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Front cover photography: Cultural terraces, such as these in the Brkini Hills, are an important element of numerous Slovenian regions (photograph: Matevž Lenarčič).
Fotografija na naslovnici: Kulturne terase, kot te v Brkinih, so pomembna prvina številnih slovenskih pokrajin (fotografija: Matevž Lenarčič).

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MACROSEISMIC INVESTIGATIONS OF THE GEOLOGICAL SITE EFFECTS ON INTENSITIES OF SELECTED EARTHQUAKES IN THE GREATER LJUBLJANA AREA

MAKROSEIZMIČNE RAZISKAVE VPLIVOV LOKALNE GEOLOŠKE ZGRADBE NA INTENZITETE IZBRANIH POTRESOV NA ŠIRŠEM OBMOČJU LJUBLJANE

Anita Jerše, Andrej Gosar, Mladen Živčić


ARHIV GIAM ZRC SAZU

Consequences of the Ljubljana 1895 earthquake.
Posledice potresa 1895 v Ljubljani.

Macroseismic investigations of the geological site effects on intensities of selected earthquakes in greater Ljubljana area

DOI: http://dx.doi.org/10.3986/AGS.793
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ABSTRACT: Ljubljana is one of three regions with the highest seismic hazard in Slovenia. In addition soft sediments in the Ljubljana basin have a strong influence on seismic ground motion. We used macroseismic data to investigate the influence of local geological structure on earthquake intensities in greater Ljubljana area. We determined intensities for eleven earthquakes according to ground classification based on Eurocode 8 standard (EC8). The results showed a systematic increase in observed seismic intensities, determined according to European Macroseismic Scale (EMS-98), as the seismogeological characteristics of the ground deteriorated. Only one ground type (D) showed slightly lower intensities than expected. This may be due to some unrevealed geological and other factors, or because of very limited macroseismic data available for this particular ground type.

KEY WORDS: European Macroseismic Scale, intensity, macroseismic investigations, Eurocode 8, seismic microzonation, Ljubljana basin

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1 Introduction

Earthquakes are a natural phenomenon that cannot be forecasted and controlled, but that can be well observed through the analysis of its effects. Macroseismic data consist of systematic descriptions of earthquakes' effects on humans, objects, buildings and nature.

The amplitude of ground oscillation depends on earthquakes' source properties (magnitude, depth, distance, focal mechanism), on the impact of regional geology on the propagation of seismic waves, and on the local geological condition known as site effects. In seismic hazard assessment for a site located on a soft ground the value of ground-motion acceleration on a base solid rock is multiplied by a corresponding soil factor.

The aim of this study is to evaluate the influence of local geological structure on certain earthquake intensities in the greater Ljubljana area, based on the ground classification according to Eurocode 8 standard (EC8) (SIST EN 1998-1, 2005; SIST EN 1998-1/A101, 2005). For the purposes of macroseismic analysis we evaluated macroseismic questionnaires, which are kept in our archive. In estimating intensity we followed the principles of the European Macroseismic Scale (EMS-98) (Grünthal 1998). Intensities were determined for areas with a radius not exceeding 5 km, which were located on homogeneous ground in accordance to EC8 classification. Based on the geological map, in scale 1 : 100,000, and its map interpreters, we divided geological substrate areas into five classes according to EC8. Data of three separate groups of earthquakes was statistically analysed. For each group we have selected the reference intensity of the comparative polygon, with which we compared the intensity in other polygons for the same earthquake.

2 Previous research of the influence of local geological structure on earthquake effects

Seismic wave amplification in alluvial deposits has contributed to damage and loss of life in several recent earthquakes, for example in Christchurch, 2011 (Bradley 2012) and in Emilia-Romagna 2012 (Maugeri et al. 2013). In areas with complex geology site effects can vary significantly (Toshinawa et al. 1997). Many techniques all over the world have been presented to investigate the relationship between intensity and geological setting using macroseismic data. The first significant study of this kind was made in New Zealand (Elder et al. 1991; Toshinawa et al. 1997). Also in Italy there have been several studies on the variation of earthquakes effects caused by site effects, for example in Palermo (Giammarinaro et al. 2005) and Rome (Cifelli et al. 2000; Sbarra et al. 2012). In Slovenia large variations in damage to buildings were observed in case of 1998 and 2004 Krn mountains earthquakes. They were explained mainly by soil-structure resonance effects (Gosar 2007; Gosar 2010).

Based on recent studies, experts had suggested (Sbarra et al. 2012) using macroseismic intensity residuals as a contribution to the elaboration of hazard maps. They found that the intensity also depends on soil variations with the depth and thickness of each layer.

3 Geological setting and ground classification based on EC8 in the greater Ljubljana area

Ljubljana, which is one of three regions with the highest seismic hazard in Slovenia (Lapajne et al. 2001), is located in a shallow sedimentary basin filled with heterogeneous Quaternary deposits (Figure 1) with various seismological properties. We distinguish three main parts: the Ljubljana Field (Ljubljansko polje), the north part of the Ljubljana Moor (Ljubljansko barje), and surrounding hills.

The bedrock of the basin is built of Permian and Carboniferous clastic rocks (claystones, sandstones, conglomerates) and partly of Mesozoic carbonate rocks. It outcrops on the margins of the hills. Ljubljana Field is covered by gravel deposits of the Sava River. Sand and gravel in the Ljubljana Moor are covered by lake and marsh sediments.

In EC8 site effects of different ground types are expressed with coefficient S (soil factor), which tell us how much greater the ground acceleration is expected in comparison with the reference solid rock. There

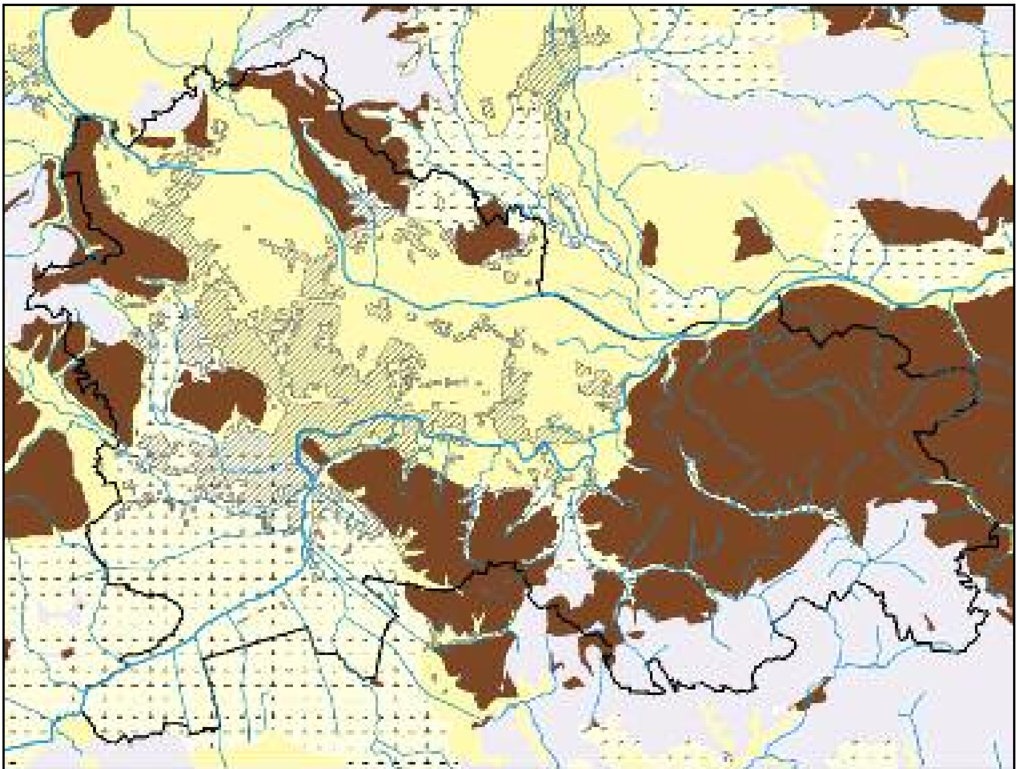

Figure 1: Geological map of the Ljubljana region (Zupančič et al. 2004).

are seven ground types described by the stratigraphic profiles and by three quantitative parameters: average shear-wave velocity in the topmost 30 m of sediments ($\upsilon_{s,30}$), the result of Standard Penetration Test (N_{spt}) and the undrained shear strength (c_u). For special ground types S_1 and S_2, soil factor S is not given and must be determined by specific investigations.

The influence of local geological structure on seismic ground motion is given in a microzonation map. Based on the geological map (OGK 100) and the map interpreter we expanded the seismic microzonation map of the Municipality of Ljubljana (Zupančič et al. 2004) to greater Ljubljana area (Figure 2). The ground is classified into five types:

- A – factor 1.00,
- C – factor 1.15,
- D – factor 1.35,
- E – factor 1.70,
- S_1 – factor 2.55.

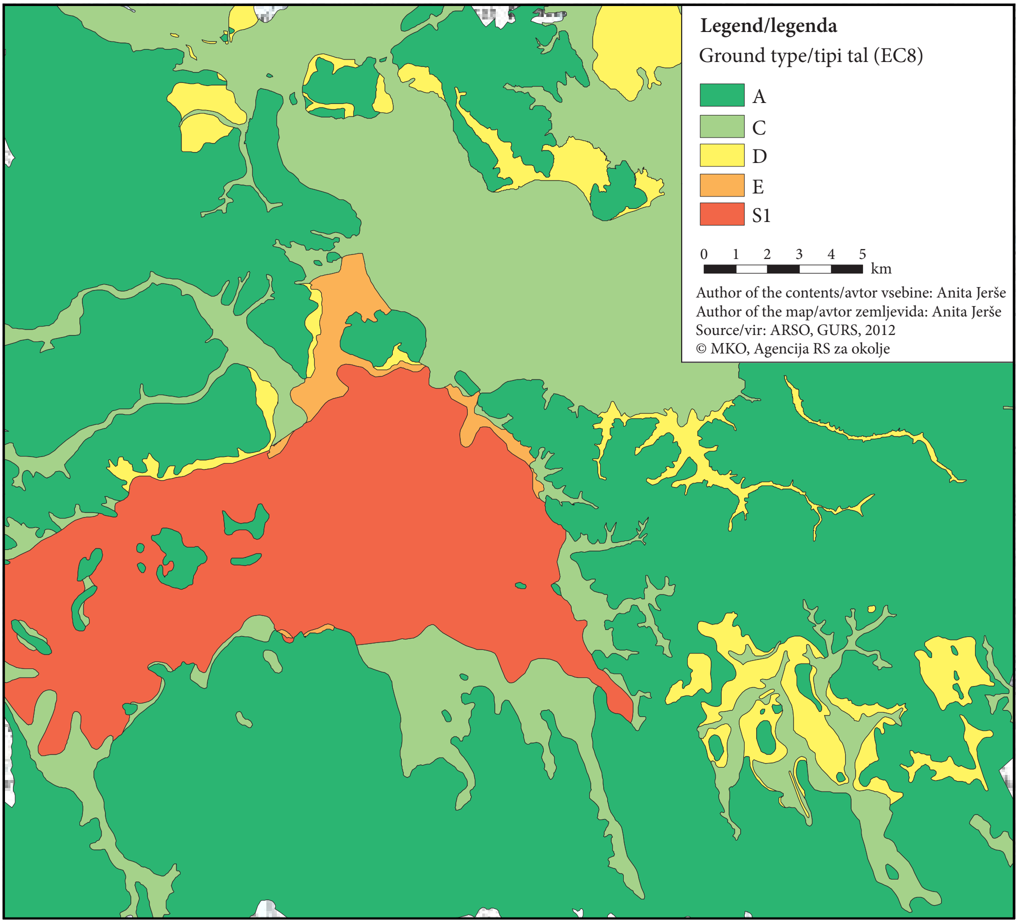

Figure 2: Map of EC8 ground types in the greater Ljubljana area.

We used ground classification based on EC8 according to the basic geological map (Zupančič et al. 2004), where the geological and lithological structure of the Ljubljana area was taken up by OGK 100, sheet Kranj (Grad and Ferjančič 1974), Ljubljana (Premru 1983), Postojna (Buser et al. 1967) and Ribnica (Buser 1969). Since the printed map OGK 100 is made on a relatively weak geodetic basis, the accuracy in the digital format is also poorer. Consequently, on the digital map they declared accuracy of the borders at 50 m. Therefore, we have to consider that observers, who filled-in the macroseismic questionnaires and are located near the boundaries, may not be placed in the right class according to EC8.

The southwestern part of the study area (Ljubljana Moor) belongs to ground type S_1, most of the eastern and western part of the area belongs to ground type A, central part has been classified as ground type C, but there are also smaller areas which fall within ground type D and E (Figure 2). In the greater Ljubljana area there is no ground type B or S_2.

4 Macroseismic data collection and intensity assessment

Effects of earthquakes on humans, objects, buildings and on nature are assessed by intensity, which is described by an intensity scale. In order to assess the intensity, the first step is to gather all the descriptive data available

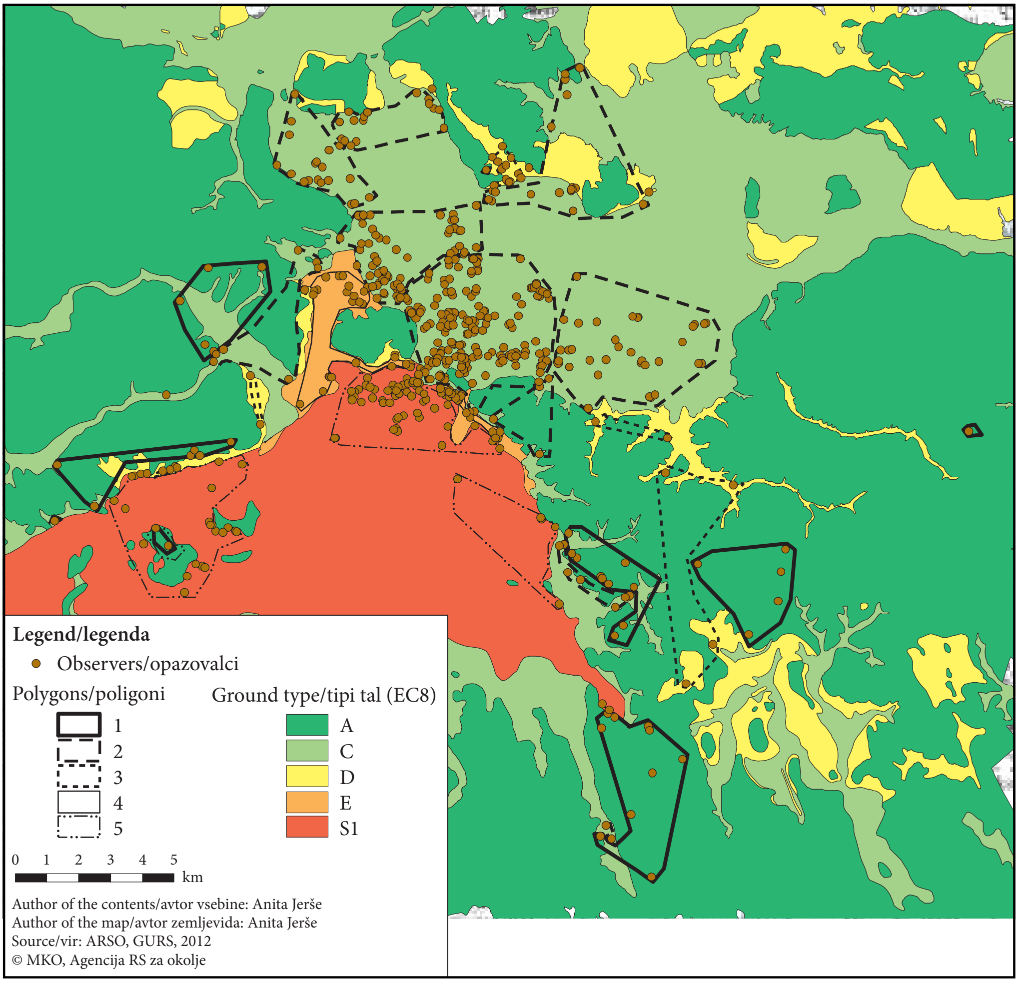

Figure 3: Map of polygons on homogeneous ground according to the EC8 classification for which we determined earthquake intensities. Points indicate the locations of the observers.

for a particular location. Then we sort the data by location and compare them with the lists of diagnostic elements and make a decision on which provides the best fit.

All macroseismic questionnaires are kept in the archives of Seismology and Geology Office. Macroseismic data include questionnaires, received by mail, via online web form and by e-mail.

We determined intensities for selected areas in Ljubljana according to ground classification based on EC8. Each determined intensity refers to small areas with a radius not exceeding 5 km and areas with homogeneous ground according to EC8, otherwise the range of shaking effects reported may be very large since geotechnical conditions of the ground vary. Consequently we divided the ground where observers reside into several polygons (Figure 3) and for each polygon we determined intensity of the earthquake. We have classified 4 polygons on the ground type S_1, 2 on ground E, 6 on ground D, 10 on ground C and 8 polygons on ground type A. In estimating the intensity we followed the principles of EMS-98 (Grünthal 1998).

5 Methodology and data analysis

For macroseismic data analysis we gathered 17 earthquakes (Table 1) which occurred between 1998 and 2005 and were strong enough for our purposes. From this group of 17 earthquakes, we then used 11 of them which best fulfilled the following requirements:

- that they occurred far enough from Ljubljana. In this case we can neglect the variations of epicentral distance between different parts of the city and thus we can see the differences in intensities due to the influence of geological substrates;
- that seismic waves are coming from similar directions. The influence of the geological structure on the propagation of earthquake waves is similar in this case;
- that they reached maximum intensity at least V EMS, and in the Ljubljana area an intensity of at least IV-V EMS;
- that there is sufficient macroseismic data available for them.

In the case of earthquakes which occurred in the vicinity of Brezovica (2002) and Cerkno (2005) there were several successive aftershocks, for which we have characterized the effects together, since there was insufficient data to allow precise assessment of the intensity for each shock separately.

Research was conducted for three separate groups of earthquakes. First, we focused on earthquakes (five of them) that best fulfilled the requirements. Their distance from Ljubljana is between 45 and 120 km. Seismic waves of this group come to Ljubljana from the northwest. In the second group earthquakes do not fullfil the requirements so well (six of them). Their distance from Ljubljana is shorter, between 10 and 45 km. Seismic waves have in these cases different arrival directions. The estimated intensities of earthquakes in this group are slightly lower than in the first group. The third group represents all eleven earthquakes. We analysed 1,296 questionnaires on seismic effects, filled-in by 616 observers. We dealt with the greater Ljubljana area, which extends in the south to Želimlje, in the north to Trzin, Dragomer in the west and in the east to the village Volavlje (Figure 3).

6 Results and Discussion

For each group we selected a comparative polygon with reference intensity and compared the intensity of other polygons with the reference one for each earthquake. The number of all estimated intensities is 224 and they are presented in Table 2.

In the table, beside intensities, there is also the number of questionnaires on which basis the intensity was estimated. Intensities, which are defined only on the basis of one questionnaire (marked red), were not used in the statistical analysis. In further research 160 intensities were used. In case when intensity is given as range for example IV–V EMS–98, we used the value of 4.5 for the calculation purpose.

We chose the polygon on ground type C as comparative, since it has mean values of geomechanical parameters in relation to other ground types. In the group of all eleven earthquakes, we chose the third one (C_3) as the comparative polygon, in the group of five earthquakes the second one (C_2), and in the group of other six earthquakes the fifth polygon (C_5). The selected polygon contains data for all earthquakes, does not contain any data that a single observer has not felt the earthquake, and has approximate mean value of intensity compared to other polygons on the ground C. We did not select polygon C_4 as comparative ground, because its values slightly deviate from the average.

For each polygon we calculated the deviation from the reference intensity for each earthquake separately and deviations of mean values from the reference intensity, which are: arithmetic mean, median, mode and modified median, where we have assumed that information »not felt« is the smallest. When calculating arithmetic mean we excluded data »not felt«.

First we made a statistical analysis of each individual polygon (Table 3), and then for grouped polygons according to ground type by EC8 (Table 4).

The results on the selection of five earthquakes showed that deviations from the reference intensity increased as the quality of the soil deteriorated (especially on ground type E). However, the results of ground type D deviate from others, since we would expect higher values than on ground C and not lower. This may be due to unrevealed geological or other factors.

Table 1: Data on earthquakes considered in this study.

Date	Time h:m:s UTC	Lat °N	Lon °E	Depth h (km)	MLV	Imax (EMS-98)	Epicentral area	Distance from the center of Ljubljana (km)	Direction from the center of Ljubljana	Number of questionnaires	Imax wider Ljubljana area (EMS-98)
25.09.1996	17:56:30	46.17	14.4	19	3.7	IV-V	SMLEDNIK – Podreča-Mavčiče	15	N	90	
13.03.1998	15:14:57	45.6	14.25	14.3	4.2	V	ILIRSKA BISTRICA – Šembije-Koritnice	50	SW	82	IV-V
26.03.1998	16:26:00	43.08	12.6	46	5.1	IV-V	ITALIJA – Umbrija	380	SW	23	
12.04.1998	10:55:33	46.31	13.63	7.6	5.5	VII-VIII	KOBARID – Lepena	80	NW	170	V
06.05.1998	2:53:00	46.28	13.7	5.1	4.2	V-VI	KOBARID – Lepena	80	NW	72	V
31.08.1998	2:32:04	45.93	14.88	15.6	4.2	VI	IVANČNA GORICA – Sela pri Dobu	35	SE	59	V
17.09.1998	5:29:43	46.01	14.77	15.7	3.4	V	LITIJA – Golišče	20	W	81	
24.09.1998	3:59:05	46.05	14.74	13	3.3	IV-V	Šmartno pri Litiji – Koške Poljane	18	E	100	
14.02.2002	3:18:00	46.13	13.1	11.2	4.5	V	FURLANIJA – Moggio Udinese	120	NW	33	IV
20.10.2002	17:42:56	46.03	14.42	11	2.5	V	Brezovica pri Ljubljani	10	SW	162	V
	17:44:13	46.02	14.41	11	2.7	V					
	17:46:01	46.02	14.41	7	2.4	IV-V	Lukovica pri Brezovici				
	17:49:19	46.03	14.4	9	1.8	III					
	18:21:54	46.01	14.4	7	3.1	V	BARJE – Podplešivica				
12.07.2004	13:04:06	46.31	13.62	11	4.9	VI-VII	KOBARID – Lepena	80	NW	100	V
22.09.2004	14:55:48	46.11	14.77	16	3.5	V	MORAVČE – Zgornji Prekar	20	NE	133	V
14.01.2005	7:58:11	46.2	14.03	19	4	V	CERKNO – Davča	45	NW	156	V
	8:05:18	46.19	14.05	19	3.8						
23.01.2009	3:28:00	46.07	14.42	19	2.9	IV	DOBROVA – Šujica	7	W	176	
01.08.2009	3:04:37	46.16	14.53	18	2.5	IV	MENGEŠ – Šinkov Turn	10	N	83	
15.01.2010	14:20:54	45.77	14.19	15	3.7	V	POSTOJNA – Veliki Otok	45	SW	139	IV
24.02.2010	5:21:25	46.1	14.6	11	3.2	V	LJUBLJANA – Dragomelj	10	NE	190	V
								Σ questionnaires of five earthquakes		**531**	
								Σ questionnaires of eleven earthquakes		**1296**	
								Σ of all questionnaires		**1849**	

Colour legend: orange earthquakes which best fulfilling the requirements; yellow earthquakes which slightly less fulfilling the requirements; uncoloured earthquakes which were not used in further research

Table 2: Intensities (EMS–98) of earthquakes by polygons. In parentheses is the number of used questionnaires.

POLYGON / EARTHQUAKE	Earthquakes which slightly less fulfill the requirements						Earthquakes which best fulfill the requirements				
	13. 03. 1998	31. 08. 1998	20. 10. 2002	22. 09. 2004	15. 01. 2010	24. 02. 2010	06. 05. 1998	12. 04. 1998	14. 02. 2002	12. 07. 2004	14. 01. 2005
A_1		IV–V (2)	I (1)	IV(2)			III–IV (1)	V (4)	III (1)		I (1)
A_2	I (1)			III–IV (5)	I (1)		I (1)	V (9)		III (1)	
A_3	I (1)	IV–V (1)	III–IV (2)	IV(4)	I (2)	IV–V (2)		V (7)		IV (2)	III–IV (2)
A_4									I (1)		
A_5	I (1)		IV–V (2)		I (2)			IV–V (1)			III (1)
A_6			V (5)	I (1)	I (1)			V (6)	I (1)	IV (1)	IV–V (4)
A_7						IV (1)					
A_8			III–IV(1)								
C_1	III–IV (2)		V (3)	I (1)	I (1)	IV (1)	III–IV (2)	V (5)		IV (2)	IV–V (2)
C_2	II (3)	V (3)	IV (6)	V (11)	IV (8)	IV–V (17)	III–IV (1)	V (6)	III–IV (1)	IV–V (4)	IV (8)
C_3 comparative polygon	**III–IV (3)**	**V (3)**	**III (6)**	**V (7)**	**IV (6)**	**IV–V (8)**	**IV (3)**	**V (4)**	**IV (4)**	**IV (2)**	**IV (10)**
C_4	IV (25)	V (18)	IV (42)	V (24)	IV (35)	IV–V (52)	IV–V (20)	V (35)	IV (5)	V (31)	IV–V (38)
C_5	IV (3)	V (4)	IV (9)	IV (9)	IV (15)	IV (15)	IV (6)	V (9)		IV–V (4)	IV (14)
C_6	IV (3)	V (8)	I (1)	IV (4)	I (1)	IV (5)	IV (4)	V (8)	I (1)	IV (3)	IV (3)
C_7	IV (5)	IV–V (2)	IV–V (3)	I (3)	I (2)	IV–V (5)	I (5)	IV–V (6)	I (1)	III (2)	IV–V (3)
C_8	IV (6)	V (3)	IV (4)	IV–V (5)	IV (4)	IV–V (3)	I (2)	V (6)	I (2)	IV–V (5)	I (2)
C_9	I (1)						III–IV (1)	IV (1)		IV (1)	
C_10			I (1)	III (1)	IV (1)	IV (2)					
D_1	III–IV (1)	I (1)		IV (1)	I (2)	IV (3)		IV–V (2)		IV (3)	
D_2	IV (1)		V (3)	I (1)	I (2)		IV (1)	V (2)		IV–V (3)	V (3)
D_3	III (1)	V (1)	IV (3)	I (2)	I (1)	IV (3)	III (1)	IV–V (2)	I (1)	III (1)	IV (1)
D_4	III–IV (2)	V (1)	IV (2)	III–IV (2)	I (1)	IV–V (11)	I (2)	V (2)	I (1)	V (2)	III–IV (2)
D_6				IV (1)		IV (1)					
E_1	IV–V (3)	V (1)	IV (9)	III–IV (6)	IV (8)	V (13)	IV–V (2)	V (7)	I (6)	V (4)	IV (4)
E_2	IV (2)	V (1)	V (8)	IV (4)	I (3)	IV–V (8)	V (5)	V (7)	I (1)	IV–V (3)	IV (12)
S1_1	IV–V (3)	IV (1)	V (13)	III–IV (8)	IV (6)	IV–V (8)	I (1)	V (5)		V (6)	V (11)
S1_2	I (2)	V (2)	III–IV (3)	IV (2)	I (2)	IV (2)	I (1)	V (3)	I (1)	IV (1)	IV (1)
S1_3	IV (6)	V (7)	IV–V (30)	IV (16)	IV (20)	IV (17)	IV–V (12)	V (20)	III (6)	V (12)	IV–V (28)
S1_4	I (1)										

Table 3: Statistical analysis of all eleven earthquakes related to individual polygons.

POLYGON / EARTHQUAKE	Earthquakes which slightly less fulfilling the requirements						Earthquakes which best fulfilling the requirements					Mean values			
	13. 03. 1998	31. 08. 1998	20. 10. 2002	22. 09. 2004	15. 01. 2010	24. 02. 2010	06. 05. 1998	12. 04. 1998	14. 02. 2002	12. 07. 2004	14. 01. 2005	Arithmetic mean (M)	Median (Me)	Mode (Mo)	Modified Me
A_1		–0,5		–1				0				–0,500	–0,5		–0,5
A_2				–1,5				0				–0,750	–0,75		–0,75
A_3			0,5	–1	n2	0		0		0	–0,5	–0,167	0	0	0
A_4															
A_5			1,5		n2							1,500	1,5	0,5	
A_6			2					0			0,5	0,833	0,5		0,5
A_7															
A_8															
C_1	0		2				–0,5	0		0	0,5	0,333	0	0	0
C_2	–1,5	0	1	0	0	0		0		0,5	0	0,000	0	0	0
C_3	0	0	0	0	0	0	0	0	0	0	0	0,000	0	0	0
C_4	0,5	0	1	0	0	0	0,5	0	0	1	0,5	0,318	0	0	0
C_5	0,5	0	1	–1	0	–0,5	0	0		0,5	0	0,050	0	0	0
C_6	0,5	0		–1		–0,5	0	0		0	0	–0,125	0	0	0
C_7	0,5	–0,5	1,5	n3	n2	0	n5	–0,5		–1	0,5	0,071	0	0,5	–0,5
C_8	0,5	0	1	–0,5	0	0	n2	0	n2	0,5	n2	0,188	0	0	0
C_9															
C_10						–0,5						–0,500	–0,5	–0,5	–0,5
D_1					n2	–0,5		–0,5		0		–0,333	–0,5	–0,5	–0,5
D_2			2		n2			0		0,5	1	0,875	0,75		0,5
D_3			1	n2		–0,5		–0,5				0,000	–0,5	–0,5	–0,5
D_4	0		1	–1,5		0	n2	0		1	–0,5	0,000	0	0	0
D_6															
E_1	1		1	–1,5	0	0,5	0,5	0	n6	1	0	0,278	0,5	1	0,5
E_2	0,5		2	–1	n3	0	1	0		0,5	0	0,375	0,25	0	0
S1_1	1		2	–1,5	0	0		0		1	1	0,438	0,5	1	0
S1_2	n2	0	0,5	–1	n2	–0,5		0				–0,200	0	0	–0,75
S1_3	0,5	0	1,5	–1	0	–0,5	0,5	0	–1	1	0,5	0,136	0	0,5	0
S1_4															

Table 4: Statistical analysis of earthquakes in accordance to EC8 classification for five earthquakes (top) and all eleven earthquakes together (bottom). Numbers next to ground type indicate how many intensities were considered in analysis.

Ground type (EC8)	Mean values for five earthquakes			
	Arithmetic mean (M)	Median (Me)	Mode (Mo)	Modified median
A (7)	–0,071	0	0	0
C (36)	0,063	0	0	0
D (10)	–0,056	0	–0,5	–0,25
E (9)	0,375	0	0	0
S1 (9)	0,333	0,5	0	0,5

Ground type (EC8)	Mean values for all eleven earthquakes together			
	Arithmetic mean (M)	Median (Me)	Mode (Mo)	Modifided median
A (17)	0	0	0	0
C (77)	0,092	0	0	0
D (21)	0,147	0	–0,5	0
E (19)	0,324	0,5	0	0
S1 (26)	0,167	0	0	0

Table 5: The number of cases when the intensity of earthquakes is smaller, greater or equal to the reference intensity in accordance to EC8 classification. The results for the group of five earthquakes (top) and all eleven earthquakes together (bottom).

Ground type (EC8)	Statistical analysis for five aearthquakes		
	$I < I_{ref}$	$I = I_{ref}$	$I > I_{ref}$
A (7)	2	4	1
C (36)	9	12	10
D (10)	5	3	2
E (9)	1	5	3
S1 (9)	1	3	5

Ground type (EC8)	Statistical analysis for all eleven earthquakes together		
	$I < I_{ref}$	$I = I_{ref}$	$I > I_{ref}$
A (17)	7	6	4
C (77)	17	30	19
D (21)	10	5	6
E (19)	4	6	9
S1 (26)	8	8	10

Results on the total of eleven earthquakes show a similar rising trend of deviations from the reference intensity as with analysis on five earthquakes. On ground D we got higher arithmetic mean of then on the ground C, but the mode is negative.

In Table 5 we present number of cases when intensity of earthquakes is smaller, greater or equal to the reference intensity on ground type C chosen as comparative ground. Blue indicates intensities that are prevailing on each ground.

For the group of five earthquakes the results showed an increase in the intensities of earthquakes as the quality of the soil deteriorated. Type A has more low intensities than high. The intensities of earthquakes on ground C are more equally distributed which was expected. Ground type E showed more high intensities than low and as well ground S_1. Ground type S_1 has also more high intensities than ground E, which is expected according to EC8. The only data to deviate is data for ground D, which showed slightly lower intensities than the intensities on ground C. We also noticed a significant data deviation within ground D intensities, suggesting a major influence of other factors. For the group of all eleven earthquakes we obtained similar results. Despite the fact that the other six earthquakes slightly less fulfil the requirements, we obtained similar results also for them.

We conducted also Wilcox rank-sum test (SPSS Inc. 1999), a nonparametric test to determine significant differences between mean values for independent samples. Test showed similar results as other tests, that the most distinguished ground from ground type C is ground S_1 and the least is ground D.

7 Conclusion

Seismic wave amplification contributed to severe damage and loss of life in a number of earthquakes in the recent past. It is because of heavy damage to structures, caused by site effects on soft ground, that studies of the effects of the local ground increased so greatly. Since quantitative seismic ground-motion data are not always available for carrying out microseismic research, macroseismic data are important for analysis of earthquake effects.

The study covered the greater Ljubljana area, for which we estimated intensities by using 1,296 macroseismic questionnaires, which correspond to 11 different earthquakes. We determined intensities for areas with a radius not exceeding 5 km which were located on homogeneous ground according to EC8. We used ground classification based on EC8 derived from OGK (Zupančič et al. 2004), but in some lithological units difficulties in determining the ground types have emerged. This is mainly due to a lack of clarity in EC8 classification based on lithology and a lack of data on quantitative geomechanical properties. This applies especially for sediments in the Ljubljana Moor (ground type S_1). Ground where observers reside was divided into several polygons and for each polygon we determined seismic intensity.

Statistical analysis was done for three separate groups of earthquakes. For each group we selected the reference polygon on ground type C, with which we compared the intensity of other polygons for the same earthquake. The results showed an increase in seismic intensities as the quality of the soil deteriorated. On ground type A there are more low intensities than high compared to the ground C. Intensities of earthquakes on ground C are more equally distributed. Ground type E and S_1 showed more high intensities than low compared to the ground type C. Ground S_1 has also more high intensities than ground E. Results on ground type D deviate from others, since according to EC8, we would expected higher values. This may be due to some unrevealed geological characteristics, like lateral distribution of soft ground, thickness of deposits, influence of topography or just because we have very limited macroseismic data for individual polygons within ground D. Therefore, it would be necessary to investigate also other properties of soft sediments in the future.

In general investigations based on intensity data in Slovenia are quite difficult to perform because there are not many strong earthquakes. Therefore, we have to use also lower intensity data, which are often not as indicative regarding the influence of local ground. The results of this study will contribute to a better assessment of seismic hazard in the greater Ljubljana area, because it is important that methodology of analysing macroseismic data sits side by side with other analyses of site effects.

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Makroseizmične raziskave vplivov lokalne geološke zgradbe na intenzitete izbranih potresov na širšem območju Ljubljane

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IZVLEČEK: Ljubljana leži na enem od treh potresno najbolj nevarnih območij v Sloveniji. Poleg tega mehkejši sedimenti v Ljubljanski kotlini močno vplivajo na potresno nihanje tal. Z makroseizmičnimi podatki smo raziskali vpliv geološke podlage na intenzitete nekaterih potresov na širšem območju Ljubljane. Določili smo intenzitete enajstih potresov na homogenih območjih, ki smo jih določili v skladu s klasifikacijo tal po evropskem standardu Evrokod 8 (EC8). Rezultati so pokazali sistematično povečevanje potresnih intenzitet, opredeljenih po Evropski potresni lestvici (EMS–98), s slabšanjem seizmogeoloških lastnosti tal. Rahlo odstopanje smo zaznali le na tleh vrste D, na katerih imajo potresi nekoliko nižje intenzitete od pričakovanih. Vzrok se lahko skriva v ostalih geoloških in drugih dejavnikih ali zgolj v tem, da imamo za posamezna območja na tleh D zelo malo podatkov.

KLJUČNE BESEDE: Evropska potresna lestvica, intenziteta, makroseizmične raziskave, Evrokod 8, potresna mikrorajonizacija, Ljubljanska kotlina

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1 Uvod

Potres je naravni pojav, ki ga ne moremo napovedati in nadzorovati, lahko pa ga dobro opišemo skozi analizo njegovih učinkov. Makroseizmični podatki podajalo sistematičen opis učinkov potresa na ljudi, predmete, zgradbe in naravo.

Amplituda nihanja tal je odvisna od žariščnih lastnosti potresa (magnituda, globina, oddaljenost, žariščni mehanizem), od vpliva regionalne geološke zgradbe na širjenje potresnega valovanja in od vpliva lokalne geološke zgradbe. Vpliv slednje imenujemo tudi vpliv lokalnih tal. Pri ocenjevanju potresne nevarnosti na mehkih tleh, pospešek nihanja tal na trdni skali v podlagi pomnožimo z ustreznim faktorjem tal.

Namen te raziskave je bil oceniti vpliv lokalne geološke zgradbe na intenzitete nekaterih potresov na širšem območju Ljubljane na podlagi klasifikacije tal po Evrokod 8 standardu (EC8) (SIST EN 1998–1, 2005; SIST EN 1998–1/A101, 2005). Za potrebe makroseizmičnih raziskav smo analizirali vprašalnike, ki jih hranimo v arhivu. Pri opredeljevanju intenzitete smo sledili načelom Evropske potresne lestvice (EMS–98) (Grünthal 1998). Intenzitete potresov smo določili za območja, katerih polmer ne presega 5 km in ki se nahajajo na homogenih tleh glede na EC8. Na podlagi geološke karte v merilu 1 : 100.000 in njenih tolmačev smo geološko podlago območja razdelili v pet razredov po EC8. Statistično analizo smo naredili za podatke treh ločenih skupin potresov. Pri vsaki skupini smo izbrali referenčno intenziteto primerjalnega poligona, s katero smo primerjali intenzitete drugih poligonov istega potresa.

2 Dosedanje raziskave vpliva lokalne geološke zgradbe na učinke potresov

Ojačitve potresnega valovanja v aluvialnih nanosih so že velikokrat prispevale k večji škodi in izgubi življenj, na primer v Christchurchu, 2011 (Bradley 2012) in v Emiliji–Romani 2012 (Maugeri s sod. 2013). Na območjih z zapleteno geološko sestavo se vpliv lokalnih tal lahko zelo spreminja (Toshinawa et. al. 1997). Po svetu je bilo narejenih že kar nekaj raziskav, s katerimi so na podlagi makroseizmičnih podatkov iskali povezavo med intenziteto in geološko podlago. Prve pomembnejše raziskave so bile narejene na Novi Zelandiji (Elder s sod. 1991, Toshinawa s sod. 1997). Tudi v Italiji je bilo opravljenih več raziskav o učinkih potresa npr. na območju Palerma (Giammarinaro s sod. 2005) in Rima (Cifelli s sod. 2000; Sbarra s sod. 2012). V Sloveniji smo velike razlike v poškodovanosti stavb opazovali v primeru potresov 1998 in 2004 v Krnskem pogorju. Pretežno smo jih lahko pojasnili z resonančnimi učinki med tlemi in objekti (Gosar 2007; Gosar 2010).

Na podlagi novejših rezultatov so strokovnjaki predlagali (Sbarra s sod. 2012) uporabo makroseizmičnih rezidualov pri izdelavi kart potresne nevarnosti. Ugotovili so, da na intenziteto vpliva tudi spreminjanje tal z globino in debelina posameznih plasti.

3 Geološke značilnosti in klasifikacija tal po EC8 na širšem območju Ljubljane

Ljubljana, ki je eno od treh potresno najbolj nevarnih območij v Sloveniji (Lapajne s sod. 2001), leži v plitvem sedimentnem bazenu zapolnjenim s heterogenimi kvartarnimi nanosi (slika 1), ki imajo različne seizmogeološke lastnosti. Razlikujemo tri glavne dele: Ljubljansko polje, Ljubljansko barje in obrobno hribovje. Podlago bazena gradijo permski in karbonski skrilavi glinavci, peščenjaki in konglomerati ter mezozojske karbonatne kamnine, ki izdanjajo na robovih hribovja. Ljubljansko polje prekrivajo prodni nanosi reke Save, na Ljubljanskem barju pa sta prod in pesek prekrita z jezerski in barjanski sedimenti.

Slika 1: Geološka karta območja Ljubljane (Zupančič s sod. 2004).

Glej angleški del prispevka.

V EC8 je vpliv lokalnih tal na učinke potresa predpisan s koeficientom tal S (ang. *soil factor*), ki nam pove, koliko večje pospeške nihanja pričakujemo v primerjavi z referenčno trdno kamnino. EC8 določa sedem tipov tal, ki so opisani s stratigrafskim profilom in tremi kvantitativnimi parametri: hitrostjo strižnega valovanja v zgornjih 30 m ($\upsilon_{s,30}$), z rezultatom standardnega penetracijskega preizkusa (N_{spt}) in strižno trdnostjo tal (c_u). Za posebna tipa tal S_1 in S_2 koeficient tal ni podan in ga je treba določiti s posebnimi raziskavami.

Vpliv krajevne geološke sestave na potresno nihanje tal podaja karta potresne mikrorajonizacije. Na podlagi geološke karte (OGK 100) in njenih tolmačev smo razširili karto potresne mikrorajonizacije Mestne občine Ljubljana (Zupančič s sod. 2004) na širše območje Ljubljane (slika 2). Tla so razdeljena v pet razredov:

- A – koeficient 1,00,
- C – koeficient 1,15,
- D – koeficient 1,35,
- E – koeficient 1,70,
- S_1 – koeficient 2,55.

Slika 2: Klasifikacija tal po EC8 na širšem območju Ljubljane.
Glej angleški del prispevka.

Uporabili smo klasifikacijo tal po EC8 na podlagi osnovne geološke karte (Zupančič s sod. 2004), kjer so geološko in litološko zgradbo območja Ljubljane povzeli po OGK 100, list Kranj (Grad in Ferjančič 1974), Ljubljana (Premru 1983), Postojna (Buser s sod. 1967) in Ribnica (Buser 1969). Ker je tiskana karta OGK 100 narejena na precej slabi geodetski podlagi, je tudi njena natančnost v digitalni obliki slabša. Na digitalni karti so zato privzeli natančnost mej 50 m. Zato moramo upoštevati, da makroseizmični opazovalci, ki se nahajajo blizu meje, morda niso uvrščeni v pravi razred tal po EC8.

Jugozahodni del ozemlja (Ljubljansko barje) spada v tip tal S_1, večina vzhodnega in del zahodnega ozemlja spada v tla A, osrednji del v tla C, vmes pa so manjša območja, ki spadajo v tip tal D in E (slika 2). Na širšem območju Ljubljane ni ugotovljenih tal tipa B ali S_2.

4 Zbiranje makroseizmičnih podatkov in opredeljevanje intenzitete

Oceno učinkov potresa na predmete, ljudi, zgradbe in naravo podaja intenziteta potresa, ki jo določimo s pomočjo intenzitetne lestvice. Prvi korak je pridobitev vseh opisnih informacij o učinkih potresa na določeni lokaciji. Podatke nato razvrstimo po naseljih ter jih primerjamo s seznamom diagnostičnih kriterijev ter določimo kateri opis intenzitetnih stopenj najbolj ustreza podatkom.

Makroseizmične vprašalnike hranimo v arhivu Urada za seizmologijo in geologijo. Podatki vključujejo vprašalnike, ki so jih opazovalci poslali po pošti, po elektronski pošti ali preko spletnega obrazca. Intenzitete smo določali za izbrana območja v Ljubljani, opredeljena s klasifikacijo tal po EC8 in ne po naseljih, kot je običajno. Vsaka ocenjena intenziteta se nanašala na območje, katerega polmer ne presega 5 km, in ki se nahaja na homogenih tleh po EC8, saj je sicer razpon zabeleženih učinkov lahko zelo velik, glede na to da se geotehnične lastnosti tal spreminjajo. Posledično smo tla, kjer prebivajo opazovalci, razdelili na več poligonov (slika 3) in vsakemu poligonu določili intenziteto potresa. Določili smo 4 poligone na tleh tipa S_1, 2 na tleh E, 6 na tleh D, 10 na tleh C in 8 poligonov na tleh tipa A. Pri opredeljevanju intenzitete smo sledili načelom Evropske potresne lestvice (EMS–98) (Grünthal 1998).

Slika 3: Poligoni homogenih tal glede na tip tal po EC8, za katere smo opredelili intenziteto potresov. Točke označujejo lokacije opazovalcev.
Glej angleški del prispevka.

5 Uporabljene metode in analiza podatkov

Za analizo makroseizmičnih podatkov smo zbrali 17 potresov (preglednica 1), ki so se zgodili med letoma 1998 in 2005 ter so bili dovolj močni za naš namen. Iz te skupine smo nato uporabili 11 tistih, ki so čim bolje izpolnjevali naslednje pogoje:

- da so čim bolj oddaljeni od Ljubljane. V tem primeru lahko zanemarimo razlike v nadžariščni razdalji med različnimi deli mesta in tako vidimo razlike v intenzitetah zaradi vpliva geološke podlage;

- da potresno valovanje prihaja iz podobne smeri. Vpliv geološke zgradbe na širjenje potresnega valovanja je v tem primeru podoben;
- da so dosegli največjo intenziteto najmanj V EMS, na območju Ljubljane pa najmanj IV–V EMS;
- da zanje obstoja zadostno število makroseizmičnih podatkov.

Pri potresih v okolici Brezovice (2002) in pri Cerknem (2005) je šlo za več zaporednih sunkov, katerih učinke smo opredeljevali skupaj, saj je bilo premalo podatkov, ki bi omogočili točno opredelitev intenzitete vsakega sunka posebej.

Raziskavo smo opravili za tri skupine potresov. Najprej smo se osredotočili na potrese (pet od njih), ki pogoje najbolje izpolnjujejo. Njihova oddaljenost od Ljubljane je med 45 in 120 km. Potresno valovanje te skupine prihaja iz severozahodne smeri. Druga skupina potresov pogojev ne izpolnjuje tako dobro (šest od njih). Njihova oddaljenost od Ljubljane je manjša in sicer med 10 in 45 km, potresno valovanje pa prihaja iz različnih smeri. Ocenjene intenzitete potresov te skupine so malo nižje od tistih v prvi skupini. Tretja skupina predstavlja vseh enajst potresov. Analizirali smo 1296 vprašalnikov o potresnih učinkih, ki jih je izpolnilo 616 opazovalcev. Obravnavali smo širše območje Ljubljane, ki se razteza na jugu do Želimelj, na severu do Trzina, na zahodu do Dragomera in na vzhodu do vasi Volavlje (slika 3).

