and regional accounts. *Report*. https://doi.org/10.2785/825704
- Geodetska uprava Republike Slovenije 1998: Državna topografska karta Republike Slovenije 1 : 25.000 (Brežice). *1:25,000 map*.
- Royal Australian Survey Corps 1988: Australia 1:50 000 topographic survey (Tamborine, Queensland). *1:50,000 map*.
- United Nations 1987: Report of the World Commission on Environment and Development: Our common future. *Report*.
- United States Geological Survey, Earth Resources Observation and Science Center 2018: Shuttle Radar Topography Mission (SRTM) 1 Arc-Second Global. *Dataset*. https://doi.org/10.5066/F7PR7TFT

5 Tables

Number all tables in the article uniformly and provide their own titles. The number and the title text are separated by a colon, and the title ends with a period. A table title is located above the corresponding table. Examples:

- Table 1: Number of inhabitants of Ljubljana.
- Table 2: Changes in average air temperature in Ljubljana (Velkavrh 2009).

Tables must be indicated in the main text in parentheses, for example: (Table 1), or as a part of the sentence, for example »… as can be seen in Table 1.« Tables should contain no formatting and must be inserted in the article file.

6 Figures

Figures encompass different graphic presentations used in the article: photography, graphs, illustrations, maps, etc.

Number all figures in the article uniformly and provide their own titles. The number and the title text are separated by a colon, and the title ends with a period. A figure title is located below the corresponding figure. Example:

- Figure 1: Location of measurement points along the glacier.

Figures must be indicated in the main text in parentheses, for example: (Figure 1), or as a part of the sentence, for example »… as can be seen in Figure 1.«

Figures should be exactly 134 mm wide (one page) or 64 mm wide (half page, one column), and up to 200 mm high.

Titles should appear in a caption only. Save colors in CMYK. Use Times New Roman font with a minimum size of 6.

Figures must be submitted as separate files. Multiple graphic files should be uploaded in one zip file. Figures should also be inserted in the main text file in order to ease the review process.

Regardless of the graphic/cartographic software used, save or export figures to the following formats:

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- xlsx file for graphs made with MS Office Excel,
- pdf or similar common files for maps and illustrations with vector drawings and/or text (embed the font if possible). See chapter 6.3 for details.

If the graphic files cannot be uploaded according to the guidelines, consult the editorial board (ags@zrc-sazu.si) in advance.

To make anonymous peer review possible, the authorship of figures can be added by authors at a later (copyediting) stage, after the review has been completed.

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Photos must be in raster format with a resolution of at least 300 dpi, preferably in jpg or tiff format.

Figures containing a screenshot should be prepared at the highest possible screen resolution. A figure can be made using Print Screen, and the captured screen is pasted to the selected graphic program (e.g., Paint) and saved as a tiff or jpg file. The size of the image or its resolution must not be changed.

6.2 Graphs

Graphs should be made using MS Excel on separate sheets and accompanied by data.

6.3 Maps and illustrations

Maps should be informative and prepared according to the journal size limitations (see general guidelines defined in chapter 6). Use Times New Roman for the legend (size 8) and colophon (size 6). List scale, source, and copyright in the colophon. List the authors of the content and authors of the maps if needed. Write the colophon in English. Use a graphic scale if possible.

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Maps should be submitted in an editable form if possible so that minor errors can be corrected even in the final stages of article production. **The preferred submission file is pdf**. As an exception, maps can be produced in digital raster form with at least 300 dpi resolution, preferably in jpg or tiff format.

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7 Supplementary materials

Authors are encouraged to make the data (input data, results, maps, spatial data, tabular data, etc.) used or generated in the preparation of the article published in *Acta geographica Slovenica* publicly available in a recognized online repository and to provide the editorial board with a link.

The publication of the data in the repository must indicate that the data are part of the published article. The article must be properly cited when using the data.

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As part of the submission process, authors are required to check off their submission's compliance with all of the following items, and submissions may be returned to authors who do not adhere to these guidelines.

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- Tables are placed in the Word file with text in the appropriate place.
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This is the review form for editorial review (version 15) of an article submitted to the AGS journal.

This is an original scientific article.
(The article is original and the first presentation of research results with the focus on methods, theoretical aspects or a case study.)

- Yes
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The article follows the standard IMRAD/ILRAD scheme.

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Notes to the editor-in-chief regarding previously published scientific work.

Is the language of the article appropriate and understandable?

RECOMMENDATION OF THE EDITOR

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If necessary, add comments and recommendations to improve the clarity of the title, abstract, keywords, introduction, methods or conclusion:

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- yes
- no

Does the article take into account relevant current and past research on the topic?

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- yes
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JOURNAL HISTORY

Acta geographica Slovenica (print version: ISSN: 1581-6613, digital version: ISSN: 1581-8314) was founded in 1952. It was originally named *Geografski zbornik / Acta geographica* (print ISSN 0373-4498, digital ISSN: 1408-8711). Altogether, 42 volumes were published. In 2002 *Geographica Slovenica* (ISSN 0351-1731, founded in 1971, 35 volumes) was merged with the journal.

Since 2003 (from Volume 43 onward), the name of the joint journal has been *Acta geographica Slovenica*. The journal continues the numbering system of the journal *Geografski zbornik / Acta geographica*.

Until 1976, the journal was published periodically, then once a year, twice a year from 2003, and three times a year since 2019.

The online version of the journal has been available since 1995. In 2013, all volumes of the magazine were digitized from the beginning of its publication to including 1994.

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Those interested in the history of the journal are invited to read the article »The History of *Acta geographica Slovenica*« in volume 50-1.

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