6 Rezultati in razprava

Za vsako od treh skupin potresov smo izbrali primerjalni poligon, katerega intenziteta je bila referenčna. Z njo smo primerjali intenzitete drugih poligonov za vsak potres (preglednica 3). Število vseh ocenjenih intenzitet znaša 224 in so podane v preglednici 2.

V preglednici je poleg intenzitete v oklepaju podano še število vprašalnikov na podlagi katerih je bila intenziteta opredeljena. Intenzitet, ki so določene le na podlagi enega vprašalnika (označeno rdeče), nismo uporabili v statistični analizi. V nadaljnji raziskavi smo uporabili 160 intenzitet. Pri razponu intenzitet, npr. IV–V EMS, je bila v izračunih uporabljena vrednost 4,5.

Za primerjalnega smo izbrali poligon na tleh tipa C, saj imajo tla C srednje vrednosti geomehanskih parametrov glede na ostale tipe tal. V skupini vseh enajstih potresov smo izbrali tretji (C_3), v skupini petih potresov drugega (C_2) in v skupini ostalih šest potresov peti poligon (C_5). Izbran poligon vsebuje podatke za vse potrese, ne vsebuje podatka, da opazovalec potresa ni čutil, in ima približne srednje vrednosti intenzitet v primerjavi z ostalimi poligoni na tleh C. Poligona C_4 nismo izbrali za primerjalnega, ker njegove vrednosti nekoliko odstopajo od povprečnih.

Za vsak poligon smo izračunali odstopanje od referenčne intenzitete za vsak potres posebej ter več srednjih vrednosti odstopanj od referenčne intenzitete, in sicer: aritmetično sredino, mediano, modus in modificirano mediano, pri kateri smo predpostavili, da je podatek »ni čutil« najmanjši. Pri izračunu aritmetične sredine pa podatka nismo upoštevali, če opazovalci potresa niso čutili.

Najprej smo opravili statistično analizo vsakega posameznega poligona (preglednica 3) in nato še za združene poligone glede na tip tal po EC8 (preglednica 4).

Rezultati na podlagi petih potresov kažejo, da odstopanja od referenčne intenzitete naraščajo s slabšanjem lastnosti tal (predvsem na tleh tipa E). Vendar pa rezultati tipa tal D odstopajo od ostalih, saj bi glede na koeficient tal po EC8 pričakovali višje vrednosti od tistih na tleh C in ne manjše. Verjetno tičijo vzroki v neodkritih geoloških in ostalih dejavnikih.

Rezultati na podlagi vseh enajstih potresov kažejo podoben trend naraščanja vrednosti odstopanj od referenčne intenzitete kot pri rezultatih analize petih potresov. Na tleh D dobimo višjo aritmetično sredino od tiste na tleh C, nasprotno pa je modus negativen.

V preglednici 5 podajamo, kolikokrat je bila intenziteta manjša, večja ali enaka referenčni intenziteti na tleh C, ki so bila privzeta za primerjalna tla. Modra barva označuje intenzitete, ki prevladujejo na posameznih tleh.

V skupini petih potresov je vidno poviševanje intenzitet s slabšanjem tal. Na tipu tal A imamo opredeljenih več nižjih intenzitet kot višjih. Tla C imajo precej enakomerno razporejene intenzitete, kar je pričakovano, glede na to, da smo ta tla izbrali za primerjalna. Tla E imajo več višjih intenzitet kot nižjih in prav tako tudi tla S_1. Tla S_1 imajo tudi več višjih intenzitet kot tla E, kar je pričakovano po EC8. Edini podatki, ki odstopajo, so tisti za tla D, saj so intenzitete na teh tleh nekoliko nižje od intenzitet na tleh C. Opazili pa smo veliko odstopanje intenzitet znotraj tal D, kar nakazuje velik vpliv drugih dejavnikov. V preglednici

Preglednica 1: Podatki o potresih uporabljenih v tej študiji.

datum	čas u:m:s UTC	zemlj. širina °N	zemlj. dolžina °E	globina (km)	MLV	Imax (EMS-98)	območje epicentra	oddaljenost od središča Ljubljane (km)	smer od centra Ljubljane	število vprašalnikov	Imax za širše območje Ljubljane (EMS-98)
25.09.1996	17:56:30	46.17	14.4	19	3.7	IV-V	SMLEDNIK – Podreča-Mavčiče	15	N	90	
13.03.1998	15:14:57	45.6	14.25	14.3	4.2	V	ILIRSKA BISTRICA – Šembije-Koritnice	50	SW	82	IV-V
26.03.1998	16:26:00	43.08	12.6	46	5.1	IV-V	ITALIJA – Umbrija	380	SW	23	
12.04.1998	10:55:33	46.31	13.63	7.6	5.5	VII-VIII	KOBARID – Lepena	80	NW	170	V
06.05.1998	2:53:00	46.28	13.7	5.1	4.2	V-VI	KOBARID – Lepena	80	NW	72	V
31.08.1998	2:32:04	45.93	14.88	15.6	4.2	VI	IVANČNA GORICA – Sela pri Dobu	35	SE	59	V
17.09.1998	5:29:43	46.01	14.77	15.7	3.4	V	LITIJA – Gološče	20	W	81	
24.09.1998	3:59:05	46.05	14.74	13	3.3	IV-V	Šmartno pri Litiji – Koške Poljane	18	E	100	
14.02.2002	3:18:00	46.13	13.1	11.2	4.5	V	FURLANIJA – Moggio Udinese	120	NW	33	IV
20.10.2002	17:42:56	46.03	14.42	11	2.5	V	Brezovica pri Ljubljani	10	SW	162	V
	17:44:13	46.02	14.41	11	2.7	V					
	17:46:01	46.02	14.41	7	2.4	IV-V	Lukovica pri Brezovici				
	17:49:19	46.03	14.4	9	1.8	III					
	18:21:54	46.01	14.4	7	3.1	V	BARJE – Podplešivica				
12.07.2004	13:04:06	46.31	13.62	11	4.9	VI-VII	KOBARID – Lepena	80	NW	100	V
22.09.2004	14:55:48	46.11	14.77	16	3.5	V	MORAVČE – Zgornji Prekar	20	NE	133	V
14.01.2005	7:58:11	46.2	14.03	19	4	V	CERKNO – Davča	45	NW	156	V
	8:05:18	46.19	14.05	19	3.8						
23.01.2009	3:28:00	46.07	14.42	19	2.9	IV	DOBROVA – Šujica	7	W	176	
01.08.2009	3:04:37	46.16	14.53	18	2.5	IV	MENGEŠ – Šinkov Turn	10	N	83	
15.01.2010	14:20:54	45.77	14.19	15	3.7	V	POSTOJNA – Veliki Otok	45	SW	139	IV
24.02.2010	5:21:25	46.1	14.6	11	3.2	V	LJUBLJANA – Dragomelj	10	NE	190	V
								Σ vprašalniki o petih potresih		**531**	
								Σ vprašalnik o enajstih potresih		**1296**	
								Σ o vseh potresih		**1849**	

barvna legenda: oranžna potresi, ki navedene pogoje najbolje izpolnjujejo | rumena potresi, ki pogoje nekoliko slabše najbolje izpolnjujejo | neobarvano potresi, ki niso bili uporabljeni v nadaljnji raziskavi

Preglednica 2: Intenzitete (EMS–98) potresov po poligonih. V oklepaju je število uporabljenih vprašalnikov.

POLIGON / POTRES	potresi, ki pogoje nekoliko slabše izpolnjujejo						potresi, ki pogoje najbolje izpolnjujejo				
	13. 03. 1998	31. 08. 1998	20. 10. 2002	22. 09. 2004	15. 01. 2010	24. 02. 2010	06. 05. 1998	12. 04. 1998	14. 02. 2002	12. 07. 2004	14. 01. 2005
A_1		IV–V (2)	I (1)	IV(2)			III–IV (1)	V (4)	III (1)		I (1)
A_2	I (1)			III–IV (5)	I (1)		I (1)	V (9)		III (1)	
A_3	I (1)	IV–V (1)	III–IV (2)	IV(4)	I (2)	IV–V (2)		V (7)		IV (2)	III–IV (2)
A_4									I (1)		
A_5	I (1)		IV–V (2)		I (2)			IV–V (1)			III (1)
A_6			V (5)	I (1)	I (1)			V (6)	I (1)	IV (1)	IV–V (4)
A_7						IV (1)					
A_8			III–IV(1)								
C_1	III–IV (2)		V (3)	I (1)	I (1)	IV (1)	III–IV (2)	V (5)		IV (2)	IV–V (2)
C_2	II (3)	V (3)	IV (6)	V (11)	IV (8)	IV–V (17)	III–IV (1)	V (6)	III–IV (1)	IV–V (4)	IV (8)
C_3 primerjalni poligon	**III–IV (3)**	**V (3)**	**III (6)**	**V (7)**	**IV (6)**	**IV–V (8)**	**IV (3)**	**V (4)**	**IV (4)**	**IV (2)**	**IV (10)**
C_4	IV (25)	V (18)	IV (42)	V (24)	IV (35)	IV–V (52)	IV–V (20)	V (35)	IV (5)	V (31)	IV–V (38)
C_5	IV (3)	V (4)	IV (9)	IV (9)	IV (15)	IV (15)	IV (6)	V (9)		IV–V (4)	IV (14)
C_6	IV (3)	V (8)	I (1)	IV (4)	I (1)	IV (5)	IV (4)	V (8)	I (1)	IV (3)	IV (3)
C_7	IV (5)	IV–V (2)	IV–V (3)	I (3)	I (2)	IV–V (5)	I (5)	IV–V (6)	I (1)	III (2)	IV–V (3)
C_8	IV (6)	V (3)	IV (4)	IV–V (5)	IV (4)	IV–V (3)	I (2)	V (6)	I (2)	IV–V (5)	I (2)
C_9	I (1)						III–IV (1)	IV (1)		IV (1)	
C_10			I (1)	III (1)	IV (1)	IV (2)					
D_1	III–IV (1)	I (1)		IV (1)	I (2)	IV (3)		IV–V (2)		IV (3)	
D_2	IV (1)		V (3)	I (1)	I (2)		IV (1)	V (2)		IV–V (3)	V (3)
D_3	III (1)	V (1)	IV (3)	I (2)	I (1)	IV (3)	III (1)	IV–V (2)	I (1)	III (1)	IV (1)
D_4	III–IV (2)	V (1)	IV (2)	III–IV (2)	I (1)	IV–V (11)	I (2)	V (2)	I (1)	V (2)	III–IV (2)
D_6				IV (1)		IV (1)					
E_1	IV–V (3)	V (1)	IV (9)	III–IV (6)	IV (8)	V (13)	IV–V (2)	V (7)	I (6)	V (4)	IV (4)
E_2	IV (2)	V (1)	V (8)	IV (4)	I (3)	IV–V (8)	V (5)	V (7)	I (1)	IV–V (3)	IV (12)
S1_1	IV–V (3)	IV (1)	V (13)	III–IV (8)	IV (6)	IV–V (8)	I (1)	V (5)		V (6)	V (11)
S1_2	I (2)	V (2)	III–IV (3)	IV (2)	I (2)	IV (2)	I (1)	V (3)	I (1)	IV (1)	IV (1)
S1_3	IV (6)	V (7)	IV–V (30)	IV (16)	IV (20)	IV (17)	IV–V (12)	V (20)	III (6)	V (12)	IV–V (28)
S1_4	I (1)										

Preglednica 3: Statistična analiza vseh enajstih potresov glede na posamezne poligone.

POLIGON / POTRES	potresi, ki nekoliko slabše izpolnjujejo pogoje						potresi, ki najbolje izpolnjujejo pogoje					srednje vrednosti			
	13. 03. 1998	31. 08. 1998	20. 10. 2002	22. 09. 2004	15. 01. 2010	24. 02. 2010	06. 05. 1998	12. 04. 1998	14. 02. 2002	12. 07. 2004	14. 01. 2005	aritmetična sredina (M)	mediana (Me)	modus (Mo)	modificirana Me
A_1		–0,5		–1				0				–0,500	–0,5		–0,5
A_2				–1,5				0				–0,750	–0,75		–0,75
A_3			0,5	–1	n2	0		0		0	–0,5	–0,167	0	0	0
A_4															
A_5			1,5		n2							1,500	1,5	0,5	
A_6			2					0			0,5	0,833	0,5		0,5
A_7															
A_8															
C_1	0		2				–0,5	0		0	0,5	0,333	0	0	0
C_2	–1,5	0	1	0	0	0		0		0,5	0	0,000	0	0	0
C_3	0	0	0	0	0	0	0	0	0	0	0	0,000	0	0	0
C_4	0,5	0	1	0	0	0	0,5	0	0	1	0,5	0,318	0	0	0
C_5	0,5	0	1	–1	0	–0,5	0	0		0,5	0	0,050	0	0	0
C_6	0,5	0		–1		–0,5	0	0		0	0	–0,125	0	0	0
C_7	0,5	–0,5	1,5	n3	n2	0	n5	–0,5		–1	0,5	0,071	0	0,5	–0,5
C_8	0,5	0	1	–0,5	0	0	n2	0	n2	0,5	n2	0,188	0	0	0
C_9															
C_10						–0,5						–0,500	–0,5	–0,5	–0,5
D_1					n2	–0,5		–0,5		0		–0,333	–0,5	–0,5	–0,5
D_2			2		n2			0		0,5	1	0,875	0,75		0,5
D_3			1	n2		–0,5		–0,5				0,000	–0,5	–0,5	–0,5
D_4	0		1	–1,5		0	n2	0		1	–0,5	0,000	0	0	0
D_6															
E_1	1		1	–1,5	0	0,5	0,5	0	n6	1	0	0,278	0,5	1	0,5
E_2	0,5		2	–1	n3	0	1	0		0,5	0	0,375	0,25	0	0
S1_1	1		2	–1,5	0	0		0		1	1	0,438	0,5	1	0
S1_2	n2	0	0,5	–1	n2	–0,5		0				–0,200	0	0	–0,75
S1_3	0,5	0	1,5	–1	0	–0,5	0,5	0	–1	1	0,5	0,136	0	0,5	0
S1_4															

Preglednica 4: Statistična analiza potresov glede na tip tal po EC8 za pet potresov (levo) in vseh enajst potresov skupaj (desno). Številke poleg tipa tal označujejo koliko intenzitet je bilo uporabljenih v analizi.

tip tal (EC8)	srednje vrednosti za pet potresov			
	aritmetična sredina (M)	mediana (Me)	modus (Mo)	modificirana Me
A (7)	–0,071	0	0	0
C (36)	0,063	0	0	0
D (10)	–0,056	0	–0,5	–0,25
E (9)	0,375	0	0	0
S1 (9)	0,333	0,5	0	0,5
tip tal (EC8)	**srednje vrednosti za vseh enajst potresov**			
	aritmetična sredina (M)	mediana (Me)	modus (Mo)	modificirana Me
A (17)	0	0	0	0
C (77)	0,092	0	0	0
D (21)	0,147	0	–0,5	0
E (19)	0,324	0,5	0	0
S1 (26)	0,167	0	0	0

Preglednica 5: Število primerov, ko je intenziteta manjša, enaka ali večja referenčni intenziteti primerjalnih tal po EC8. Rezultati za skupino petih potresov (levo) in vseh enajstih potresov skupaj (desno).

tip tal (EC8)	statistična analiza za pet potresov		
	$I<I_{ref}$	$I=I_{ref}$	$I>I_{ref}$
A (7)	2	4	1
C (36)	9	12	10
D (10)	5	3	2
E (9)	1	5	3
S1 (9)	1	3	5
tip tal (EC8)	**statistična analiza za vseh enajst potresov**		
	$I<I_{ref}$	$I=I_{ref}$	$I>I_{ref}$
A (17)	7	6	4
C (77)	17	30	19
D (21)	10	5	6
E (19)	4	6	9
S1 (26)	8	8	10

intenzitet vseh enajstih potresov smo dobili podobne rezultate. Kljub temu, da ostalih šest potresov nekoliko slabše izpolnjuje pogoje, smo tudi pri njih dobili podobne rezultate.

Opravili smo tudi Wilcoxov rank–sum test (SPSS Inc. 1999), to je neparametričen test, da bi določili značilne razlike med srednjimi vrednostmi neodvisnih vzorcev. Pokazal je podobne rezultate kot drugi testi in sicer, da se od tal C najbolj razlikujejo tla S_1 in najmanj tla D.

7 Sklep

Ojačitve potresnega valovanja so v preteklosti pogosto prispevale k večji škodi in izgubi življenj ob potresih. Prav zaradi težkih poškodb objektov, povzročenih z lokalnimi učinki, so se študije vplivov mehkih sedimentov zelo povečale. Ker kvantitativni podatki gibanja tal niso vedno na voljo za izvedbo mikroseizmičnih raziskav, je pomembna analiza makroseizmičnih podatkov o učinkih potresa.

Raziskave so zajele širše območje Ljubljane, za katerega smo opredelili intenzitete z uporabo 1296 makroseizmičnih vprašalnikov, ki so se nanašali na 11 različnih potresov. Intenzitete smo določali za območja katerih polmer ni presegel 5 km in ki ležijo na homogenih tleh po EC8. Tla smo klasificirali po EC8 na podlagi OGK (Zupančič s sod. 2004), vendar se je pri nekaterih litoloških enotah pojavila dilema pri določanju tipa tal. Vzrok je predvsem v nedorečenosti pri klasificiranju tal po EC8 glede na opis litološke sestave in pomanjkanju kvantitativnih podatkov o geomehanskih lastnostih. To velja predvsem za sedimente Ljubljanskega barja (tip tal S_1). Območje smo nato znotraj istega tipa tal razdelili na več poligonov in vsakemu poligonu določili intenziteto potresa.

Statistične analize smo opravili na treh različnih skupinah potresov. Za vsako skupino smo izbrali referenčni poligon na tipu tal C. Rezultati so pokazali povišanje intenzitete potresov na slabših tleh. Na tipu tal A je bilo opredeljenih več nižjih intenzitet kot višjih v primerjavi s tlemi C. Intenzitete potresov na tleh C so enakomerno razporejene. Tla E in S1 imajo več višjih intenzitet kot nižjih v primerjavi s tlemi tipa C. Tla S1 pa imajo tudi več višjih intenzitet kot tla E. Na tipu tal D se pojavi odstopanje rezultatov, saj bi po EC8 pričakovali višje vrednosti. Morda tičijo vzroki v ostalih neodkritih geoloških dejavnikih, kot so lateralna razširjenost mehkih zemljin, debelina nanosov, vpliv topografije ali pa zgolj v tem, da imamo za posamezne poligone na tleh D zelo malo podatkov. V prihodnje bi bilo torej dobro raziskati tudi druge lastnosti mehkih sedimentov.

Raziskave na podlagi podatkov o intenzitetah je v Sloveniji dokaj težko opravljati, saj ni veliko močnih potresov. Zato se moramo zadovoljiti s podatki o nižjih intenzitetah, ki pa pogosto niso tako indikativni glede vpliva lokalnih tal. Rezultati te študije prispevajo k boljši oceni potresne nevarnosti na širšem območju Ljubljane, saj je pomembno, da metodologijo analize makroseizmičnih podatkov postavimo ob bok drugim metodam analize lokalnih učinkov potresov.

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8 Literatura

Glej angleški del prispevka.

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THE TERRACED LANDSCAPE IN THE BRKINI HILLS

TERASIRANA POKRAJINA V BRKINIH

Lučka Ažman Momirski, Drago Kladnik

Cultivated terraces are one of the most typical cultural landscape elements in the Brkini Hills.
Kmetijske terase so ena najbolj značilnih prvin brkinske kulturne pokrajine.

The terraced landscape in the Brkini Hills

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ABSTRACT: The study of terraced landscapes is becoming an increasingly important area of international research. This paper starts by presenting the most important research and professional activities related to terraced landscapes and examples of studying them around the globe. This is followed by a detailed presentation of the features of the unique terraced landscape in the Brkini Hills, Slovenia. For a more detailed analysis, five villages were selected in the central and western part of the region. Interdisciplinary research includes studying extremely unfavorable demographic processes, natural factors at work in the modern terraced landscape, historical changes in landscape phenomena, and a detailed observation of the terrace forms that comprise the terraced landscape. Despite modern mechanized farming, the remaining farmers are finding it increasingly difficult to maintain the terraced landscape, which is also threatened by afforestation. The mixture of very long terrace platforms and the distinct intermediate slopes presents a unique experiential value that is increasingly being lost.

KEY WORDS: rural geography, cultural landscape, land use, terraced landscape, cultivated terraces, Brkini Hills, Slovenia

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1 Introduction

The study of terraced landscapes intensified at the close of the twentieth century. In 1997, Cinque Terre, a belt on the northeastern coast of the Ligurian Sea in Italy, was added to the UNESCO World Heritage List (under the new »cultural landscape« category; Alberti and Lodatti 2012). This steep cliff coast is also an exceptionally picturesque terraced area. The significance of areas »whose character is the result of the action and interaction of natural and/or human factors« (Internet 1, Article 1 of the General Provisions) was also highlighted by the adoption of the European Landscape Convention.

Between 2001 and 2010, several international projects on safeguarding, restoring, and planning terraced landscapes were carried out, including the following:
- PATTER: the purpose of this project was to identify and describe the types and condition of cultivated terraces on the Spanish island of Majorca, and in the areas surrounding Nice and Genoa (Lasanta et al. 2013);
- PROTERRA: this project supported twelve pilot actions aimed at restoring cultivated terraces in six Mediterranean countries (Internet 2);
- ALPTER: the main goal of this project was to improve awareness of the spatial features of terraced landscapes in the Alpine region (Internet 3); and
- TERRISC: this project explores the preservation of terraced landscapes as a strategy for preventing natural disasters, especially floods and erosion, in the Balearic and Canary Islands, Portugal, and southwest France (Internet 4).

The EU included cultivated terraced landscapes in its 2007–2013 rural development plan, its Biodiversity Action Plan for Agriculture (to improve or maintain biodiversity and prevent its decrease due to agricultural activities), and its Soil Thematic Strategy. The EU also supports areas with limited development opportunities and agricultural areas with highly ranked natural values, which in many cases include terraced land. The preservation and maintenance of terraced landscapes are also among the priorities of the Soil Thematic Strategy (Lasanta et al. 2013).

The international study of terraced landscapes reached its peak with the first two international conferences on terraced landscapes. At the first one, which took place in China in the fall of 2010, the International Terraced Landscapes Alliance (ITLA) was established and the Honghe Declaration on the protection and development of terraces (Internet 5) was adopted. Together with over a hundred conference papers on various aspects of terraced landscapes from around the globe, this declaration is also published in extensive volumes in Chinese and English (Peters and Junchao 2012). Not many regional studies of terraced landscapes were presented at the conference. In addition to a fairly insufficient presentation of the global distribution of terraced landscapes (Rivera 2012) and the ALPTER project results in the Veneto region (Alberti and Lodatti 2012), the noteworthy contributions are on efforts to protecting the traditional terraced landscape in the southern Chinese province of Yunnan (Wenxing, Kun and Lingchong 2012) and efforts to protect and develop terraced areas in the Philippine Cordilleras (Baguilat 2012). Ann Kendall's article (2012) presents in detail the study of extensification of cultivated terraces in the Alpujarra Valley on the southern rims of the Sierra Nevadas (Douglas, Critchley and Park 1996) and compares them to the Inca terraces in Peru.

The second ITLA conference was held in Peru in the spring of 2014. It began with the presentation of an important Chinese achievement: in 2013, the cultural landscape of the Hani rice terraces in Honghe Prefecture in the province of Yunnan was listed as a World Heritage Site (Junchao 2014). The extensive study of eleven terraced landscapes in Peru took into account both active and abandoned terraces (Lambruschini 2014), and especially interesting was the comparison of the features and issues of terraced landscapes in Peru and Japan (Baba 2014). The restoration of Bolivian terraces was presented in detail using the case of the settlements in Tapacarí Province in the Cochabamba Department (Crespo 2014). There were a few presentations of European terraced landscapes; noteworthy among them were the efforts to preserve the terraced landscape in the Cembra Valley north of Trento in the Trentino–Alto Adige region in Italy (Zanotelli 2014).

With the expansion of the research area, the publication of research findings also intensified. The results of the ALPTER project had already been presented in two publications: *Terraced Landscapes of the Alps: Atlas* (Scaramellini and Varotto 2008) and *Terraced Landscapes of the Alps: Projects in Progress* (Fontanari and Patassini 2008). The first publication also includes several syntheses of results of regional studies conducted as part of this project (Castex et al. 2008; Brancucci and Comenale Pinto 2008; Freppaz et al. 2008; Mazzoleni et al. 2008; Werder et al. 2008; Chemin and Varotto 2008; Ažman Momirski 2008; Arnberger, Eder and Brandenburg 2008). With regard to the ALPTER project, one also needs to mention the interdisciplinary volume on the terraced landscape of the Gorizia Hills (Ažman Momirski et al. 2008), which also includes studies on land use changes and landslide hazard. This publication is definitely the most comprehensive Slovenian presentation of this topic to date.

An exhaustive chronological overview of research on cultivated terraces and terraced landscapes in Slovenia, and an outline of Slovenian terraced landscapes were only published a few years ago (Ažman Momirski and Kladnik 2009). Considering that in many parts of Slovenia cultivated terraces have fairly strongly (and in some places even predominantly) characterized the landscape, one would rightfully expect that much more research has been done in this area. The currency of this research topic was definitely the impetus for two graduate-level studies by Helena Križaj Smrdel (2010a; 2010b). Continued national research on Slovenian terraced landscapes provided the motivation for a volume on terraced landscapes in sub-Mediterranean Slovenia (Ažman Momirski 2014).

The traditional terraced landscape of the Brkini Hills is unique in both Slovenia and beyond, and it therefore deserves more detailed treatment. It has been studied relatively poorly to date. Perhaps the most direct treatment so far has been provided by a comparative study of the land use changes in the Mediterranean terraced settlements of Krkavče in the Koper Hills and Ostrožno Brdo in the Brkini Hills (Ažman Momirski and Gabrovec 2014); Ostrožno Brdo is also one of the five sample settlements in this study. It was also studied as a pilot area by Križaj Smrdel (2010a; 2010b). It is interesting that in his detailed demographic and economic study of the region between Mount Snežnik and Mount Slavnik, in which he also describes in detail the conditions in the Brkini Hills, the recognized Slovenian social geographer Vladimir Klemenčič was barely aware of cultivated terraces and terraces as important landscape elements because he mentions them only fleetingly in two places (Klemenčič 1959).

1.1 Outline of the study area

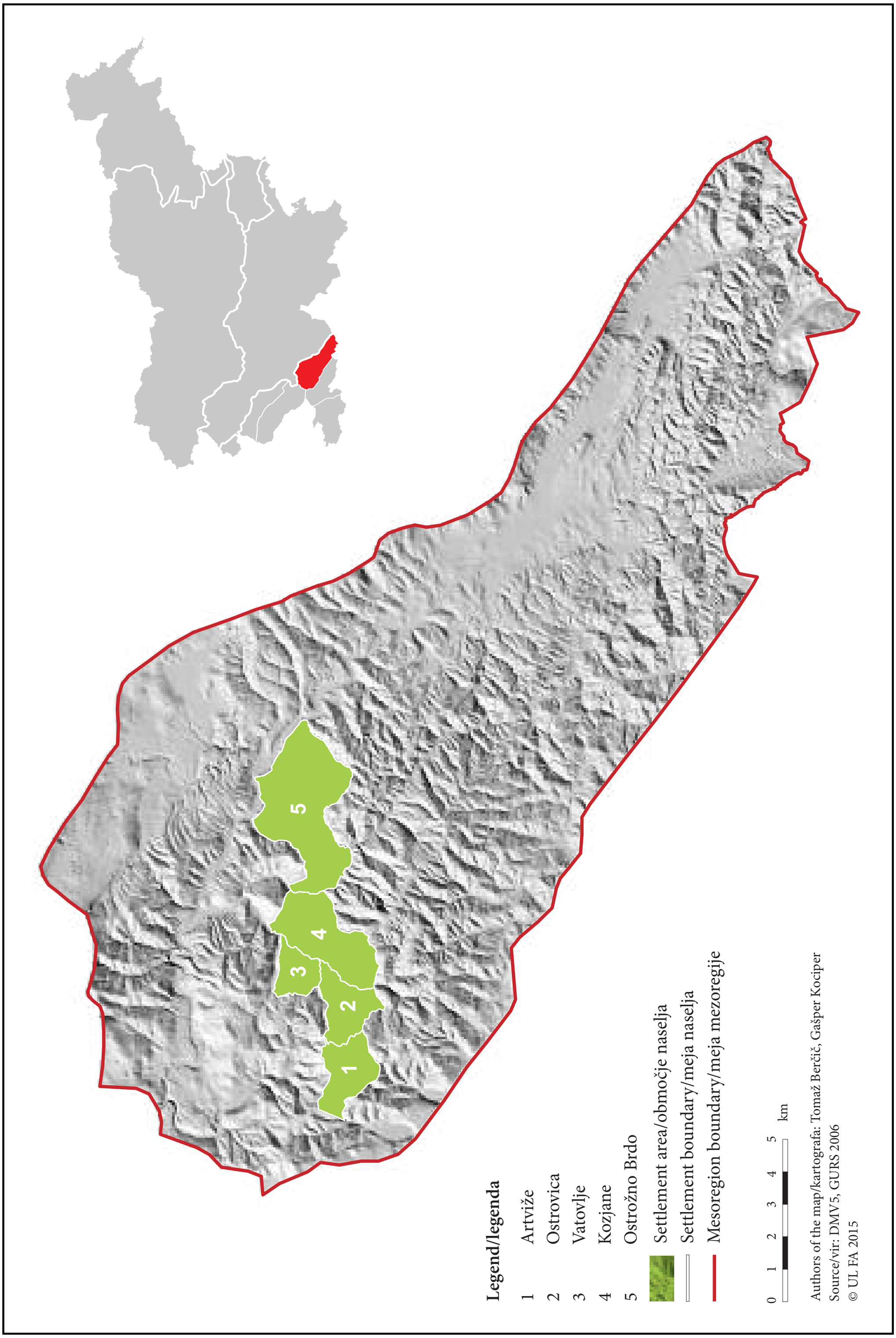
Slovenia is among the few places in Europe with cultivated terraces throughout the entire country. They appear in all types of Slovenian landscapes, but differ by frequency, purpose, and contemporary function (Ažman Momirski and Kladnik 2009).

Not many countries can compare to Slovenia in terms of landscape diversity; it is located at the intersection of the Alps, the Pannonian Plain, the Dinaric Alps, and the Mediterranean, and is influenced by the Germanic, Hungarian, Slavic, and Romance cultures. It is known for both its natural and cultural diversity, as well as its variability and transitional character. One can distinguish between four basic landscape types and nine subtypes (Kladnik, Perko and Urbanc 2009). One of the basic Slovenian landscape types is the Mediterranean landscape, which is divided into two subtypes: Mediterranean low hills and Mediterranean plateaus (Perko 1998). Mediterranean hills are characterized by a poorly permeable flysch substratum, and Mediterranean plateaus are characterized by a permeable limestone substratum, of which diverse karst features are typical. The majority of terraces that define the most typical terraced landscapes can be found in the Mediterranean region, but many can also be found in karst Dinaric landscapes and the winegrowing Pannonian low hills (Ažman Momirski and Kladnik 2009). They are rarer elsewhere, but only a few Slovenian landscapes lack them completely. Among the nine natural subtypes, only the Pannonian plains are completely without any terraces.

The Brkini Hills are classified under Mediterranean low hills, but their characteristics make them significantly different from typical Mediterranean low hills (e.g., the Gorica, Koper, and Vipava Hills, and even the flysch Vipava Valley); because of their higher elevation (their highest point, 817 m above sea level, is at Saint Servulus' Church above Artviže), they are more like hills, and because of their location towards the interior of Slovenia they combine the features of the Mediterranean and continental climates (Ogrin 1996).

The mesoregion of the Brkini Hills and Reka Valley has a diverse landscape composition and runs in a northwest-southeast Dinaric direction in southwest Slovenia (Figure 1). It has an area of 341.5 km², which accounts for 1.68% of Slovenia's total area. The region is divided between the municipalities of Divača, Hrpelje - Kozina, Ilirska Bistrica, and Pivka, and also includes the Reka Valley in addition to the Brkini Hills. The Reka Valley is divided into the Podgora area, the Ilirska Bistrica Basin, the gorge section of the valley, and the Vreme Valley; in addition, the Košana Valley north of the Reka Valley is also part of the mesoregion.

Figure 1: Location of the five settlements studied in the Brkini Hills mesoregion and the location of the mesoregion in Slovenia. ➤


1
2
3
4
5
Legend/legenda
1 Artviže
2 Ostrovica
3 Vatovlje
4 Kozjane
5 Ostrožno Brdo
Settlement area/območje naselja
Settlement boundary/meja naselja
Mesoregion boundary/meja mezoregije
0 1 2 3 4 5 km
Authors of the map/kartografa: Tomaž Berčič, Gašper Kociper
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The Brkini Hills are predominantly composed of impermeable Eocene flysch and can be divided into the western, central, and eastern parts. There is another area of less pronounced flysch hills beyond the Jelšane lowland to the southeast, which can be referred to as the Jelšane Hills (Šebenik and Kladnik 1998). The majority of terraces – which can be classified as agricultural under the basic typology (Ažman Momirski and Kladnik 2009) – can be found in the central and western parts of the Brkini Hills. Therefore, five settlements were selected in this area for more detailed study: Artviže in the Municipality of Hrpelje - Kozina, Ostrovica, Vatovlje, and Kozjane in the Municipality of Divača, and Ostrožno Brdo in the Municipality of Ilirska Bistrica.

The selected settlements in the northwestern part of the mesoregion border on one another, and the total area they cover runs in an east-west direction and measures 2,201.9 ha or 6.4% of the entire mesoregion. The average elevation of the mesoregion is 562 m, but the average elevation of the area studied is nearly 635 m. Compared to the rest of the mesoregion, it includes more land with a northern and eastern aspect, but even more obvious is its greater inclination: its predominant slope gradient ranges from 30.1% to 50% (16.8° to 26.6°; 44.5% of the area), whereas the inclination in the rest of the region predominantly ranges from 15.1% to 30% (8.6° to 16.7°; 32.4% of the region). In the entire mesoregion, 30.9% of land has a slope gradient below 15% (below 8.5°), whereas in the pilot area this percentage is only 10.6%. The Brkini Hills and the Reka Valley have a 71.4 percent share of forest, which ranks them among extremely wooded Slovenian mesoregions. The study area is even more wooded than that (81.4%); meadows and pastures predominate among agricultural areas and tilled land accounts for less than one percent (0.83%).

The study area of the five settlements lies in Škocjan Caves Regional Park, which covers 450 km² and includes the entire Reka watershed (Internet 6). The five settlements studied also partly extend into water protection zones. The southern part of Ostrožno Brdo extends into a natural asset area (the Šmagurka Creek Valley), and its northern part along the Reka River belongs to important ecological areas or special conservation areas.

The sample settlements selected vary by location. Ostrožno Brdo and Kozjane are located at the top of the ridge, Artviže lies slightly below the top, and Ostrovica and Vatovlje lie on the slopes. Ostrožno Brdo and Kozjane are ribbon villages and the other three are clustered villages.

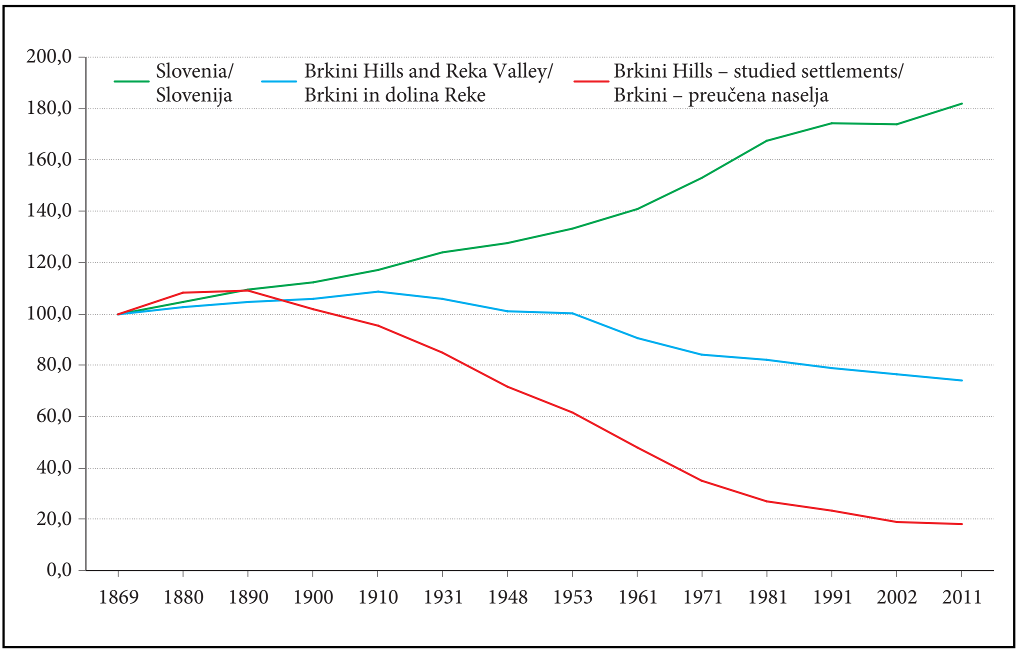


Figure 2: Comparison of changes in the population (index) of Slovenia, the Brkini Hills mesoregion, and the five settlements studied in the census years between 1869 and 2011.

All of the settlements are away from main traffic routes and major employment centers. In addition, their dramatic demographic development has been influenced by their location at the edges of their respective municipalities. In 2011, all five settlements had a total population of 191, which is only 16.8% of the population they had during the peak year of 1890, when 1,140 people lived in the area. The population began to rapidly and inexorably decrease after the Second World War, even though it had already been decreasing persistently during the first half of the twentieth century. Ostrožno Brdo is the largest among the five; in 2011, it had a population of 94, and a full 433 in 1890. Kozjane is now the smallest settlement in terms of population (13 people lived there in 2011), even though its population in 1880 was 283; this was twice as much as in Ostrovica and Vatovlje, which are now ahead of Kozjane by a few inhabitants (Ostrovica has a population of 17 and Vatovlje a population of 20). Compared to its maximum population in 1880, the population in Kozjane decreased to 4.6%; Artviže seems to have fared best, with a population of 28.0% compared to the peak year of 1880.

The population of the entire mesoregion of the Brkini Hills and Reka Valley is 15,086. The share of population of the five sample settlements in the entire mesoregion is 1.3%, and the share of population of the mesoregion in Slovenia is 0.7%. In the mesoregion as a whole, the population has also been gradually decreasing ever since the peak year of 1910, whereas the population in the rest of Slovenia is characterized by gradual growth across all time periods (Figure 2).

The demographic profile of the Brkini Hills and especially the sample settlements is affected not only by the extensive decrease in the population, but also the closely related unfavorable age structure, characterized by a predominance of the elderly and only a small number of young people. The share of farming population has also decreased because people found jobs in the valley. Despite the widespread use of agricultural machinery, the remaining farmers find it difficult to manage and maintain the available farmland and subsequently also the cultivated terraces; accordingly, an increasing number of these terraces are abandoned and gradually becoming overgrown with bushes and trees.

1.2 Theoretical premises

With the new cultural geography, the study of landscapes should extend beyond mere morphological analysis and become interpretative in nature. Attention is directed towards metaphorical, ideological, value-related, and other intangible qualities of landscapes. According to this perspective, the world cannot be comprehended merely through objective approaches, but can be experienced and understood even more deeply by using a subjective approach. The »landscape« refers not only to physical reality and hence, primarily to space, but also to the organization and perception of the social, cultural, cognitive, political, and economic elements of human existence. Thus a landscape is also a mental map and image, in which one can identify diverse stories connected with people's past and their everyday lives (Urbanc 2008).

In Slovenian geography, the evaluation of landscapes has been tackled most seriously by Bojan Erhartič. In addition to the intrinsic or existential, cultural, socioeconomic, functional, geosystemic, and research and educational types of landscape values, he also identified aesthetic values, which provide unique experiences. Human perception appreciates diversity, complexity, typical patterns, and a local character. He also mentions attraction value, in which the presence of a specific phenomenon improves the quality of life in a non-material sense and provides an important ace in the hole for tourism (Erhartič 2012).

The aesthetic value of terraced landscapes, including the one in the Brkini Hills, is defined by a repeating pattern of terrace platforms and slopes, or slope geometrization. Terraced landscapes are spatial features with exceptional physiognomy, in which terraces are the most important element of the cultural landscape. These types of landscapes are attractive not only during the time of year when the lush and colorful vegetation seduce the locals and passersby, but also in the winter, when the geometry of the terraces becomes even more pronounced in the landscape (Ažman Momirski and Radikon 2008). Due to their typical landform, there are frequent attempts to typify terraces that influence the landscape aesthetics. The land use typology of terraces (Ažman Momirski and Kladnik 2009) is widely accepted and used, but some authors also typify terraces by geographical area. Such typological approaches may be inappropriate because terrace types can also occur outside a defined geographical area. Due to their uniqueness, Križaj Smrdel (2010b) defined the terraces in the Brkini Hills as a Brkini type of cultivated terraces or as one of the three types of traditional terraces in Slovenia. The exceptionality of the Brkini Hills terraced landscape lies in the clearly identifiable cultivated terraces across an extensive area that account for the majority of farmland around the largely elongated settlements along the ridges. Even though the land use on them has extensified and parts of them are already becoming overgrown with bushes and trees, the majority are still used and properly maintained.

A combination of usually very long, mostly grass-covered terrace platforms adapted to the terrain, and pronounced intermediate slopes, which are reinforced with fruit trees in places, offers a unique experiential value, which is becoming increasingly evident when comparing this landscape to other attractive landscapes in Slovenia and abroad. It is probably no coincidence that terraced landscapes are often included in the various slideshows of exceptionally beautiful and picturesque landscapes available on the Internet (e.g., Internet 7). In fact, one of the most frequently used photo from Slovenia is the aerial photo of the Brkini Hills slope with Ostrožno Brdo taken by Marjan Garbajs. Thanks to its aesthetic value, it has been published in several volumes (e.g., Perko and Orožen Adamič 1998; Luthar et al. 2008; Križaj Smrdel 2010a) and scholarly papers with illustrations (e.g., Kladnik, Perko and Urbanc 2009).

1.3 Methodology

The ALPTER project team, founded in 2003 and 2004 based on university initiatives, developed the methodological bases for evaluating terraced landscapes. The bases envisage a description of the selected study area and a presentation of its geological conditions, climate, historical development, land use, terrace characteristics, drainage, accessibility, ownership, land protection, terrace conservation status, and developmental factors. *Terraced landscapes of the Alps: Atlas* (Scaramellini and Varotto 2008) contains several articles on the theoretical and methodological bases and the methodology of measuring and evaluating terraced landscapes (e.g., Scaramellini 2008; Acovitsióti-Hameau 2008; Bonardi 2008; Brancucci and Masetti 2008); the article »Mapping and Geographical Classification of Terraced Landscapes: problems and proposals« (Varotto and Ferrarese 2008) is especially valuable from the methodological point of view.

Digital orthophoto maps (a color orthophoto with a pixel resolution of 0.50 m), a digital elevation model (DEM), and the register of the current use of agricultural and forest land (Internet 8) were used to produce maps. Data obtained through deskwork were supplemented through field research and mapping. The 5 × 5 m digital elevation model used (DMV 5) was created in 2011 in parallel with the cyclical recording and design of the orthophoto. The register of the current use of agricultural and forest land is kept by the Ministry of Agriculture and Environment for all of Slovenia. An interpretational key is used for determining the current use, which includes various definitions of the available data.

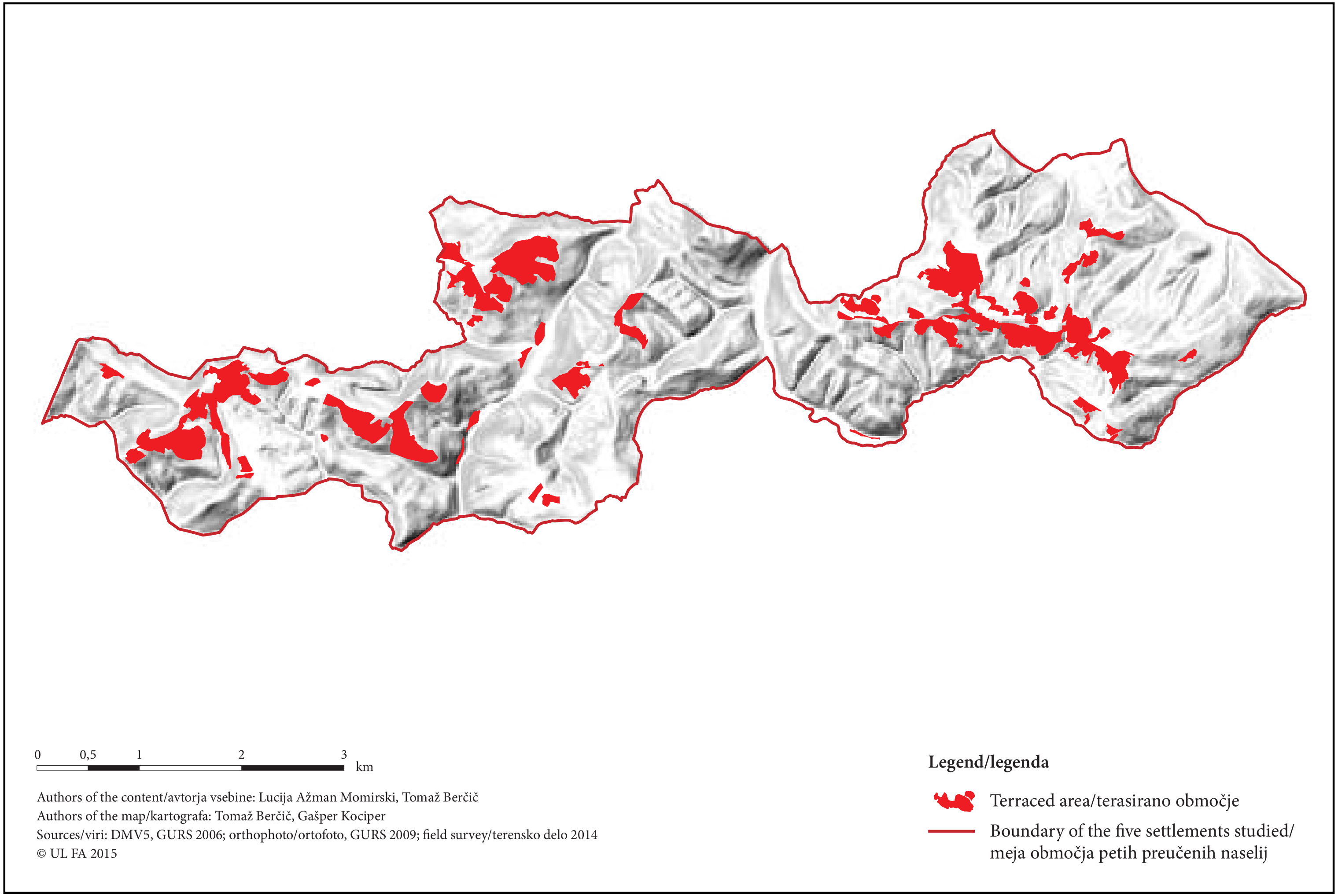
The data on the current use are captured using a computer-supported interpretation of orthophotos and supplemented with data from other registers, field research, and measurements. The register of current land use defines agricultural land as any land with cultivation potential that is not defined as forest. Minimum areas of data capture are specified for the individual types of land use (Internet 8). The following five basic land categories can be found on the terraces in the Brkini Hills: tilled land and gardens, orchards, grassland, forest, and built-up areas.

Even though the local names of terraces and their components are an interesting research topic, this study uses the generally known technical terms. A terrace is composed of two basic elements: the terrace platform and the terrace slope (Ažman Momirski et al. 2008). The terrace platform is the flat part of the terrace, where crops are usually grown, and the terrace slope is the steeper part connecting two platforms. Terrace slopes may be covered with soil and grassed over, and in the Mediterranean region they are often made from stacked rocks that were cleared from the fields.

2 Results

The claims that all the ridges in the Brkini Hills have been converted into cultivated terraces (Križaj Smrdel 2010a, 25) are not true. The ridges have been converted into terraces only in part; a far more typical spatial feature in the Brkini Hills is the terraced upper parts of the slopes below the ridges (Figure 3). The study area includes 228 ha or 10% of terraced land.

Figure 3: Terraced areas in the five settlements studied in the Brkini Hills. ➤


0 0,5 1 2 3 km
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Authors of the map/kartografa: Tomaž Berčič, Gašper Kociper
Sources/viri: DMV5, GURS 2006; orthophoto/ortofoto, GURS 2009; field survey/terensko delo 2014
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Legend/legenda
Terraced area/terasirano območje
Boundary of the five settlements studied/
meja območja petih preučenih naselij

MATEVŽ LENARČIČ

Figure 4: Aerial photo of Ostrožno Brdo with the two most pronounced terraced areas and village of Prelože in the background.

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Figure 5: Aerial photo of Ostrovica with its main terraced area and village of Misliče in the background.

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Figure 6: Many cultivated terraces away from the settlements and terraces with unclear ownership status are already being overgrown with forest.

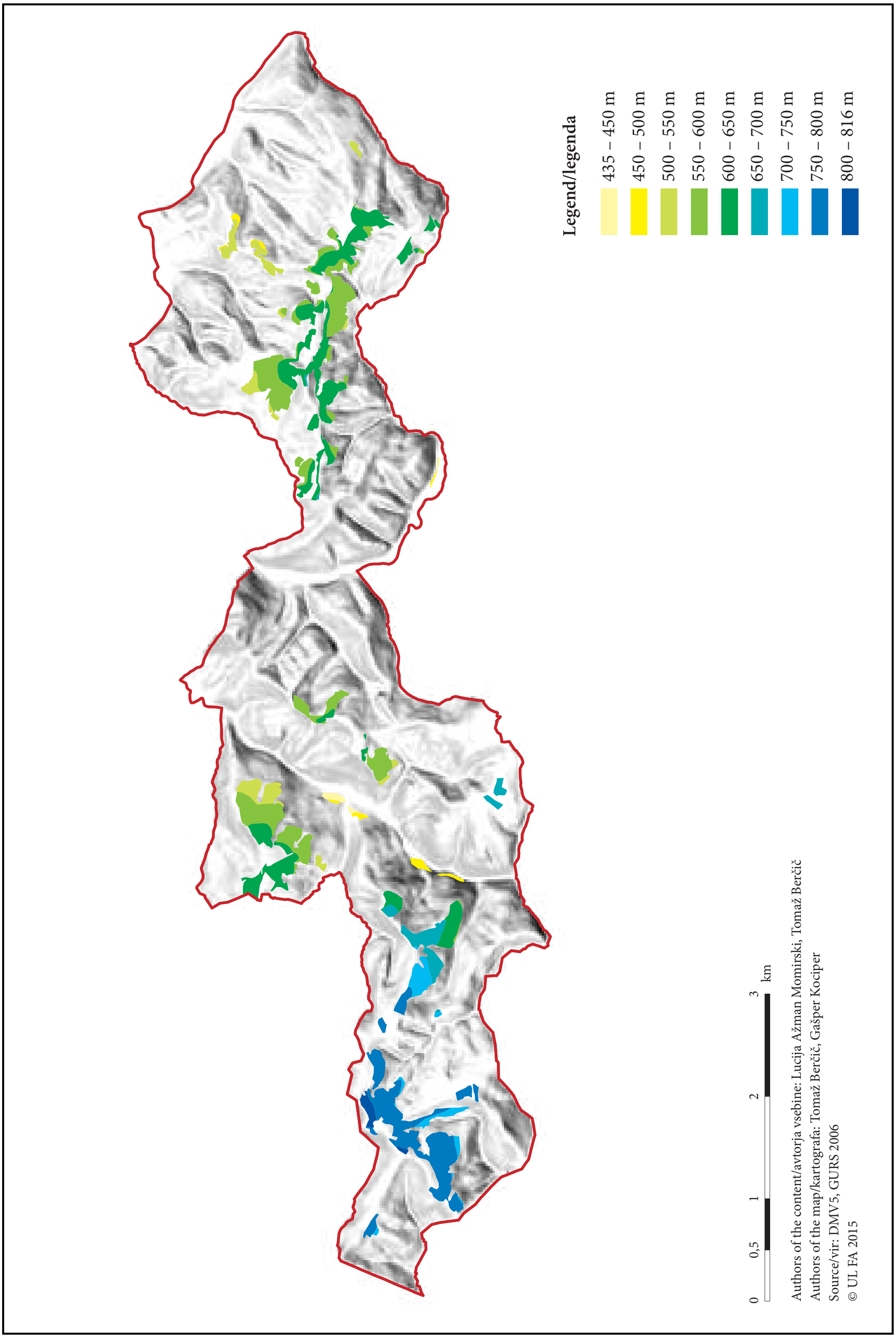
Terraced landscapes can be easily identified in three settlements in particular. Two terraced areas stand out in Ostrožno Brdo. The first, which is among the most extensive contiguous terraced areas, lies in the northwestern part of the village, and the second, which is significantly smaller, lies in its northwestern corner (Figure 4). The terraced area in the Ostrožno Brdo cadastral district measures 93.6 ha and accounts for 10% of the area of the entire village.

There is a conical belt of easily identifiable and extremely picturesque terraces on the slope west of Ostrovica (Figure 5), and in Vatovlje the entire eastern and southern slopes are terraced.

A significant number of deteriorated terraces can be identified on the sunny slope south of Ostrožno Brdo, where the edges between the terrace platforms and terrace slopes can no longer be clearly traced. The slope has been converted into a dynamic, rolling terrain, where traces of the former terraces can still be found. The terraces on the lower part of the slope in Ostrovica and in particular in Vatovlje have already largely been overgrown with forest (Figure 6). The terraces in Artviže are also no longer completely intact, even though the terraced landscape there has started being overgrown only recently. In line with the extremely unfavorable demographic development, extensive terraced areas have been overgrown in Kozjane; the satellite images (GURS 2011) also show that all of the farmland in the northeastern part of the village has already been overgrown with forest.

Over 70% of terraces in the study area lie on eastern or southern slopes. Surprisingly few have a western aspect (i.e., only 11%). The terraced slope in Ostrožno Brdo is interesting in this regard because the majority of the terraces there have a northern aspect. Similarly surprising findings were revealed by a study of the cadastral district and settlement of Medana in the Gorizia Hills, where, however, aspect does not have any significant effect on the distribution of vineyards and winegrowing terraces because of the low elevations and favorable microclimatic conditions (Ažman Momirski, Škvarč and Kodrič 2008). Despite their considerable elevation (between 443 and 655 m above sea level; and between 437 in 816 m in the area

Figure 7: Elevation of terraced areas in the five settlements studied in the Brkini Hills. ➤ p. 40
Figure 8: Slope gradient of terraced areas in the five settlements studied in the Brkini Hills. ➤ p. 41


Legend/legenda
435 – 450 m
450 – 500 m
500 – 550 m
550 – 600 m
600 – 650 m
650 – 700 m
700 – 750 m
750 – 800 m
800 – 816 m
0 0,5 1 2 3 km
Authors of the content/avtorja vsebine: Lucija Ažman Momirski, Tomaž Berčič
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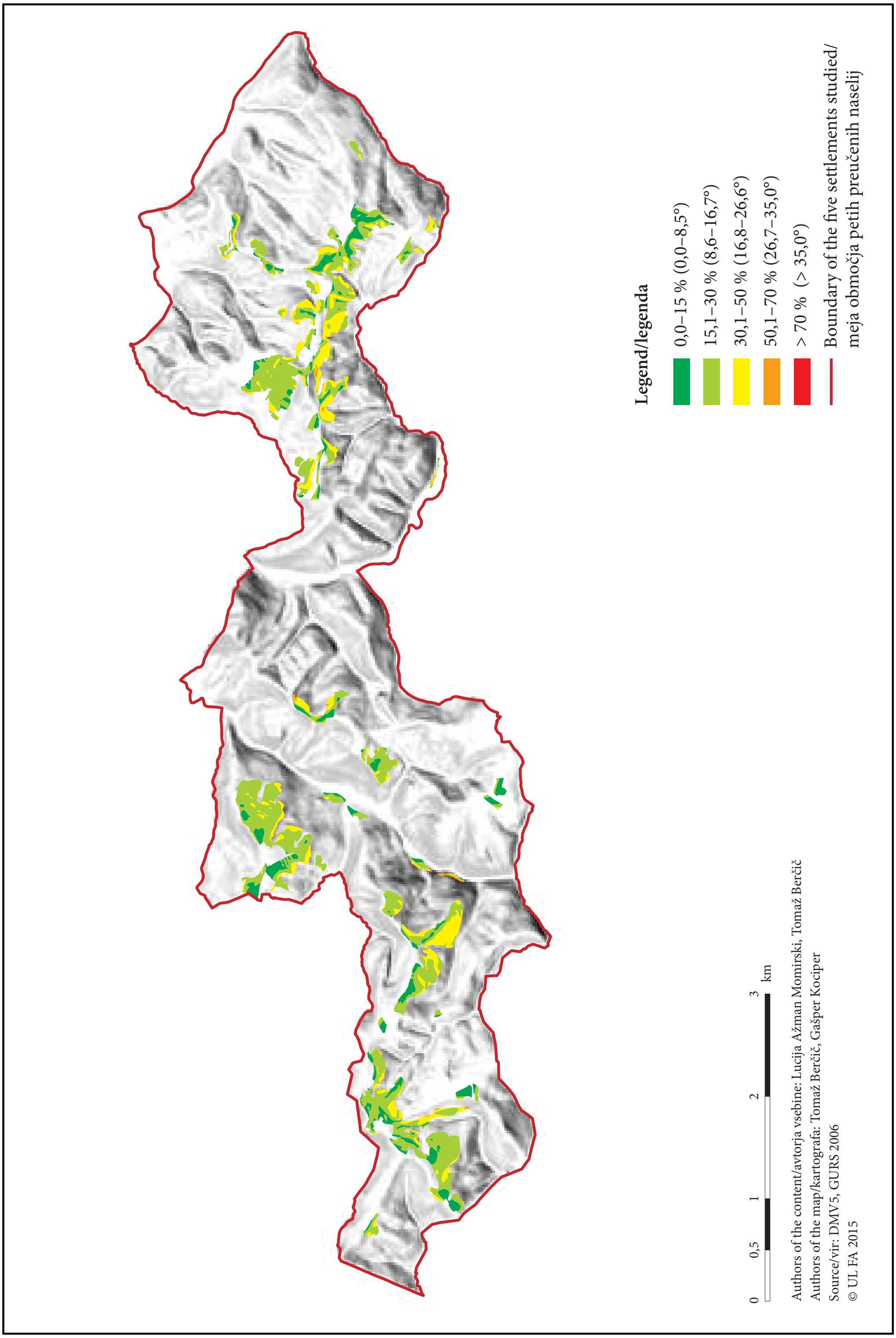
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0,0–15 % (0,0–8,5°)
15,1–30 % (8,6–16,7°)
30,1–50 % (16,8–26,6°)
50,1–70 % (26,7–35,0°)
> 70 % (> 35,0°)
Boundary of the five settlements studied/
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DRAGO KLADNIK

Figure 9: Long terraces with tall slopes in Ostrožno Brdo.

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Figure 10: Terrace slopes in the form of dry stone walls are extremely rare.

of all five settlements; Figure 7), the cultivated terraces on the northern slopes in Ostrožno Brdo lie immediately below the ridge and are thus sufficiently well insulated to enable intensive arable farming on the terrace platforms and the growth of fruit trees on the slopes between them. The conditions for this were even more favorable in the recent past. Elevation had a strong impact on the selection of crops; for example, grapevines do not grow at higher elevations (except on trellises). After the massive conversion of tilled fields into meadows, which are also used for grazing cattle, only a few individual fields are still tilled in the terraced areas, where people mostly grow wheat for flour of their own.

Three-quarters of terraces lie on moderate slopes with a slope gradient ranging from 15.1% to 30% (8.6° to 16.7°), and there are no terraces on extremely steep slopes (Figure 8). This explains the relatively wide terrace platforms, although their width varies considerably, with some being even up to three times wider than the narrowest ones. Just under one-fifth of terraces lie on slopes with a gradient between 0 and 15% (0.0° and 8.5°), and just over one-fifth of them lie on relatively steep slopes with a gradient between 30.1% and 50% (16.8° and 26.6°).

The terraces in the Brkini Hills are typically quite long. They are usually approximately 150 m long, but in some places (the most terraced areas of Ostrožno Brdo and Vatovlje) they are over 300 m long. According to the locals, they were created by hand, in which the terrace slopes were reinforced with the rocks they had removed from the fields, which they then covered with soil and planted with grass. The terraced soil slopes are grassed over, and often planted with fruit trees; the traditional trees used are cherry and plum trees, the roots of which reinforce the slopes well. Colnarič et al. (1985) recommend that a terrace slope should have a 1 : 1 ratio between the height and width; however, steeper terrace slopes with a ratio of 1 : 0.7 are permissible on loamy-sand, sandy-loam, firm marl, and rock substrata. The majority of the terrace slopes in Ostrožno Brdo are steeper than the 1 : 1 ratio; they are mostly approximately 1.5 m tall, and exceptionally also up to 3 m (Figure 9).

The center of Kozjane also features typical Mediterranean terraces with reinforced slopes in the form of dry stone walls (Figure 10).

A comparison of the parcellation in the cadastral survey created under Emperor Francis I and the orthophoto of the terraced land in the northwestern part of Ostrožno Brdo revealed that the survey map and the orthophoto overlap completely. Hence, it can be concluded that individual terraces, and especially their slopes, have remained completely the same over nearly two hundred years; that is, their platforms have the same length and width, and their slopes have the same height and width. Geomechanically, the terraces in the Brkini Hills are thus very stable, in which an important role is played by plants and their roots, which make the ground more stable by creating suction, while also functioning as reinforcement. Geomechanical instability is often connected with rapid social development and the subsequent growth in property value and increased surface vulnerability (Zorn and Komac 2011); it can also be a short-term consequence of the long-term effects of climate changes (Zorn and Komac 2013). For the time being, the Brkini Hills are not yet affected by these problems.

Irrigation and drainage are not used on the terraces in the area studied, even though a small irrigation system has been set up along the border between the Janeževo Brdo, Prelože, and Čelje cadastral districts not far from there. Because more precipitation is retained on the platforms than on slopes without terraces, the terraces accumulate more water. They can also be conceived of as a reservoir that retains the water from the frequent heavy rain (Ažman Momirski 2007). In the extreme north of Ostrožno Brdo, right next to the Reka River, irrigation and drainage have been carried out, which, however, has nothing to do with the cultivated terraces.

Now there are only a few tilled fields and gardens left and, even so, their number is significantly smaller than that of orchards (Križaj Smrdel 2010a). In addition to orchards and, naturally, forest, the other most frequent types of land use include grassland (i.e., meadows and pastures; Figure 11). Cattle are being grazed in many abandoned tilled fields (Figure 12) because livestock farming has become more important than the previously predominant subsistence arable farming.

In the past decades, spontaneous afforestation has been the predominant process of land use changes across the entire study area. The share of forest is also relatively high (16%) in terraced areas, which indicates that cultivated terraces are being overgrown. Nonetheless, the study also revealed individual cases of deforestation. The locals in the Brkini Hills are reviving traditional orchard cultivation (apples, pears,

Figure 11: Contemporary land use in the terraced areas of the five settlements studied in the Brkini Hills. ➤ p. 44

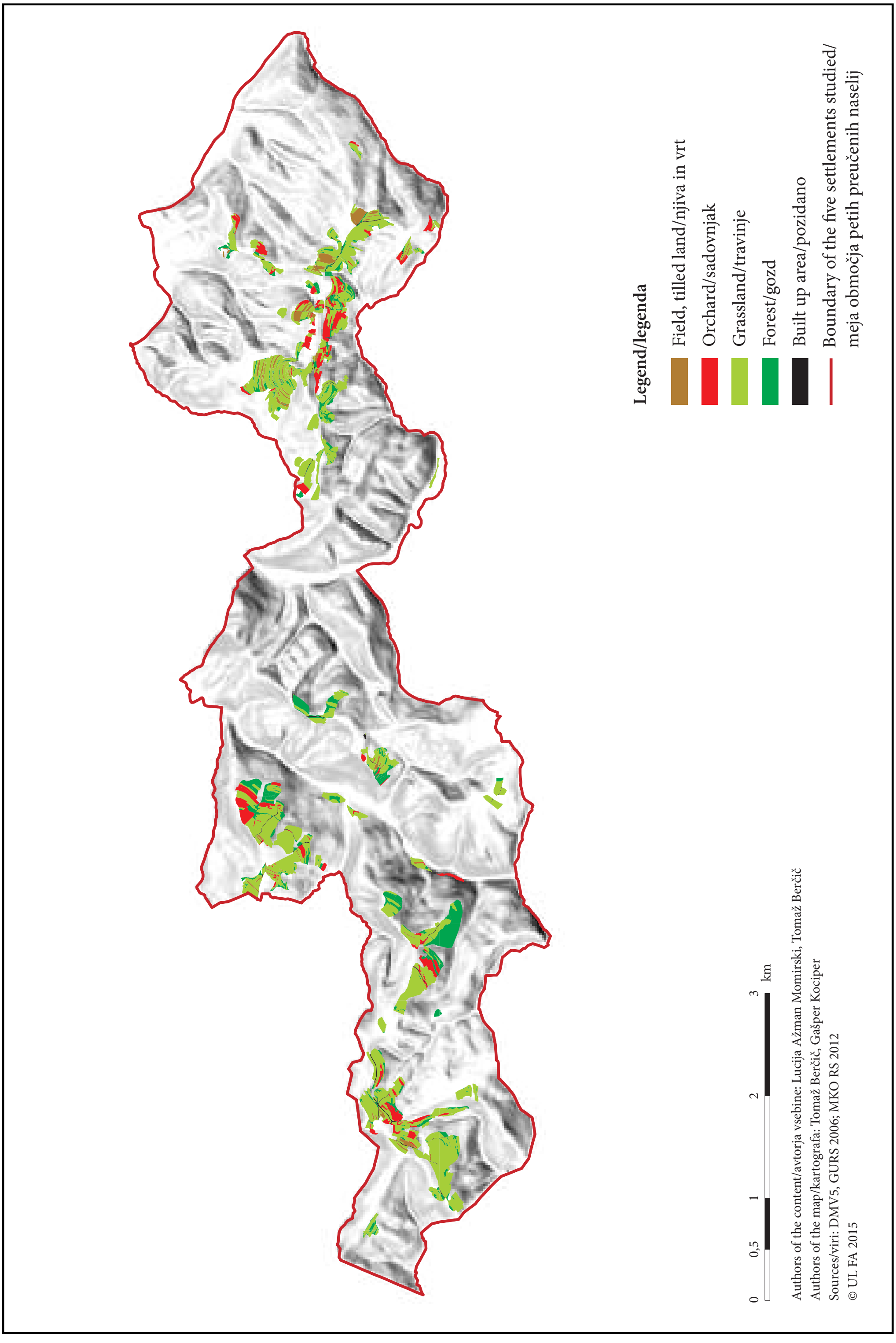
Legend/legenda
Field, tilled land/njiva in vrt
Orchard/sadovnjak
Grassland/travinje
Forest/gozd
Built up area/pozidano
Boundary of the five settlements studied/
meja območja petih preučenih naselij
0 0,5 1 2 3 km
Authors of the content/avtorja vsebine: Lucija Ažman Momirski, Tomaž Berčič
Authors of the map/kartografa: Tomaž Berčič, Gašper Kociper
Sources/viri: DMV5, GURS 2006; MKO RS 2012
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Figure 12: Cattle are being grazed on many abandoned terraces.

plums, hazelnuts, cherries, sour cherries, and peaches) because the area offers excellent conditions for both integrated and organic production. Orchard cultivation goes back to the late eighteenth century, when it was primarily promoted by teachers and priests (Volk et al. 2011). The temperatures, precipitation regime, and typical windy conditions have a beneficial effect on fruit quality. The majority of orchards were already set up on the terraces (specifically, the terrace slopes) by the beginning of the nineteenth century. Today the orchards on the terraces are an important land use category because they cover a full 12% of the terraced areas. Fruit trees have traditionally been planted on terrace slopes to prevent erosion, in which the terrace platform can be used for other cultivation. Despite the efforts, in many places the fruit trees are no longer being properly maintained and are beginning to disappear, which also threatens the existence of terraces.

3 Discussion

Terraces are important for agricultural production because the soil on them has unique chemical and physical properties that allow the production of high-quality crops. Due to increased general awareness of the quality of the food produced, the Brkini Hills have invaluable agricultural potential.

The relation between the landscape shaped by agriculture and the effects of its character is also important. Terraced landscapes are not only an important agricultural resource, but also a great tourism opportunity. This type of landscape is attractive in every season: in the spring, when nature is waking up and clads itself in fresh green colors, in the summer, when the lush and colorful vegetation seduces the locals and passers-by, in the fall, when it dons an incredibly picturesque garment of yellow and brown shades, and in the winter, when the geometry of the terraces comes most to the fore. The advantage of the Brkini Hills is that, because of higher elevations, the climate there is very pleasant during the summer hot spells. The appeal and dramatic effect of the landscape there is sufficient to make the study area an important tourism destination. However, one needs to bear in mind the lesson learned from other terraced landscapes across Europe (e.g., Cinque Terre): that tourism itself does not impact the maintenance and restoration of terraces, and

Figure 13: A modified and newly terraced slope between villages Ostrožno Brdo and Prelože.

the planting of permanent crops, but that this primarily involves the challenges connected with land management and balanced regional development.

No large-scale systematic restoration of terraces was established in the settlements studied in the upper parts of the Brkini Hills. However, on the borders of Ostrožno Brdo towards Prelože, a slope with a northern aspect was identified that has been modified in its upper part and mechanically converted into terraces in its central and lower parts. This might have been surprising considering the general and omnipresent overgrowth and decay of cultivated terraces if one had not been familiar with the complex land-ownership conditions that accelerate land fragmentation. The traditional attachment of Slovenian farmers to their land also contributes its share; the farmers in the Brkini Hills are no exception in this case, which hinders the sale of farmland or even makes it impossible. In the upper part of the terraced area, winter wheat had already been planted on the wide terrace platforms adapted to mechanized farming (Figure 13), whereas the lower terraces were still being »worked on.« Similarly, only a few examples of new terrace construction can be found elsewhere in Europe because as a rule, farmers can barely maintain the cultivated terraces.

An important advantage of the step-like transformation of the slopes in the Brkini Hills is that there are no landslides in the terraced areas. Improved demographic and economic conditions could prevent the land from being overgrown with low-quality forest stands. Considering the exceptionally unfavorable demographic profile, planned measures for preserving the population and maintaining the cultural landscape are vital because only in this way can the development vitality of the area be restored and further attraction of the countryside be ensured.

4 Conclusion

The terraced landscape of the Brkini Hills is such an important value that it deserves to be preserved for future generations. To this end, mechanized farming should be made possible on the terraces and access roads should be built for this purpose.

The development vision for agriculture in the Brkini Hills and the local economy in general should definitely be based on environmentally friendly organic farming because there is an increasing demand for organically produced food. In addition, secondary activities on farms should be promoted, and crafts based on local tradition and low-impact forms of tourism should be developed. This would most likely help preserve the severely endangered cultural landscape, on which terraces in particular have left a unique and clearly identifiable mark.

However, all of this can only be carried out if there is a sufficient vital population that can maintain the cultural landscape. The infrastructure has already been improved and now appropriate conditions must also be provided for the remaining population to make a living in this area, bearing in mind that the population's age structure must be rejuvenated. Without this, nothing bodes well for even the most attractive and unique landscape. The development trends in the past and current century indicate that, without additional efforts, this area will experience a demographic collapse and be transformed back into the original forest landscape.

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Terasirana pokrajina v Brkinih

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IZVLEČEK: Mednarodno preučevanje terasiranih pokrajin postaja čedalje bolj pomembno raziskovalno področje. Uvodnemu delu članka, kjer predstavljamo najpomembnejše raziskovalne in strokovne aktivnosti, povezane s terasiranimi pokrajinami, in primere njihovega preučevanje po svetu, sledi podroben prikaz značilnosti samosvoje terasirane pokrajine Brkinov. Za podrobnejšo obravnavo smo izbrali pet naselij v osrednjem in zahodnem delu pokrajine. Interdisciplinarna raziskava je obsegala proučevanje izrazito neugodnih demografskih procesov, naravnih dejavnikov sodobne terasirane pokrajine, zgodovinskih sprememb pokrajinskih pojavov pa tudi podrobno opazovanje oblik teras, ki terasirano pokrajino sestavljajo. Kmetovalci jo kljub novodobni strojni obdelavi vse težje ohranjajo; njen obstoj ogroža tudi ogozdovanje. V Brkinih se čedalje bolj izgublja preplet marsikod zelo dolgih terasnih ploskev in izrazitih vmesnih brežin, ki predstavlja edinstveno doživljajsko vrednoto.

KLJUČNE BESEDE: geografija podeželja, kulturna pokrajina, raba tal, terasirana pokrajina, kmetijske terase, Brkini, Slovenija

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1 Uvod

Raziskovanje terasiranih pokrajin se je intenziviralo na prelomu iz drugega v tretje tisočletje. Leta 1997 je bil na UNESCO-v seznam svetovne dediščine (v na novo uvedeno kategorijo 'kulturna pokrajina') uvrščen pas severovzhodne obale Ligurskega morja v Italiji, imenovan Cinque Terre (Alberti in Lodatti 2012). Strma klifna obala je obenem izjemno slikovito terasirano pobočje. Pomembnost območij, katerih »*… značilnosti so plod delovanja in medsebojnega vplivanja naravnih in/ali človeških dejavnikov …*« (internet 1, Splošne določbe, 1. člen), poudarja tudi sprejetje Evropske konvencije o krajini (*European Landscape Convention*).

V prvem desetletju novega tisočletja je bilo izvedenih več mednarodnih projektov o varovanju, obnovi in načrtovanju terasiranih pokrajin, med njimi:

- PATTER, katerega namen je bil poiskati in opisati vrste kmetijskih teras ter stanje njihove ohranjenosti na španskem otoku Majorki ter na območjih francoske Nice in italijanske Genove (Lasanta s sod. 2013),
- PROTERRA, ki je podprl 12 pilotnih ukrepov, katerih cilj je obnavljanje kmetijskih teras v šestih sredozemskih državah (internet 2),
- ALPTER, katerega glavni cilj je bil izboljšati poznavanje prostorskih prvin terasiranih pokrajin na območju Alp (internet 3) in
- TERRISC, ki preučuje ohranjanje terasirane pokrajine kot strategijo za preprečevanje naravnih nesreč, zlasti poplav in erozije, na Balearskih in Kanarskih otokih ter na Portugalskem in v jugozahodni Franciji (internet 4).

Evropska unija je kmetijske terasirane pokrajine vključila v načrt razvoja podeželja v obdobju 2007–2013, akcijski načrt biodiverzitete v kmetijstvu (zaradi izboljšanja ali vzdrževanja biodiverzitete in preprečevanja zmanjšanja biodiverzitete zaradi kmetijskih aktivnosti) ter tematsko strategijo varovanja prsti. Evropska unija izraža podporo tudi območjem z omejenimi možnostmi razvoja in kmetijskim območjem z visoko opredeljenimi naravnimi vrednotami, ki jih v številnih primerih predstavljajo prav terasirana zemljišča. Prednostna naloga tematske strategije za varovanje prsti je med drugim ohranjanje in vzdrževanje terasirane pokrajine (Lasanta s sod. 2013).

Mednarodno preučevanje terasiranih pokrajin je doseglo vrhunca s prvima dvema svetovnima konferencama o terasiranih pokrajinah. Na prvi, ki je bila na Kitajskem jeseni 2010, je bilo ustanovljeno Mednarodno združenje terasiranih pokrajin (*International Terraced Landscapes Alliance* – ITLA). Sprejeta je bila tudi Honghejska deklaracija (*Honghe Declaration*) o varovanju in razvoju terasiranih pokrajin (internet 5), ki je skupaj z več kot stotimi konferenčnimi znanstvenimi in strokovnimi prispevki o raznovrstnih vidikih terasiranih pokrajin z vseh koncev sveta objavljena tudi v zajetnih monografijah v kitajskem in angleškem jeziku (Peters in Junchao 2012). Regionalnih orisov terasiranih pokrajin ni veliko. Poleg dokaj pomanjkljivega prikaza svetovne razprostranjenosti terasiranih pokrajin (Rivera 2012) in predstavitve rezultatov projekta ALPTER na območju Benečije (Alberti in Lodatti 2012) lahko izpostavimo le še prizadevanja za varovanje tradicionalne terasirane pokrajine v južnokitajski pokrajini Junan (Yúnnán) (Wenxing, Kun in Lingchong 2012) ter za zaščito in razvoj terasiranih območij v filipinski Kordiljeri (Baguilat 2012). V prispevku Kendallove (2012) je zaradi primerjave z inkovskimi terasami v Peruju podrobno predstavljena tudi študija ekstenzifikacije terasiranih kmetijskih zemljišč v dolini Alpujarra na južnih obronkih španskega pogorja Sierra Nevada (Douglas, Critchley in Park 1996).

Druga svetovna konferenca pod okriljem združenja ITLA je bila spomladi 2014 v Peruju. Začela se je s predstavitvijo pomembnega dosežka Kitajske, saj je leta 2013 kulturna pokrajina terasiranih rižišč ljudstva Hani v prefekturi Honghe pokrajine Junan postala del svetovne kulturne dediščine (Junchao 2014). V pregledni raziskavi enajstih terasiranih pokrajin v Peruju so upoštevana tako aktivna kot opuščena območja teras (Lambruschini 2014), posebej zanimiva pa je bila primerjava značilnosti in problematike terasiranih pokrajin v Peruju in na Japonskem (Baba 2014). Obnova bolivijskih območij teras je bila zelo podrobno predstavljena za naselja province Tapacarí v okrožju Cochabamba (Crespo 2014). Prikazov evropskih terasiranih pokrajin je bilo malo. Med njimi velja omeniti napore za ohranitev terasirane pokrajine v dolini Cembra severno od mesta Trento v deželi Trentinsko – Zgornje Poadižje (Zanotelli 2014).

S širitvijo raziskovalnega področja se je okrepilo tudi publiciranje njegovih izsledkov. Rezultati dela v okviru projekta ALPTER so bili že prej objavljeni v publikacijah *Terraced landscapes of the Alps: Atlas* (Scaramellini in Varotto 2008) in *Terraced landscapes of the Alps: Projects in progress* (Fontanari in Patassini 2008). V prvi je tudi več sinteznih prikazov rezultatov regionalnih študij, izvedenih v okviru projekta (Castex s sod. 2008; Brancucci in Comenale Pinto 2008; Freppaz s sod. 2008; Mazzoleni s sod. 2008; Werder s sod. 2008;

Chemin in Varotto 2008; Ažman Momirski 2008; Arnberger, Eder in Brandenburg 2008). V sklopu projekta ALPTER je treba izpostaviti še interdisciplinarno monografijo o terasirani pokrajini Goriških brd (Ažman Momirski s sod. 2008), ki vključuje tudi raziskave o spreminjanju rabe tal in plazovitosti. Publikacija je zagotovo najbolj celovit slovenski prikaz obravnavane tematike doslej.

Izčrpen kronološki pregled preučevanja kmetijskih teras in terasirane pokrajine v Sloveniji je bil skupaj z orisom slovenskih terasiranih pokrajin objavljen šele pred nekaj leti (Ažman Momirski in Kladnik 2009). Glede na dejstvo, da so kulturne terase v mnogih predelih Slovenije dokaj izrazito, v nekaterih pa celo prevladujoče zaznamovale pokrajinsko podobo, bi lahko na tem področju upravičeno pričakovali več opravljenega raziskovalnega dela. Aktualnost raziskovalne teme je zagotovo vplivala tudi na v okviru podiplomskega študija pripravljena prispevka Helene Križaj Smrdel (2010a; 2010b). Nadaljevanje nacionalnih raziskav slovenskih terasiranih pokrajin je povod za pripravo monografije o terasiranih pokrajinah v submediteranski Sloveniji (Ažman Momirski 2014).

Tradicionalna terasirana pokrajina Brkinov je povsem samosvoja tako v okviru Slovenije kot tudi širše, zato si zasluži podrobnejšo obravnavo. Doslej je bila razmeroma slabo preučena. Še najbolj neposredno se je dotika primerjalna študija sprememb rabe tal na območjih sredozemskih terasiranih naselij Krkavče v Koprskih brdih in Ostrožno Brdo v Brkinih (Ažman Momirski in Gabrovec 2014), ki je tudi eno od petih vzorčnih naselij v pričujoči študiji. Kot eno od sondnih območij jo je raziskovala tudi Križaj Smrdelova (2010a; 2010b). Zanimivo je, da se priznani slovenski socialni geograf Vladimir Klemenčič v svoji zelo podrobni demografski in gospodarski študiji pokrajine med Snežnikom in Slavnikom, v kateri natančno oriše tudi razmere v Brkinih, kmetijskih teras in terasiranosti kot pomembne pokrajinske prvine skorajda ni zavedal, saj terase bežno omenja le na dveh mestih (Klemenčič 1959).

1.1 Oris preučevanega območja

Slovenija je kot le redkokatera evropska država prepredena s kulturnimi terasami. Te se pojavljajo v vseh tipih slovenskih pokrajin, vendar se razlikujejo po pogostnosti, namenu in sodobni funkciji (Ažman Momirski in Kladnik 2009).

Le malokatera država se po pokrajinski pestrosti lahko primerja s Slovenijo, saj se na njenem ozemlju stikajo in prepletajo Alpe, Panonska nižina, Dinarsko gorovje in Sredozemlje ter germanski, madžarski, slovanski in romanski kulturni vplivi. Zato Slovenija slovi tako po naravni kot kulturni raznolikosti, pa tudi spremenljivosti in prehodnosti. Razlikujemo štiri temeljne pokrajinske tipe in devet podtipov (Kladnik, Perko in Urbanc 2009). Eden od temeljnih pokrajinskih tipov v Sloveniji so sredozemske pokrajine, ki se delijo na podtipa sredozemska gričevja in sredozemske planote (Perko 1998). Za prva je značilna slabo prepustna flišna podlaga, za druge pa prepustna apnenčasta, ki jo zaznamujejo raznovrstni kraški pojavi. Največ teras, ki opredeljujejo najbolj značilne terasirane pokrajine, je prav v sredozemskem prostoru, precej jih je tudi v kraških dinarskih pokrajinah in vinorodnih panonskih gričevjih (Ažman Momirski in Kladnik 2009, 31), medtem ko se drugje redkeje pojavljajo, vendar je brez njih le redkokatera slovenska pokrajina. Med devetimi naravnimi podtipi so povsem brez njih le panonske ravnine.

Brkini so sicer uvrščeni med sredozemska gričevja, vendar se po svojih značilnostih bistveno razlikujejo od tipičnih sredozemskih gričevij (Goriška, Koprska in Vipavska brda, tudi flišna Vipavska dolina), saj imajo zaradi večje nadmorske višine (najvišje, 817 m, se vzpnejo pri cerkvici sv. Socerba nad Artvižami) poteze hribovja, glede na lego proti notranjosti Slovenije pa se v njihovem podnebju prepletajo lastnosti sredozemskega in celinskega podnebja (Ogrin 1996).

Pokrajinsko neenotna mezoregija Brkini in dolina Reke se v dinarski smeri severozahod–jugovzhod razteza v jugozahodnem delu države (slika 1). Meri 341,5 km^2, kar je 1,68 % površine Slovenije. Med občine Divača, Hrpelje-Kozina, Ilirska Bistrica in Pivka razdeljeno območje mezoregije poleg Brkinov sestavljajo še dolina Reke, ki se deli na Podgoro, Ilirskobistriško kotlino, debrski del doline in Vremsko dolino, severno nad dolino Reke pa je k mezoregiji pripojena še Košanska dolina. Brkine, ki jih prevladujoče sestavlja vododržni fliš eocenske starosti, lahko razdelimo na zahodni, osrednji in vzhodni del. Onstran Jelšanskega podolja na jugovzhodu je še manj izrazit predel prav tako flišnih brd, ki bi ga lahko poimenovali Jelšanska brda (Šebenik in Kladnik 1998). Največ teras, po temeljni tipologiji (Ažman Momirski in Kladnik 2009) jih lahko opredelimo za poljedelske, je v osrednjem in zahodnem delu Brkinov, zato smo tam izbrali območja petih naselij za podrobnejšo obravnavo. Artviže spadajo v občino Hrpelje - Kozina, Ostrovica, Vatovlje, Kozjane v občino Divača in Ostrožno Brdo v občino Ilirska Bistrica.

Slika 1: Lega območij petih preučenih naselij znotraj mezoregije Brkini in dolina Reke ter lega mezoregije v Republiki Sloveniji.
Glej angleški del prispevka.

Izbrana naselja v severozahodnem delu mezoregije mejijo druga na drugo, njihovo skupno območje je razpotegnjeno v smeri od zahoda proti vzhodu in meri 2201,9 ha ali 6,4 % mezoregije. Medtem ko je povprečna nadmorska višina mezoregije 562 m, je povprečna nadmorska višina preučevanega območja skoraj 635 m. Opazno je, da je na njem v primerjavi s celotno mezoregijo nekoliko več zemljišč s severno in vzhodno ekspozicijo, še precej bolj očitna pa je njegova večja nagnjenost, saj je prevladujoč naklonski razred od 30,1 do 50 % (od 16,8 do 26,6°) (44,5 %), v celotni regiji pa od 15,1 do 30 % (od 8,6 do 16,7°) (32,4 %). V celotni mezoregiji je do 15 % (do 8,5°) nagnjenih zemljišč 30,9 %, na pilotnem območju vsega 10,6 %. Z 71,4 % deležem gozda Brkini z dolino Reke spadajo med zelo gozdnate slovenske mezoregije. Podrobno preučeno območje petih naselij je še bistveno bolj gozdnato (81,4 %), med kmetijskimi zemljišči prevladujejo travniki in pašniki, njiv je manj kot odstotek (0,83 %).

Podrobno preučeno ozemlje petih naselij je na območju okrog 450 km^2 prostranega Regijskega parka Škocjanske jame, ki zajema celotno porečje Reke (internet 6). Na ozemlja petih izbranih naselij deloma segajo tudi vodovarstvena območja. Ostrožno Brdo v svojem južnem delu sega na območje naravnih vrednot (dolina potoka Šmagurke), v severnem delu, ob reki Reki pa spada med ekološko pomembna območja oziroma med posebna ohranitvena območja.

Izbrana vzorčna naselja se medsebojno razlikujejo glede na lego. Ostrožno Brdo in Kozjane sta postavljeni na temenu slemena, Artviže nekoliko pod temenom, medtem ko je za Ostrovico in Vatovlje značilna pobočna lega. Ostrožno Brdo in Kozjane sta obcestni naselji, preostala tri pa so gručasta.

Vsa naselja so prometno odmaknjena in oddaljena od večjih zaposlitvenih središč. Ob tem je njihov dramatičen demografski razvoj zaznamovala tudi lega na obrobju matičnih občin. V vseh petih izbranih naseljih je leta 2011 živelo 191 ljudi, kar je glede na demografski višek v letu 1890 (1140 ljudi) le še 16,8 %. Število prebivalcev se je začelo naglo in nezadržno zmanjševati po drugi svetovni vojni, čeprav je že v prvi polovici 20. stoletja vseskozi vztrajno nazadovalo. Največje med petimi naselji je Ostrožno Brdo, kjer je leta 2011 živelo 94 ljudi, leta 1890 pa kar 433. Zdaj so glede na število prebivalcev najmanjše naselje Kozjane (leta 2011 je tam živelo 13 ljudi), ki so leta 1880 imele 283 prebivalcev, kar je bilo več kot dvakrat toliko kot na Ostrovici in Vatovljah, ki dandanes Kozjane prekašata za nekaj prebivalcev (Ostrovica 17 in Vatovlje 20). Na Kozjanah je torej število prebivalcev glede na maksimum nazadovalo na 4,6 %, še najbolje pa so jo odnesle Artviže, kjer živi še 28,0 % ljudi glede na maksimalno število leta 1880.

Slika 2: Primerjava spreminjanja prebivalstva (indeks) na območjih Slovenije, mezoregije Brkini in petih preučenih naselij v popisnih letih 1869–2011.
Glej angleški del prispevka.

Sicer pa v celotni mezoregiji Brkini in dolina Reke živi 15.086 ljudi. Delež petih vzorčnih naselij v prebivalstvu mezoregije je 1,3 %, delež prebivalstva mezoregije znotraj Slovenije pa 0,7 %. Tudi v mezoregiji kot celoti se število prebivalcev od demografskega viška v letu 1910 vseskozi postopoma zmanjšuje, medtem ko je za Slovenijo za vse časovne preseke značilna postopna rast (slika 2).

Demografsko podobo Brkinov in še bolj vzorčnih naselij pa ne kazi le močno zmanjševanje števila prebivalcev, pač pa tudi z njim tesno povezana neugodna starostna sestava s prevlado ostarelih in z le majhnim številom mladih ljudi. Zaradi zaposlovanja v dolini se je zmanjšal tudi delež kmečkega prebivalstva. Preostali kmetovalci kljub novodobnemu razmahu rabe kmetijskih strojev le stežka obvladujejo in vzdržujejo razpoložljiva kmetijska zemljišča in s tem seveda tudi kmetijske terase, zato jih je čedalje več opuščenih; postopoma jih preraščata grmovje in drevje.

1.2 Teoretska izhodišča

Z novo kulturno geografijo naj bi preučevanje pokrajine preseglo zgolj morfološko analizo in postalo interpretativno. Pozornost se usmerja na metaforične, ideološke, vrednostne in druge neoprijemljive kakovosti pokrajine. Skladno s tovrstnim pogledom sveta ne moremo dojeti zgolj z objektivnim pristopom, ampak ga lahko izkusimo in še globlje razumemo s subjektivnim. Pokrajina se ne nanaša zgolj na fizično realnost, predvsem na prostor torej, ampak tudi na organizacijo in dojemanje družbenih, kulturnih, miseljenjskih, političnih ter gospodarskih prvin človekovega obstoja. Tako je pokrajina tudi miselni zemljevid in podoba, v kateri je mogoče prepoznati številne zgodbe, prepletene s preteklostjo in vsakdanjim življenjem ljudi (Urbanc 2008).

V slovenski geografiji se je z vrednotenjem pokrajine še najresneje spoprijel Erhartič, ki je izpostavil vrednotenje narave. Med zvrstmi vrednot je ob intrizičnih ali eksistenčnih, kulturnih, socialno-ekonomskih, funkcijskih, geosistemskih ter znanstvenoraziskovalnih in izobraževalnih izdvojil tudi estetske vrednote, ki zagotavljajo svojevrstna doživetja. Človekovo zaznavanje ceni raznolikost, kompleksnost, značilne vzorce in lokalni značaj. Govora je tudi o privlačnostni vrednoti, kjer navzočnost določenega pojava izboljša kakovost življenja v nematerialnem smislu in je marsikod pomemben turistični adut (Erhartič 2012, 34–38).

Estetsko vrednost terasiranih pokrajin, brkinska ni izjema, določa ponavljajoči se vzorec terasnih ploskev in brežin oziroma geometrizacija pobočja. Terasirane pokrajine so prostorski pojav z izjemno fiziognomijo, v kateri so najpomembnejša prvina kulturne pokrajine terase. Takšna pokrajina je privlačna in urejena ne samo v tistih letnih časih, ko bujnost in barvitost vegetacije zapeljujeta pogled tu živečih ali mimoidočih, temveč tudi pozimi, ko postane geometrija teras v pokrajini še bolj prepoznavna (Ažman Momirski in Radikon 2008). Zaradi značilno oblikovanega površja so pogosti poskusi tipizacije teras, ki vplivajo na estetski videz pokrajine. Nesporna in splošno uporabna je tipizacija teras glede na rabo tal (Ažman Momirski in Kladnik 2009), medtem ko nekateri avtorji opredeljujejo terasne tipe glede na geografsko območje. Takšni tipološki pristopi so lahko pomanjkljivi, saj se tipi teras pojavljajo tudi izven opredeljenega geografskega območja. Tako je Križaj Smrdelova terase v Brkinih zaradi njihove izjemnosti opredelila kot brkinski tip kulturnih teras, enega od treh tipov tradicionalnih teras v Sloveniji (Križaj Smrdel 2010b). Izjemnost brkinske terasirane pokrajine lahko utemeljimo z veliko razsežnostjo izrazito oblikovanih kmetijskih teras, ki v bližini povečini slemenskih naselij sestavljajo glavnino vaških kmetijskih zemljišč. Čeprav se je zemljiška raba na njih ekstenzivirala in se del že zarašča z grmičevjem in drevjem, je glavnina še vedno v rabi in je primerno vzdrževana.

Preplet reliefni izoblikovanosti prilagojenih, marsikod zelo dolgih, večinoma s travo poraslih terasnih ploskev in izrazitih vmesnih brežin, mestoma utrjenih s sadnim drevjem, predstavlja edinstveno doživljajsko vrednoto, ki se je ob možnostih vizualne primerjave privlačnih pokrajin ne le v domačem, ampak tudi v svetovnem merilu čedalje bolj zavedamo. Ni najbrž naključje, da se med raznimi na spletu dostopnimi kolaži estetsko izjemnih, slikovitih pokrajinskih podob kot po pravilu pojavljajo prav terasirane pokrajine (na primer internet 7). Pri nas je bila zelo pogosto uporabljena prav zračna fotografija terasiranega brkinskega slemena z Ostrožnim Brdom, ki jo je posnel Marjan Garbajs. Tudi zaradi svoje estetske sporočilnosti je objavljena v več monografijah (na primer Perko in Orožen Adamič 1998; Luthar s sod. 2008; Križaj Smrdel 2010a) in s fotografijami opremljenih znanstvenih prispevkih (na primer Kladnik, Perko in Urbanc 2009).

1.3 Metodologija

V letih 2003 in 2004 na podlagi univerzitetnih pobud ustanovljena skupina projekta ALPTER je izoblikovala metodološka izhodišča za vrednotenje terasiranih pokrajin. Opredeljena izhodišča so predvidela opis lokacije izbranega preučevanega območja ter predstavitev njegovih geoloških razmer, podnebja, zgodovinskega razvoja, rabe tal, značilnosti teras, odvodnjavanja, dostopnosti, lastništva, varovanja zemljišč, stanja ohranjenosti teras in razvojnih dejavnikov. O teoretsko-metodoloških izhodiščih ter metodologiji zajemanja in vrednotenja terasiranih pokrajin je v publikaciji *Terraced landscapes of the Alps: Atlas* (Scaramellini in Varotto 2008) objavljenih več prispevkov (na primer Scaramellini 2008; Acovitsióti-Hameau 2008; Bonardi 2008; Brancucci in Masetti 2008), med katerimi je z metodološkega zornega kota še posebej dragocen članek *Kartiranje in geografska klasifikacija terasiranih pokrajin: problematika in predlogi* (Varotto in Ferrarese 2008).

Za izdelavo kartografskega gradiva smo uporabili digitalne ortofoto načrte (DOF – barvni ortofoto z velikostjo slikovnega elementa 0,50 m), digitalni model višin (DMV) ter evidenco dejanske rabe kmetijskih in gozdnih zemljišč (internet 8). Kabinetno pridobljene podatke smo dopolnili s terenskimi ogledi in kartiranjem. Uporabljeni digitalni model višin 5 × 5 m (DMV 5) je bil izdelan leta 2011 vzporedno s cikličnim snemanjem in izdelavo ortofota. Evidenco dejanske rabe kmetijskih in gozdnih zemljišč za območje celotne Slovenije vodi Ministrstvo za kmetijstvo in okolje. Za določanje dejanske rabe se uporablja interpretacijski ključ, ki vsebuje različne opredelitve razpoložljivih podatkov.

Podatki o dejanski rabi so zajeti z metodo računalniško podprte interpretacije ortofoto posnetkov in dopolnjeni z uporabo drugih evidenc, terenskimi ogledi in meritvami. V evidenci dejanske rabe so kot kmetijska zemljišča določena vsa zemljišča, ki imajo pridelovalni potencial in niso opredeljena kot gozd. Za posamezne vrste rabe so določene tudi najmanjše površine zajema (internet 8). Na terasah v Brkinih se pojavlja naslednjih pet temeljnih zemljiških kategorij: njiva in vrt, sadovnjak, travinje, gozd in pozidano.

Čeprav so lokalna poimenovanja teras in njihovih delov zanimiva raziskovalna tema, v raziskavi uporabljamo splošno znane strokovne izraze. Posamezno teraso sestavljata temeljni oblikovni prvini terasna ploskev in terasna brežina (Ažman Momirski s sod. 2008). Terasna ploskev je uravnani del terase, kamor se praviloma sadi kmetijske kulture, terasna brežina pa je nagnjeni del terase, ki premošča višinske razlike med terasnimi ploskvami. Terasne brežine so lahko nasute z zemljino in zatravljene, v sredozemski pokrajini so pogosto oblikovane iz zloženega otrebljenega kamenja.

2 Rezultati

Nekatere trditve (Križaj Smrdel 2010a), da so vsa brkinska slemena spremenjena v kmetijske terase, niso točne. Slemena so le deloma terasirana, bistveno bolj značilna prostorska prvina Brkinov je, da so terasirani zgornji deli pobočij pod njimi (slika 3). Na podrobno preučenem območju je terasiranih 228 ha ali 10 % zemljišč.

Slika 3: Terasirana območja v petih podrobno preučenih brkinskih naseljih.
Glej angleški del prispevka.

Dobro prepoznavna terasirana pokrajina je predvsem v treh naseljih. V Ostrožnem Brdu izstopata dve terasirani območji. Prvo, ki je med najbolj prostranimi sklenjenimi terasiranimi zemljišči, je na severozahodu vasi, drugo, precej manjše, pa na njenem severovzhodu (slika 4). Območje teras v katastrski občini Ostrožno Brdo meri 93,6 ha oziroma 10 % vaškega ozemlja.

Slika 4: Zračni posnetek Ostrožnega Brda z obema najbolj izrazitima terasiranima območjema; v ozadju je naselje Prelože.
Glej angleški del prispevka.

Slika 5: Zračni posnetek Ostrovice z glavnim terasiranim območjem; v ozadju je naselje Misliče.
Glej angleški del prispevka.

Na Ostrovici je na pobočju zahodno od vasi lijakast pas dobro prepoznavnih in izjemno slikovitih teras (slika 5), na Vatovljah pa je v celoti terasirano vzhodno in južno pobočje.

Na prisojnem pobočju južno od Ostrožnega Brda je mogoče opaziti precej propadlih teras, pri katerih pregibi med terasnimi ploskvami in terasnimi brežinami niso več jasno prepoznavni. Pobočje je preoblikovano v razgiban, valovit teren, na katerem je še vedno mogoče prepoznati, da so bile tamkaj nekoč urejene terase. Terase v spodnjem delu pobočja na Ostrovici in še posebno na Vatovljah so že v znatni meri zaraščene z gozdom (slika 6). Tudi terase na Artvižah niso več povsem nedotaknjene, čeprav se je tamkaj zaraščanje terasirane pokrajine začelo šele pred kratkim. Skladno z izrazito neugodnim demografskim razvojem so obsežna zaraščena terasirana območja v naselju Kozjane, kjer je mogoče tudi iz vzorcev na satelitskih posnetkih (GURS 2011) razbrati, da je vsa kmetijska zemljišča na severovzhodu vasi že prerasel gozd.

Slika 6: Mnoge od naselij oddaljene kmetijske terase in terase z neurejenim lastništvom že prerašča gozdno drevje.
Glej angleški del prispevka.

Več kot 70 % teras na obravnavanem območju ima vzhodno in južno lego. Zahodnih ekspozicij je presenetljivo malo, le 11 %. Zanimiva pa je izpostavljenost terasiranega pobočja na Ostrožnem Brdu, kjer ima največ teras severno lego. Podobno presenetljivo ugotovitev smo razkrili tudi v raziskavi za katastrsko občino in naselje Medana v Goriških brdih, kjer pa zaradi nizke nadmorske višine in ugodnih mikroklimatskih razmer ekspozicija na razporeditev vinogradov in vinogradniških teras nima odločilnega pomena (Ažman Momirski, Škvarč in Kodrič 2008). Vsekakor so na Ostrožnem Brdu kljub precejšnji nadmorski višini (med 443 in 655 m; na območju vseh petih naselij pa med 437 in 816 m) (slika 7) tudi v severni legi zaradi lege tik pod ovršjem slemena kmetijske terase dovolj dobro osončene, da omogočajo, še bolj pa so to v polpretekli dobi, intenzivno njivsko rabo na terasnih ploskvah in rast sadnega drevja na brežinah med njimi. Na izbor kmetijskih kultur je pomembno vplivala nadmorska višina, ki v višjih legah ne omogoča rasti vinske trte (razen v brajdah). Po množični spremembi njiv v travnike, na katerih pasejo tudi živino, so na terasiranih območjih obdelane le še posamezne njive, na katerih pridelujejo predvsem ozimno pšenico, namenjeno domači oskrbi s krušno moko.

Slika 7: Nadmorska višina terasiranih območij v petih podrobno preučenih brkinskih naseljih.
Glej angleški del prispevka.

Slika 8: Nakloni terasiranih območij v petih podrobno preučenih brkinskih naseljih.
Glej angleški del prispevka.

Tri petine teras je na zmerno nagnjenih pobočjih z naklonom od 15,1 % do 30,0 % (od 8,6 do 16,7°), teras na izrazito strmih pobočjih ni (slika 8). To pojasnjuje razmeroma široke terasne ploskve, vendar se širine terasnih ploskev precej razlikujejo, saj so najširše tudi do trikrat širše od najožjih. Slaba petina teras je na pobočjih z naklonom od 0 do 15,0 % (od 0,0 do 8,5°), dobra petina pa na bolj strmih pobočjih z naklonom od 30,1 do 50,0 % (od 16,8 do 26,6°).

Značilna prvina brkinskih teras je njihova precejšnja dolžina. Običajno so terase dolge približno 150 m, vendar ponekod na najbolj izrazito terasiranih območjih Ostrožnega Brda in Vatovelj presegajo dolžino 300 metrov. Po pripovedovanju domačinov so bile ročno izdelane tako, da je bila brežina sicer utrjena s kamenjem, ki so ga izkopali med obdelovanjem kmetijskega zemljišča, a so ga pozneje zasuli z zemljino in zatravili. Terasne brežine so zemljate in zatravljene, marsikod zasajene s sadnim drevjem, tradicionalno predvsem s češnjami in slivami, katerih korenine jih dodobra utrdijo. Colnarič in sodelavci (1985) priporočajo razmerje med višino in širino terasne brežine 1 : 1, na ilovnato-peščeni, peščeno-ilovnati, trdni lapornati in skalnati podlagi pa naj bi bile dopustne tudi bolj strme brežine z razmerjem 1 : 0,7. Terasne brežine v Ostrožnem Brdu so večinoma bolj strme od razmerja 1 : 1, visoke v glavnem okrog metra in pol, izjemoma celo do treh metrov (slika 9).

Slika 9: Dolge terase z visokimi brežinami na Ostrožnem Brdu.
Glej angleški del prispevka.

Na Kozjanah so v središču vasi urejene tudi značilne mediteranske terase z utrjeno brežino v obliki suhega zidu (slika 10).

Slika 10: Terase z brežinami v obliki suhega zidu so zelo redke.
Glej angleški del prispevka.

Primerjava parcelacije franciscejskega katastra in ortofoto posnetka terasiranih zemljišč na severozahodu Ostrožnega Brda je razkrila, da se izris in ortofoto posnetek povsem prekrivata. Iz tega lahko sklepamo, da so posamezne terase, predvsem pa njihove brežine, v slabih 200 letih ostale povsem enake, torej enako dolge in z enako širokimi terasnimi ploskvami ter z enako visokimi in širokimi terasnimi brežinami. Geomehansko so torej brkinske terase zelo stabilne, pri čemer imajo pomembno vlogo rastline in njihov koreninski sistem, ki na stabilnost tal vplivajo tako, da ustvarjajo sukcijo, obenem pa delujejo kot armatura. Geomehanske nestabilnosti so pogosto povezane s hitrim družbenim razvojem, posledično rastjo vrednosti premoženja in zato večjo ranljivostjo površja (Zorn in Komac 2011), lahko pa so tudi kratkoročna posledica dolgoročnih učinkov podnebnih sprememb (Zorn in Komac 2013). Vendar zaenkrat v Brkinih teh problemov ni.

Namakanja ali osuševanja teras na obravnavanem območju ni, čeprav je nedaleč stran, na meji med katastrskimi občinami Janeževo Brdo, Prelože in Čelje, postavljen majhen namakalni sistem. Ker se na terasnih ploskvah zadrži več padavin kot na neterasiranih pobočjih, terase akumulirajo večjo količino vode. Razumemo jih lahko tudi kot rezervoar, kjer se zadržuje voda, ki pogosto pade v obliki močnejših nalivov (Ažman Momirski 2007). Na skrajnem severu območja naselja Ostrožno Brdo, neposredno ob reki Reki, so bile sicer izvedene hidromelioracije, ki pa s kmetijskimi terasami nimajo nobene zveze.

Slika 11: Sodobna raba tal na terasiranih območjih petih podrobno preučenih brkinskih naselij.
Glej angleški del prispevka.

Njive in vrtovi so v sodobnosti le še skromno zastopani in jih je bistveno manj od sadovnjakov (Križaj Smrdel 2010a). Poleg sadovnjakov in seveda gozda je najbolj zastopano travinje, torej travniki in pašniki (slika 11). Na mnogih opuščenih njivah pasejo živino (slika 12), saj je živinoreja postala pomembnejša od nekoč prevladujoče samooskrbnega poljedelstva.

Slika 12: Na mnogih opuščenih terasah pasejo govejo živino.
Glej angleški del prispevka.

V zadnjih desetletjih je izrazito prevladujoč proces spreminjanja rabe tal na celotnem preučenem območju ogozdovanje. Delež gozda je razmeroma velik (16 %) tudi na terasiranih območjih, kar kaže na zaraščanje kmetijskih teras. Kljub temu smo v posameznih primerih ugotovili tudi krčenje gozda. V Brkinih načrtno oživljajo tradicionalno sadjarstvo (jabolka, hruške, slive, leske, višnje, breskve, češnje), ki ima na tem območju odlične razmere tako za integrirano kot ekološko pridelavo. Zametki sadjarstva, ki so ga spodbujali predvsem učitelji in župniki, so s konca 18. stoletja (Volk s sod. 2011). Temperaturne razmere, padavinski režim in značilna vetrovnost ugodno vplivajo na kakovost sadja. Večji del sadovnjakov je bil že na začetku 19. stoletja urejen na terasah oziroma terasnih brežinah. Dandanes so sadovnjaki na terasah pomembna zemljiška kategorija, saj so zasajeni na kar 12 % terasiranih območij. Sadno drevje tradicionalno sadijo na terasnih brežinah, s čimer preprečujejo erozijo, pri čemer je uravnana terasna ploskev na razpolago za drugačno kmetijsko rabo. Kljub naporom sadno drevje marsikod ni več vzdrževano in propada, s tem pa je ogrožen tudi obstoj teras.

3 Razprava

Terase so za kmetijsko pridelavo pomembne, saj ima prst na njih svojske kemijske in fizikalne lastnosti, zato je mogoče na njih gojiti visoko kakovostne kmetijske kulture. V obdobju povečane ozaveščenosti o kakovosti pridelane hrane je kmetijski potencial, ki ga premorejo Brkini, neprecenljiv.

Pomemben je tudi odnos med pokrajino, ki jo je oblikovalo kmetijstvo, in učinki njene podobe. Terasirane pokrajine niso samo pomemben kmetijski vir, ampak so hkrati lahko precejšnja turistična priložnost. Takšna pokrajina je privlačna in urejena v vseh letnih časih: spomladi, ko se prebuja narava in se obarva s svežimi zelenimi odtenki, poleti, ko bujnost in barvitost pestrega rastlinja zapeljuje pogled tam živečih in mimoidočih, jeseni, ko se odene v neverjetno slikovito paleto rumenkasto-rjavkastih barvnih odtenkov, in pozimi, ko geometrija teras v ogoleli pokrajini postane še najbolj prepoznavna. Prednost Brkinov je, da je tamkajšnje podnebje v času poletnih temperaturnih viškov zaradi večje nadmorske višine zelo prijetno. Privlačnost in dramatičnost brkinske pokrajine je tolikšna, da bi preučeno območje lahko postalo pomembna turistična destinacija. Ob tem se je seveda treba zavedati, kar je nauk tudi iz drugih terasiranih pokrajin v Evropi, kakršna je na primer Cinque Terre, da turizem sam po sebi ne vpliva na vzdrževanje in obnavljanje teras ter saditev trajnih nasadov, ampak gre predvsem za izziva upravljanja z zemljišči in uravnoteženega regionalnega razvoja.

V preučenih naseljih vršnega dela Brkinov nismo zaznali nobenega sistematičnega obnavljanja teras v večjem obsegu. Zato pa smo na meji naselja Ostrožno Brdo, v smeri proti Preložam, naleteli na v zgornjem delu preurejeno, v srednjem in spodnjem delu pa povsem na novo strojno terasirano pobočje z vzhodno ekspozicijo. To bi bilo ob množičnem, vsepovsod prisotnem zaraščanju in propadanju kmetijskih teras presenetljivo, če ne bi poznali zapletenih zemljiškoposestnih razmer, ki pospešujejo zemljiško razdrobljenost. Svoje prispeva tudi tradicionalna navezanost slovenskega kmeta, brkinski ni nikakršna izjema, na zemljo, kar zavira ali celo onemogoča promet s kmetijskimi zemljišči. V zgornjem delu terasiranega območja je bila na širokih, strojni obdelavi prilagojenih terasnih ploskvah že zasajena ozimna pšenica (slika 13), spodaj ležeče terase pa so bile še »v delu«. Primerov novega terasiranja je malo tudi drugod po Evropi, saj kmetovalci kulturne terase praviloma komajda vzdržujejo.

Slika 13: Preurejeno in na novo terasirano pobočje med Ostrožnim Brdom in Preložami.
Glej angleški del prispevka.

Pomembna prednost stopničastega preoblikovanja pobočij v Brkinih je, da na terasiranih območjih ne prihaja do plazenja pobočij. Izboljšanje demografskih in gospodarskih razmer bi lahko preprečilo nadaljnje zaraščanje zemljišč z nekakovostnimi gozdnimi sestoji. Načrtni ukrepi za ohranjanje poseljenosti in vzdrževanje kulturne pokrajine so glede na izjemno slabo demografsko podobo nujni, ker se le na ta način lahko povrne razvojna vitalnost in zagotovi nadaljnja privlačnost podeželja.

4 Sklep

Terasirana pokrajina v Brkinih je tako pomembna vrednota, da bi jo veljalo ohranjati zanamcem. Zato je treba na terasah omogočiti strojno obdelavo in za ta namen nanje urediti dovozne poti.

Razvojna vizija brkinskega kmetijstva in lokalnega gospodarstva nasploh zagotovo temelji na okolju prijaznem ekološkem kmetovanju, saj je po na ta način pridelani hrani vse večje povpraševanje. Ob tem velja spodbujati dopolnilne dejavnosti na kmetijah, razvijati na krajevnih značilnostih temelječo obrt in mehke oblike turizma. Verjetno bi to lahko pripomoglo k ohranjanju močno ogrožene kulturne pokrajine, ki ji je prav terasiranost vtisnila edinstven, nikjer drugje tako izrazito prepoznaven pečat.

Vse to pa bo izvedljivo le ob zadostnem številu vitalnih prebivalcev, ki bodo lahko skrbeli za vzdrževanje kulturne pokrajine. Infrastruktura se je že izboljšala, treba bo poskrbeti še za primerne možnosti preživetja preostalega prebivalstva, ki se bo seveda moralo pomladiti. Brez tega se še tako privlačni in enkratni pokrajini ne obeta nič dobrega. Razvojne težnje prejšnjega in začetka novega stoletja obetajo, da bo brez dodatnih prizadevanj prišlo tako do demografskega zloma kot do nezadržne popolne preobrazbe v prvobitno gozdno pokrajino.

5 Literatura

Glej angleški del prispevka.

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STRUCTURAL CHANGES IN LAND USE OF AGRICULTURAL HOLDINGS IN HILLY RURAL AREAS

SPREMEMBE V STRUKTURI UPORABE ZEMLJIŠČ NA KMEČKIH GOSPODARSTVIH NA HRIBOVITIH PODEŽELSKIH OBMOČJIH

Kristina Knific, Štefan Bojnec

Cultural landscape of the Škofja Loka Hills.
Kulturna pokrajina Škofjeloškega hribovja.

Structural changes in land use of agricultural holdings in hilly rural areas

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ABSTRACT: This paper analyses structural changes in agricultural holdings in the Škofja Loka region focusing on land use in the years 2000 and 2010. The analysis is conducted for the Škofja Loka region by socio-economic types of agricultural holdings, and by territories with different levels of economic development and different natural factors for agricultural production. Structural changes are different between municipalities with different natural factors for agricultural production and different levels of economic development as well as socio-economic types of agricultural holdings. State support for agricultural activity has mitigated overgrowth of agricultural land on naturally less favoured territories.

KEY WORDS: geography, structural changes, agricultural activity, agricultural holding, hilly areas, Slovenia

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1 Introduction

Over the last two decades, the agricultural research conducted in the transition countries of Central and Eastern Europe has often been related to land reforms, policies and agricultural land markets (e.g. Csaki and Lerman 2000; Bojnec 2013). In Slovenia, agricultural holdings comprise the greatest part of rural areas: as much as 96% of the land (Dernulc et al. 2002; Razpotnik Visković 2011). Their role in rural areas is multifunctional and includes the production of sufficient quantities of quality food, social role (above all the preservation of settlements, cultural and natural heritage, quality of life in rural areas and balanced spatial development) and also an environmental role (above all the protection of water resources, biodiversity conservation and climate changes; van Huylenbroeck et al. 2007). The competitiveness of Slovenian agriculture is low due to unfavourable size (dominance of small and medium-sized farms) and the socio-economic and production structure of farms (Cunder 1997; Vešter 2005). The production structure is limited due to the low production potential in the less-favoured areas for agricultural production which cover 85% of Slovenian territory, of which slightly less than 72% are hill and mountain areas (Republic of Slovenia 2009). The existence of agricultural activity of agricultural holdings in these areas depends on the State's support (e.g. Knific and Bojnec 2009; 2010; Slabe-Erker 2005) and provides the basis for the development of other economic activities in rural areas (Flury, Giuliani and Buchli 2008), being simultaneously oriented towards sustainable forms of agricultural production and the development of supplementary activities on farms (Bojnec, Jurinčič and Vodeb 2007; Korošec 2007; Kladnik 1999; Klemenčič, Lampič and Potočnik Slavič 2009). With the accession to the European Union (EU), Slovenia adopted its policies, among which common agricultural policy and rural development policy are the most important in view of agricultural activity. The EU Financial Perspective 2007–2013 allocated a little less than 42% of the EU budget to support agriculture and its role in rural development (European Parliament 2008).

The speed and the direction of change depend on the policy objectives and measures implemented (Happe 2004); however, not all agricultural holdings respond in the same way (Wolek 2009).

In order to maintain the cultivation of agricultural land in marginal areas, non-production related support is introduced by agricultural policy (Happe 2004; Brady et al. 2009; Kropp and Whitaker 2011).

This paper presents the results of the analysis of structural changes in land management in agricultural holdings of the Škofja Loka region with emphasis on the differences between 2000 (three years before Slovenia's accession to the EU) and 2010. In 2000, the rules of the common market were established in Slovenia, the state's support was mostly production related and the implementation of pre-accession assistance (SAPARD measures) began. After Slovenia's accession to the EU in 2004, non-production related payments were gradually established.

The analysis was conducted on three samples and sub-samples of agricultural holdings, namely: the sample of all agricultural holdings in the Škofja Loka region and sub-samples in view of communities or municipalities with different natural resources for agricultural production and economic development as well as by socio-economic types of agricultural holdings.

The research is focused on:

- the municipality of Škofja Loka, which is economically developed with relatively favourable conditions for agriculture as it covers the area of »Sorško polje« and
- the economically less developed municipality Gorenja vas-Poljane with a greater distance from city centres (local markets), with poorer conditions for agricultural production.

The research by municipalities or communities allowed the detection of changes and differences in the direction and size of the land under the management of agricultural holdings also in the cases when they cannot be detected by researching the sample of all agricultural holdings in the Škofja Loka region. In addition, research by socio-economic types of agricultural holdings allows the detection of changes and differences in the direction and size of the land under the management of a particular socio-economic type of agricultural holding, reflecting the importance of agricultural activity of AHs for its survival (Kovačič 1996; Frenkel and Rosner 1999; Wolek 2009).

2 Method

An agricultural holding is defined as a household with a farm, which complies with the criteria of a comparable farm in Europe. In the frame of this research, we classified socio-economic types of farms after

Kovačič (1996) with a variation: due to our noticing the significance of a supplementary activity on a farm we subdivide mixed and supplementary farms into mixed farms, supplementary farms and aged farms/farms in abandonment. The data on the land areas managed by agricultural holdings in the Škofja Loka region were collected for the population of AHs during the state's statistical censuses registering of farms (agriculture) in the years 2000 and 2010 (Dernulc et al. 2002; SORS 2010). The analyses of the changes in arithmetic means of the area of the land managed by agricultural holdings in the years 2000 and 2010 or between the two municipalities by socio-economic types of agricultural holdings are conducted by means of a t-test and the programme Statistical Package for the Social Sciences. The acceptable level of risk amounts to 5%. We define the socio-economic type of AH population based on (like Kovačič 1996 and Udovič, Kovačič and Kramarič 2006) the employment status of the agricultural holding core. Land in agricultural holding managing is all the land used by an agricultural holding and is divided into forest, infertile land and agricultural land. Agricultural land includes agricultural land in use, overgrown agricultural land or such land in the process of becoming overgrown and other uncultivated agricultural land. Agricultural land in use includes private and hired agricultural land in use and is further subdivided into fields and gardens, orchards, vineyards, and meadows and pastures (Dernulc et al. 2002).

3 Results

In the Škofja Loka region the number of agricultural holdings decreased by 7% in the period between 2000 and 2010, which is two times less than the average for agricultural holdings in the Republic of Slovenia, which decreased by 14%; Kutin Slatnar et al. 2012) and more than three times less than the EU average, which decreased by 27% or by 19.8%, excluding Malta for the period 2003–2010 (Eurostat 2011). The decrease in the number of agricultural holdings between 2000 and 2010 differs in the municipality of Škofja Loka (–9%) and the community of Gorenja vas-Poljane (–5%). The number of commercial farms (pure, mixed and supplementary farms) slightly increased in the municipality of Škofja Loka (+ 4%) and decreased in the community of Gorenja vas-Poljane (–4%). The number of supplementary farms increased, while the number of mixed farms and farms in abandonment decreased (Table 1). Farms in abandonment exit the sector twice as fast in the area of the municipality of Škofja Loka than in the area of the community of Gorenja vas-Poljane.

Most of the land in the region of Škofja Loka is managed by agricultural holdings. In 2000, agricultural holdings composed 69% of the surface area in the municipality of Škofja Loka and in community Gorenja vas-Poljane they composed 66% in 2010. The average area managed by agricultural holdings was 19.2 ha, of which slightly over 61% was forest (12 ha), 38% agricultural land (7.31 ha) and 0.9% (0.17 ha) infertile agricultural land. Between 2000 and 2010, the area of infertile land reduced statistically significantly in agricultural holding population, in agricultural holdings by municipalities or communities and in all socio-economic types except mixed farms.

3.1 Forest area managed by agricultural holdings

In 2010 agricultural holdings composed 122 km^2 of forest, while in 2000 they composed slightly over 3% less. In comparison to 2000, the average forest area in agricultural holdings in 2010 statistically significantly increased in supplementary farms, while it decreased in pure and mixed farms and in farms in abandonment (Table 1).

3.2 Agricultural land

In the year 2000, agricultural holdings composed slightly less than 7.2 ha of agricultural land on average, which is by one fifth higher than the average value of AHs in Slovenia (5.9 ha; Dernulc et al. 2002). The total area of agricultural land in use decreased by 7% in agricultural holdings in the Škofja Loka region between the years 2000 and 2010, due to, above all, the reduction of the area managed by the farms in abandonment and aged farms (–657 ha); however, with commercial farms it increased (+ 289 ha). *The average area of agricultural land* of agricultural holdings increased statistically significantly just with the agricultural holdings in the municipality of Škofja Loka, due to, above all, abandonment of agricultural production with

Table 1: Land managed by agricultural holdings in the years 2000 and 2010.

		Number of agricultural holdings	Land in total (ha)				Forest (ha)				Infertile land (ha)			
			Arithmetic mean	Standard deviation	t-statistics	Risk level (p-value)	Arithmetic mean	Standard deviation	t-statistics	Risk level (p-value)	Arithmetic mean	Standard deviation	t-statistics	Risk level (p-value)
Population	2000 (A)	1,089	18.97	16.38			11.60	12.44			0.22	0.44		
	2010 (B)	1,018	19.24	18.16			11.99	14.81			0.17	0.24		
	Difference (B-A)	−71	0.27	1.78	−0.36	0.36	0.39	2.37	−0.65	0.26	−0.05	−0.20	3.62	0.00
Agricultural holdings in the community of Gorenja-vas Poljane	2000 (A)	590	18.69	15.53			10.77	10.66			0.20	0.45		
	2010 (B)	561	18.50	15.91			11.20	11.48			0.16	0.23		
	Difference (B-A)	−29	−0.19	0.38	0.21	0.42	0.43	0.82	−0.66	0.25	−0.04	−0.22	2.00	0.02
Agricultural holdings in the municipality of Škofja Loka	2000 (A)	499	19.30	17.34			12.57	14.21			0.25	0.44		
	2010 (B)	457	20.15	20.56			12.95	18.05			0.18	0.25		
	Difference (B-A)	−42	0.85	3.22	−0.68	0.25	0.38	3.84	−0.36	0.36	−0.07	−0.19	3.17	0.00
Pure farms	2000 (A)	104	36.56	20.06			22.15	16.83			0.39	0.63		
	2010 (B)	122	30.20	17.85			16.93	13.63			0.26	0.27		
	Difference (B-A)	18	−6.36	−2.21	2.50	0.01	−5.22	−3.20	2.53	0.01	−0.13	−0.36	1.93	0.03
Mixed farms	2000 (A)	371	21.62	15.23			13.38	12.11			0.23	0.51		
	2010 (B)	123	17.62	11.85			8.72	8.97			0.23	0.33		
	Difference (B-A)	−248	−4.00	−3.38	3.00	0.00	−4.66	−3.14	4.55	0.00	0.00	−0.18	0.02	0.49
Farms in abandonment	2000 (A)	518	13.40	12.86			8.04	9.92			0.17	0.31		
	2010 (B)	436	10.83	10.13			6.15	7.26			0.12	0.16		
	Difference (B-A)	−82	−2.57	−2.73	3.46	0.00	−1.89	−2.66	3.39	0.00	−0.05	−0.15	3.30	0.00
Supplementary farms	2000 (A)	35	26.07	19.71			16.58	14.73			0.28	0.34		
	2010 (B)	264	30.71	22.56			21.94	20.25			0.18	0.25		
	Difference (B-A)	229	4.64	2.85	−1.29	0.10	5.36	5.52	−1.92	0.03	−0.10	−0.09	1.52	0.07
Aged farms	2000 (A)	61	16.09	14.66			10.13	10.31			0.30	0.56		
	2010 (B)	73	12.39	15.40			8.12	13.75			0.13	0.27		
	Difference (B-A)	12	−3.70	0.74	1.42	0.08	−2.01	3.44	0.97	0.17	−0.17	−0.29	2.09	0.02

Source: Statistical Office of the Republic of Slovenia and own calculation from the data bases of agricultural censuses in the years 2000 and 2010.

Table 2: Agricultural land, uncultivated agricultural land in use and overgrowing agricultural land in the years 2000 and 2010.

		Number of agricultural holdings	Uncultivated agricultural land (ha)				Overgrowing agricultural land (ha)				Agricultural land (ha)			
			Arithmetic mean	Standard deviation	t-statistics	Risk level (p-value)	Arithmetic mean	Standard deviation	t-statistics	Risk level (p-value)	Arithmetic mean	Standard deviation	t-statistics	Risk level (p-value)
Population	2000 (A)	1,089	0.68	2.65			0.45	2.52			7.15	5.98		
	2010 (B)	1,018	0.28	1.53			0.25	1.39			7.31	6.36		
	Difference (B–A)	−71	−0.40	−1.12	4.22	0.00	−0.20	−1.13	2.34	0.01	0.16	0.38	−0.61	0.27
Agricultural holdings in the community of Gorenja vas-Poljane	2000 (A)	590	0.88	3.44			0.68	3.29			7.72	6.81		
	2010 (B)	561	0.39	1.91			0.35	1.76			7.47	6.48		
	Difference (B–A)	−29	−0.49	−1.53	3.01	0.00	−0.33	−1.53	2.15	0.02	−0.25	−0.33	0.64	0.26
Agricultural holdings in the municipality of Škofja Loka	2000 (A)	499	0.44	1.09			0.19	0.97			6.48	4.73		
	2010 (B)	457	0.15	0.83			0.12	0.69			7.12	6.22		
	Difference (B–A)	−42	−0.29	−0.26	4.55	0.00	−0.07	−0.28	1.14	0.13	0.64	1.49	−1.79	0.04
Pure farms	2000 (A)	104	1.36	6.30			0.97	5.97			14.03	9.09		
	2010 (B)	122	0.41	2.35			0.25	1.71			13.18	8.47		
	Difference (B–A)	18	−0.95	−3.95	1.45	0.06	−0.72	−4.26	1.19	0.12	−0.85	−0.62	0.73	0.23
Mixed farms	2000 (A)	371	0.59	1.38			0.35	1.30			8.01	4.98		
	2010 (B)	123	0.14	0.55			0.13	0.55			8.81	6.37		
	Difference (B–A)	−248	−0.45	−0.83	5.17	0.00	−0.22	−0.75	2.58	0.01	0.80	1.39	−1.28	0.07
Farms in abandonment	2000 (A)	518	0.48	1.26			0.30	1.19			5.19	4.44		
	2010 (B)	436	0.23	1.35			0.22	1.34			4.92	4.59		
	Difference (B–A)	−82	−0.25	0.09	2.94	0.00	−0.08	0.15	1.04	0.15	−0.27	0.15	0.94	0.17
Supplementary farms	2000 (A)	35	2.03	6.67			1.74	6.54			9.21	7.48		
	2010 (B)	264	0.42	1.76			0.36	1.65			8.67	5.98		
	Difference (B–A)	229	−1.61	−4.91	1.42	0.08	−1.38	−4.89	1.24	0.05	−0.54	−1.50	0.41	0.34
Aged farms	2000 (A)	61	0.98	2.40			0.68	2.33			5.66	5.25		
	2010 (B)	73	0.18	0.85			0.16	0.85			4.41	3.48		
	Difference (B–A)	12	−0.80	−1.55	2.50	0.01	−0.52	−1.48	1.65	0.05	−1.25	−1.77	1.59	0.05

Source: Statistical Office of the Republic of Slovenia and own calculation from the data bases of agricultural censuses in the years 2000 and 2010.

Table 3: Owned and leased agricultural land in use in the years 2000 and 2010.

		Number of agricultural holdings	Agricultural land in use (ha)											
			Total				Own				Leased			
			Arithmetic mean	Standard deviation	t-statistics	Risk level (p-value)	Arithmetic mean	Standard deviation	t-statistics	Risk level (p-value)	Arithmetic mean	Standard deviation	t-statistics	Risk level (p-value)
Population	2000 (A)	1,089	6.69	5.08			6.11	4.64			0.58	1.66		
	2010 (B)	1,018	6.80	5.98			6.06	4.99			0.74	2.30		
	Difference (B–A)	–71	0.11	0.90	–0.43	0.33	–0.05	0.35	0.24	0.40	0.16	0.64	–1.77	0.04
Agricultural holdings in the community of Gorenja vas-Poljane	2000 (A)	590	7.04	5.44			6.48	5.09			0.56	1.74		
	2010 (B)	561	6.75	5.92			6.10	4.99			0.64	2.08		
	Difference (B–A)	–29	–0.29	0.48	0.86	0.19	–0.38	–0.10	1.25	0.11	0.08	0.34	–0.73	0.23
Agricultural holdings in the municipality of Škofja Loka	2000 (A)	499	6.29	4.58			5.68	3.99			0.61	1.56		
	2010 (B)	457	6.86	6.06			6.00	4.99			0.86	2.55		
	Difference (B–A)	–42	0.57	1.48	–1.64	0.05	0.32	1.00	–1.11	0.08	0.25	0.99	–1.79	0.04
Pure farms	2000 (A)	104	13.05	6.10			11.23	5.45			1.83	3.61		
	2010 (B)	122	12.60	8.08			10.03	5.63			2.57	4.78		
	Difference (B–A)	18	–0.45	1.98	0.48	0.32	–1.20	0.18	1.62	0.05	0.74	1.17	–1.32	0.09
Mixed farms	2000 (A)	371	7.65	4.61			7.03	4.34			0.62	1.48		
	2010 (B)	123	8.54	6.30			7.22	5.32			1.31	2.60		
	Difference (B–A)	–248	0.89	1.69	–1.44	0.08	0.19	0.98	–0.36	0.36	0.69	1.12	–2.82	0.00
Farms in abandonment	2000 (A)	518	4.89	3.98			4.51	3.74			0.38	1.09		
	2010 (B)	436	4.33	3.73			4.07	3.57			0.26	0.86		
	Difference (B–A)	–82	–0.56	–0.25	2.22	0.01	–0.44	–0.17	1.85	0.03	–0.12	–0.23	1.82	0.03
Supplementary farms	2000 (A)	35	7.46	4.25			7.20	4.26			0.26	0.75		
	2010 (B)	264	8.17	5.76			7.57	5.20			0.60	1.85		
	Difference (B–A)	229	0.71	1.51	–0.89	0.19	0.37	0.94	–0.48	0.32	0.34	1.10	–1.99	0.02
Aged farms	2000 (A)	61	4.97	4.28			4.77	4.06			0.20	0.61		
	2010 (B)	73	3.95	2.97			3.87	2.84			0.09	0.40		
	Difference (B–A)	12	–1.02	–1.31	1.57	0.05	–0.90	–1.22	1.47	0.07	–0.11	–0.21	1.28	0.10

Source: Statistical Office of the Republic of Slovenia and own calculation from the data bases of agricultural censuses in the years 2000 and 2010.

the farms in abandonment (abandonment of agricultural production) and the reduction of the area in the aged farms (Table 2).

Overgrowing agricultural land amounted to 6.8% of all agricultural land managed by agricultural holdings or 0.45 ha per agricultural holding in the year 2000, which is 1.3 times less than the Slovenian average (Dernulc et al. 2002); however, in the year 2010 its average area almost halved. The average area of overgrowing agricultural land decreased statistically significantly with agricultural holdings, with mixed and supplementary farms as well as with aged farms, in the community of Gorenja vas-Poljane (Table 2). This is due to the state's support related to the units of area payments.

The percentage of infertile land managed by agricultural holdings was lower in 2010 than in 2000 with the population of agricultural holdings by municipalities and by socio-economic types, with the exception of mixed farms (Table 2).

The average area of agricultural land in use totalled 6.7 ha per agricultural holding in the year 2000, which is slightly more than 13% higher than the Slovenian average (5.9 ha; Dernulc et al. 2002). During the years 2000 and 2010, the average area of agricultural land in use increased statistically significantly by 10% in agricultural holdings in the municipality of Škofja Loka, due to, above all, abandonment of agricultural production on farms in abandonment and the reduction in the area of agricultural land in use with aged farms and farms in abandonment (Table 3). A greater average area of the leased agricultural land in use with the population of AHs in the year 2010, compared to the year 2000, resulted from a bigger area of the leased agricultural land in use with agricultural holdings in the municipality of Škofja Loka or a greater area of the leased agricultural land in use of commercial farms; however, the average leased area of agricultural land in use decreased with non-commercial farms (Table 3). Agricultural holdings in the municipality of Škofja Loka composed almost 6 times greater an area of fields (1.8 ha/agricultural holding), and agricultural holdings in the community Gorenja vas-Poljane composed a fourth bigger area of permanent meadows and pastures.

During the years 2000 and 2010 there were changes in agricultural holdings in the area of agricultural land in uses by the agricultural land in use classes in the polarization of the growth in the size of agricultural holdings by the area of agricultural land in use in two directions: a group of relatively big commercial farms (agricultural land in use above 15 ha) and a group of smaller farms (agricultural land in use 3–5 ha). The reasons are ascribed, beside the abandoning of agricultural production on smaller farms in terms of the area of agricultural land in use, to the maintaining of agricultural production on particular small farms that are predominantly self-reliant (3–5 ha of agricultural land in use) and to the increase in farm sizes and taking advantage of the economy of scale with the rest of the farms in the direction of bigger farms by the area of agricultural land in use (above 15 ha of agricultural land in use). The polarisation is a bit more explicit with agricultural holdings in the municipality of Škofja Loka.

4 Conclusion

Most of the land in the Škofja Loka region was managed by agricultural holdings in the years 2000 and 2010. The average area of agricultural holding land (forest, agricultural land and infertile land) in the Škofja Loka region increased statistically insignificantly; however, the total area of land managed by agricultural holdings decreased, above all due to the decreasing of the area of the land managed by farms in abandonment (small, mainly self-reliant farms). The number of farms in abandonment and mixed farms decreased; however, the number of supplementary farms increased. For their survival, forest with wood processing as a supplementary activity on a farm was important for some supplementary farms between the years 2000 and 2010. The changes were more significant in the area with a more developed industry and better natural conditions for agricultural production. The number of pure farms is seemingly stable, above all due to the retirement of pure farmers and farmers with non-agricultural jobs.

Between the years 2000 and 2010, the structural changes in agricultural holdings with different natural conditions for farming and economic development differ in the direction and the scope of these changes. In the area with limited chances for agricultural production, the state's support relating to the area of agricultural land in use prevented the overgrowing of agricultural land; moreover, the area of infertile land decreased and the area of uncultivated agricultural land decreased in both studied areas and including all socio-economic types. The structural changes which are reflected in the abandonment of farming by small-scale farms and in increasing the farming areas with the rest (above all leasing agricultural land in use) are relatively slower than those of the Slovenian average and more explicit with agricultural holdings in the area with better natural conditions for farming. We can perceive the polarisation in the growth of the area of agricultural holdings by the area of agricultural land in use, in two directions: a group of relatively big commercial farms (agricultural land in use above 15 ha) and a group of smaller, mainly self-reliant farms (agricultural land in use 3–5 ha). The increase in the area of agricultural land in use results, above all, from a bigger area of the leased agricultural land in use with commercial farms; however, the area of their own agricultural land in use did not increase.

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Spremembe v strukturi uporabe zemljišč na kmečkih gospodarstvih na hribovitih podeželskih območjih

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IZVLEČEK: V prispevku so analizirane strukturne spremembe na kmečkih gospodarstvih na škofjeloškem območju s poudarkom na empirični analizi zemlje v upravljanju v letih 2000 in 2010. Analiza je izvedena za škofjeloško območje, po socio-ekonomskih tipih kmečkih gospodarstev in po območjih z različno gospodarsko razvitostjo in različnimi danostmi za kmetijsko pridelavo. Strukturne spremembe zemlje na škofjeloškem območju so za obdobje 2000–2010 potrjene in so med občinama z različnimi naravnimi danostmi za kmetijko pridelavo in gospodarsko razvitostjo različne, prav tako so zaznane razlike po socio-ekonomskih tipih kmečkih gospodarstev. Državne pomoči kmetijski dejavnosti so preprečile zaraščanje kmetijske zemlje na območju s slabšimi naravnimi danostmi.

KLJUČNE BESEDE: geografija, strukturne spremembe, kmetijska dejavnost, kmečka gospodarstva, hribovito območje, Slovenija

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1 Uvod

V zadnjih dveh desetletjih se raziskave v kmetijstvu tranzicijskih držav srednje in vzhodne Evrope pogosto navezujejo na zemljiške reforme, politiko in trge kmetijskih zemljišč (npr. Csaki in Lerman 2000; Bojnec 2013). V Slovenji so kmečka gospodarstva najpomembnejši upravljavci podeželske krajine, saj upravljajo s kar 96 % zemljišč (Dernulc s sod. 2002; Razpotnik Visković 2011). Njihova vloga na podeželju je multifunkcionalna in obsega poleg proizvodnje zadostnih količin kakovostne hrane tudi socialno vlogo (predvsem ohranjanje poseljenosti, kulturne in naravne dediščine, kakovosti življenja na podeželju in uravnotežen prostorski razvoj) ter okoljsko vlogo (predvsem varovanje vodnih virov, ohranjanje biološke raznovrstnosti in podnebne spremembe) (van Huylenbroeck s sod. 2007). Konkurenčnost slovenskega kmetijstva je zaradi neugodne velikostne (prevlada majhnih in srednje velikih kmetij), socio-ekonomske in proizvodne strukture kmetij nizka (Cunder 1997; Vešter 2005). Proizvodna struktura je omejena predvsem zaradi nizkih proizvodnih potencialov na območjih z omejenimi možnostmi za kmetijsko pridelavo, ki pokrivajo 85 % ozemlja Slovenije, od tega je nekaj manj kot 72 % hribovsko gorskih območij (RS 2009). Obstanek kmetijske dejavnosti kmečkih gospodarstev na teh območjih je povezan z državno pomočjo (npr. Knific in Bojnec 2009, 2010; Slabe-Erker 2005) in daje osnovo za ekonomski razvoj drugih dejavnosti na podeželju (Flury, Giuliani in Buchli 2008) s sočasnim usmerjenjem v trajnostne oblike kmetijske pridelave in razvoj dopolnilnih dejavnosti na kmetiji (Bojnec, Jurinčič in Vodeb 2007; Korošec 2007; Kladnik 1999; Klemenčič, Lampič in Potočnik Slavič 2009). Slovenija je s pristopom k Evropski Uniji (EU) prevzela njene politike, od katerih sta z vidika kmetijske dejavnosti najpomembnejši skupna kmetijska politika in politika razvoja podeželja. EU je v finančni perspektivi 2007–2013 nekaj manj kot 42 % proračuna EU namenila pomočem kmetijstvu in njegovi vlogi pri razvoju podeželja (European Parliament 2008). Od ciljev politik oziroma izvedenih ukrepov je odvisna hitrost in smer sprememb (Happe 2004), vendar vsa kmečka gospodarstva ne odreagirajo enako (Wolek 2009). Za ohranitev obdelanosti kmetijske zemlje na marginalnih območjih so uvedene neproizvodno vezane pomoči (Happe 2004; Brady s sod. 2009; Kropp in Whitaker 2011).

V okviru tega prispevka predstavimo rezultate analize strukturnih sprememb zemlje v upravljanju kmečkih gospodarstev na Škofjeloškem s poudarkom na ugotavljanju razlik med letoma 2000 (tri leta ped pristopom Slovenije k EU) in 2010. V letu 2000 so se v Sloveniji uveljavila pravila skupnega trga, državne pomoči so bile pretežno vezane na proizvodnjo, pričeli so se izvajati ukrepi predpristopne pomoči SAPARD. Po pristopu Slovenije k EU v letu 2004 pa so se postopoma uveljavila neproizvodno vezana plačila.

Analiza je izvedena skozi tri vzorce in pod-vzorce kmečkih gospodarstev, in sicer: za celoten vzorec kmečkih gospodarstev za škofjeloško območje, znotraj njega po občinah z različnimi naravnimi danostmi za kmetijsko pridelavo in gospodarsko razvitostjo ter po socio-ekonomskih tipih kmečkih gospodarstev. Z raziskavo se osredotočimo na:

- Škofjeloško območje, natančneje na občini Škofja Loka, ki je gospodarsko bolj razvito območje z relativno ugodnejšimi pogoji za kmetijstvo, ker del območja obsega Sorško polje, in
- Gorenja vas–Poljane, ki je gospodarsko slabše razvita z večjo oddaljenostjo do mestnih središč (lokalni trgi), s slabšimi pogoji za kmetijsko pridelavo, ki so relativno slabši za celotno območje občine, ki se nahaja na območju z omejenimi pogoji za kmetijsko pridelavo. Raziskava po občinah omogoči zaznavo sprememb in razlik v smeri in obsegu zemlje v upravljanju kmečkih gospodarstev tudi v primeru, ko le-te pri populaciji celotnega območja ni mogoče zaznati. Nadalje raziskava po socio-ekonomskih tipih kmečkih gospodarstev omogoči zaznati spremembe in razlike v smeri in obsegu zemlje v upravljanju posameznega socio-ekonomskega tipa kmečkih gospodarstev, ki odraža pomen kmetijske dejavnosti kmečkih gospodarstev za njegovo preživetje (Kovačič 1996; Frenkel in Rosner 1999; Wolek 2009).

2 Metoda

Kmečka gospodarstva so gospodinjstva s kmetijo, ki izpolnjuje kriterije evropsko primerljive kmetije. V okviru te raziskave določamo socio-ekonomske tipe kmečkih gospodarstev po Kovačiču (1996) s to razliko, da zaradi zaznave pomena dopolnilne dejavnosti na kmetiji razdelimo mešane in dopolnilne kmetije na mešane, dopolnilne kmetije ter kmetije v opuščanju. Podatki o površinah zemlje v upravljanju kmečkih gospodarstev na Škofjeloškem so bili zbrani za populacijo kmečkih gospodarstev v okviru državnih statističnih popisov kmetijstva v letih 2000 in 2010 (Dernulc s sod. 2002; SURS 2010). Analize razlik aritmetičnih sredin zemlje v upravljanju kmečkih gospodarstev med letoma 2000 in 2010 oziroma med občinama oziroma po socio-ekonomskih tipih kmečkih gospodarstev so izvedene s t-testom in uporabo programa Statistical Package for the Social Sciences. Sprejemljiva stopnja tveganja znaša 5 %. Pri določitvi socio-ekonomskega tipa populacije kmečkih gospodarstev izhajamo (Kovačič 1996; Udovič, Kovačič in Kramarič 2006) iz zaposlitvenega statusa jedra KG. Zemljišča v upravljanju kmečkega gospodarstva so vsa zemljišča v uporabi, ki jih ima kmečko gospodarstvo v uporabi in jih delimo na gozd, nerodovitna zemljišča in kmetijska zemljišča. Kmetijska zemljišča zajemajo kmetijska zemljišča v uporabi, kmetijska zemljišča v zaraščanju in druga neobdelana kmetijska zemljišča. Kmetijska zemljišča v uporabi obsega lastna in najeta kmetijska zemljišča v uporabi ter jih delimo na njive in vrtove, sadovnjake, vinograde ter travnike in pašnike (Dernulc s sod. 2002).

3 Rezultati

Na Škofjeloškem se je v obdobju 2000–2010 število kmečkih gospodarstev zmanjšalo za 7 %, kar je dvakrat manj od povprečja za kmečka gospodarstva v Republiki Sloveniji (–14 %; Kutin Slatnar s sod. 2012) oziroma za več kot trikrat manj od povprečja EU-27 (–19,8 %, brez Malte in za obdobje 2003–2010 (Eurostat 2011). Zmanjšanje števila kmečkih gospodarstev je bilo med leti 2000 in 2010 pri občinah Škofja Loka (–9 %) in Gorenja vas-Poljane (–5 %) različno. Število komercialnih kmetij (čiste, mešane in dopolnilne kmetije) se je v občini Škofja Loka nekoliko povečalo (+ 4 %), v občini Gorenja vas-Poljane pa zmanjšalo (–4 %). Povečalo se je število dopolnilnih kmetij, zmanjšalo pa število mešanih kmetij in kmetij v opuščanju (preglednica 1). Kmetije v opuščanju so izstopale iz sektorja dvakrat hitreje na območju občine Škofja Loka kot na območju občine Gorenja vas-Poljane.

Večina zemlje na Škofjeloškem je v upravljanju kmečkih gospodarstev. V letu 2000 so kmečka gospodarstva na Škofjeloškem razpolagala s 69 % površine ozemlja občin Škofja Loka in Gorenja vas-Poljane, v letu 2010 pa 66 %. Povprečna površina zemljišč v upravljanju kmečkih gospodarstev je bila 19,2 ha zemljišč, od tega je bilo nekaj nad 61 % gozda (12 ha), 38 % kmetijskih zemljišč (7,31 ha) in 0,9 % (0,17 ha) nerodovitnih kmetijskih zemljišč. Med leti 2000 in 2010 se je površina nerodovitnih zemljišč statistično značilno zmanjšala pri populacij kmečkih gospodarstev, pri kmečkih gospodarstvih po občinah in pri vseh socio-ekonomskih tipih, razen pri mešanih kmetijah.

3.1 Površina gozda v upravljanju kmečkih gospodarstev

Leta 2010 so kmečka gospodarstva KG razpolagala z 122 km^2 gozda, v letu 2000 pa z nekaj nad 3 % manj. Povprečna površina gozda na kmečko gospodarstvo je bila v letu 2010, primerjalno z letom 2000, statistično značilno večja pri dopolnilnih kmetijah, medtem ko se je pri čistih in mešanih kmetijah in kmetijah v opuščanju zmanjšala (preglednica 1).

3.2 Kmetijska zemljišča

Kmečka gospodarstva so v letu 2000 v povprečju razpolagala z nekaj manj kot 7,2 ha kmetijskih zemljišč, kar je za petino več od povprečne vrednosti kmečkih gospodarstev v Sloveniji (5,9 ha; Dernulc s sod. 2002). Skupna površina kmetijska zemljišča v uporabi se je pri kmečkih gospodarstvih na Škofjeloškem med leti 2000 in 2010 zmanjšala za 7 % predvsem zaradi zmanjšanja površin v upravljanju kmetij v opuščanju in ostarelih kmetijah (–657 ha), medtem ko se je pri komercialnih kmetijah povečala (+ 289 ha). Povprečna površina kmetijskih zemljišč kmečkega gospodarstva se je statistično značilno povečala le pri kmečkih gospodarstvih iz občine Škofja Loka, in sicer predvsem na račun opuščanja kmetijske pridelave pri kmetijah v opuščanju (opustitev kmetijske pridelave) in zmanjšanja površine pri ostarelih kmetijah (preglednica 2).

Kmetijska zemljišča v zaraščanju so v letu 2000 obsegala 6,8 % vseh kmetijskih zemljišč v upravljanju kmečkih gospodarstev oziroma 0,45 ha na kmečko gospodarstvo, kar je za 1,3-krat manj od slovenskega povprečja (Dernulc s sod. 2002), v letu 2010 pa se je njihova povprečna površina skoraj prepolovila. Povprečna površina kmetijske zemlje v zaraščanju se je statistično značilno zmanjšala pri kmečkih gospodarstvih iz občine Gorenja vas-Poljane, pri mešanih in dopolnilnih kmetijah ter ostarelih kmetijah (preglednica 2). Rezultat pripisujemo predvsem državnim pomočem vezanim na enoto površine.

Preglednica 1: Zemlja v upravljanju kmečkih gospodarstev v letih 2000 in 2010.

		število kmečkih gospodarstev	vsa zemljišča (ha)				gozd (ha)				nerodovitna zemljišča (ha)			
			aritmetična sredina	standardni odklon	t-statistika	stopnja tveganja (p-vrednost)	aritmetična sredina	standardni odklon	t-statistika	stopnja tveganja (p-vrednost)	aritmetična sredina	standardni odklon	t-statistika	stopnja tveganja (p-vrednost)
populacija	2000 (A)	1.089	18,97	16,38			11,60	12,44			0,22	0,44		
	2010 (B)	1.018	19,24	18,16			11,99	14,81			0,17	0,24		
	Razlika (B-A)	–71	0,27	1,78	–0,36	0,36	0,39	2,37	–0,65	0,26	–0,05	–0,20	3,62	0,00
kmečka gospodarstva iz občine Gorenja vas-Poljane	2000 (A)	590	18,69	15,53			10,77	10,66			0,20	0,45		
	2010 (B)	561	18,50	15,91			11,20	11,48			0,16	0,23		
	Razlika (B-A)	–29	–0,19	0,38	0,21	0,42	0,43	0,82	–0,66	0,25	–0,04	–0,22	2,00	0,02
kmečka gospodarstva iz občine Škofja Loka	2000 (A)	499	19,30	17,34			12,57	14,21			0,25	0,44		
	2010 (B)	457	20,15	20,56			12,95	18,05			0,18	0,25		
	Razlika (B-A)	–42	0,85	3,22	–0,68	0,25	0,38	3,84	–0,36	0,36	–0,07	–0,19	3,17	0,00
čiste kmetije	2000 (A)	104	36,56	20,06			22,15	16,83			0,39	0,63		
	2010 (B)	122	30,20	17,85			16,93	13,63			0,26	0,27		
	Razlika (B-A)	18	–6,36	–2,21	2,50	0,01	–5,22	–3,20	2,53	0,01	–0,13	–0,36	1,93	0,03
mešane kmetije	2000 (A)	371	21,62	15,23			13,38	12,11			0,23	0,51		
	2010 (B)	123	17,62	11,85			8,72	8,97			0,23	0,33		
	Razlika (B-A)	–248	–4,00	–3,38	3,00	0,00	–4,66	–3,14	4,55	0,00	0,00	–0,18	0,02	0,49
kmetije v opuščanju	2000 (A)	518	13,40	12,86			8,04	9,92			0,17	0,31		
	2010 (B)	436	10,83	10,13			6,15	7,26			0,12	0,16		
	Razlika (B-A)	–82	–2,57	–2,73	3,46	0,00	–1,89	–2,66	3,39	0,00	–0,05	–0,15	3,30	0,00
dopolnilne kmetije	2000 (A)	35	26,07	19,71			16,58	14,73			0,28	0,34		
	2010 (B)	264	30,71	22,56			21,94	20,25			0,18	0,25		
	Razlika (B-A)	229	4,64	2,85	–1,29	0,10	5,36	5,52	–1,92	0,03	–0,10	–0,09	1,52	0,07
ostarele kmetije	2000 (A)	61	16,09	14,66			10,13	10,31			0,30	0,56		
	2010 (B)	73	12,39	15,40			8,12	13,75			0,13	0,27		
	Razlika (B-A)	12	–3,70	0,74	1,42	0,08	–2,01	3,44	0,97	0,17	–0,17	–0,29	2,09	0,02

Vir: SURS in lastni izračuni iz podatkov baz popisov kmetijstva v letih 2000 in 2010.

Preglednica 2: Kmetijska zemlja, neobdelana kmetijska zemljišča v uporabi in kmetijska zemlja v zaraščanju v letih 2000 in 2010.

		število kmečkih gospodarstev	neobdelana kmetijska zemljišča (ha)				kmetijska zemljišča v zaraščanju (ha)				kmetijska zemljišča (ha)			
			aritmetična sredina	standardni odklon	t-statistika	stopnja tveganja (p-vrednost)	aritmetična sredina	standardni odklon	t-statistika	stopnja tveganja (p-vrednost)	aritmetična sredina	standardni odklon	t-statistika	stopnja tveganja (p-vrednost)
populacija	2000 (A)	1.089	0,68	2,65			0,45	2,52			7,15	5,98		
	2010 (B)	1.018	0,28	1,53			0,25	1,39			7,31	6,36		
	Razlika (B-A)	–71	–0,40	–1,12	4,22	0,00	–0,20	–1,13	2,34	0,01	0,16	0,38	–0,61	0,27
kmečka gospodarstva iz občine Gorenja vas-Poljane	2000 (A)	590	0,88	3,44			0,68	3,29			7,72	6,81		
	2010 (B)	561	0,39	1,91			0,35	1,76			7,47	6,48		
	Razlika (B-A)	–29	–0,49	–1,53	3,01	0,00	–0,33	–1,53	2,15	0,02	–0,25	–0,33	0,64	0,26
kmečka gospodarstva iz občine Škofja Loka	2000 (A)	499	0,44	1,09			0,19	0,97			6,48	4,73		
	2010 (B)	457	0,15	0,83			0,12	0,69			7,12	6,22		
	Razlika (B-A)	–42	–0,29	–0,26	4,55	0,00	–0,07	–0,28	1,14	0,13	0,64	1,49	–1,79	0,04
čiste kmetije	2000 (A)	104	1,36	6,30			0,97	5,97			14,03	9,09		
	2010 (B)	122	0,41	2,35			0,25	1,71			13,18	8,47		
	Razlika (B-A)	18	–0,95	–3,95	1,45	0,06	–0,72	–4,26	1,19	0,12	–0,85	–0,62	0,73	0,23
mešane kmetije	2000 (A)	371	0,59	1,38			0,35	1,30			8,01	4,98		
	2010 (B)	123	0,14	0,55			0,13	0,55			8,81	6,37		
	Razlika (B-A)	–248	–0,45	–0,83	5,17	0,00	–0,22	–0,75	2,58	0,01	0,80	1,39	–1,28	0,07
kmetije v opuščanju	2000 (A)	518	0,48	1,26			0,30	1,19			5,19	4,44		
	2010 (B)	436	0,23	1,35			0,22	1,34			4,92	4,59		
	Razlika (B-A)	–82	–0,25	0,09	2,94	0,00	–0,08	0,15	1,04	0,15	–0,27	0,15	0,94	0,17
dopolnilne kmetije	2000 (A)	35	2,03	6,67			1,74	6,54			9,21	7,48		
	2010 (B)	264	0,42	1,76			0,36	1,65			8,67	5,98		
	Razlika (B-A)	229	–1,61	–4,91	1,42	0,08	–1,38	–4,89	1,24	0,05	–0,54	–1,50	0,41	0,34
ostarele kmetije	2000 (A)	61	0,98	2,40			0,68	2,33			5,66	5,25		
	2010 (B)	73	0,18	0,85			0,16	0,85			4,41	3,48		
	Razlika (B-A)	12	–0,80	–1,55	2,50	0,01	–0,52	–1,48	1,65	0,05	–1,25	–1,77	1,59	0,05

Vir: SURS in lastni izračuni iz podatkov baz popisov kmetijstva v letih 2000 in 2010.

Preglednica 3: Lastna in najeta kmetijska zemljišča v uporabi v letih 2000 in 2010.

			kmetijska zemljišča v uporabi (ha)											
			skupaj				lastna				najeta			
		število kmečkih gospodarstev	aritmetična sredina	standardni odklon	t-statistika	stopnja tveganja (p-vrednost)	aritmetična sredina	standardni odklon	t-statistika	stopnja tveganja (p-vrednost)	aritmetična sredina	standardni odklon	t-statistika	stopnja tveganja (p-vrednost)
populacija	2000 (A)	1.089	6,69	5,08			6,11	4,64			0,58	1,66		
	2010 (B)	1.018	6,80	5,98			6,06	4,99			0,74	2,30		
	Razlika (B-A)	−71	0,11	0,90	−0,43	0,33	−0,05	0,35	0,24	0,40	0,16	0,64	−1,77	0,04
kmečka gospodarstva iz občine Gorenja vas-Poljane	2000 (A)	590	7,04	5,44			6,48	5,09			0,56	1,74		
	2010 (B)	561	6,75	5,92			6,10	4,99			0,64	2,08		
	Razlika (B-A)	−29	−0,29	0,48	0,86	0,19	−0,38	−0,10	1,25	0,11	0,08	0,34	−0,73	0,23
kmečka gospodarstva iz občine Škofja Loka	2000 (A)	499	6,29	4,58			5,68	3,99			0,61	1,56		
	2010 (B)	457	6,86	6,06			6,00	4,99			0,86	2,55		
	Razlika (B-A)	−42	0,57	1,48	−1,64	0,05	0,32	1,00	−1,11	0,08	0,25	0,99	−1,79	0,04
čiste kmetije	2000 (A)	104	13,05	6,10			11,23	5,45			1,83	3,61		
	2010 (B)	122	12,60	8,08			10,03	5,63			2,57	4,78		
	Razlika (B-A)	18	−0,45	1,98	0,48	0,32	−1,20	0,18	1,62	0,05	0,74	1,17	−1,32	0,09
mešane kmetije	2000 (A)	371	7,65	4,61			7,03	4,34			0,62	1,48		
	2010 (B)	123	8,54	6,30			7,22	5,32			1,31	2,60		
	Razlika (B-A)	−248	0,89	1,69	−1,44	0,08	0,19	0,98	−0,36	0,36	0,69	1,12	−2,82	0,00
kmetije v opuščanju	2000 (A)	518	4,89	3,98			4,51	3,74			0,38	1,09		
	2010 (B)	436	4,33	3,73			4,07	3,57			0,26	0,86		
	Razlika (B-A)	−82	−0,56	−0,25	2,22	0,01	−0,44	−0,17	1,85	0,03	−0,12	−0,23	1,82	0,03
dopolnilne kmetije	2000 (A)	35	7,46	4,25			7,20	4,26			0,26	0,75		
	2010 (B)	264	8,17	5,76			7,57	5,20			0,60	1,85		
	Razlika (B-A)	229	0,71	1,51	−0,89	0,19	0,37	0,94	−0,48	0,32	0,34	1,10	−1,99	0,02
ostarele kmetije	2000 (A)	61	4,97	4,28			4,77	4,06			0,20	0,61		
	2010 (B)	73	3,95	2,97			3,87	2,84			0,09	0,40		
	Razlika (B-A)	12	−1,02	−1,31	1,57	0,05	−0,90	−1,22	1,47	0,07	−0,11	−0,21	1,28	0,10

Vir: SURS in lastni izračuni iz podatkov baz popisov kmetijstva v letih 2000 in 2010.

Površina nerodovitnih zemljišč v upravljanju kmečkih gospodarstev je bila v letu 2010, primerjalno z letom 2000, manjša pri populacij kmečkih gospodarstev, pri kmečkih gospodarstvih po občinah in po socio-ekonomskih tipih, razen pri mešanih kmetijah (preglednica 2).

Povprečna površina kmetijskega zemljišča v uporabi je v letu 2000 znašala 6,7 ha/KG, kar je za nekaj več kot 13 % več od slovenskega povprečja (5,9 ha; Dernulc s sod. 2002). Med leti 2000 in 2010 se je povprečna površina KZU statistično značilno povečala za desetino pri kmečkih gospodarstvih iz občine Škofja Loka, predvsem na račun opuščanja kmetijske pridelave pri kmetijah v opuščanju in zmanjšanja površine kmetijskega zemljišča v uporabi pri ostarelih kmetijah in kmetijah v opuščanju (preglednica 3). Večja povprečna površina najetega kmetijskega zemljišča v uporabi v letu 2010, primerjalno z letom 2000, pri populaciji kmečkih gospodarstev izhaja predvsem iz večje površine najetih kmetijskih zemljišč v uporabi pri kmečkih gospodarstvih iz občine Škofja Loka oziroma večje površine najetih kmetijskih zemljišč v uporabi komercialnih kmetij, medtem ko se je povprečna najeta površina kmetijskih zemljišč v uporabi zmanjšala pri nekomercialnih kmetijah (preglednica 3). Kmečka gospodarstva iz občine Škofja Loka so razpolagala s skoraj 6-krat večjo površino njiv (1,8 ha/kmečkih gospodarstvo), kmečkih gospodarstev iz občine Gorenja vas-Poljane pa z četrtino večjo površino trajnih travnikov in pašnikov.

Med letoma 2000 in 2010 so pri kmečkih gospodarstvih nastale tudi spremembe v površini kmetijskih zemljišč v uporabi po razredih kmetijskih zemljišč v uporabi v smeri polarizacije rasti velikosti kmečkih gospodarstev po površini kmetijskih zemljišč v uporabi, in sicer v dve smeri: skupina relativno velikih komercialnih kmetij (kmetijska zemljišča v uporabi nad 15 ha) in skupina manjših kmetij (kmetijska zemljišča v uporabi 3–5 ha). Razloge za navedeno pripisujemo poleg opuščanja kmetijske pridelave pri manjših kmetijah po površini kmetijskih zemljišč v uporabi tudi relativnemu ohranjanju kmetijske pridelave pri posameznih malih kmetijah, ki so pretežno samooskrbne (3–5 ha kmetijskih zemljišč v uporabi) in povečevanju velikosti kmetije in koriščenju ekonomije obsega pri preostalih kmetijah v smeri večjih kmetij po površini kmetijskih zemljišč v uporabi (nad 15 ha kmetijskih zemljišč v uporabi). Polarizacija je nekoliko izrazitejša pri kmečkih gospodarstvih iz občine Škofja Loka.

4 Sklep

Večino kmetijskih zemljišč na Škofjeloškem so v letih 2000 in 2010 v upravljala kmetijska gospodarstva. Povprečna površina zemlje (gozd, kmetijska zemlja in nerodovitna zemljišča) kmečkega gospodarstva na Škofjeloškem se je statistično neznačilno povečala, medtem ko se je skupna površina zemlje u upravljanju kmečkih gospodarstev zmanjšala, predvsem na račun zmanjšanja površine zemlje v upravljanju kmetij v opuščanju (manjše, pretežno samooskrbne kmetije). Število kmetij v opuščanju in mešanih kmetij se je zmanjšalo, povečalo se je število dopolnilnih kmetij. Za preživetje dela dopolnilnih kmetij je med leti 2000 in 2010 pomemben tudi gozd s predelavo lesa v okviru dopolnilne dejavnosti na kmetiji. Spremembe so bile izrazitejše na območju z bolj razvito industrijo in boljšimi naravnimi danostmi za kmetijsko predelavo. Število čistih kmetij se navidezno ohranja predvsem zaradi upokojevanja gospodarjev čistih kmetov, kot tudi tistih z nekmetijskimi zaposlitvami.

Strukturne spremembe med leti 2000 in 2010 se pri kmečkih gospodarstvih med območjema z različnimi naravnimi danostmi za kmetijsko pridelavo in gospodarsko razvitostjo razlikujejo v smeri in obsegu sprememb. Na območju z omejenimi možnostmi za kmetijsko pridelavo so državne pomoči vezane na površino kmetijskega zemljišča v uporabi preprečile zaraščanje kmetijske zemlje, zmanjšala se je tudi površina nerodovitnih zemljišč, medtem ko se je površina neobdelanih kmetijskih zemljišč zmanjšala na obeh območjih in pri vseh socio-ekonomskih tipih. Strukturne spremembe, ki se odražajo z opuščanjem kmetijske pridelave pri manjših kmetijah in povečevanju površin pri preostalih (predvsem najem kmetijskih zemljišča v uporabi) so relativno počasnejše od slovenskega povprečja in izrazitejše pri kmečkih gospodarstvih na območju z boljšimi naravnimi danostmi za kmetijsko pridelavo. Opazna je smer polarizacije rasti velikosti kmečkih gospodarstev po površini kmetijskih zemljišč v uporabi, in sicer v dveh smereh: skupina relativno velikih komercialnih kmetij (kmetijska zemljišča v uporabi nad 15 ha) in skupina manjših, pretežno samooskrbnih kmetij (kmetijska zemljišča v uporabi 3–5 ha). Rast površine kmetijskih zemljišč v uporabi izvira predvsem iz večjega obsega najetih kmetijskih zemljišč v uporabi pri komercialnih kmetijah, medtem ko se površina njihove lastnih kmetijskih zemljišč v uporabi ni povečala.

5 Literatura

Glej angleški del prispevka.

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EVALUATING THE DEVELOPMENT POTENTIAL OF FARMS ON URBAN OUTSKIRTS: METHODOLOGY

VREDNOTENJE RAZVOJNEGA POTENCIALA OBMESTNIH KMETIJ – METODOLOGIJA

Nika Razpotnik Visković

BOJAN ERHARTIČ

Dilapidated hay-rack: result of modernisation or abandonment of farming?
Propadajoči kozolec: posledica modernizacije ali opuščanja kmetijske dejavnosti?

Evaluating the development potential of farms on urban outskirts: methodology

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ABSTRACT: This article presents a methodology for evaluating the development potential of farms on urban outskirts, which forms an important basis for long-term (spatial) planning of the development of Slovenian agriculture. It uses publically available spatial and statistical data, and analyzes and evaluates the characteristics of farms that show their future development potential and tendencies: vitality and stability, potential to expand, potential for conflicts, quality and structure of farmland, and effects of spatial planning and special protection measures on their development potential. This methodology is used to evaluate farms on urban outskirts, where development factors differ from those in areas with less favorable farming conditions.

KEY WORDS: geography, farm, spatial development of agriculture, methodology, evaluation, urban outskirts, Slovenia

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1 Introduction

The spatial organization of agriculture is a key element in planning its long-term development. Adopting high-quality spatial planning documents and carrying out spatial development measures to stimulate the development of agriculture also depend on the level of familiarization with farms' development potential and structure. This has already been highlighted by Van der Ploeg (1995) and researchers following him (Howden et al. 1998; Vanclay, Messiti and Howden 1998). The fact that some farms are production-oriented depends not only on natural conditions, but also on market opportunities and the personal interest of individual farm owners (Perpar and Udovč 2007). In turn, this strongly depends on these farms' development potential.

A detailed analysis of farms' development potential is thus both a time-consuming and expensive process, especially if it requires fieldwork. To help develop expert bases for adopting spatial planning measures, this article introduces a methodology for evaluating the development potential of farms on urban outskirts based on publically available spatial planning and statistical data. With this methodology, one can analyze and evaluate the characteristics of farms that reflect their development potential and future development tendencies. It is intended for evaluating farms on urban outskirts, where development factors differ from those in areas with less favorable farming conditions (Ribeiro, Ellis Burnet and Torkar 2013; Štravs, Bavec and Bavec 2011; Ravbar 2006). It has been tested on the example of Kamnik Bistrica Plain (Razpotnik Visković 2012).

2 Methodology for evaluating the development potential of farms on urban outskirts

This methodology is suitable for evaluating full-time, part-time, and hobby farms following the typology developed by Udovč, Kovačič, and Kramarič (2006). It has been shown that encouraging only a specific socioeconomic type of farm is not justified (Razpotnik Visković 2013) and also that various socioeconomic types of farms can be evaluated as equal in terms of stability. Transitions between individual types are the result of changes and decisions in rural households and the wider socioeconomic environment, with their main goal being the economic stabilization of the farm (Kovačič 1996).

According to this methodology, the farms are assigned estimations from 1 to 5 based on the values of selected indicators for thematic categories (Figure 1, Tables 1–4). Higher value means larger development potential. All of the twenty indicators selected were assigned also weights reflecting their relative importance for development potential of farms (Chapter 3). Certain phases of the evaluation took into account the characteristics of individual socioeconomic farm types and their differences. The higher final sum of weighted values for the farm means its higher development potential.

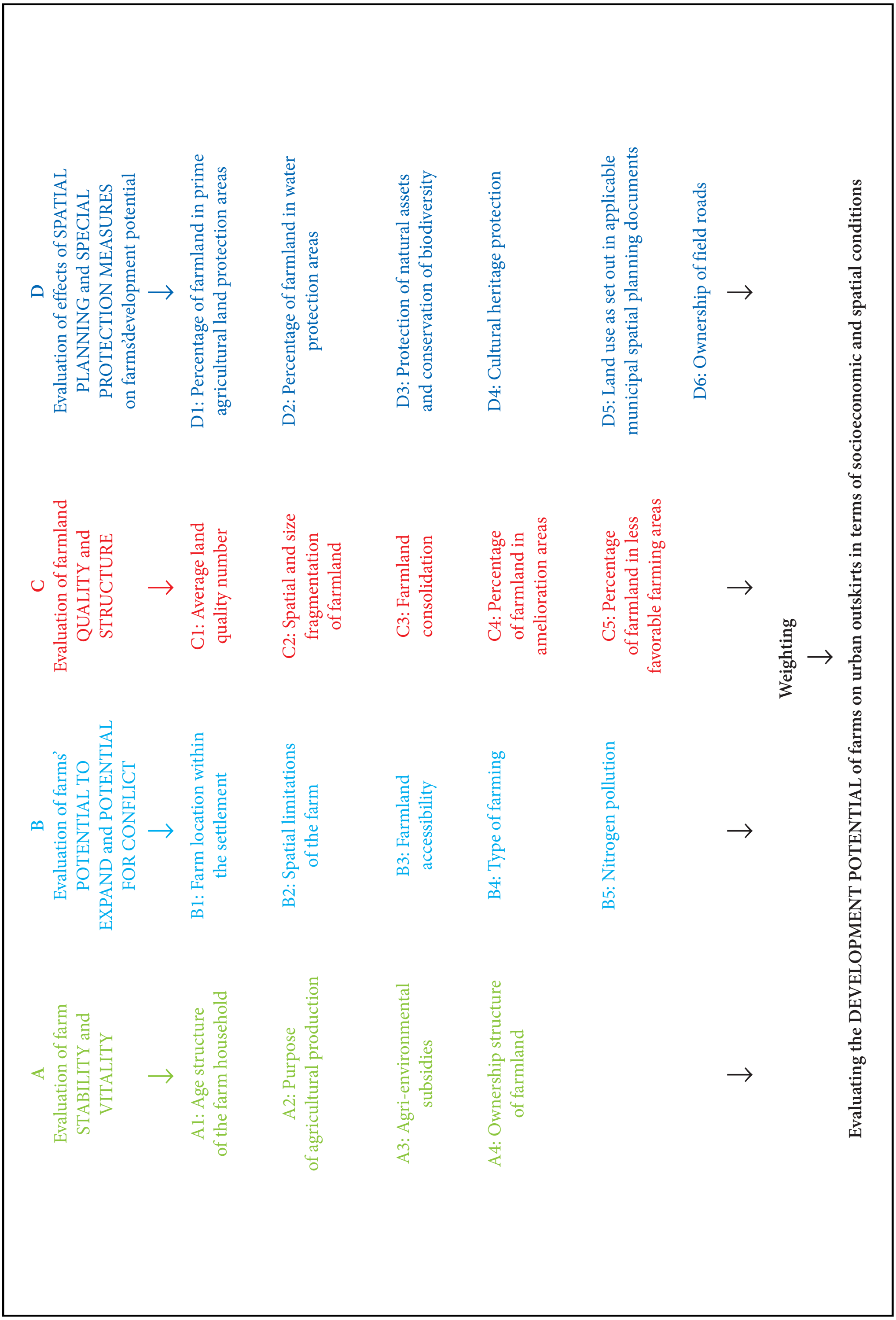
The evaluation is based on indicators accessible in official databases and spatial planning documents:

- The Agricultural Census (Internet 1) – provided by Slovenian Statistical Office;
- Records on Actual Land Use, Data on Land Quality Number, Less Favorable Agricultural Areas (Internet 2), Register of Amelioration Systems and Installations (Internet 3) – provided by Ministry of Agriculture and the Environment;
- Records on Recipients of Agri-Environmental Subsidies (Internet 4) – provided by Agency of the Republic of Slovenia for Agricultural Markets and Rural Development;
- Environmental Atlas of Slovenia (Internet 5) – provided by Slovenian Environment Agency;
- Register of Immovable Cultural Heritage (Internet 6) – provided by Ministry of Culture;
- Public Infrastructure, Register of Spatial Units (Internet 7) – provided by Surveying and Mapping Authority of the Republic of Slovenia); and
- Current municipal spatial planning documents for the area included in the evaluation.

2.1 Stability and vitality of farms

The age structure of rural households is a key factor influencing the stability and vitality of farms. If the owner of a full-time farm is already retired and other active members of his household are also exclusively

Figure 1: Methodology for evaluating the development potential of farms on urban outskirts. ➤ p. 82


A
Evaluation of farm STABILITY and VITALITY
A1: Age structure of the farm household
A2: Purpose of agricultural production
A3: Agri-environmental subsidies
A4: Ownership structure of farmland
B
Evaluation of farms' POTENTIAL TO EXPAND and POTENTIAL FOR CONFLICT
B1: Farm location within the settlement
B2: Spatial limitations of the farm
B3: Farmland accessibility
B4: Type of farming
B5: Nitrogen pollution
C
Evaluation of farmland QUALITY and STRUCTURE
C1: Average land quality number
C2: Spatial and size fragmentation of farmland
C3: Farmland consolidation
C4: Percentage of farmland in amelioration areas
C5: Percentage of farmland in less favorable farming areas
D
Evaluation of effects of SPATIAL PLANNING and SPECIAL PROTECTION MEASURES on farms'development potential
D1: Percentage of farmland in prime agricultural land protection areas
D2: Percentage of farmland in water protection areas
D3: Protection of natural assets and conservation of biodiversity
D4: Cultural heritage protection
D5: Land use as set out in applicable municipal spatial planning documents
D6: Ownership of field roads
Weighting
Evaluating the DEVELOPMENT POTENTIAL of farms on urban outskirts in terms of socioeconomic and spatial conditions

engaged in farming, the likelihood of changing the farm's socioeconomic type is smaller than compared to part-time and hobby farms (Udovč, Kovačič and Kramarič 2006). Therefore, the evaluation of the multigeneration household age type (Kladnik 1999) for full-time farms differs from that for part-time and hobby farms.

The evaluation of the purpose of agricultural production relied on the analysis of the role of part-time farms in transforming urban outskirts (Razpotnik Visković 2013). This shows that full-time farms that engage in farming exclusively for their own use are rare. The percentage of part-time farms that engage in farming solely for their own use is slightly higher. In both cases, farm vitality and stability is questionable because in the modern socioeconomic system this type of farming does not provide the same standard as market-oriented or hobby farms.

Agri-environmental subsidies are intended to be used for investments in environmentally friendlier farming and preserving public environmental assets. However, not all environmental measures should be treated exclusively as investments because they may result from reduced intensity and size of the farming activity on the farm.

Rented farmland is an adjustment to fragmented ownership structure and the small size of farms. Compared to farmland ownership, rental entails greater uncertainty for the renting farm and the absence of investment in this land. It is mainly used by full-time and part-time farms in order to secure sufficient farmland for economic survival, whereas it is rarely used by hobby farms (Razpotnik Visković 2013).

2.2 Potential to expand and potential for conflicts

Farm location within the settlement primarily causes conflicts with the non-farming residents of the settlement (Golobič, Marušič and Kovačič 2003). Disagreements may arise in connection with the activity taking place in the farmyard and its buildings, or with the transport to farmland. Potential expansion of the farm buildings also depends on the farm's location within the settlement. Many farms, especially those crowded into the built-up areas of settlements, are spatially limited by physical barriers (terrain, waterways, adjacent buildings, main roads) or regulations and special protection measures set out in spatial planning documents. They can make up for the lack of space by buying or renting available farmland in the neighborhood. Full-time farms are most likely to utilize this manner of solving their spatial limitations.

Table 1: Estimation of farm stability and vitality.

A1: Household age structure

Household type:	*Young*	*Multigeneration*	*Middle-aged*	*Aging*	*Split generation*
Full-time farm	5	5	3	1	2
Part-time and hobby farm	5	4	3	1	2

A2: Purpose of agricultural production

Purpose of agricultural production:	*Predominantly for sale*	*Predominantly for own use*	*For own use*
Full-time	5	2	1
Part-time	5	3	1
Hobby	5	4	3

A3: Agri-environmental subsidies (AES)

AES:	*Yes*	*No*
All farms	5	1

A4: Ownership structure of farmland used (FU)

Percentage of rented FU:	*0*	*Up to 15%*	*15–30%*	*30–50%*	*More than 50%*
Full- and part-time	5	4	3	2	1
Hobby	5	4	2	2	1

Accessing farmland is an important aspect because this slows down or interferes with traffic and leaves mud on the roads (Perpar and Kovačič 2006). Agricultural machinery is slower and wider than other vehicles, and so it reduces traffic safety on heavy traveled sections of roads. It can also prove problematic when turning onto the main road.

The type of farming (Dernulc et al. 2002) refers to the production orientation or the predominant agricultural activities on the farm. Livestock farms are more likely to come into conflict with the local population and therefore they were assigned lower values than those engaged in crop production. The scale of livestock farming is also an important basis for determining the level of nitrogen pollution caused by manure (Čergan et al. 2003) The limit values of individual classes were defined based on the Decree on the Release of Hazardous Substances and Plant Nutrients into the Soil (Uredba … 1996) and the author's own analyses of the values of livestock units per hectare for farms on urban outskirts (Razpotnik Visković 2013).

2.3 Farmland quality and structure

The land quality number (Sln. *talno število*) refers to the land's production capacity and depends on the soil characteristics, which have a permanent character; the higher the value, the better the production capacity. The classes were created following the methodology for evaluating problematic conditions in areas with factors limiting agricultural production (Cunder, Rednak and Zagorc 2007; Ciglič et al. 2012).

Size fragmentation provides information on the size of individual patches of land, and spatial fragmentation provides information on their spatial distribution and distance from the farm buildings. The fragmentation coefficient (Gosar 1978) was used to assess both.

Farmland consolidation is evaluated using the area-weighted mean shape index (AWMSI), which takes into account the size of individual patches of land, and their shape and distribution (McGarigal and Marks 1995).

Table 2: Estimation of the potential to expand and the potential for conflicts.

B1: Farm location within the settlement

Farm location within the settlement:	*Outside the built-up area*	*On the edges of the built-up area*	*Within the built-up area, with farms nearby*	*Within the built-up area, with no farms nearby*
All farms	5	4	2	1

B2: Spatial limitations of the farm

Spatial limitation:	*Farmyard with available land for expansion*	*Built-up farmyard with available adjacent land*	*Built-up farmyard with limitations in the neighborhood (another farm nearby)*	*Built-up farmyard with limitations in the neighborhood (no other farms nearby)*
Full-time	5	3	2	1
Part-time and hobby	5	2	2	1

B3: Farmland accessibility

Farmland accessibility:	*Accessible only on unclassified roads (including field roads)*	*Also accessible on public (local) roads*	*Also accessible on national and local roads*	
All farms	5	3	2	

B4: Type of farming

Type of farming:	*Crop production*	*Mixed crop and livestock production*	*Livestock farming*	
All farms	5	3	1	

B5: Nitrogen pollution

Livestock units/ha:	*More than 2*	*2–1.5*	*1.5–1*	*1–0.75*	*Less than 0.75*
All farms	1	2	3	4	5

Amelioration is divided into drainage, irrigation, and agroamelioration, which includes measures to improve the physical, chemical, and biological properties of the soil, and access to the farmland (Internet 8).

2.4 Effects of spatial planning and special protection measures on farms' development potential

The areas designated for permanent protection of prime agricultural land are specified in the municipal spatial planning documents. As part of evaluating farmland quality, it would make sense to identify land with power lines, land with gas pipelines, and land along freeways and highways that is exposed to continual pollution. Farming should be restricted in these areas.

Measures in water protection areas are implemented in order to reduce danger, threats, and risks by existing or planned activities to waterways (Zakon o vodah 2002). Limited agricultural activity in these areas refers to fertilizing and using biocides, and depends on the water protection regime level.

The protection of natural assets and cultural heritage was also taken into account in the evaluation of farms' development potential. The protection regimes demand adjustments by the landowners in these areas and impose restrictions on them (Šmid Hribar and Ledinek Lozej 2013) because farmers whose buildings are protected or located in special protection areas must follow rigid regulations when they plan to expand or modernize their farms.

Defining land use within the settlement or the morphological units designated for farming is important in terms of both the farms' expansion and the reduced pressure from the non-farming population in the settlement. The ownership of field roads is important in terms of access to the farmland and risk of disagreement among the users of field roads and the owners of land on which these roads are located.

Table 3: Estimation of farmland quality and structure.

C1: Average land quality number					
Average land quality number:	*0–25*	*26–39*	*40–57*	*58–75*	*76–100*
All farms	1	2	3	4	5
C2: Spatial and size fragmentation of farmland					
**Fragmentation coefficient:*	*Less than 4*	*4–6.5*	*6.5–10*	*10–14.7*	*More than 14.7*
All farms	5	4	3	2	1
C3: Farmland consolidation					
**Area-weighted mean shape index*	*Less than 1.46*	*1.46–1.61*	*1.61–1.84*	*1.84–2.13*	*More than 2.13*
All farms	5	4	3	2	1
C4: Percentage of farmland in amelioration areas					
Percentage of farmland in amelioration areas:	*0%*	*0–15%*	*15–30%*	*30–45%*	*More than 45%*
All farms	1	2	3	4	5
C5: Percentage of farmland in less favorable farming areas					
Percentage of farmland in less favorable farming areas:	*Up to 25%*	*25–50%*	*50–75%*	*More than 75%*	
All farms	5	4	2	1	

*Limit values of classes are defined based on the data for the sample farms on the Kamnik Bistrica Plain (Razpotnik Visković 2012), using the Jenks natural breaks classification method.

Table 4: Estimation of effects of spatial planning and special protection measures on farms' development potential.

D1: Percentage of farmland in prime agricultural land protection areas

Percentage of farmland in prime agricultural land protection areas:	*Less than 50%*	*50–75%*	*75–90%*	*More than 90%*
All farms	1	2	4	5

D2: Percentage of farmland in water protection areas (WPA)

Percentage of farmland in WPA:	*0*	*Up to 10% in WPA1 or up to 30% in WPA2 and/or WPA3*	*10–20% in WPA1 or more than 30% in WPA2 and/or WPA3*	*20–50% in WPA1*	*More than 50% in WPA1*
All farms	5	4	3	2	1

D3: Protection of natural assets and conservation of biodiversity

Percentage of farmland in areas of natural assets, Natura 2000 sites, and/or ecologically important areas:	*0*	*Up to 15%*	*15–25%*	*25–50%*	*More than 50%*
All farms	5	4	3	2	1

D4: Cultural heritage protection

Cultural heritage protection:	*No*	*Farm located on a cultural heritage protection site*	*Farm includes a structure protected as cultural heritage*
All farms	5	3	1

D5: Land use as set out in current municipal spatial planning documents

Land use in the morphological unit the farm belongs to:	*Agricultural activities and structures*	*Mixed*	*Residential construction areas*
Full- and part-time	5	3	1
Hobby	5	4	1

D6: Ownership of field roads

Ownership of field roads:	*Mostly public or owned by the municipality*	*A small portion is public or owned by the municipality*	*Private*
All farms	5	3	1

3 Weighting

All of the twenty indicators selected were assigned weights reflecting their relative relations to other parameters. The weights were defined using the pair-wise comparison method (Saaty 1980), which means that all the indicator pairs within an individual thematic category (A, B, C, and D) were compared, based on which their significance in relation to other pairs was determined on a scale of 1 to 9. Four comparison matrices were obtained. In each matrix, the values were added up for each column, after which every element in the matrix was divided by the corresponding column sum. This yielded the normalized values. In the next step, the average of elements in each line of the normalized matrix was calculated, which yielded a weight for each criterion (Dular 2007). In the end, indicators from all the categories were combined and the weight values were normalized again. Each category was assigned the same meaning or weight: the sum of the weights of the criteria in an individual category is 0.25, and the sum of the weights of all the categories is 1. For a more detailed explanation and weighting options, see Razpotnik Visković (2012).

Table 5: Weights of indicators used for evaluating the development potential of farms on urban outskirts.

Indicator	Weight	Indicator	Weight	Indicator	Weight	Indicator	Weight
A1: Household age structure	0.09	B1: Farm location within the settlement	0.08	C1: Average land quality number	0.08	D1: Percentage of farmland in prime agricultural land protection areas	0.05
A2: Purpose of agricultural production	0.06	B2: Spatial limitations of the farm	0.07	C2: Spatial and size fragmentation of farmland	0.06	D2: Percentage of farmland in water protection areas (WPA)	0.03
A3: Agri-environmental subsidies (AES)	0.03	B3: Farmland accessibility	0.05	C3: Farmland consolidation	0.05	D3: Protection of natural assets and conservation of biodiversity	0.03
A4: Ownership structure of farmland used (FU)	0.07	B4: Type of farming	0.03	C4: Percentage of farmland in amelioration areas	0.04	D4: Cultural heritage protection	0.02
		B5: Nitrogen pollution	0.02	C5: Percentage of farmland in less favorable farming areas	0.02	D5: Land use as set out in current municipal spatial planning documents	0.07
						D6: Ownership of field roads	0.05
Total	0.25	Total	0.25	Total	0.25	Total	0.25

4 Conclusion

Spatial planners can use the methodology for evaluating the development potential of farms on urban outskirts presented in this article to obtain important information on farms' current state and development potentials. The cartographic presentation of the evaluation results makes it possible to identify any concentrations of farms with a specific development potential within settlements or to determine that there are no such concentrations and that the farms are scattered and diverse. Farms can also be studied by individual categories of evaluating their development potential in order to determine:

- Their socioeconomic status;
- The most or least vital farms and farms that are problematic in terms of causing potential conflicts with other users of space;
- Farms with the best or least favorable land structure; and
- The extent to which the current spatial planning documents are adapted to farming and its development.

This makes it possible to define the areas in which farms have greater development potential and to apply this to planning the long-term development of agriculture. The evaluation of farms' development potential should be included in the expert bases for drafting local spatial plans (or municipal spatial plans under the current legislation) that take into account the »*rural settlement patterns, the appertaining forests, the traffic and public utilities network, and access to social services*« (Pogačnik 2006, 215).

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Vrednotenje razvojnega potenciala obmestnih kmetij – metodologija

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IZVLEČEK: V prispevku je predstavljena metodologija vrednotenja razvojnega potenciala obmestnih kmetij, ki je pomembna podlaga za dolgoročno (prostorsko) načrtovanje razvoja slovenskega kmetijstva. Temelji na javno dostopnih prostorskih in statističnih podatkih, analizira in vrednoti pa značilnosti kmetij, ki kažejo njihov razvojni potencial in razvojne težnje v prihodnje: vitalnost in stabilnost kmetij, širitveni potencial in konfliktnost, kakovost in strukturo kmetijskih zemljišč ter učinke prostorsko-načrtovalskih in varovalnih ukrepov na razvojni potencial. Metodologija je namenjena vrednotenju kmetij na obmestnih območjih, kjer se razvojni dejavniki razlikujejo od tistih na območjih z manj ugodnimi razmerami za kmetijstvo.

KLJUČNE BESEDE: geografija, kmetija, prostorski razvoj kmetijstva, metodologija, vrednotenje, obmestje, Slovenija

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1 Uvod

Prostorsko urejanje kmetijske dejavnosti je ključno za načrtovanje dolgoročnega razvoja kmetijstva. Sprejemanje kakovostnih prostorskih aktov in izvajanje posegov v prostor, ki bodo spodbujali razvoj kmetijstva, sta odvisna od poznavanja razvojnega potenciala in strukture kmetij, na kar so opozorili že van der Ploeg (1995) in njegovi sledilci (Howden s sod. 1998; Vanclay s sod. 1998). Proizvodna usmeritev posameznih kmetijskih gospodarstev ni odvisna le od naravnih danosti, temveč tudi od tržnih možnosti in osebnega interesa posameznih lastnikov kmetij (Perpar in Udovč 2007), ki pa sta močno odvisna od razvojnega potenciala kmetij.

Natančna analiza razvojnega potenciala kmetij je tako časovno kot finančno zahteven postopek, še posebej, ko je potrebno terensko delo. V pomoč izdelavi strokovnih podlag za sprejemanje prostorskih ukrepov predstavljamo metodologijo vrednotenja razvojnega potenciala obmestnih kmetij, ki temelji na javno dostopnih prostorskih in statističnih podatkih. Njen namen je analiza in vrednotenje značilnosti kmetij, ki odsevajo njihov razvojni potencial in prihodnje razvojne težnje. Metodologija je namenjena vrednotenju kmetij na obmestnih območjih, kjer se razvojni dejavniki razlikujejo od tistih na območjih z manj ugodnimi razmerami za kmetijstvo (Ribeiro, Ellis Burnet in Torkar 2013; Štravs, Bavec in Bavec 2011; Ravbar 2006). Preizkušena je bila na primeru Kamniškobistriške ravnine (Razpotnik Visković 2012).

2 Metodologija vrednotenja razvojnega potenciala obmestnih kmetij

Metodologija je primerna za vrednotenje čistih, mešanih in dopolnilnih kmetij po tipologiji Udovča in sodelavcev (2006), saj se je izkazalo, da spodbujanje samo določenega socialno-ekonomskega tipa kmetij ni upravičeno (Razpotnik Visković 2013) in da socialno-ekonomske tipe z vidika stabilnosti lahko ovrednotimo kot enakovredne. Prehodi med posameznimi tipi so posledica sprememb in odločitev na ravni kmečkega gospodinjstva in širšega družbeno-gospodarskega okolja, njihov namen pa je ekonomska stabilizacija kmetije (Kovačič 1996).

Po tej metodologiji so kmetijam za posamezne kazalnike, ki smo jih razporedili v štiri vsebinske sklope (slika 1), pripisane ocene od 1 do 5 glede na vrednosti teh kazalnikov (preglednice 1–4). Višja ocena pomeni večji razvojni potencial. Relativno večji oziroma manjši pomen posameznega kazalnika za razvojni potencial kmetije v primerjavi z drugimi smo na koncu uravnavali s pomočjo ponderiranja (poglavje 3). V nekaterih delih vrednotenja smo upoštevali značilnosti posameznih socialno-ekonomskih tipov kmetij in razlike med njimi. Višja končna vrednost (seštevek obteženih ocen) pomeni večji razvojni potencial kmetije.

Vrednotenje je zasnovano na kazalnikih dostopnih v uradnih podatkovnih zbirkah in prostorskih aktih:
- Popis kmetijskih gospodarstev (internet 1) – skrbnik podatkov Statistični urad Republike Slovenije,
- Evidenca dejanske rabe kmetijskih zemljišč, podatki o talnem številu, območja z omejenimi možnostmi za kmetijsko dejavnost (internet 2); Kataster melioracijskih sistemov in naprav (internet 3) – skrbnik podatkov Ministrstvo za kmetijstvo in okolje,
- Evidenca prejemnikov kmetijskookoljskih plačil (internet 4) – skrbnik podatkov Agencija Republike Slovenije za kmetijske trge in razvoj podeželja,
- Atlas okolja (internet 5) – skrbnik Agencija Republike Slovenije za okolje,
- Register nepremične kulturne dediščine (internet 6) – skrbnik Ministrstvo za kulturo,
- Gospodarska javna infrastruktura, Register prostorskih enot (internet 7) – skrbnik Geodetska uprava Republike Slovenije ter
- veljavni občinski prostorski akti za območje vrednotenja.

2.1 Stabilnost in vitalnost kmetij

Starostna sestava kmečkih gospodinjstev je ključni dejavnik stabilnosti in vitalnosti kmetij. Če je gospodar čiste kmetije že upokojenec in se ostali aktivni člani ukvarjajo izključno s kmetijstvom, je verjetnost spremembe socialno-ekonomskega tipa kmetije manjša v primerjavi z mešanimi in dopolnilnimi kmetijami

Slika 1: Metodologija vrednotenja razvojnega potenciala obmestnih kmetij. ➤ s. 92

A	B	C	D
Vrednotenje STABILNOSTI in VITALNOSTI kmetij	Vrednotenje ŠIRITVENEGA POTENCIALA in KONFLIKTNOSTI kmetij	Vrednotenje KAKOVOSTI in STRUKTURE kmetijskih zemljišč	Vrednotenje učinkov PROSTORSKONAČRTOVALSKIH in VAROVALNIH UKREPOV na razvoj kmetij
↓	↓	↓	↓
A1 – starostna sestava kmečkega gospodinjstva	B1 – lega kmetije v naselju	C1 – povprečno talno število kmetijskih zemljišč	D1 – delež kmetijskih zemljišč na območjih varstva najboljših kmetijskih zemljišč
A2 – namen kmetijske pridelave	B2 – prostorska utesnjenost kmetije	C2 – prostorska in velikostna razdrobljenost kmetijskih zemljišč	D2 – delež kmetijskih zemljišč na vodovarstvenih območjih
A3 – kmetijskookoljska plačila	B3 – dostopnost do kmetijskih zemljišč	C3 – zaokroženost kmetijskih zemljišč	D3 – varstvo naravnih vrednot in ohranjanje biotske raznovrstnosti
A4 – lastniška struktura kmetijskih zemljišč v uporabi	B4 – tip kmetovanja	C4 – delež kmetijskih zemljišč na območjih melioracijskih sistemov	D4 – varstvo kulturne dediščine
	B5 – okoljsko obremenjevanje z dušikom	C5 – Delež kmetijskih zemljišč na območjih z omejenimi možnostmi za kmetovanje	D5 – namenska raba v veljavnih prostorskih aktih občin
			D6 – lastniška ureditev poljskih poti
↓	↓	↓	↓

uteževanje

↓

Vrednotenje RAZVOJNEGA POTENCIALA obmestnih kmetij z vidika socialno – ekonomskih in prostorskih razmer

(Udovč s sod. 2006). Tako se vrednotenje čistih kmetij pri generacijskem starostnem tipu gospodinjstva (Kladnik 1999) razlikuje od vrednotenja dopolnilnih ter mešanih kmetij.

Pri vrednotenju namena kmetijske pridelave smo se oprli na analizo vloge polkmetij v preobrazbi obmestij (Razpotnik Visković 2013). Ta kaže, da so redke čiste kmetije, ki bi se s kmetijsko dejavnostjo ukvarjale izključno za lastno porabo, njihov delež pa je nekoliko višji med mešanimi kmetijami. V obeh primerih dvomimo v vitalnost in stabilnost takih kmetij, saj v sodobnem družbeno-ekonomskem sistemu tak način gospodarjenja ne zagotavlja življenjske ravni, primerljive s tržno usmerjenimi ali dopolnilnimi kmetijami.

Kmetijsko-okoljska plačila so namenjena investiranju v okolju prijaznejše kmetovanje in ohranjanju javnih naravnih dobrin. Opozarjamo pa, da vseh okoljskih ukrepov ne moremo obravnavati izključno kot investicije, saj so lahko posledica zmanjševanja intenzivnosti in obsega kmetijske dejavnosti na kmetiji.

Najem kmetijskih zemljišč je prilagoditev na razdrobljeno lastniško strukturo in majhen obseg kmetij. V primerjavi z lastništvom pomeni najem večjo negotovost za kmetijo najemnico in odsotnost investicij v ta kmetijska zemljišča. Zanj se odločajo predvsem čiste in mešane kmetije, da si zagotovijo zadostne površine kmetijskih zemljišč za ekonomsko preživetje, redkeje pa zemljišča najemajo dopolnilne kmetije (Razpotnik Visković 2013).

2.2 Širitveni potencial in konfliktnost

Lega kmetij v naselju vpliva na konfliktnost predvsem z nekmečkimi prebivalci naselja (Golobič, Marušič in Kovačič 2003). Nesoglasja so lahko povezana z dejavnostjo na kmečkem dvorišču in v kmečkih poslopjih ali pa s prevozom do kmetijskih zemljišč. Od lege v naselju je odvisna tudi možnost prostorske širitve gospodarskega središča kmetije. Številne kmetije, posebej tiste, ki so utesnjene znotraj strnjenih delov naselij, so prostorsko omejene, bodisi zaradi fizičnih omejitev (relief, vodotoki, sosednje stavbe, prometnice) bodisi zaradi predpisov in varovalnih ukrepov, opredeljenih v prostorskih dokumentih. Prostorsko stisko lahko rešujejo z odkupom ali najemom morebitnih razpoložljivih zemljišč v soseščini. Ocenjujemo, da so v tak način reševanja prostorske utesnjenosti pripravljene investirati predvsem čiste kmetije.

Dostopanje do kmetijskih zemljišč je pomembno zaradi upočasnitve oziroma oviranja prometa in onesnaževanja javnih prometnic z blatom, ki ga kmetijski stroji prinašajo s kmetijskih zemljišč (Perpar in

Preglednica 1: Ocene vrednotenja stabilnosti in vitalnosti kmetij.

A1 – starostna sestava gospodinjstva					
tip gospodinjstva:	*mlado*	*generacijsko*	*zrelo*	*starajoče*	*kombinirano*
čiste	5	5	3	1	2
mešane in dopolnilne	5	4	3	1	2
A2 – namen kmetijske pridelave					
namen kmetijske pridelave:	*v glavnem za prodajo*	*v glavnem za lastno porabo*	*za lastno porabo*		
čiste	5	2	1		
mešane	5	3	1		
dopolnilne	5	4	3		
A3 – kmetijskookoljska plačila					
izplačilo KOP:	*da*	*ne*			
vse kmetije	5	1			
A4 – lastniška struktura kmetijskih zemljišč v uporabi (v nadaljevanju KZU)					
delež najetih KZU:	*ni najetih KZU*	*v najemu do 15 % KZU*	*v najemu od 15 do 30 % KZU*	*v najemu od 30 do 50 % KZU*	*v najemu več kot 50 % KZU*
čiste in mešane	5	4	3	2	1
dopolnilne	5	4	2	2	1

Kovačič 2006). Vozila s kmetijsko mehanizacijo so v primerjavi z drugimi vozili počasnejša in širša, zato na prometno obremenjenih odsekih zmanjšujejo varnost v cestnem prometu, problematično je tudi njihovo vključevanje na prometnice.

Tip kmetovanja (Dernulc s sod. 2002) označuje proizvodno usmerjenost oziroma prevladujoče dejavnosti na kmetiji. Živinorejske kmetije smo ocenili kot bolj izpostavljene konfliktom z okoliškim prebivalstvom, zato smo jim pripisali nižje ocene v primerjavi s tistimi, ki se ukvarjajo z rastlinsko pridelavo. Obseg živinoreje je pomembno izhodišče tudi za ugotavljanje stopnje obremenjevanja zemljišč z dušikom iz živinskih gnojil (Čergan s sod. 2003). Mejne vrednosti razredov GVŽ/ha smo določili na podlagi Uredbe o vnosu nevarnih snovi in rastlinskih hranil v tla (1996) in lastnih analiz vrednosti GVŽ/ha za obmestne kmetije (Razpotnik Visković 2013).

2.3 Kakovost in struktura kmetijskih zemljišč

Talno število izraža pridelovalno sposobnost zemljišča in je določeno z lastnostmi tal, ki so trajnega značaja, pri čemer višja vrednost pomeni boljšo pridelovalno sposobnost zemljišča. Razrede smo povzeli po metodologiji za vrednotenje težavnostnih razmer na območjih z omejenimi dejavniki za kmetijsko pridelavo (Cunder, Rednak in Zagorc 2007; Ciglič s sod. 2012).

Velikostna razdrobljenost daje informacijo o velikosti posameznih zemljiških kosov, prostorska razdrobljenost pa o prostorski razporeditvi kosov posesti in njihovi oddaljenosti od sedeža kmetije. Za njuno ovrednotenje smo uporabili koeficient razdrobljenosti (Gosar 1978).

Preglednica 2: Ocene vrednotenja širitvenega potenciala in konfliktnosti.

B1 – lega kmetije v naselju

lega kmetije v naselju:	*zunaj strnjenega dela naselja*	*na robu strnjenega dela naselja*	*znotraj strnjenega dela naselja, v soseščini so kmetije*	*znotraj strnjenega dela naselja, v soseščini ni kmetij*
vse kmetije	5	4	2	1

B2 – prostorska utesnjenost kmetije

prostorska utesnjenost:	*kmečko dvorišče z razpoložljivimi zemljišči za širitev kmetije*	*pozidano kmečko dvorišče, a z razpoložljivimi sosednjimi zemljišči*	*pozidano kmečko dvorišče in omejitve v soseščini, z drugo kmetijo v soseščini*	*pozidano kmečko dvorišče in omejitve v soseščini, ni kmetije v soseščini*
čiste	5	3	2	1
mešane in dopolnilne	5	2	2	1

B3 –dostopnost do kmetijskih zemljišč

dostop do kmetijskih zemljišč:	*dostop le po nekategoriziranih cestah (med njimi tudi poljske poti)*	*dostop tudi po (občinskih) javnih poteh*	*dostop tudi po državnih in občinskih lokalnih cestah*
vse kmetije	5	3	2

B4 – tip kmetovanja

tip kmetovanja:	*rastlinska pridelava*	*mešana pridelava*	*živinoreja*
vse kmetije	5	3	1

B5 – okoljsko obremenjevanje z dušikom

vrednost GVŽ/ha:	*več kot 2*	*od 2 do 1,5*	*od 1,5 do 1*	*od 1 do 0,75*	*manj kot 0,75*
vse kmetije	1	2	3	4	5

Zaokroženost kmetijskih zemljišč je vrednotena s pomočjo površinsko obteženega povprečnega indeksa oblike AWMSI *(*ang. *area-weigted mean shape index*), ki upošteva velikost zemljiških kosov, njihovo obliko in razpršenost (McGarigal in Marks 1995).

Melioracije se delijo na osuševanje, namakanje in agromelioracije. Slednje obsegajo ukrepe, ki izboljšujejo fizikalne, kemijske in biološke lastnosti tal ter dostop do kmetijskih zemljišč (internet 8).

2.4 Učinki prostorskonačrtovalskih in varovalnih ukrepov na razvojni potencial kmetij

Območja varstva kmetijskih zemljišč so opredeljena v občinskih prostorskih aktih in so namenjena trajnemu ohranjanju najkakovostnejšeih kmetijskih zemljišč. V okviru vrednotenja kakovosti kmetijskih zemljišč bi bilo smiselno izločiti tista, prek katerih potekajo daljnovodi, pod katerimi potekajo plinovodi ter zemljišča ob avtocestah in hitrih cestah, saj so izpostavljena trajnemu onesnaževanju. Na teh zemljiščih bi morala biti kmetijska dejavnost omejena.

Ukrepi na vodovarstvenih območjih so namenjeni zmanjševanju nevarnosti, ogroženosti in tveganj, ki jih vodooskrbi lahko povzročajo že obstoječe ali načrtovane dejavnosti (Zakon o vodah 2002). Omejitve kmetijske dejavnosti na teh območjih se nanašajo na gnojenje in uporabo sredstev za zaščito rastlin, odvisne pa so od ravni vodovarstenega režima.

Pri vrednotenju razvojnega potenciala kmetij smo upoštevali tudi varovanje naravnih vrednot in varstvo kulturne dediščine. Varovalni režimi od lastnikov zemljišč na teh območjih zahtevajo prilagoditve in so omejevalni (Šmid Hribar in Ledinek Lozej 2013), saj se morajo kmetije, katerih objekti so zavarovani ali pa so na varovanem območju, pri širitvi ali posodabljanju držati strogih predpisov.

Preglednica 3: Ocene vrednotenja kakovosti in strukture kmetijskih zemljišč.

C1 – povprečno talno število kmetijskih zemljišč					
povprečno talno število kmetijskih zemljišč:	*od 0 do 25*	*od 26 do 39*	*od 40 do 57*	*od 58 do 75*	*od 76 do 100*
vse kmetije	1	2	3	4	5
C2 – prostorska in velikostna razdrobljenost kmetijskih zemljišč					
**koeficient razdrobljenosti:*	*pod 4*	*od 4 do 6,5*	*od 6,5 do 10*	*od 10 do 14,7*	*nad 14,7*
vse kmetije	5	4	3	2	1
C3 – zaokroženost kmetijskih zemljišč					
**površinsko obtežen povprečni indeks oblike*	*pod 1,46*	*od 1,46 do 1,61*	*od 1,61 do 1,84*	*od 1,84 do 2,13*	*nad 2,13*
vse kmetije	5	4	3	2	1
C4 – delež kmetijskih zemljišč na območjih melioracijskih sistemov					
delež kmetijskih zemljišč na območju melioracijskih sistemov:	*0 %*	*od 0 do 15 %*	*od 15 do 30 %*	*od 30 do 45 %*	*več kot 45 %*
vse kmetije	1	2	3	4	5
C5 – delež kmetijskih zemljišč na območjih z omejenimi možnostmi za kmetovanje					
delež kmetijskih zemljišč na območjih z omejenimi možnostmi za kmetovanje:	*do 25 %*	*od 25 do 50 %*	*od 50 do 75 %*	*več kot 75 %*	
vse kmetije	5	4	2	1	

*mejne vrednosti razredov so določene na podlagi podatkov za vzorčne kmetije na Kamniškobistriški ravnini (Razpotnik Visković 2012) in z uporabo Jenksove metode naravnih meja.

Preglednica 4: Ocene vrednotenja učinkov prostorskonačrtovalskih in varovalnih ukrepov na razvoj kmetij.

D1 – delež kmetijskih zemljišč na območjih varstva najboljših kmetijskih zemljišč

delež kmetijskih zemljišč na območjih varstva najboljših kmetijskih zemljišč:	*manj kot 50 %*	*od 50 do 75 %*	*od 75 do 90 %*	*več kot 90 %*
vse kmetije	1	2	4	5

D2 – delež kmetijskih zemljišč na vodovarstvenih območjih

delež kmetijskih zemljišč na vodovarstvenih območjih:	*zemljišča niso na VVO*	*do 10 % na VVO1 ali do 30 % na VVO2 in/ali VVO3*	*od 10 do 20 % na VVO1 ali več kot 30 % na VVO2 in/ali VVO3*	*od 20 do 50 % na VVO1*	*več kot 50 % na VVO1*
vse kmetije	5	4	3	2	1

D3 – varstvo naravnih vrednot in ohranjanje biotske raznovrstnosti

delež kmetijskih zemljišč na območjih naravnih vrednot, območjih natura 2000 in/ali ekološko pomembnih območjih:	*zemljišča niso teh na območjih*	*do 15 % zemljišč na teh območjih*	*od 15 do 25 % zemljišč na teh območjih*	*od 25 do 50 % zemljišč na teh območjih*	*več kot 50 % zemljišč na teh območjih*
vse kmetije	5	4	3	2	1

D4 – varstvo kulturne dediščine

varstvo kulturne dediščine:	*ne*	*kmetija je na območju varstva kulturne dediščine*	*kmetija ima objekt s statusom kulturne dediščine*
vse kmetije	5	3	1

D5 – namenska raba v veljavnih prostorskih aktih občin

namenska raba v morfološki enoti, v kateri je kmetija:	*kmetijske dejavnosti in objekti*	*mešano*	*območja stanovanjske gradnje*
čiste in mešane	5	3	1
dopolnilne	5	4	1

D6 – lastniška ureditev poljskih poti

lastniška ureditev poljskih poti:	*večina poljskih poti ima status javnega dobra ali je v občinski lasti*	*manjši del poljske poti ima status javnega dobra ali je v občinski lasti*	*poljske poti so v zasebni lasti*
vse kmetije	5	3	1

Opredelitev namenske rabe v naselju oziroma morfoloških enot, namenjenih kmetovanju, je pomembna tako za širitev kmetij kot zmanjševanje pritiska nekmečkih prebivalcev naselja. Od lastniške ureditve poljskih poti pa je odvisno nemoteno zagotavljanje dostopa do kmetijskih zemljišč in zmanjšanje nevarnosti za nesoglasja med uporabniki poti in lastniki zemljišč, prek katerih potekajo poljske poti.

3 Določitev uteži

Vsakemu od dvajsetih izbranih kazalnikov smo pripisali utež, ki prikazuje njegov relativen odnos do ostalih parametrov. Uteži smo določali z metodo primerjave parov (Saaty 1980), kar pomeni, da smo primerjali vsak par kazalnikov znotraj vsebinskega sklopa (A, B, C, D) in določili pomen prvega v primerjavi z drugim z lestvico števil od 1 do 9. Dobili smo štiri primerjalne matrike in nato v vsaki izmed njih sešteli vrednosti v stolpcih in vsak element v matriki delili s pripadajočo vsoto stolpca. S tem smo prišli do normaliziranih vrednosti. V naslednjem koraku smo izračunali povprečje elementov v vsaki vrstici normalizirane matrike

Preglednica 5: Uteži kazalnikov vrednotenja razvojnega potenciala obmestnih kmetij.

kazalnik	utež	kazalnik	utež	kazalnik	utež	kazalnik	utež
A1 – starostna sestava gospodinjstva	0,09	B1 – lega kmetije v naselju	0,08	C1 – povprečno talno število kmetijskih zemljišč	0,08	D1 – delež kmetijskih zemljišč na območjih varstva najboljših kmetijskih zemljišč	0,05
A2 – namen kmetijske pridelave	0,06	B2 – prostorska utesnjenost kmetije	0,07	C2 – prostorska in velikostna razdrobljenost kmetijskih zemljišč	0,06	D2 – delež kmetijskih zemljišč na vodovarstvenih območjih	0,03
A3 – kmetijskookoljska plačila	0,03	B3 –dostopnost do kmetijskih zemljišč	0,05	C3 – zaokroženost kmetijskih zemljišč	0,05	D3 – varstvo naravnih vrednot in ohranjanje biotske raznovrstnosti	0,03
A4 – lastniška struktura kmetijskih zemljišč v uporabi	0,07	B4 – tip kmetovanja	0,03	C4 – delež kmetijskih zemljišč na območjih melioracijskih sistemov	0,04	D4 – varstvo kulturne dediščine	0,02
		B5 – okoljsko obremenjevanje z dušikom	0,02	C5 – delež kmetijskih zemljišč na območjih z omejenimi možnostmi za kmetovanje	0,02	D5 – namenska raba v veljavnih prostorskih aktih občin	0,07
						D6 – lastniška ureditev poljskih poti	0,05
skupaj	0,25	skupaj	0,25	skupaj	0,25	skupaj	0,25

in tako prišli do uteži za vsak kriterij (Dular 2007). Kazalnike iz vseh sklopov smo na koncu združili in znova normalizirali vrednosti uteži. Vsakemu od sklopov smo pripisali enak pomen oziroma težo – vsota uteži kriterijev iz enega sklopa je 0,25, njihova skupna vsota pa 1,00. Za podrobnejši prikaz in možnosti uteževanja glej Razpotnik Visković (2012).

4 Sklep

S predstavljeno metodologijo vrednotenja razvojnega potenciala obmestnih kmetij si prostorski načrtovalci na območju njihove obravnave lahko zagotovijo pomembne informacije o trenutnem stanju in razvojnih perspektivah kmetij. S kartografskim prikazom rezultatov vrednotenja lahko prepoznamo morebitna zgostitvena jedra kmetij z večjim ali manjšim razvojnim potencialom znotraj naselij ali pa ugotovimo, da takih jeder ni in so kmečka gospodarstva prostorsko razpršena ter raznolika. Kmetije lahko preučujemo tudi po posameznih sklopih vrednotenja razvojnega potenciala in ugotovimo:

- njihov socialno-ekonomski položaj,
- najbolj oziroma najmanj vitalne kmetije in problematične kmetije z vidika konfliktnosti z ostalimi uporabniki prostora,
- katere kmetije imajo najbolj oziroma najmanj ugodno zemljiško strukturo in
- v kolikšni meri so veljavni prostorski dokumenti prilagojeni kmetovanju in njegovemu razvoju.

Na ta način lahko opredelimo področja, na katerih imajo kmetije močnejši razvojni potencial in to upoštevamo v dolgoročnem načrtovanju razvoja kmetijstva. Vrednotenje razvojnega potenciala kmetij priporočamo kot del strokovnih podlag za pripravo lokalnih prostorskih načrtov (po veljavni zakonodaji so to občinski prostorski načrti), skladno s *»kmečko poselitvijo, pripadajočimi gozdnimi zemljišči, ureditvijo prometnih in komunalnih omrežij ter dostopnostjo do družbenih servisov«* (Pogačnik 2006, 215).

5 Literatura

Glej angleški del prispevka.

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GEOGRAPHICAL IMAGINATION OF LANDSCAPES: ANALYSIS OF THE BOOK OF PHOTOGRAPHS SLOVENIAN LANDSCAPES

GEOGRAFSKO ZAMIŠLJANJE POKRAJIN: ANALIZA FOTOMONOGRAFIJE SLOVENSKE KRAJINE

Mimi Urbanc, Primož Gašperič, Jani Kozina

BOJAN ERHARTIČ

The Logar Valley: an example of the visual appearance of an Alpine landscape.
Logarska dolina: primer izgleda alpske pokrajine.

Geographical imagination of landscapes: analysis of the book of photographs Slovenian landscapes

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ABSTRACT: The article focuses on the geographical imagination of landscapes, depicted in the photographs. The research stems from the assumption that photographs play an important role in shaping and preserving individual and collective imagination of a landscape and that geography as a science is closely connected to visual representations of the world. The empirical part of the research entails selecting and defining/coding the photographs from the book *Slovenian Landscapes* by Dušan Ogrin and their analysis through statistical methods. The purpose of the article is to demonstrate what kind of image of the landscape this book creates. The goal is to design/formulate a methodology for photograph interpretation, especially to select the indicators and their categories as well as the criteria for a quantitative photograph evaluation. Using these methods, the appearance of the landscapes is analysed according to the individual indicators, placing special emphasis on surface form as the most important landscape element.

KEY WORDS: geography, surface, landscapes, landscape imagination, photographs, statistics, Slovenia

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1 Introduction

Symbols and rituals and their dissemination and reception play an important role in shaping a nation (Hvithamar et al. 2009). National iconographies and tradition, whether existing or newly constructed and just arising, help build, strengthen, and maintain a nation's connectedness (Jager 2009; Cosgrove and Daniels 1988). Texts (in the widest sense of the word; Anderson 2007) and photographs (Jager 2009) play a decisive role in this process, which can be defined by the term geographical imagination.

Geographical imagination as a discursive practice has accompanied man since the beginnings of mankind. But it is much younger as a concept within geography in light of its scientific paradigm, which was formed during the post-Enlightenment era systematics of modern science. It is even younger in Slovenian geography, which has dealt with individual aspects of geographical imagination, but within other conceptual traditions.

The concept relates to the perception of space through pictures, texts, and discourses. It gained notice through post-modern approaches in social theories and practices, which also had a resounding influence on geography. In human geography, these kinds of approaches focused on understanding the ways in which society and its way of life are reflected in space, settlements, and landscapes (Gregory 1994; Hoelscher 2006).

Geographical imagination, a process as well as a result, has placed great importance on photographs since the very beginnings of photography techniques. Their fundamental communicative value is in their visual representation. Visual culture is embedded in the modern social-political context (Davison and Falihi 2010). Visuality shapes knowledge as well as entertainment and what we see is almost if not more important than what we hear or read. Visuality is closely connected to geography, as graphic images are very important to it for shaping knowledge and disseminating it. Some even go so far in their discussions on the close link between geography and visuality as to claim that geography is a »visual science« (Gregory 1993; Smith 2000; Sui 2000).

Even though visuality is integrated into the very core of geography, it only became an object of geographical studies in the late twentieth century. Previously to that, it was regarded mostly as a supplement or addition to geographical knowledge or as merely one of the ways to acquire it. The idea of geographical imagination caused visuality, especially visuality through photographs, graphs, and maps, to become the primary study target and a tool in cultural and historic analyses (Rose 2001; Crang 2003; Driver 2003; Matless 2003; Rose 2003; Schwartz and Ryan 2003; Cosgrove 2006; Duncan and Duncan 2009; Rose 2012).

The bond between geography and visuality is most solid precisely in the case of the landscape. Tuan (1976) states that humanistically oriented geographers are not interested in landscape as part of a territory, but as a visual and aesthetic experience. Influenced by humanist and behaviourist ideas, Cosgrove (2008) defined the landscape as »way of seeing«. With this, landscape got two new dimensions, a cognitive and an experiential one, which have become the means and the result of landscape dynamics, balance, symbolism, ideology, and identity (Terkenli 2001).

Geographical imagination combines the imagination and the depiction of space from outsiders as well as from insiders. This article focuses on the latter, the inhabitants of Slovenia and their imagining of the landscape. More specifically, on the book of photographs *Slovenian landscapes* (Ogrin 1997). The purpose of the paper is to illustrate what kind of landscape images the book creates; what photographs it uses to depict it. The goal is to uncover the typical landscape elements and to determine to what degree the surface as the most important landscape component part (Perko 2007; Hrvatin and Perko 2009) influences other landscape elements that are depicted in the photographs.

The title of the aforementioned book adopts the term »*krajina*«, where the term »*pokrajina*«, landscape, is usually used. The use of the two terms and their mutual delineation in content and concept has been discussed in several instances (Ogorelec 1987; Lovrenčak 1996; Gams 2007) and will not be continued at this time, as it is not relevant to the contents of the article. Approaching the subject from a geographical standpoint, the term »*pokrajina*« will be used as it can be interchangeable with »*krajina*«. The terms in English remain »landscape« for both instances.

2 Methodology of the photograph interpretation

The subject of the analysis was the book of photographs entitled *Slovenian landscapes*, by author Dušan Ogrin, more specifically the second revised edition (Ogrin 1997). The book selection was chosen for its overwhelming presence of photographs among the text and because the author is a landscape architect, an expert and undoubtedly an opinion leader in the field of landscapes. In addition, landscape architects are a step in front of geographers in understanding and studying the non-material aspects of the landscape. The works of Kučan (1996, 1998, 2007) merit mentioning, in which she defined the subtle and logical interweaving of geographical imagination and of landscape; another extensive work is the *Regional distribution of landscape types in Slovenia*. The result was obtained through field work in an intuitive and holistic manner (Marušič 1995; Marušič, Ogrin and Jančič 1998); it is presented in five volumes and defines the elemental morphological landscape units of Slovenia (Marušič s sodelavci et al. 1998a, 1998b, 1998c, 1998d, 1998e).

The book of photographs reflects landscape taste, meaning the cherished, the preserved, the reproduced (Lowenthal and Prince 1965) and, as the author writes in the introduction, that which is beautiful and worth preserving. The nearly square shape and larger book format (width 285 mm, height 305 mm) enable wide and unhindered photographs to be displayed, which increases the expressive power of the depicted area. The analysis encompassed 307 photographs of different sizes: almost 73% are full-paged or half-paged, while the smallest photographs aid in additionally illustrating the discussed topic.

The photographs contain titles, which stated the location of the depicted area in most cases. In some cases, the location was also determined through the expert knowledge of the authors, who recognized the photographed areas. Each photograph was first categorized into a certain landscape type. Here, the research adopted the natural geographical typization, which divides Slovenia into an Alpine, Mediterranean, Dinaric, and a Pannonian landscape types (Perko 1998). The only further distinction was the division of the Alpine types into two parts due to quite distinctive internal differences. The area consisting mostly of Alpine mountain ranges was placed in the true Alpine landscapes and the area consisting of mostly Alpine hillsides and interim plains was placed with the Prealpine landscapes (Figure 1).

Each photograph was then defined/coded according to nine predetermined indicators, each signifying a certain landscape element. To unify the defining/coding process as much as possible, it was done in its entirety by only one person. First, the prevailing landform unit was determined in each image. Then, each photograph was virtually divided into two parts and the landforms and the land use was separately determined for the foreground and the background. Next, the prevailing settlement type, infrastructure type, along with any visibly movable and water elements was recognized in each photograph. The selected indicators with the corresponding categories are as follows:

- landform units (plain, hummocks, hills, low plateau, high plateau, mountain range, cliff, coastal plain;
- landforms in the foreground (valley, shore, flat surface, gentle slopes, steep slopes, karst surface, undulating surface);
- landforms in the background (valley, shore, cliffs, flat surface, gentle slopes, karst surface, undulating surface);
- land use in the foreground (rocks, built up, shrubbery, field, permanent crop, grassland, park, forest, mixed use);
- land use in the background (rocks, built up, shrubbery, field, permanent crop, grassland, park, forest, mixed use);
- settlement (nucleated settlement, dispersed settlement, individual buildings, not settled);
- infrastructure (road, electrical wiring, footpath, no infrastructure);
- movable elements (living creatures, transportation vehicles);
- water elements (still bodies of water, running bodies of water, no water elements).

Photographs of poorer quality, depictions of a larger area and photographs with a greater number of unevenly distributed elements proved a special challenge in evaluating the photographs. Figure 2 illustrating the Škofja Loka hills presents a challenge in delineating between the foreground and the background. The infrastructure is also not visible, but definitely exists considering the settlement and land use. As the photograph is in a smaller format and the depicted territory is very diverse in its landforms, the land use and the movable elements are also that much harder to determine. Photograph 3, depicting the Kamniško polje plain, has some elements in the background that are harder to detect. The problem does not lie in recognizing the individual categories (landforms, land use, and settlement are recognizable), but in their share and type.

The landscape elements depicted in the photographs were analysed in more detail using the location coefficient, association analysis, and factor analysis.

Figure 1: A map of the landscapes and the photograph locations. ➤

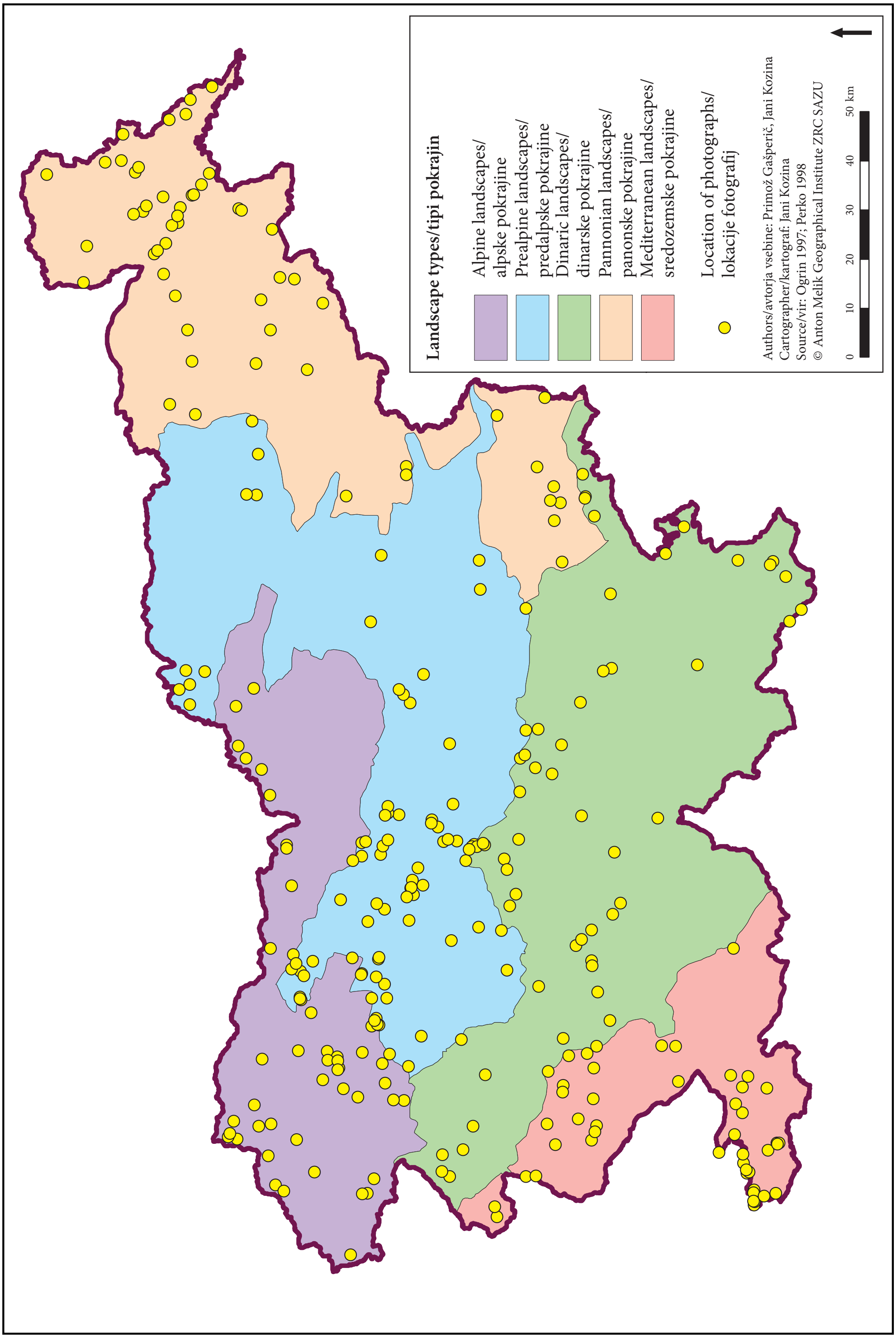
Landscape types/tipi pokrajin
Alpine landscapes/ alpske pokrajine
Prealpine landscapes/ predalpske pokrajine
Dinaric landscapes/ dinarske pokrajine
Pannonian landscapes/ panonske pokrajine
Mediterranean landscapes/ sredozemske pokrajine
Location of photographs/ lokacije fotografij
Authors/avtorja vsebine: Primož Gašperič, Jani Kozina
Cartographer/kartograf: Jani Kozina
Source/vir: Ogrin 1997; Perko 1998
© Anton Melik Geographical Institute ZRC SAZU
0 10 20 30 40 50 km

Figure 2: An example of problematic determining of the landscape elements in the Škofja Loka hills in the Prealpine region (Ogrin 1997).

Figure 3: An example of problematic determining of the landscape elements in the Kamniško polje plain in the Prealpine region (Ogrin 1997).

3 Visual appearance of the landscapes

The majority of the photographs depict landscapes in the Prealpine area, as some of the largest and most densely populated areas in Slovenia fall in this category, like the Ljubljana and Celje basins. Landscapes in the Alpine area along with the ones in the Prealpine area, as their name implies, together form the Alpine area; they are depicted on almost half of all the photographs. They are followed by a fifth of the photographs from the Pannonian area, with equally small shares of both the Dinaric and Mediterranean landscapes (Figure 4).

An interesting aspect is the comparison of the proportion of the share of the photographs to the share of surface area of the individual landscape type. While there are no noticeable differences in the case of the Alpine and Pannonian landscapes, these do occur in the other three landscape types. A greater share of the photographs in comparison to the share of landscape type coverage can be detected in the Prealpine and the Mediterranean landscapes, while the opposite is true of the Dinaric landscapes.

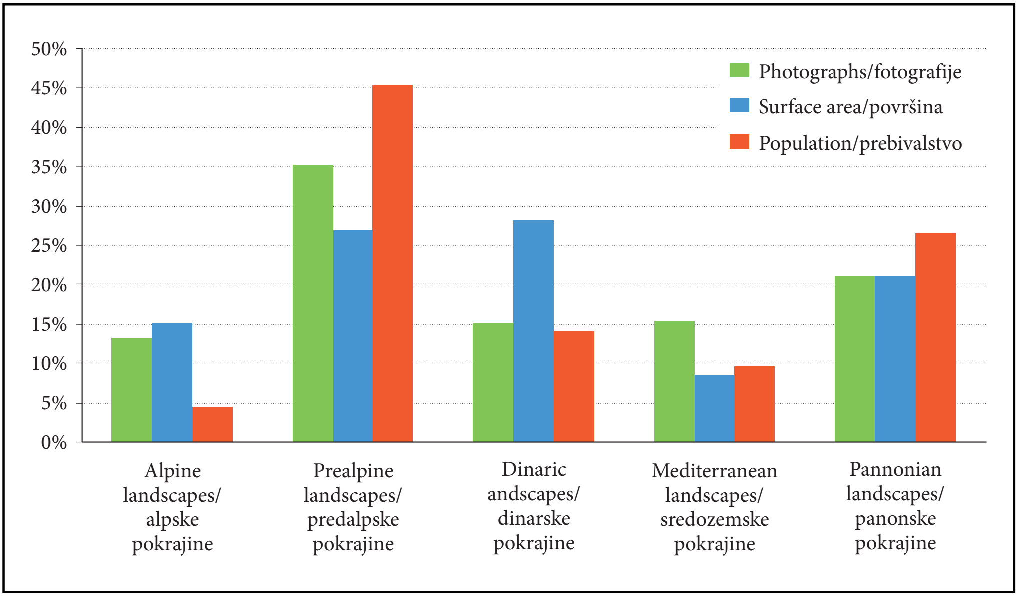

Figure 4: Comparison of the shares of the photographs with the shares of the surface area and population in the landscapes.

The landscapes that are depicted in the photographs in the selected book can be further described using selected indicators of landscape elements:

- **Alpine landscapes** are expressly hilly, mountainous, or contain high plateaus. The foreground usually shows steeper or gentler slopes or a valley with steeper slopes in the background. Land use in the foreground is mostly grassland or forest, only occasionally with mixed or built up lots. The background is predominantly forest and rocks. Settlement occurs in the form of individual buildings or there is no settlement at all. There is also mostly no infrastructure and if there is, it is a road, electrical wiring, or a footpath, which is also typical of the other landscape types. There are practically no movable elements, only a sporadic living creature. Water elements rarely occur.
- **Prealpine landscapes** illustrate an intertwinement of hillsides and plains. Hummocks make up a smaller share as well. The landforms in the foreground are mostly flat, with a few valleys and steep and gentle slopes. The background consists predominantly of steep slopes, with gentler slopes in some places or a plain surface. Land use in the foreground is varied. The majority consists of grassland, followed by fields, forests, and built up lots. The forest prevails in the background. Settlement is depicted similarly to the Alpine landscapes. A few more condensed settlements occur. Movable and water elements are rare.

Figure 5: An example of a photograph of an Alpine area depicts the Špik mountain group in Upper Carniola (Ogrin 1997).

Figure 6: An example of a photograph of a Prealpine landscape depicts the transition of the level part of Upper Carniola towards the edges of the Kamnik mountains (Ogrin 1997).

- **Dinaric landscapes** are depicted as hilly and hummocky. A few high and low plateaus appear. The foreground is prevailed mostly by karst and undulating surfaces and gentle slopes. The background has a similar appearance, only with more steep slopes replacing the undulating surface. Land use in the foreground is similarly varied as in the Prealpine landscapes. A few more instances of fields and rocks can be noted. Forest is most common in the background. Settlement is illustrated to be somewhat more dispersed in comparison to the (Pre)Alpine landscapes. Transportation vehicles occur more often and, surprisingly, even running bodies of water that are a very rare phenomenon in this type of landscapes.

Figure 7: An example of a photograph of a Dinaric landscape depicts the wavy surface near Unec in Inner Carniola (Ogrin 1997).

Figure 8: An example of a photograph of a Mediterranean landscape depicts the Šmarje settlement in Slovenian Istria (Ogrin 1997).

- **Mediterranean landscapes** are similarly depicted in their landforms as the Dinaric landscapes with hills and hammocks. An additional element is the coastal plain, with less high plateaus. The foreground depicts mostly karst and flatland; the former is also featured greatly in the background. In addition, gentles slopes and coasts are pictured. Land use in the foreground is similar to the Dinaric landscapes. In place of fields, there are more permanent crops. The background is still mostly covered with forest, however, built up and mixed lots and permanent crops are also important categories. The settlement is usually depicted as condensed settlements and individual buildings. The landscape is rarely depicted as not settled or in a dispersed settlement form. Mediterranean landscapes feature transportation vehicles and still bodies of water more than any of the other landscapes.
- **Pannonian landscapes** depict an intertwining of flatlands and hummocks. The foreground is prevailed by a flat surface with occasional gentle slopes that are more prominent in the background. Fields are most abundant in the foreground with regards to the land use, with grasslands and permanent crops following in frequency. The background is mostly covered in forest; however, an important share of the background is also assumed by fields and permanent crops. Settlement is depicted as not settled as well as with individual buildings, and dispersed settlement. Running bodies of water are present in a considerable number of cases.

The differences in the appearance in the landscapes can be compared in more detail using the location coefficient. Its value illustrates to what extent the depiction of a certain indicator category in a landscape deviates from the national average. The more the location coefficient value exceeds the value 1, the more the depiction of a certain indicator category among all the photographs is higher than the Slovenian average. Values below 1 indicate a below average concentration. The location coefficient calculation can be formulated using the equation:

$$\textit{location coefficient} = \frac{\dfrac{\textit{the number of photographs depicting a certain indicator category in a landscape}}{\textit{the number of all the photographs of the landscape}}}{\dfrac{\textit{the number of photographs depicting a certain indicator category in Slvenia}}{\textit{the number of all the photographs of Slovenia}}}$$

Table 1 contains the most important indicator categories of landscape elements that express an above average deviation from the national average in an individual landscape type (location coefficient > 1.25).

Table 1: The visual landscape characteristics that are most prominent in relation to the other landscapes (location coefficient > 1.25). The order of the categories in an individual cell indicates a decreasing succession of deviation strength.

Indicators of landscape elements	Alpine landscapes	Prealpine landscapes	Dinaric landscapes	Mediterranean landscapes	Pannonian landscapes
Landform unit	Mountains, high plateau, hills	Hills, flatland	Hummocks, high plateau, low plateau	Shore platform, low plateau, hummocks	Flatland, hummocks
Landform in the foreground	Valley, steep slope	Level surface, steep slope	Wavy surface, karst surface, gentle slope	Coast, karst surface	Flatland
Landform in the background	Steep slope	Steep slope	Karst surface, gentle slope	Coast, karst surface	Flatland, gentle slope
Land use in the foreground	Mixed use, grassland, forest	Built up	Mixed use, field	Park, permanent crop, mixed use	Permanent crop, field
Land use in the background	Rock	/	Grassland	Mixed use, built up, permanent crop	Field, permanent crop
Settlement	/	/	Dispersed settlement	Condensed settlement	Dispersed settlement
Infrastructure	/	/	Electrical wiring, footpath	Footpath	/
Movable elements	Living creature	Living creature	/	Transportation vehicle	/
Water element	/	/	Running body of water	/	Running body of water

Figure 9: An example of a photograph of a Pannonian landscape depicts the Kobilje settlement in Prekmurje (Ogrin 1997).

Table 2: The level of correlation between the indicators of landscape elements and their representation in the landscape types.

Indicator of landscape element	$\chi 2$	Degrees of freedom	p (2-tailed)	V
Landform unit	301.122	40	0.000	0.443
Landform in the foreground	214.801	35	0.000	0.374
Landform in the background	281.923	40	0.000	0.429
Land use in the foreground	88.105	45	0.013	0.240
Land use in the background	120.186	50	0.010	0.280
Settlement	48.724	20	0.016	0.199
Infrastructure	14.157	20	0.814	0.107
Movable elements	23.751	10	0.017	0.197
Water elements	36.225	15	0.001	0.243

The correlation between non-numeric indicators of landscape elements and their representation in individual landscape types were determined through association analysis. It indicated that almost all the indicators, except infrastructure, were statistically significantly correlated to their representation in the landscapes ($p < 0.05$) (Table 2). This means that statistically significant differences exist in the appearance of the landscapes in relation to the discussed indicators. The amount of the Cramer coefficient (*V;* interval between 0 and 1) shows a very strong correlation for landform units and landforms, a moderately strong correlation for land use and water elements, and a weak correlation for settlement and movable elements.

4 Landform as the most important element in landscape appearance

Since landforms were detected as the most important landscape element in our analysis, we discuss it here in more detail. We were interested in how landforms influence the other landscape elements depicted in the photographs. This case deals with more complex dimensions, so the explorative factor analysis (EFA) was implemented (see Fulgosi 1988; Rogerson 2001).

The descriptive data collected through the photograph defining/coding were converted into numeric data by cross-tabulating the data on the landscape type (Alpine, Prealpine, etc.) and the landform unit. The 307 photographs were divided into 27 groups that represented the new units for this analysis. In addition, the remaining eight indicators of landscape elements were divided so that their categories became the new variables. After eliminating a large portion of »non-essential« contents (categories represented in less than 5% of the photographs within an individual indicator) and by considering the other assumptions for implementing a factor analysis (see Larose 2006; Field 2009), 24 variables were included in the analysis.

Since most of the variables are not distributed normally, their values had to be converted into ranges and the EFA was carried out using the *polychoric correlation matrix*, which enables the R-Menu command in the SPSS program (Basto and Pereira 2012). The *main component method* with a *varimax* orthogonal rotation was used for the factor extraction. The *Kaiser–Mayer–Olkin* test confirmed the suitability of the sample size, $KMO = 0.800$, which is considerably above the recommended minimal value of 0.5 (Kaiser 1974). *The Bartlett's sphericity test* $\chi^2 (276) = 2902.032$, $p < 0.001$ indicated that the variables are correlated highly enough. In order to determine the number of common factors, the *parallel analysis* measure (Courtney 2013) was used, which identified three factors (Table 3), which together account for 80.8% of the common variance and express a high degree of reliability, $\alpha_{polychoric\ correlation} > 0.9$ (Field 2009). The coefficients values, $GFI > 0.95$, $AGFI > 0.95$, and $RMSR < 0.1$ confirmed a very good adjustment of the model to the results (Basto and Pereira 2012).

The results showed that the factor 1 accounts for over a third (37.7%) of the common variance. It expresses that steep slopes, gentle slopes, and valleys are the prevalent landforms in the foreground, while steep slopes are most common in the background. Land use is mostly forest, but grasslands are also typical for the foreground. Settlement is dispersed or individual buildings are pictured. The photographs also depict movable elements (living creatures) and linear infrastructure. This factor could be summed up with the term »hill factor«.

Table 3: Factor matrix.

Variable	Rotated factor loadings		
	Factor 1	Factor 2	Factor 3
Landforms in the foreground_steep slope	0.954	–0.145	–0.017
Landforms in the foreground_valley	0.945	–0.001	0.196
Landforms in the background_steep slope	0.934	–0.176	–0.066
Land use in the foreground_forest	0.828	0.327	0.085
Land use in the background_forest	0.807	0.495	0.130
Land use in the foreground_grassland	0.806	0.293	0.167
Movable elements_living creature	0.785	0.236	–0.016
Settlement_individual building	0.749	0.480	0.223
Landforms in the foreground_gentle slope	0.722	0.295	0.346
Infrastructure_electrical wiring	0.684	0.599	0.124
Infrastructure_road	0.680	0.635	0.038
Infrastructure_footpath	0.605	0.506	0.298
Settlement_dispersed settlement	0.585	0.376	–0.101
Land use in the foreground_field	0.244	0.881	–0.044
Landforms in the foreground_flatland	0.188	0.798	–0.273
Movable elements_transportation vehicle	0.224	0.772	0.265
Land use in the background_field	–0.162	0.767	–0.460
Landforms in the background_gentle slope	0.413	0.741	0.106
Water element_running body of water	0.564	0.729	–0.219
Settlement_condensed settlement	0.586	0.649	0.292
Land use in the foreground_permanent crop	–0.087	0.609	0.330
Landforms in the background_karst surface	0.096	0.159	0.968
Landforms in the foreground_karst surface	0.131	0.124	0.964
Landforms in the backround_flatland	–0.099	0.465	–0.855
Own values/eigenvalues	9.045	6.750	3.589
% of variance	37.689	28.127	14.956
$a_{polychoric\ correlation}$	0.966	0.911	0.938

Factor 2 accounts for more than a quarter (28.1%) of the common variance. The landforms in the foreground are flatland with gentle slopes in the background. Fields are prevalent in the background with regards to land use, with permanent crops also appearing in the foreground. The settlement is condensed. The depiction of running bodies of water is characteristic. The lineal infrastructure from factor 1 correlates quite highly with factor 2. The factor can be described as »flatland factor«.

Factor 3 accounts for about a sixth (15.0%) of the common variance. It is expressed by a prevalence of karst forms in the foreground as well as in the background. Flatlands occur only rarely in the background. Its simplicity and clean lines can deem it the term »karst factor«.

Table 4 depicts the representativeness of the factors for each individual landscape type. The factors that are more than one standard deviation above average and are therefore most characteristic of an individual landscape type are marked in bold letters. The remaining above average characteristic factors are marked, but not in bold. This has proven that some landscape types are more diverse than others, as the characteristics of multiple factors are combined in them. The Prealpine hills and the Dinaric and Mediterranean hummocks have proven the most varied (intertwinement of all three factors). Alpine and Dinaric hills, Prealpine flatlands, and Pannonian hummocks and flatlands also belong among the more diverse landscapes (intertwinement of two factors). In some (for a certain landscape less characteristic) landform units no factor stands out (for example the mountains in the Prealpine landscapes or the hills in the Pannonian landscapes).

An overview of the factors indicates that factor 1 (hill factor) stands out expressly in the hills of the entire Alpine region and also in the Alpine mountains, the Dinaric hills, the Prealpine and Pannonian flatlands, and in almost all the hummocks. Factor 2 (flatland factor) is most expressly characteristic of the Prealpine hills and flatlands and the Pannonian hummocks and flatlands, as well as the hummocks in the Dinaric

Table 4: Representativeness of the factors for the individual landscape types and their landform units.

Landscapes	Landform units	Representativeness of the factors
Alpine landscapes	mountains	hill factor
	high plateau	karst factor
	hills	**hill factor**, karst factor
Prealpine landscapes	mountains	/
	high plateau	/
	hummocks	hill factor
	hills	**hill factor**, **flatland factor**, karst factor
	low plateau	/
	other	/
	flatland	hill factor, **flatland factor**
Dinaric landscapes	high plateau	karst factor
	hummocks	hill factor, flatland factor, **karst factor**
	hills	hill factor, karst factor
	low plateau	karst factor
	other	karst factor
	flatland	/
Mediterranean landscapes	cliff	/
	shore platform	karst factor
	hummocks	hill factor, flatland factor, karst factor
	hills	**karst factor**
	low plateau	karst factor
	other	karst factor
	flatland	/
Pannonian landscapes	hummocks	hill factor, **flatland factor**
	hills	/
	low plateau	/
	flatland	hill factor, **flatland factor**

and Mediterranean landscapes. Factor 3 (karst factor) is most expressed in the Dinaric hummocks and Mediterranean hills, but it is typical for almost all the landform units of the Dinaric and Mediterranean landscapes and also of the (Pre)Alpine hills and the high and karstified Alpine plateaus.

5 Discussion: landscape taste

The photographs of the selected monograph reflect the author's landscape taste, which, in addition to individual taste, also undoubtedly reflects and, at the same time, shapes and generalizes the landscape taste. The author's view of the landscape is affected by the cultural, social, and intellectual environment, while his »expert« geographical imagination of the landscape or his »landscape scientific reasoning« is a medium that (co)creates the taste of the wider public and its idea of social and spatial reality. The analysed photographs illustrate how society and its way of life are mirrored in the landscape and, inversely, how the depicted landscape wishes to indirectly steer social development.

If landscape is understood as a way of perception, the question arises what kind of perception does the selected monograph trigger? What kind of landscape, what kind of Slovenia can be recognized in it? The first result is certainly Alpine, as almost half (48%) of the landscape imagination is based on the image of Alpine life, even though Alpine landscapes (true Alpine and Prealpine ones combined) encompass a somewhat smaller share (42%) of the Slovenian territory. The conclusion that the share of the Mediterranean photographs (15%) is considerably larger than the share of Mediterranean landscapes (9%) leads to the assumption that an important share of the landscape imagination is also based on Mediterranean life. From that aspect, the Dinaric landscapes have a less important role, while the meaning of the Pannonian landscapes is balanced. The great density of the photographs of the Mediterranean landscapes is most likely the consequence of at least three factors: the first is that Mediterranean landscapes must be more firmly anchored in the geographical imagination of Slovenians, as they are burdened by a historical political heritage. The second reason lies in the diversity and landscape variety that offers an abundance of attractive photographic motifs. The third group of reasons could be deemed a fashion trend and a longing for the popular Mediterranean diet and lifestyle.

The fact that the Prealpine image of Slovenia is more highly ranked than the true Alpine one is surprising, considering the fact that the mountainous region had and still has a notable role in the identification of the Slovenians (Triglav, the fight between the Slovenian and German camps in conquering the mountains in the past, and similar factors). Perhaps, part of the deciding factor was that Prealpine landscapes are marked by a greater variety and diversity, while the mountainous region is more »uniformed« in shape and colour and relatively less »sensitive« to the seasons. It is also surprising that the (true) Alpine landscapes are less represented in the book than Pannonian landscapes considering that dramatic landscapes with a high relief energy are more attractive for the camera lens and that flatlands offer fewer attractive motifs.

As expected, the correlation between the landscape elements depicted in the photographs and their representation according to the individual landscape type indicates that the location in a certain landscape (Alpine, Prealpine, etc.) is very determined by the landform units, landforms, land use, and water elements; settlement and movable elements determine it to a lesser extent, while the depiction of infrastructure does not differ noticeably between the landscapes. This points to a polycentric or proportional regional structure, because the entire country is covered quite evenly with regards to settlement or the presence of man and transport axis (Kozina 2010a; Kozina 2010b).

A more detailed overview of land use leads to a number of interesting conclusions. For instance, in more rarely settled Dinaric landscapes, where there are fewer tilled lots and surface waters, fields and running bodies of water stand out in the photographs; in Prealpine landscapes, which are more abundant with agricultural lots and water sources, this prevalence cannot be detected. The reason for this is most likely that fields and waters are a rare source in Dinaric landscapes and therefore receive more attention. Water, in this case still bodies of water or marine waters, stand out together with transportation vehicles in Mediterranean landscapes, which stresses or strengthens the maritime and traffic position of that part of Slovenia. This landscape element also stands out in the depiction of Pannonian landscapes and points to the importance of the Mura River, water for agriculture and other activities like the milling industry, and to drought protection.

Forest depictions are especially expressive. They occur less often in the foreground (most often in the Alpine area), while it is a prevailing category in all landscapes. It is apparent that the forest is understood as a frame, a constant that does not need to be expressly emphasized because it covers more than 60 % of the Slovenian surface (Hrvatin in Perko 2003).

As a whole, a third of the photographs do not depict settlements; living creatures are also a real rarity in most cases. The absence of (condensed, city) settlement and living creatures implies a static and humanless character of the landscapes. The absence of people undoubtedly expresses a latent perception of landscape as a natural formation, which leads to the conclusion that an urban landscape does not exist here. The photographs point only to a rural (as opposed to an urban) landscape, which reflects an anti-urban character of the Slovenian way of life (Hočevar et al. 2005; Poljak Istenič 2011, 2012; Uršič and Hočevar 2007; Uršič 2010, 2015) and an image of rurality that, it seems, has not faded together with the diminishing numbers of the farming population and the meaning of agriculture. This rurality is reinforced by the large share of fields depicted in the foreground. The (agricultural) activity creates a cultivated landscape, an inactivity that results in a forest that is placed in the background. The image of rurality has become a construct; this is undoubtedly true of cultural landscapes. The analysis results for the discussed book confirm this fact.

6 Conclusion

The results of the analysis of the book of photographs have shown that especially the Prealpine and Mediterranean landscapes are overrepresented in volume in it, while the Dinaric landscapes are underrepresented. Field surfaces are also overrepresented. Forest is relatively evenly represented; however, it is depicted only as a background/framework feature, not a central factor. Water is stressed where it is a rare or limited source, but is vital for agriculture. This agriculture is evidently the main topic and the clearly expressed designing element of the cultural landscape. The other fundamental type, the antipod to the farming landscape, the urban landscape, is completely omitted. The most important landscape shaping factor is the landform, which is usually depicted in the form of three dimensions in the photographs: a higher, more scattered, more scarcely settled, and forest landform (factor 1), a lower, flatter/gentler, more densely settled, and more cultivated landform (factor 2), and a karst, less diverse landform (factor 3).

Photographs shape and distribute knowledge. In the same way, landscapes effect and shape landscape taste and vice versa; landscape taste shapes the landscape (Lowenthal and Prince 1965). This mutual and layered process is geographical imagination, defined as a spatially oriented cultural and historical knowledge that defines social groups. Geographical depiction blurs the differences between the actual and the imaginary world and shapes people's identity, their understanding of the world, and the world itself. This kind of analysis speaks more of the people than of the landscape: it reveals what a society cherishes, how it pictures its landscape, what is people's self-image, and what kind of image they want to pass on to others.

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Geografsko zamišljanje pokrajin: analiza fotomonografije *Slovenske krajine*

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IZVLEČEK: V središču prispevka so geografske predstave o pokrajinah, izražene s fotografijami. Izhajamo iz predpostavke, da imajo fotografije pomembno vlogo pri oblikovanju in ohranjanju individualnih in kolektivnih predstav o pokrajini ter da je geografija kot veda tesno povezana z vizualnimi predstavami sveta. Empirični del obsega izbor in opredeljevanje/kodiranje fotografij iz knjige Dušana Ogrina *Slovenske krajine* ter njihovo analizo s pomočjo statističnih metod. Namen prispevka je prikazati, kakšno podobo pokrajin ustvarja omenjena knjiga. Cilj je zasnova/oblikovanje metodologije interpretacije fotografij, zlasti nabor kazalnikov in njihovih kategorij ter kriterijev za kvantitativno vrednotenje fotografij. Na tak način smo želeli analizirati izgled pokrajin po posameznih kazalnikih in se posebej osredotočiti na oblikovanost površja kot najpomembnejšo prvino pokrajin.

KEYWORDS: geografija, relief, pokrajine, zamišljanje pokrajin, fotografije, statistika, Slovenija

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1 Uvod

Simboli in rituali ter njihovo posredovanje in sprejemanje imajo zelo pomembno vlogo pri oblikovanju naroda (Hvithamar s sod. 2009). Nacionalne ikonografije in tradicije, bodisi obstoječe bodisi na novo skonstruirane ali porajajoče pomagajo graditi, krepiti in vzdrževati povezanost naroda (Jager 2009; Cosgrove in Daniels 1988). Besedila (v najširšem pomenu besede) (Anderson 2007) in fotografije (Jager 2009) so odigrala odločilno vlogo v tem procesu, ki ga opredeljujejo s izrazom geografsko zamišljanje.

Geografsko zamišljanje kot diskurzivna praksa spremlja človeka od začetkov človeštva. Kot koncept znotraj geografije v luči njene znanstvene paradigme, izoblikovane v porazsvetljenski sistematiki modernih znanosti, pa je mnogo mlajši. Še mlajši je v slovenski geografiji, ki se je s posameznimi vidiki geografskega zamišljanja že ukvarjala, vendar v okviru drugih konceptualnih tradicij.

Koncept, ki se nanaša na dojemanje prostora preko slik, besedil in diskurzov, se je začel uveljavljati s postmodernimi pristopi v družbenih teorijah in praksah, ki so v veliki meri vplivali tudi na geografijo. V humani geografiji so se tovrstni pristopi osredotočali na razumevanje načinov, kako se družba in njen način življenja zrcalita v prostoru, krajih in pokrajini (Gregory 1994; Hoelscher 2006).

V geografskem zamišljanju, ki je tako proces kot tudi rezultat, igrajo fotografije od samih začetkov fotografskih tehnik pomembno vlogo. Njihova temeljna sporočilna vrednost je v njihovi vizualni predstavnosti. Vizualna kultura je vtisnjena v sodobni družbeno-politični kontekst (Davison in Falihi 2010). Vizualnost oblikuje tako znanje kot tudi številne oblike zabave in, kar vidimo, je vsaj tako pomembno ali celo bolj kot tisto, kar slišimo oziroma preberemo. Vizualnost je tesno povezana z geografijo. Zanjo so grafične podobe zelo pomembne pri oblikovanju znanja in njegovem podajanju. Nekateri gredo v svojem razmišljanju o tesni povezanosti med geografijo in vizualnostjo tako daleč, da trdijo, da je geografija »vizualna veda« (Gregory 1993; Smith 2000; Sui 2000).

Čeprav je vizualnost vgrajena v samo bistvo geografije, je šele ob koncu 20. stoletja postala predmet geografskega preučevanja. Prej je bila večinoma razumljena kot dopolnilo oziroma dodatek h geografskemu znanju in način njegovega pridobivanja. Z idejo geografskega zamišljanja je vizualnost zlasti prek fotografij, grafov in zemljevidov postala primarni vir preučevanja in orodje v kulturnih in zgodovinskih analizah (Rose 2001; Crang 2003; Driver 2003; Matless 2003; Rose 2003; Schwartz in Ryan 2003; Cosgrove 2006; Duncan in Duncan 2009; Rose 2012).

Vez med geografijo in vizualnostjo je najtrdnejša prav na primeru pokrajine. Tuan (1976) pravi, da humanistično usmerjenih geografov pokrajina ne zanima kot del ozemlja, ampak kot vizualna in estetska izkušnja. Pod vplivom humanističnih in behaviorističnih idej je Cosgrove (2008) pokrajino opredelil kot »način videnja«. S tem je pokrajina dobila novi dimenziji, kognitivno in izkustveno, ki sta postali sredstvo ter proizvod pokrajinske dinamike, uravnoteženosti, simbolizma, ideologije in identitete (Terkenli 2001).

Geografsko zamišljanje združuje zamišljanje in upodabljanje prostora, tako zunanjih opazovalcev (outsiders) kot tudi udeleženih opazovalcev (insiders). V tem prispevku se bomo osredotočili na slednje, na prebivalce Slovenije in njihovo zamišljanje pokrajine. Natančneje na fotomonografijo *Slovenske krajine* (Ogrin 1997). Namen prispevka je prikazati, kakšno podobo pokrajin ustvarja omenjena knjiga; torej s kakšnimi fotografijami jo prikazuje. Razkriti želimo tipične prvine pokrajin in ugotoviti, v kolikšni meri oblikovanost površja oziroma relief kot najpomembnejša pokrajinska prvina (Perko 2007; Hrvatin in Perko 2009) vpliva na ostale pokrajinske prvine, prikazane na fotografijah.

V naslovu omenjene knjige je izraz krajina, sicer uporabljamo izraz pokrajina. Njuna raba in medsebojna vsebinska ter konceptualna razmejitev je bila že večkrat obravnavana (Ogorelec 1987; Lovrenčak 1996; Gams 2007) in je na tem mestu ne bi nadaljevali, saj ni bistvena za vsebino članka. Izhajajoč iz tradicije geografije uporabljamo izraz pokrajina, ki ga pomensko enačimo s krajino.

2 Metodologija interpretacije fotografij

Predmet analize je bila fotomonografija z naslovom *Slovenske krajine*, avtorja Dušana Ogrina, in sicer 2. dopolnjena izdaja (Ogrin 1997). Izbor knjige utemeljujemo z razlogoma, da fotografije prevladujejo nad besedilom, avtor pa je krajinski arhitekt, strokovnjak in nedvomno mnenjski vodja s področja pokrajine. Poleg tega so krajinski arhitekti korak pred geografi v razumevanju in preučevanju tudi nematerialnih vidikov pokrajine. Omeniti velja dela Kučanove (1996, 1998, 2007), v katerih je opredelila subtilno in logično prepletanje geografskega zamišljanja in pokrajine, in obsežno nalogo *Regionalna razdelitev krajinskih tipov v Sloveniji*. Rezultat, opredelitev temeljnih krajinskih morfoloških enot Slovenije, ki je nastala s terenskim delom na intuitiven in holističen način (Marušič 1995; Marušič, Ogrin in Jančič 1998), je predstavljen v 5 knjigah (Marušič s sod. 1998a, 1998b, 1998c, 1998d, 1998e).

Fotomonografija kaže pokrajinski okus, torej cenjeno, ohranjeno, reproducirano (Lowenthal in Prince 1965) in, kot je sam avtor zapisal v uvodu, kar je lepo in je vredno ohraniti. Skoraj kvadratna oblika in večji format knjige (širina 285 mm, višina 305 mm) omogočata prikaz širokih in preglednih fotografij, ki povečajo izrazno moč prikazanega območja. Analiza je zajela 307 slik različnih velikosti; skoraj 73 % je celostranskih in polstranskih, najmanjše pa dodatno osvetlijo obravnavane teme.

Slike so vsebovale podnapise, kjer je bila v večini primerov navedena lokacija prikazanega ozemlja. V nekaterih primerih smo lokacijo ugotovili tudi kot poznavalci prikazanih območij. Vsaka fotografija je bila najprej uvrščena v posamezen tip pokrajin. Ob tem smo se naslonili na naravnogeografsko tipizacijo, ki Slovenijo deli na alpski, sredozemski, dinarski in panonski svet (Perko 1998). Zaradi notranje pestrosti alpskih pokrajin smo jih razdelili na dva dela. K pravim alpskim pokrajinam smo prišteli alpsko visokogorje, k predalpskim pokrajinam pa alpska hribovja in vmesne ravnine (slika 1).

Slika 1: Zemljevid pokrajin in lokacije fotografij.
Glej angleški del prispevka.

Vsaka fotografija je bila nato opredeljena/kodirana glede na vnaprej dogovorjenih devet kazalnikov, ki prikazujejo posamezne pokrajinske prvine. Da bi bil postopek opredeljevanja/kodiranja čim bolj enoten, ga je v celoti izvedla ena oseba. Najprej nas je na vsaki sliki zanimal prevladujoč reliefni tip. Nato smo vsako fotografijo poskušali »v mislih« razdeliti na dva dela in ločeno določiti reliefne oblike ter rabo zemljišč v ospredju in ozadju. V nadaljevanju smo na posamezni sliki prepoznavali še prevladujoč tip poselitve, vrsto infrastrukture ter določili vidne premične in vodne elemente. Izbrani kazalniki s pripadajočimi kategorijami so naslednji:

- reliefni tip (ravnina, gričevje, hribovje, nizka planota, visoka planota, visokogorje, klif, morska obalna ravnica);
- reliefne oblike v ospredju (dolina, obala, ravno površje, položna pobočja, strma pobočja, kraško površje, valovito površje);
- reliefne oblike v ozadju (dolina, obala, klifi, ravno površje, položna pobočja, strma pobočja, kraško površje, valovito površje);
- raba zemljišč v ospredju (skalovje, pozidano, grmičevje, njiva, trajni nasad, travinje, park, gozd, mešana raba);
- raba zemljišč v ozadju (skalovje, pozidano, grmičevje, njiva, trajni nasad, travinje, park, gozd, mešana raba);
- poselitev (strnjeno naselje, razpršena poselitev, posamezne stavbe, neposeljeno);
- infrastruktura (cesta, električna napeljava, pešpot/steza, ni infrastrukture);
- premični elementi (živa bitja, prevozna sredstva);
- vodni elementi (stoječe vode, tekoče vode, brez vodnih elementov).

Poseben izziv pri ocenjevanju so predstavljale slike slabše kakovosti, prikazi večjega območja in večjega števila neenakomerno razporejenih elementov. Na sliki 2, ki prikazuje Škofjeloško hribovje, je težje določljiva meja med prednjim in zadnjim delom slike. Prav tako ni vidna infrastruktura, ki glede na poselitev in rabo zemljišč prav gotovo obstaja. Ker je slika manjšega formata, prikazano ozemlje pa reliefno zelo razgibano, je težje določljiva tudi raba zemljišč in premični elementi. Na sliki 3, ki prikazuje Kamniško polje, so težje določljivi elementi v ozadju. Težava ni v prepoznavi posameznih kategorij (reliefne oblike, raba zemljišč in poselitev so prepoznavni), temveč v njihovem deležu in vrsti.

Pokrajinske prvine, prikazane na fotografijah, smo podrobneje analizirali s pomočjo lokacijskega koeficienta, analize asociacije in faktorske analize.

Slika 2: Primer problematičnega določevanja pokrajinskih prvin v Škofjeloškem hribovju predalpskega sveta (Ogrin 1997).
Glej angleški del prispevka.

Slika 3: Primer problematičnega določevanja pokrajinskih prvin na Kamniškem polju predalpskega sveta (Ogrin 1997).
Glej angleški del prispevka.

3 Izgled pokrajin

Največ fotografij prikazuje predalpske pokrajine, kjer je nekaj naših največjih in najgosteje poseljenih območij, denimo Ljubljanska in Celjska kotlina. Alpske in predalpske pokrajine, ki – tako kot pove že njihovo ime – skupaj tvorijo alpski svet, so prikazane na skoraj polovici vseh fotografij. Njim s petinskim deležem sledijo panonske, tem pa z enakomerno najmanjšima deležema dinarske in sredozemske (slika 4).

Zanimiva je primerjava razmerja med deležem fotografij in deležem površin določenega tipa pokrajine. Medtem ko v primeru alpskih in panonskih pokrajin večjih razlik ni, se te pojavljajo v ostalih treh tipih pokrajin. Večji delež fotografij v primerjavi z deležem površja je zaznati v predalpskih in sredozemskih pokrajinah, ravno obratno pa velja za dinarske pokrajine.

Slika 4: Primerjava deležev fotografij z deležem površin in prebivalcev pokrajin.
Glej angleški del prispevka.

Pokrajine, kot jih kažejo fotografije v izbrani knjigi, lahko s pomočjo izbranih kazalnikov pokrajinskih prvin opišemo na naslednji način:

- **Alpske pokrajine** so izrazito hribovite, visokogorske oziroma z visokimi planotami. V ospredju so bodisi strma ali položna pobočja bodisi dolina, v ozadju zgolj strma pobočja. Raba zemljišč v ospredju je večinoma travinje ali gozd, le redko mešana in pozidana zemljišča. V ozadju prevladujeta gozd in skalovje. Poselitev je v obliki posameznih stavb oziroma je ni. Prav tako večinoma ni infrastrukture, če pa že, je to cesta, električna napeljava ali pešpot/steza, kar je značilno tudi za ostale tipe pokrajin. Premičnih elementov praktično ni, le sem ter tja se pojavi kakšno živo bitje. Redki so tudi vodni elementi.

Slika 5: Primer fotografije alpskega sveta prikazuje visokogorje Špikove skupine na Gorenjskem (Ogrin 1997).
Glej angleški del prispevka.

- **Predalpske pokrajine** kažejo preplet hribovij in ravnin. Manjši delež predstavljajo tudi gričevja. Reliefne oblike v ospredju so v glavnem ravne, nekaj pa je tudi dolin ter strmih in položnih pobočij. V ozadju prevladujejo predvsem strma pobočja, ponekod tudi položna ali pa je svet raven. Raba zemljišč v ospredju je pestra. Največ je travinja, ki mu sledijo njiva, gozd in pozidana zemljišča. V ozadju prevladuje gozd. Poselitev je prikazana podobno kot pri alpskih pokrajinah. Nekoliko več je le strnjenih naselij. Redko so prikazani premični in vodni elementi.

Slika 6: Primer fotografije predalpskega sveta prikazuje prehod ravninskega dela Gorenjske proti obronkom Kamniških planin (Ogrin 1997).
Glej angleški del prispevka.

- **Dinarske pokrajine** so upodobljene v obliki hribovij in gričevij. Nekaj je tudi visokih in nizkih planot. V ospredju prevladuje predvsem kraško in valovito površje ter položna pobočja. Podoben izgled je tudi v ozadju, le da je namesto valovitega sveta več strmih pobočij. Raba zemljišč v ospredju je podobno pestra kot v predalpskih pokrajinah. Nekoliko več je samo njiv in skalovja. V ozadju prevladuje gozd. Poselitev je v primerjavi s (pred)alpsko prikazana malce bolj razpršeno. Večkrat se pojavljajo prevozna sredstva in, presenetljivo, tudi tekoče vode, ki so v tem tipu pokrajin zelo redek pojav.

Slika 7: Primer fotografije dinarskega sveta prikazuje valovito površje pri Uncu na Notranjskem (Ogrin 1997).
Glej angleški del prispevka.

- **Sredozemske pokrajine** so reliefno prikazane podobno kot dinarske, v obliki hribovij in gričevij. Dodatno nastopa še morska obalna ravnica, manj pa je visokih planot. V ospredju je videti večinoma kraško in ravno površje, prvo izrazito prevladuje tudi v ozadju. Poleg tega se pojavljajo tudi položna pobočja in obala. Raba zemljišč v ospredju je podobna kot v dinarskem svetu. Namesto njiv se pojavlja več trajnih nasadov. V ozadju še vedno prevladuje gozd, vendar so pomembne kategorije tudi pozidana in mešana zemljišča ter trajni nasadi. Poselitev je najpogosteje prikazana v obliki strnjenih naselij in posameznih stavb. Redko je pokrajina prikazana neposeljena oziroma v obliki razpršene poselitve. Sredozemske pokrajine v največji meri od vseh prikazujejo prevozna sredstva in stoječe vode v obliki morja.

Slika 8: Primer fotografije primorskega sveta prikazuje območje naselja Šmarje v Slovenski Istri (Ogrin 1997).
Glej angleški del prispevka.

- **Panonske pokrajine** kažejo preplet ravnin in gričevij. V ospredju izrazito prevladuje ravno površje z redkimi položnimi pobočji, ki pridejo bolj do izraza v ozadju. Pri rabi zemljišč v ospredju prevladujejo njive, ki jim sledijo travinje in trajni nasadi. V ozadju je večinoma gozd, vendar pomemben delež zavzemajo tudi njive in trajni nasadi. Poselitev je prikazana tako v obliki neposeljenega sveta kot v obliki posameznih stavb in razpršene poselitve. Precejkrat so prisotne tekoče vode.

Slika 9: Primer fotografije panonskega sveta prikazuje območje naselja Kobilje v Prekmurju (Ogrin 1997).
Glej angleški del prispevka.

Razlike v izgledu pokrajin lahko natančneje primerjamo z lokacijskim koeficientom. Njegova vrednost ponazarja, v kolikšni meri prikaz posamezne kategorije kazalnika v pokrajini odstopa od državnega povprečja. Čim bolj vrednost lokacijskega koeficienta presega vrednost 1, tem bolj je prikaz posamezne kategorije kazalnika med vsemi fotografijami v pokrajini višji od slovenskega povprečja. Vrednosti pod 1 kažejo podpovprečno koncentracijo. Izračun lokacijskega koeficienta lahko zapišemo v obliki naslednje enačbe:

$$\textit{lokacijski količnik} = \frac{\dfrac{\textit{število fotografij, ki prikazujejo posamezno kategorijo kazalnika v pokrajini}}{\textit{število vseh fotografij pokrajine}}}{\dfrac{\textit{število vseh fotografij, ki prikazujejo posamezno kategorijo kazalnika v Sloveniji}}{\textit{število vseh fotografij pokrajine}}}$$

V preglednici 1 so navedene najpomembnejše kategorije kazalnikov pokrajinskih prvin, ki v posameznem tipu pokrajin v večji meri nadpovprečno odstopajo od državnega povprečja (lokacijski koeficient > 1,25).

Povezanost neštevilskih kazalnikov pokrajinskih prvin z njihovo zastopanostjo po posameznih tipih pokrajin smo ugotavljali z analizo asociacije. Izkazalo se je, da so skoraj vsi obravnavani kazalniki, z izjemo infrastrukture, statistično značilno povezani z njihovo zastopanostjo po pokrajinah ($p < 0,05$) (preglednica 2). To pomeni, da obstajajo statistično značilne razlike v izgledu pokrajin po obravnavanih kazalnikih. Velikost Cramerjevega koeficienta (*V;* interval med 0 in 1) kaže, da prihaja do zelo močne povezanosti v primeru reliefnega tipa in reliefnih oblik, zmerno močne povezanosti v primeru rabe zemljišče in vodnih elementov ter šibke povezanosti v primeru poselitve in premičnih elementov.

Preglednica 1: Vizualne lastnosti pokrajin, ki najbolj izstopajo v razmerju do ostalih pokrajin (lokacijski koeficient > 1,25). Vrstni red kategorij v posamezni celici kaže padajoče zaporedje moči izstopanja.

kazalniki pokrajinskih prvin	alpske pokrajine	predalpske pokrajine	dinarske pokrajine	sredozemske pokrajine	panonske pokrajine
reliefni tip	visokogorje, visoka planota, hribovje	hribovje, ravnina	gričevje, visoka planota, nizka planota	morska obalna ravnica, nizka planota, gričevje	ravnina, gričevje
reliefne oblike v ospredju	dolina, strmo pobočje	ravno površje, strmo pobočje	valovito površje, kraško površje, položno pobočje	obala, kraško površje	ravno površje
reliefne oblike v ozadju	strmo pobočje	strmo pobočje	kraško površje, položno pobočje	obala, kraško površje	ravno površje, položno pobočje
raba zemljišč v ospredju	mešana raba, travinje, gozd	pozidano	mešana raba, njiva	park, trajni nasad, mešana raba	trajni nasad, njiva
raba zemljišč v ozadju	skalovje	/	travinje	mešana raba, pozidano, trajni nasad	njiva, trajni nasad
Poselitev	/	/	razpršena poselitev	strnjeno naselje	razpršena poselitev
infrastruktura	/	/	električna napeljava, pešpot/steza	pešpot/steza	/
premični elementi	živo bitje	živo bitje	/	prevozno sredstvo	/
vodni element	/	/	tekoča voda	/	tekoča voda

Preglednica 2: Stopnja povezanosti med kazalniki pokrajinskih prvin in njihovo zastopanostjo po tipih pokrajin.

kazalnik pokrajinske prvine	*χ2*	stopinje prostosti	*p* (dvostranska)	*V*
reliefni tip	301,122	40	0,000	0,443
reliefne oblike v ospredju	214,801	35	0,000	0,374
reliefne oblike v ozadju	281,923	40	0,000	0,429
raba zemljišč v ospredju	88,105	45	0,013	0,240
raba zemljišč v ozadju	120,186	50	0,010	0,280
poselitev	48,724	20	0,016	0,199
infrastruktura	14,157	20	0,814	0,107
premični elementi	23,751	10	0,017	0,197
vodni elementi	36,225	15	0,001	0,243

4 Oblikovanost površja kot najpomembnejša prvina v izgledu pokrajin

Ker se je oblikovanost površja tudi v naši analizi pokazala kot najpomembnejša pokrajinska prvina, smo se odločili za njegovo natančnejšo obravnavo. S tega vidika nas je zanimalo, kako relief vpliva na ostale pokrajinske prvine, prikazane na fotografijah. Ker imamo v tem primeru opravka s kompleksnejšimi razsežnostmi, smo se odločili za uporabo eksplorativne faktorske analize (EFA) (glej Fulgosi 1988; Rogerson 2001).

V ta namen smo opisne podatke, zbrane z interpretacijo/kodiranjem fotografij, pretvorili v številske s križanjem podatkov o tipu pokrajin (alpske, predalpske …) in reliefnem tipu. Tako smo 307 fotografij razdelili v 27 skupin, ki so bile nove enote te analize. Obenem smo osem preostalih kazalnikov pokrajinskih prvin razdelili tako, da so njihove kategorije postale nove spremenljivke. Po izločitvi velikega dela »nebistvenih« vsebin (kategorij, prikazanih na manj kot 5 % fotografij znotraj posameznega kazalnika) in ob upoštevanju ostalih zahtev za izvedbo faktorske analize (glej Larose 2006; Field 2009) smo vanjo vključili 24 spremenljivk.

Ker se večina spremenljivk ne porazdeljuje normalno, smo njihove vrednosti pretvorili v range in EFA izvedli na podlagi polihorične korelacijske matrike, kar omogoča ukaz R-Menu v programu SPSS (Basto in Pereira 2012). Za ekstrakcijo faktorjev smo uporabili metodo glavnih komponent z ortogonalno rotacijo varimax. Kaiser–Mayer–Olkinov preizkus je potrdil ustreznost velikosti vzorca, KMO = 0,800, kar je precej nad priporočeno minimalno vrednostjo 0,5 (Kaiser 1974). Bartlettov preizkus sferičnosti χ^2 (276) = 2902,032, p < 0,001, je pokazal, da so spremenljivke med seboj dovolj visoko povezane. Za določitev števila skupnih faktorjev smo uporabili merilo Paralelne analize (Courtney 2013), s čimer smo identificirali tri faktorje (preglednica 3), ki skupaj pojasnijo 80,8 % skupne variance in izkazujejo visoko mero zanesljivosti, $\alpha_{polihorične\ korelacije} > 0,9$ (Field 2009). Vrednosti koeficientov, *GFI* > 0,95, *AGFI* > 0,95 in *RMSR* < 0,1, so potrdile zelo dobro prileganje modela dobljenim rezultatom (Basto in Pereira 2012).

Rezultati so pokazali, da faktor 1 pojasnjuje dobro tretjino (37,7 %) skupne variance. Zanj je značilno, da od reliefnih oblik v ospredju izstopajo bodisi strma oziroma položna pobočja bodisi dolina, medtem ko so v ozadju v glavnem strma pobočja. Raba zemljišč je večinoma gozdnata, se pa pojavljajo v ospredju tudi travinja. Poselitev je razpršena, ali pa gre za prikaz posameznih stavb. Na fotografijah se pojavljajo tudi premični elementi (živa bitja) in linijska infrastruktura. Z enim izrazom lahko ta faktor imenujemo »faktor hribovitosti«.

Faktor 2 pojasnjuje dobro četrtino (28,1 %) skupne variance. Zanj je značilno, da so reliefne oblike v ospredju ravne, v ozadju pa položna pobočja. Od rabe zemljišč tako v ospredju kot v ozadju prevladujejo njive, se pa pojavljajo v ospredju tudi trajni nasadi. Poselitev je strnjena. Značilen je prikaz tekočih voda in prevoznih sredstev. Linijska infrastruktura iz faktorja 1 se precej visoko povezujejo tudi s faktorjem 2. Po opisu sodeč lahko ta faktor poimenujemo »faktor ravninskosti«.

Faktor 3 pojasnjuje okoli šestino (15,0 %) skupne variance. Zanj je značilna prevlada kraških oblik tako v ospredju kot v ozadju. Le redko je v ozadju prikazana ravnina. Zaradi svoje enostavnosti in čistih potez ga lahko imenujemo tudi »faktor kraškosti«.

Preglednica 3: Faktorska matrika.

spremenljivka	uteži rotiranih faktorjev		
	faktor 1	faktor 2	faktor 3
reliefne oblike v ospredju_strmo pobočje	0,954	–0,145	–0,017
reliefne oblike v ospredju_dolina	0,945	–0,001	0,196
reliefne oblike v ozadju_strmo pobočje	0,934	–0,176	–0,066
raba zemljišč v ospredju_gozd	0,828	0,327	0,085
raba zemljišč v ozadju_gozd	0,807	0,495	0,130
raba zemljišč v ospredju_travinje	0,806	0,293	0,167
premični elementi_živo bitje	0,785	0,236	–0,016
poselitev_posamezna stavba	0,749	0,480	0,223
reliefne oblike v ospredju_položno pobočje	0,722	0,295	0,346
infrastruktura_električna napeljava	0,684	0,599	0,124
infrastruktura_cesta	0,680	0,635	0,038
infrastruktura_pešpot/steza	0,605	0,506	0,298
poselitev_razpršena poselitev	0,585	0,376	–0,101
raba zemljišč v ospredju_njiva	0,244	0,881	–0,044
reliefne oblike v ospredju_ravno površje	0,188	0,798	–0,273
premični elementi_prevozno sredstvo	0,224	0,772	0,265
raba zemljišč v ozadju_njiva	–0,162	0,767	–0,460
reliefne oblike v ozadju_položno pobočje	0,413	0,741	0,106
vodni element_tekoča voda	0,564	0,729	–0,219
poselitev_strnjeno naselje	0,586	0,649	0,292
raba zemljišč v ospredju_trajni nasad	–0,087	0,609	0,330
reliefne oblike v ozadju_kraško površje	0,096	0,159	0,968
reliefne oblike v ospredju_kraška površje	0,131	0,124	0,964
reliefne oblike v ozadju_ravno površje	–0,099	0,465	–0,855
lastne vrednosti	9,045	6,750	3,589
% variance	37,689	28,127	14,956
$\alpha_{polihorične\ korelacije}$	0,966	0,911	0,938

Preglednica 4 prikazuje reprezentativnost faktorjev za posamezen reliefni tip pokrajin. Faktorji, ki so nadpovprečni za več kot en standardni odklon in so torej najbolj značilni za posamezen reliefni tip pokrajin, so označeni odebeljeno. Ostali nadpovprečno značilni faktorji so označeni neodebeljeno. Ob tem se je izkazalo, da so nekateri reliefni tipi pokrajin pestrejši od drugih, saj se v njih prepletajo značilnosti več faktorjev. Kot najbolj pestri (prepletanje vseh treh faktorjev) so se izkazali predalpska hribovja ter dinarska in sredozemska gričevja. Med bolj pestre (prepletanje dveh faktorjev) sodijo tudi alpska in dinarska hribovja, predalpske ravnine ter panonska gričevja in ravnine. V nekaterih (za posamezno pokrajino manj značilnih) reliefnih tipih noben faktor ne prihaja do izraza (na primer visokogorje v predalpskih pokrajinah ali hribovje v panonskih pokrajinah).

Pregled po faktorjih kaže, da faktor 1 (faktor hribovitosti) izrazito izstopa v hribovjih celotnega alpskega sveta, poleg tega pa še v alpskem visokogorju, dinarskih hribovjih, predalpskih in panonskih ravninah ter skorajda vseh gričevjih. Faktor 2 (faktor ravninskosti) je najbolj značilen za predalpska hribovja in ravnine ter panonska gričevja in ravnine, hkrati pa še za gričevja dinarskih in sredozemskih pokrajin. Faktor 3 (faktor kraškosti) je najbolj poudarjen v dinarskih gričevjih in sredozemskih hribovjih, sicer pa je značilen za skoraj vse reliefne tipe dinarskih in sredozemskih pokrajin in tudi (pred)alpska hribovja ter visoke in zakrasele alpske planote.

5 Razprava: pokrajinski okus

Fotografije izbrane monografije odsevajo pokrajinski okus avtorja, ki poleg edinstvenega in individualnega okusa nedvomno odraža in istočasno oblikuje tudi obči pokrajinski okus. Na avtorjevo videnje pokrajine

Preglednica 4: Reprezentativnost faktorjev za posamezne reliefne tipe pokrajin.

pokrajina	reliefni tip	reprezentativnost faktorjev
alpske pokrajine	visokogorje	hribovitost
	visoka planota	kraškost
	hribovje	**hribovitost**, kraškost
predalpske pokrajine	visokogorje	/
	visoka planota	/
	gričevje	hribovitost
	hribovje	**hribovitost**, **ravninskost**, kraškost
	nizka planota	/
	drugo	/
	ravnina	hribovitost, **ravninskost**
dinarske pokrajine	visoka planota	F3
	gričevje	hribovitost, ravninskost, **kraškost**
	hribovje	hribovitost, kraškost
	nizka planota	kraškost
	drugo	kraškost
	ravnina	/
sredozemske pokrajine	klif	/
	morska obalna ravnica	kraškost
	gričevje	hribovitost, ravninkost, kraškost
	hribovje	**kraškost**
	nizka planota	kraškost
	drugo	kraškost
	ravnina	/
panonske pokrajine	gričevje	hribovitost, **ravninskost**
	hribovje	/
	nizka planota	/
	ravnina	hribovitost, **ravninkost**

vplivajo kulturno, družbeno in intelektualno okolje, obenem pa je njegovo »strokovno« geografsko zamišljanje pokrajine oziroma njegovo »pokrajinsko znanstveno rezoniranje« medij, ki (so)oblikuje okus širših množic in njihove ideje o družbeni in prostorski realnosti. Analizirane fotografije kažejo, kako se družba in njen način življenja zrcalita v pokrajini in, obratno, kako upodobljena pokrajina želi posredno usmerjati družbeni razvoj.

Če pokrajino razumemo kot način videnja, se porodi vprašanje, kakšno videnje prinaša izbrana fotomonografija? Kakšno pokrajino, kakšno Slovenijo torej vidimo v njej? Prvi izsledek je, da gotovo alpsko, saj skoraj polovica (48 %) pokrajinskega zamišljanja temelji na podobi alpskosti, čeprav alpske pokrajine (prave alpske in predalpske skupaj) obsegajo nekoliko manjši delež (42 %) slovenskega ozemlja. Ugotovitev, da je delež fotografij sredozemskih pokrajin (15 %) precej večji od deleža površin sredozemskih pokrajin (9 %), vodi v domnevo, da pomemben del pokrajinskega zamišljanja temelji tudi na sredozemskosti. S tega vidika imajo manj pomembno vlogo dinarske pokrajine, medtem ko je pomen panonskih pokrajin uravnotežen. K veliki gostoti fotografij sredozemskih pokrajin verjetno prispevajo vsaj trije dejavniki, in sicer, potreba po trdnejši umestitvi sredozemskih pokrajin v geografsko zamišljanje Slovencev, saj jih bremeni zgodovinska politična dediščina. Drugi razlog je v razgibanosti in pokrajinski pestrosti, ki nudita obilo privlačnih fotografskih motivov. Tretjo skupino razlogov bi lahko imenovali modni trend in iskanje priljubljenega Sredozemlja v načinu prehranjevanja in življenjskem slogu.

Dejstvo, da je predalpska podoba Slovenije pred pravo alpsko, je presenetljivo ob vedenju, da je visokogorje odigralo in še vedno igra vidno vlogo v identifikaciji Slovencev (Triglav, boj med slovenskim in nemškim taborom pri osvajanju visokogorja v preteklosti in podobno). Mogoče je pri tem odločalo tudi dejstvo, da predalpske pokrajine zaznamuje večja pestrost in raznolikost, medtem ko je visokogorje oblikovno in barvno bolj »uniformirano« in razmeroma manj »občutljivo« na letne čase. Prav tako presenetljivo je dejstvo, da (prave) alpske pokrajine po deležu fotografij zaostajajo za panonskimi pokrajinami, saj so dramatične pokrajine z veliko reliefno energijo privlačnejše za fotografski objektiv in obratno, ravninski svet nudi manj privlačnih motivov.

Po pričakovanjih povezanost med pokrajinskimi prvinami, prikazanimi na fotografijah, z njihovo zastopanostjo po posameznih tipih pokrajin, pokaže, da lega v določeni pokrajini (alpski, predalpski …) določa predvsem reliefni tip, reliefne oblike, rabo zemljišč in vodne elemente, v manjši meri pa poselitev in premične elemente, medtem ko se prikaz infrastrukture med pokrajinami bistveno ne razlikuje. To nakazuje na policentrično oziroma skladno regionalno strukturo, saj smo z vidika poselitve oziroma prisotnosti človeka in prometnic razmeroma enakomerno prepredli praktično celo Slovenijo (Kozina 2010a; Kozina 2010b).

Vrsto zanimivih ugotovitev ponuja podrobnejši pregled rabe zemljišč. Tako denimo v redkeje poseljenih dinarskih pokrajinah, kjer je sicer manj obdelovalnih zemljišč in površinskih voda, po koncentraciji na fotografijah izstopajo njive in tekoče vode, v predalpskih pokrajinah, ki so sicer bogatejše z vidika kmetijskih zemljišč in vodnih virov, pa tega iz fotografij ni zaznati. Razlog je verjetno v tem, da so njive in vode v dinarskih pokrajinah redek vir in se jim zato pripisuje večji pomen. Voda, v tem primeru stoječa oziroma morska, izstopa skupaj s prevoznimi sredstvi v sredozemskih pokrajinah, kar poudarja oziroma krepi maritimni in prometni položaj tega dela Slovenije. Ta pokrajinska prvina izstopa tudi v prikazu panonskih pokrajina in kaže na pomen Mure oziroma vode za kmetijstvo in druge dejavnosti, kot so denimo mlinarstvo, ter varstva pred sušami.

Upodobitve gozda so zelo povedne. V ospredju se sicer redkeje pojavlja (še najpogosteje v alpskem svetu), medtem ko je v ozadju prevladujoča kategorija v vseh pokrajinah. Očitno je gozd razumljen kot okvir, stalnica, ki je ni potrebno posebej poudarjati, saj pokriva več kot 60 % površja Slovenije (Hrvatin in Perko 2003).

Celokupno tretjina fotografij ne kaže naselij, živa bitja pa so v večini primerov prava redkost. Odsotnost (strnjene, mestne) poselitve in živih bitij implicira statičen in ahuman značaj pokrajin. Odsotnost ljudi nedvomno izraža latentno dojemanje pokrajine kot naravne tvorbe, kar nas vodi do ugotovitve, da urbana pokrajina ne obstaja. Fotografije kažejo zgolj podeželsko (za razliko od urbane) pokrajino, kar odraža protiurbani značaj slovenskega načina življenja (Hočevar s sod. 2005; Poljak Istenič 2011, 2012; Uršič in Hočevar 2007; Uršič 2010, 2015) in podobe kmečkosti, za katero se zdi, da ni bledela sočasno z nazadovanjem deleža kmečkega prebivalstva in pomena kmetijstva. Kmečkost utrjuje tudi že omenjeni velik delež njiv, ki so postavljene v ospredju. (Kmetijska) aktivnost je ustvarila kultivirano pokrajino, neaktivnost, katere rezultat je gozd, pa je postavljena v ozadje. Podoba kmečkosti je postala konstrukt in za kulturne pokrajine lahko to trdimo z gotovostjo. Rezultati analize obravnavane knjige to nedvomno potrjujejo.

6 Sklep

Rezultati analize fotomonografije so pokazali, da so v njej po obsegu precenjene zlasti predalpske in sredozemske pokrajine, podcenjene pa dinarske. Ravno tako so precenjena njivska zemljišča. Gozd je prikazan dokaj uravnoteženo, vendar nastopa le kot obrobje in ne kot središče. Voda je poudarjena tam, kjer je redek ali omejen vir, vendar nujen za kmetijstvo. Slednje je rdeča nit in jasno izražen oblikovalec kulturne pokrajine. Drugi temeljni tip kot antipod kmetijski pokrajini, to je urbana pokrajina, pa je povsem izpuščen. Najpomembnejši oblikovalec pokrajine je relief, ki je na fotografijah večinoma prikazan v treh razsežnostih. Poudarjeni so višji, bolj razčlenjen, redkeje poseljen in gozdnat relief (faktor 1), nižji, ravnejši/položnejši, gosteje poseljen in bolj kultiviran relief (faktor 2) in kraški, manj razgiban relief (faktor 3).

Fotografije znanje oblikujejo in ga tudi podajajo. Enako pokrajine vplivajo na oblikovanje pokrajinskega okusa in obratno; pokrajinski okus oblikuje pokrajino (Lowenthal in Prince 1965). Ta dvosmerni in večplastni proces je geografsko zamišljanje, definirano kot prostorsko orientirano kulturno in zgodovinsko védenje, ki opredeljuje družbene skupine. Geografsko upodabljanje briše razlike med dejanskim in navideznim svetom in oblikuje identiteto ljudi, razumevanje sveta in tudi svet sam. Zato tovrstna analiza več pove o ljudeh kot o pokrajini: razkriva, kaj družba ceni, kako si predstavlja svojo pokrajino, kakšno samopodobo imajo ljudje in kakšno podobo hoče posredovati drugim.

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7 Literatura

Glej angleški del prispevka.

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DID THE 2008 GLOBAL ECONOMIC CRISIS AFFECT LARGE FIRMS IN EUROPE?

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Did the 2008 global economic crisis affect large firms in Europe?

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ABSTRACT: The paper analyses the spatial distribution of the largest global corporations found on the Forbes Global 2000 list and with headquarters in Europe. The analysis includes the effects of the 2008 global financial crisis on changes in corporate financial performance. Research has shown that London has the largest economic potential in Europe, while companies in Central and Eastern European cities exhibit high rates of growth. The crisis triggered a decentralisation of corporate headquarters' location resulting in more cities with corporate headquarters.

KEY WORDS: geography, globalization, economic crisis, corporations, cities, Forbes Global 2000

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1 Introduction

Large affluent cities create easy access to information, which makes it easier for specialists and scientists to work together. Such cities also create the optimal living conditions for corporate elites in terms of income, social interaction, and cultural offerings. Cities are home to the headquarters of international corporations as well political institutions, media outlets, and progressive centres of the production and »consumption« of cultural offerings. Large corporations have the opportunity to concentrate in cities, which results in innovative synergies (Ravbar, Bole and Nared 2005). Corporations help drive the growth of the central city as well as its suburbs by attracting qualified workers and specialists from around the world (Beaverstock and Boardwell 2000). Large corporations play a key role in accelerating the establishment of international linkages and shaping cities as centres of global activity. Another area of corporate-driven growth is the development of a knowledge-based economy (Dorocki and Borowiec 2012; Rachwał 2013), which helps accelerate globalisation (Pain 2008). It is worth noting that economic recession is not the only factor affecting corporate performance (Rachwał and Boguś 2012). Globalised economic processes are becoming a key driver of growth and decline today.

Globalisation and its associated corporate location factors and their increasing importance (Płaziak and Szymańska 2014) as well as the development of new management practices (Szymańska 2012) became ever more relevant in the 1990s (Beaverstock, Smith and Taylor 1999). Linkages between large cities increased and manifested themselves via the establishment of daughter units in countries without corporate headquarters. Globalisation also triggered a change in spatial management, both on a regional and global scale (Lüthi, Thierstein and Goebel 2010). The process of globalisation accelerated rapidly in the years that followed, with the formation of global corporations valued at more than 20 billion USD (Zioło 2006). Key elements of globalisation include corporate expansion via the acquisition of other companies and the relocation of business activity to countries with lower labour costs (Kilar 2009b). Global corporations establish sales offices in foreign countries, which strengthen trade linkages between host cities. In turn, this leads to a growing significance of BRIC nations and other emerging markets (Liu, Derudder and Taylor 2014). This includes Central and Eastern Europe following its transition from communism to capitalism in the early 1990s, which helped spark an investment boom in the region (Ravbar 2009; Lorber 1999). The region now hosts an increasing number of world-class companies, which serve as harbingers of the world economy. This led to a relative decline of the significance of the United States, although it remains the world's most powerful economy (Csomós 2013a; Wilczyński and Wilczyński 2011).

Many researchers attempt to create typologies of cities based on a variety of social and economic indicators. Nelson (1955) analysed and classified 897 American cities based on business activity and employment in different sectors. He established ten city types. O. D. Duncan (1960) classified cities based on their spatial impact and principal function. M. Paccione (2001) classified American metropolitan areas based on four principal functions:

- multifunctional,
- service oriented,
- production oriented,
- consumer oriented.

Paccione also created sub-types for each of the four principal types. Goe and Shanahan (1991) investigated the role of industry in the urban economy in order to assess the significance of a city. Krätke (2007) focused on the effect of the high-tech industry in strengthening a city's economy.

A key concept in this field of research is that of the world city, which is designed to help assess the significance of international linkages between cities (Hall 1966). The world city concept was further developed in the 1980s and 1990s (Friedmann 1986, 1995). Today, advanced research on this subject is performed by researchers part of the Globalization and World Cities network (Internet 3). This group of researchers investigates linkages between large corporations in the area of accountancy, advertising, management consultancy, financial services, and law (Beaverstock, Smith and Taylor 1999). Analysis of data for 1998 and 2000 has shown London and New York to be the most important global cities (Taylor, Catalano and Walker 2002). Similar results were obtained for 2004 (Taylor and Aranya 2008). The latest data indicate London and New York as the most linked global cities; however, the emergence of certain Asian cities is also becoming apparent (Taylor et al. 2010; Csomós and Derudder 2014). Cities in Central and Eastern Europe are also gaining in significance due to an increasing number of international linkages (Derudder et al. 2010).

The purpose of this paper is to assess spatial differences relative to the effects of the 2008 global financial crisis on the performance of the largest European corporations.

2 Methods

The paper analyses data obtained from the Forbes Global 2000 list for 2006 and 2012 (Internet 2). The list of the 2000 largest public companies in the world is compiled based on four parameters: revenue, profit, assets, market value. The minimum value for each category is as follows: revenue (3.89 bln USD), profit (232.2 mln USD), assets (7.85 bln USD), market value (4.25 bln USD). A company must fit into at least one of the four categories in order to make the list. Next, the data were aggregated at the city level for cities with corporate headquarters (Csomós 2013b). The data were used to calculate each company's return on sales for each of the studied cities relative to the number of corporate headquarters per city.

In order to make the research more broadly applicable, additional indicators were calculated that present the situation at the country level. Two typologies were created in order to illustrate spatial differences across Europe. The first typology analyses the relationship between changes in revenue and changes in the number of corporate headquarters in selected European countries in the period 2006–2012 (Fig. 3). All corporate data were obtained from the Forbes Global 2000 list. Changes in revenue for European companies were compared to average global changes in revenue for the period 2006–2012 (+ 50%). The purpose of this step was to show how revenues of European companies fare against those of companies around the world. Five types of cities were identified:

- type 1 is characterised by a revenue growth rate below the world average and a decrease in the number of corporate headquarters,
- type 2 is characterised by a revenue growth rate below the world average and stability in the number of corporate headquarters,
- type 3 is characterised by a revenue growth rate above the world average and a decrease in the number of corporate headquarters,
- type 4 is characterised by a revenue growth rate above the world average and stability in the number of corporate headquarters,
- type 5 is characterised by a revenue growth rate above the world average and an increase in the number of corporate headquarters.

A second typology was created in order to evaluate the effects of the 2008 global financial crisis on European economies. This typology is based on the profit and revenues of Forbes Global 2000 companies headquartered in Europe in 2006–2012 (Figure 4). Two boundary values were used to assess European companies in terms of profit growth rates (+ 61.8%) and revenue growth rates (+ 50%). Both boundary values were calculated for all Forbes Global 2000 companies and represent averages. This comparison evaluates European Forbes companies relative to all Forbes companies. The following six types of cities were identified:

- type 1 is characterised by decreasing profit growth rates and increasing revenue growth rates below the world average,
- type 2 is characterised by decreasing profit growth rates and increasing revenue growth rates above the world average,
- type 3 is characterised by increasing profit growth rates and increasing revenue growth rates below the world average,
- type 4 is characterised by increasing profit growth rates below the world average and increasing revenue growth rates above the world average,
- type 5 is characterised by increasing profit growth rates above the world average and increasing revenue growth rates below the world average,
- type 6 is characterised by increasing profit growth rates and increasing revenue growth rates above the world average.

The analysis included all cities in Europe and the European part of Russia.

3 Results

3.1 Number of corporate headquarters per city

The largest number of corporate headquarters associated with European companies listed by Forbes Global 2000 were found in London (89) and Paris (65). Both are considered leading globally linked cities

(Taylor et al. 2010; Raźniak 2013; Raźniak and Winiarczyk-Raźniak 2013). London and Paris lead Europe in terms of the number of corporate headquarters, with Stockholm and Madrid far behind with 23 and 28 headquarters, respectively (Figure 1). The part of Europe leading the continent in terms of the number of corporate headquarters is the central part of Western Europe stretching from London to Paris to Milan and Western Germany. This part of Europe is home to the vast majority of the largest European corporations and is known by its pentagonal shape (Kincses, Nagy and Tóth 2013). This pentagonal region generates about 50% of the GDP of the European Union and includes 40% of its residents, but only 20% of its area (ESPON Atlas 2006). This European region is characterised by strong links between cities, most likely due to the presence of a large number of corporate headquarters and sales offices of global corporations (Allen 2008; Wall and Knap van den 2011). The region also enjoys a very high rate of investment

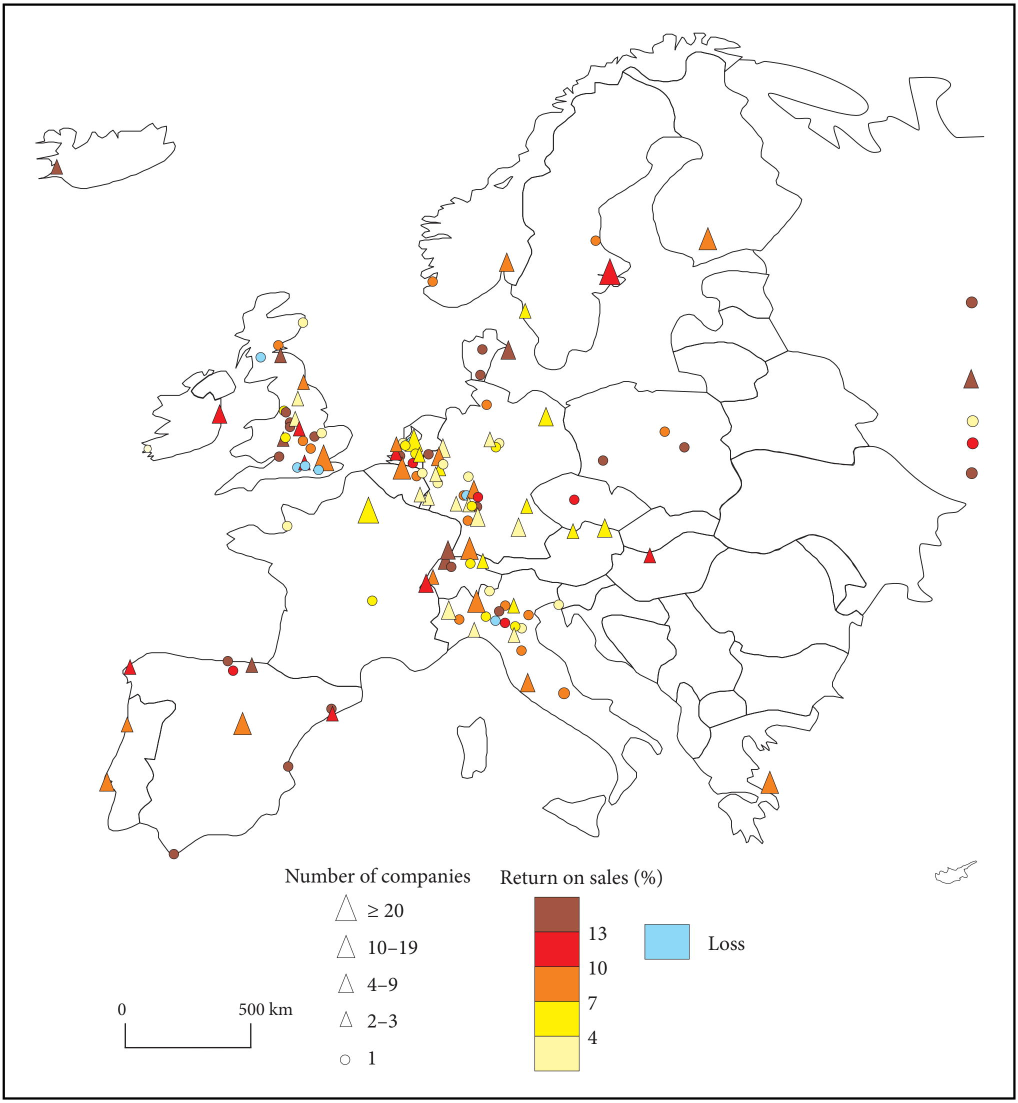

Figure 1: Return on sales of the largest European companies versus the number of the largest European companies per city in 2006, as listed by Forbes Global 2000 (Source: Author's own work based on *Forbes Global 2000, Globalization and World Cities*).

(Burger, Knaap van der and Wall 2013). On the other hand, Central and Eastern Europe possesses far fewer corporate headquarters. Three cities in Poland are home to one corporate headquarters each. Thirteen corporations are headquartered in five cities in Russia. Finally, one city in Hungary is home to two corporate headquarters and one city in the Czech Republic is home to one corporate headquarters.

The number of corporate headquarters decreased in 2012 in the largest European cities (Figure 2). This pattern held true in London, with 21 fewer companies on the Forbes Global 2000 list between 2006 and 2012. Paris also lost the headquarters of five companies. On the other hand, the number of corporate headquarters in Moscow increased rapidly from eight in 2006 to twenty in 2012. The energy sector (Taylor and Csomós 2012) and the financial sector (Agibetova and Samson 2008) in Moscow are growing rapidly. In addition, the two sectors are much less dominated by foreign corporations than in other countries in Central and Eastern Europe (Karreman 2009).

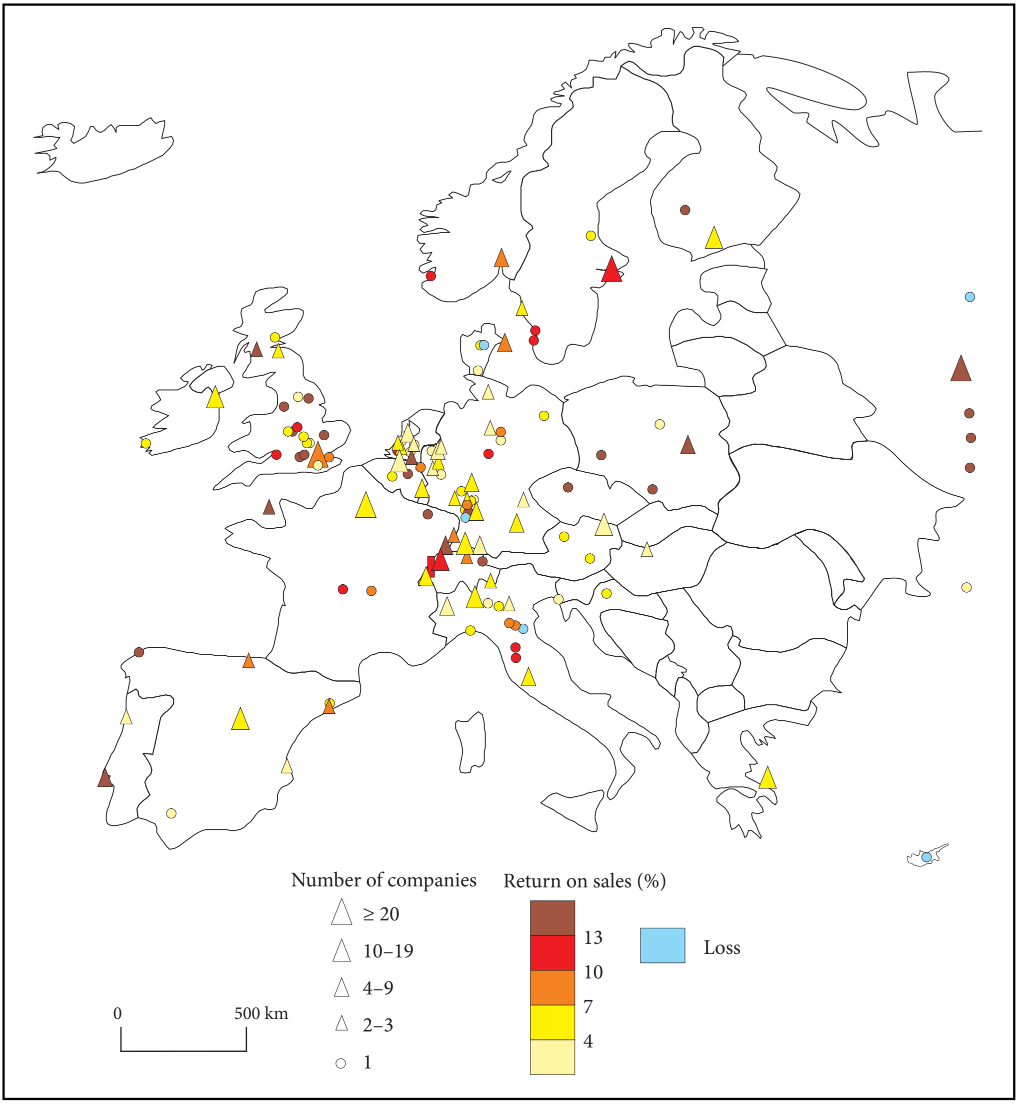

Figure 2: Return on sales of the largest European companies versus the number of the largest European companies per city in 2012, as listed by Forbes Global 2000 (Source: Author's own work based on *Forbes Global 2000, Globalization and World Cities*).

The number of Polish corporations is also increasing on the Forbes Global 2000 list. This is especially true in Warsaw where the number of Forbes corporations increased from one to four during the study period. In France, the city with the largest number of corporate headquarters is Paris. Only two Forbes corporations were found outside of Paris in 2006 (Clermont-Ferrand and Granville). This pattern held true in 2012, with only three Forbes corporations outside of Paris (Clermont-Ferrand, Limoges and Mets). In other developed countries in Europe, the spatial pattern was more regular. This includes Germany, Switzerland, Holland and Italy. Even in Great Britain, which is dominated by London, 25 Forbes corporations were found outside of London in 2006 and 18 in 2012.

The European cities with the highest return on sales were home to only one Forbes company headquarters (Gibraltar 57.1%, Lipetsk 39.1%, Silkeborg 23.7%). Cities with more than ten Forbes companies had a return on sales of 7% to 10%. Stockholm had a higher rate of return at 12.4%. Amsterdam had a lower rate of return at 5.6%. High return on sales values were noted for cities in Eastern Europe, especially the Russian cities of Lipetsk (39.1%) and Cherepovets (21%).

By 2012 many European companies had experienced the effects of the 2008 global financial crisis (Figure 2). The average rate of return on sales for all Forbes Global 2000 companies headquartered in Europe decreased slightly from 7.09% in 2006 to 6.92% in 2012. The decline was noted primarily in Western Europe, while Central and Eastern Europe continued to maintain a healthy rate of return on sales. Cities with more than ten corporate headquarters were characterised by a rate of return on sales of 4% to 7% in 2012, which was a decline from 2006 (7% to 10%) (Figure 1). A higher rate of return on sales was noted for London, Stockholm, and the rapidly globalising Moscow (Raźniak 2014). High rates of return on sales were also posted by Polish companies in the mining sector including KGHM Polska Miedź S. A., with a very high rate of return on sales of 50.1% in 2012. Another Polish mining company, Jastrzębska Spółka Węglowa, also enjoyed a high rate of 22.2% (Sitek et al. 2013). Jastrzębska Spółka Węglowa is one of the largest employers in southern Poland with 29,500 workers (Kłosowski et al. 2013). A high rate of return on sales was also noted by companies in Warsaw, which may help increase economic security in the city (Raźniak and Winiarczyk-Raźniak 2014) and may help attract qualified workers from across Poland (Winiarczyk-Raźniak and Raźniak 2012). Warsaw's higher standard of living in terms of income and access to services provided by the city's government may also help attract investors to the city (Winiarczyk-Raźniak and Raźniak 2011). The weaker performance of cities with a large number of corporate headquarters may result from the diversity of corporations present, as those with superb performance may by offset to some extent by those with weaker financial results including losses. The opposite is also true. Cities with only one Forbes company experienced weak financial performance when that one company experienced weak financial performance and could not be offset by the strong performance of other companies.

London and Paris dominate Europe in terms of the number of corporate headquarters of Forbes Global 2000 companies. However, the economic significance of London and Paris decreased as a result of the 2008 global financial crisis. On the other hand, the number of Forbes corporations in Eastern Europe increased during the same time period, as did the rate of return of sales relative to Western Europe.

3.1 Company typologies based on selected parameters

As many as eight countries were classified as Type 1 (the weakest). All eight were affluent nations in Western Europe (Figure 3). Belgium and Norway were classified as Type 2, which is a partly weak type. Both countries are also affluent. Type 5 or the most positive type was noted for just a few countries in Western Europe including Switzerland, Austria, Luxembourg, and Ireland. Type 4 or one of the more positive types was noted for Hungary and the Czech Republic in Central Europe. The strongest type (5) was noted for Poland and Russia. Reasons for this may include economic recession in Western Europe and economic growth in Central and Eastern Europe due to lower labour costs that attract investment. This may help explain the general predominance of positive types in Eastern Europe and the predominance of negative types in Western Europe.

The weakest type, Type 1, includes Holland, Denmark and as well as Italy, a country strongly affected by the 2008 global financial crisis (Figure 4). Type 2, characterised by decreasing profits and small revenues, includes Greece and Hungary, both of which were strongly affected by the 2008 global financial crisis and experienced a decrease in GDP. Type 2 also includes Luxembourg, which has the largest GDP per capita in Europe (Internet 1). Luxembourg experienced a small decline in profits, but remains highly attractive to global corporations characterised by very high revenue growth rates.

Overall, the most common types in Western Europe were Types 3 and 4. While the strongest economies in Europe are characterised by Forbes companies with increasing profits and revenues below world average, Forbes companies in other regions of the world enjoy even higher profits and revenues. Type 5 is only represented by Norway. Type 6, the most positive of the types identified and characterized

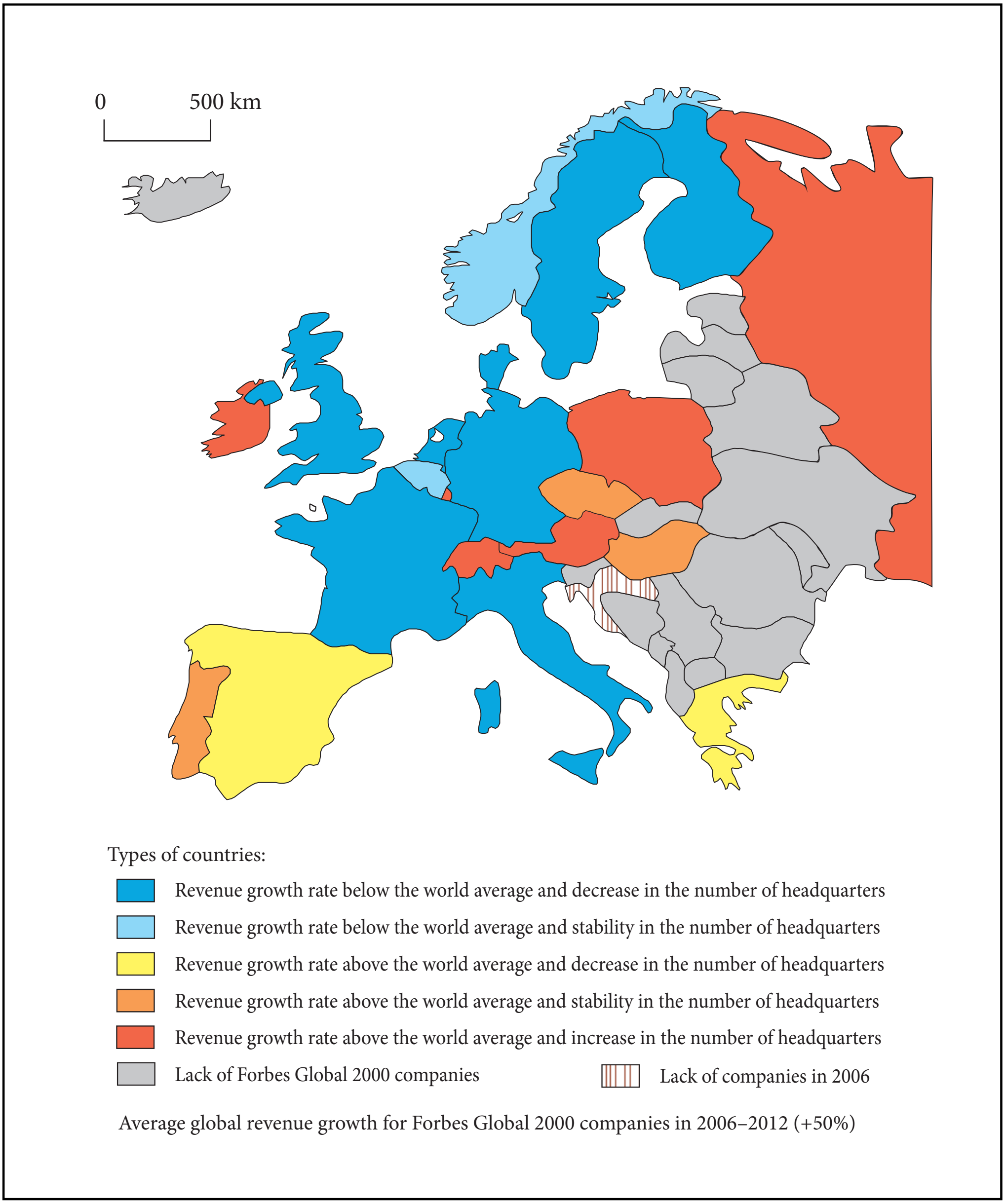

Figure 3: Typology of countries based on revenue growth rates and the number of corporate headquarters of the largest European companies in 2006–2012 (Source: Author's own work based on *Forbes Global 2000, Globalization and World Cities*).

by growth in the studied parameters exceeding the world average, was noted for countries in Eastern Europe including Poland, Russia, and the Czech Republic. On the other hand, only Western European countries such as Portugal, Austria, and Ireland include cities classified here as Type 6 with increasing profits and revenues at rates exceeding the world average.

It may be argued that the largest companies in Europe are experiencing profit and revenue growth, but at a rate that is lower than the world average.

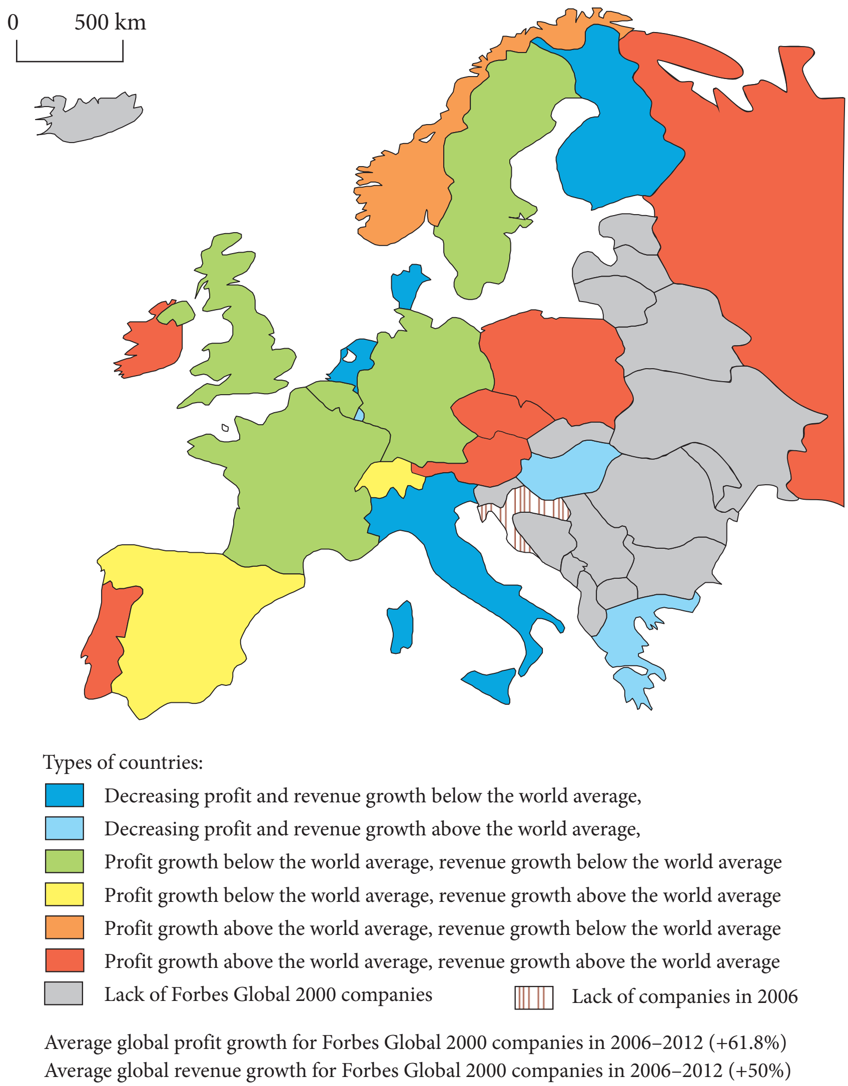

Figure 4: Typology of countries based on profit growth rates and revenue growth rates for the largest European companies in 2006–2012 (Source: Author's own work based on *Forbes Global 2000, Globalization and World Cities*).

4 Discussion and conclusion

Both the financial results and the number of corporate headquarters vary significantly between Eastern Europe and Western Europe. Despite the 2008 global financial crisis, London and Paris continue to possess the largest number of Forbes corporations. However, the number of these corporations did decline between 2006 and 2012. Overall, the number of Forbes corporations in the old fifteen member states of the European Union is decreasing, while that in other European countries is increasing. This is especially true of the European part of Russia. It may be argued that Moscow is becoming a key decision centre in Eastern Europe and the world. In addition, the revenues and profits of European companies are increasing at a lower rate than those of non-European companies. This may lead to an overall downgrade of European companies on the world stage. In summary, the 2008 global financial crisis affected mostly the largest companies in Western Europe, while their Eastern European counterparts continued to enjoy higher than average growth rates. Eastern Europe's high growth rates may be explained in part by the region's difficult political history reaching the early 1990s. The politics of the era had severely limited the economic potential of companies in Central and Eastern Europe. This delay in economic development is being offset quite rapidly, especially in the case of Moscow and Warsaw. At the same time, the number of global companies with headquarters in China is increasing rapidly and their financial results are also strong. Many Chinese companies are becoming key players in global markets, which is illustrated by the presence of three Chinese banks in the top three spots on the Forbes list.

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ENVIRONMENTAL IMPACT OF DUSTING FROM THE KOPER PORT BULK CARGO TERMINAL ON THE AGRICULTURAL SOILS

OKOLJSKI VPLIV PRAŠENJA S TERMINALA KOPRSKEGA PRISTANIŠČA ZA RAZSUTI TOVOR NA KMETIJSKA TLA

Nina Zupančič, Aleksander Horvat, Simona Skobe

MATEJ FISTER

Bulk cargo terminal of Luka Koper port could threat the environmental pollution in the case of accidental dusting of potentially toxic material.
Terminal za razsuti tovor Luke Koper lahko v primeru nehotenega prašenja onesnaži okolje s potencialno strupenimi snovmi.

Environmental impact of dusting from the Koper port bulk cargo terminal on the agricultural soils

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COBISS: 1.01

ABSTRACT: Areas around seaports are prone to environmental damage. In the port of Koper, Slovenia hematite was transhipped during a strong wind. The broader area was accidentally covered with hematite dust. Since the soils had already been geochemically mapped, we repeated the sampling to compare the geochemical composition of the topsoil. No soil contamination was established. The enrichment factors show depletion of majority of elements. According to the distances from the dust source, SiO_2, Na_2O and Cr have decreasing, and Fe_2O_3 increasing trends. The SiO_2 and Cr content correspond to the concentration of quartz rich sand, and the dissolution of carbonate closer to the sea. Co and Ni are probably bound to the clay minerals. Cu, Pb, and Zn could have some anthropogenic contribution.

KEY WORDS: soil contamination, micaceous hematite, dusting, seaport, Northern Adriatic Sea, Port of Koper, Slovenia

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1 Introduction

Seaports are major hubs of economic activity and of environmental pollution in coastal urban areas (Bailey and Solomon 2004). Activities at seaports can seriously affect local communities and marine- and land-based ecosystems throughout a region. These impacts range from increased cancer risk to the contamination of water bodies and soil (Bailey and Solomon 2004).

The main air pollutants related to port activities include diesel exhaust, particulate matter (PM), volatile organic compounds (VOCs), nitrogen oxides (NOx), ozone, and sulphur oxides (SOx). Other air pollutants from port operations such as carbon monoxide (CO), formaldehyde, heavy metals, dioxins and pesticides used to fumigate produce can also be a problem (Bagley et al. 1996; Bailey and Solomon 2004; Sharma 2006). Most articles dealing with seaport pollution concentrate on ship exhaust (Saxe and Larsen 2004; Tzannatos 2010) and the contamination of marine sediments and biota (Solis-Weiss et al. 2004; Adamo et al. 2005; Cukrov et al. 2011).

Less is known about the effects of dusting at bulk cargo terminals on soil. During cargo handling operations, emissions can often occur. The dust is often primary of concern due to its highly visible nature. If cargoes include harmful substances, accidents involving them may affect the environment. The severity of pollution will depend on the nature of the substance and the amount and concentration released into the port environment (Internet 1).

Northern Adriatic coast region has been populated since Roman times and settlements have depended on agriculture, viticulture, fishing and trade. Still now, the area produces significant share of vegetables and grapes. With the development of the ports new source of pollution has emerged, possibly influencing the content of heavy metals in soil. In different regions of Slovenia and abroad several authors studied soil contamination from different point of view (i.e. Aubert and Pinta 1977; Kabata–Pendias and Pendias 1984; Alloway 1990; Adriano 2001; Zupan, Grčman and Lobnik 2008; Andjelov 2012) but none of the studies focused on seaport as possible source of potentially toxic elements.

Situated in the Slovenian part of the northern Adriatic Sea, the Port of Koper (Luka Koper) is a multi-purpose port that has the status of an entry point for goods designated for the European Union. The port's Terminal for Minerals handles minerals, industrial minerals and other bulk material, mostly bauxite, borax, cement, phosphates, ilmenite, clinker, perlite, sintermagnesite, scrap etc. (Internet 2).

The port operations create emissions of different materials into the atmosphere. Airborne dust levels increase during the handling of particulate bulk cargos. Special measures during dry windy weather are taken (Internet 3).

In spite of them, accidental dusting occurred in March 2011 due to a very strong bora wind blowing 7.3 m/s during the transhipment of bulk cargo. Institute of Public Health Maribor estimated that in four days 1000 kg of dust was emitted (Žerjal 2011). Iron oxide dust covered the town of Koper and surrounding area. The company published the material safety data sheet provided by the owner of the goods, which was in line with international standards. According to it, the material was MIOX®, physiologically harmless natural micaceous hematite (α-Fe_2O_3), used for applications in anticorrosive and decorative paints, plastics, rubber and ceramic industries (Internet 4). However, some members of the public claimed the dust was toxic, as unofficial results of the analyses had shown that the dust contained not only particles of iron oxide, but also magnesium, aluminium, cobalt and nickel (Internet 5).

In 2008 a study was performed to evaluate the influence of four main possible contamination sources in the area – the port, viticulture, a chemical factory and agriculture (Zupančič and Skobe 2014). The results of this study served as background values of soil heavy metal content.

In present study, the influence of the 2011 dusting on the geochemical composition and contamination of the soils is estimated.

2 Materials and methods

The broader area topography is characterised by hilly hinterland developed on Eocene carbonate flysch rocks, and the Holocene alluvial plains of the Rižana and Badaševica rivers (Pleničar et al. 1973). The soil's parent material is derived from weathered flysch and the soil types are eutric (TIS/ICPVO 1990–2015).

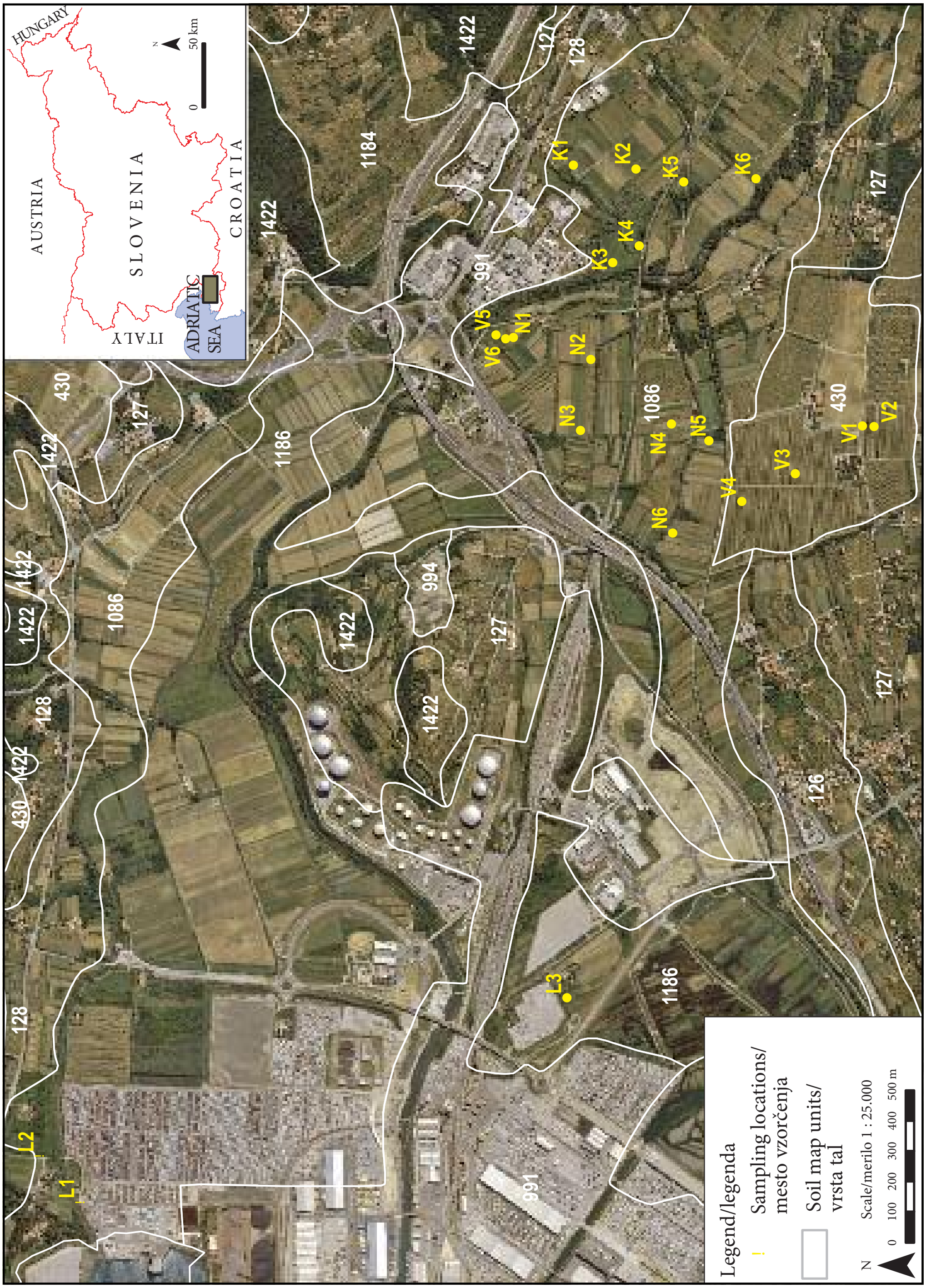

Figure 1: Soil sampling locations in the Koper area. Legend: 430 – deep cultivated (trench – ploughed) soil, eutric, 100 %; 1086 – alluvial soils, eutric, deep, on loamy alluvium, 60 % and alluvial soils, eutric, deeply gleyed, on loamy alluvium, 40 %; 1186 – gley, eutric, mineral, medium strong, 50 % and gley, eutric, mineral, moderately strong, 50 % (soil map after TIS/ICPVO 1990–2015).

In 2011 after the accidental dusting soil was sampled from the same locations as in 2008 study (Figure 1), although three locations around the port were unfortunately no longer reachable due to construction works. In 2008 study (Zupančič and Skobe 2014) sampling locations were chosen according to land use (agriculture (N1 – N6), viniculture (V1 – V6), vicinity of port (L1 – L3) and chemical factory (K1 – K6)). Micro locations were selected according to the concept of random sampling (Davis 1986). 21 topsoil (15 cm) samples weighing 1.5–2 kg were collected. According to the soil map (TIS/ICPVO 1990–2015) the port samples soil type was gley (Eutric Gleysol (IUSS 2014)) developed on natural and partly artificially filled in marine and river sediments of a local flysch origin. The vineyard samples from locations owned by the wine producing company (V1 – V4) were on slopes, with the soil type being deep cultivated (trench – ploughed) soil (Eutric Cambisol (Aric) (IUSS 2014)), developed on Eocene flysch. Soils from two private vineyards (V5, V6), the vicinity of industrial factory, and farmland are alluvial, developed on flysch alluvium (Eutric Fluvisol (IUSS 2014)).

The soil samples were air-dried, ground, split and sieved to < 0.063 mm to produce a 20 g sample. ACME Analytical Laboratories in Canada determined their chemical composition. Total abundances of the major oxides and several minor elements were reported on a 0.2g sample analysed by ICP-emission spectrometry following a Lithium metaborate/tetraborate fusion and dilute nitric digestion. Loss on ignition (LOI) is by weight difference after ignition at 1000 °C. Total carbon (TOT/C) and sulphur were determined by the Leco method. Refractory elements were determined by ICP mass spectrometry following same decomposition. In addition a separate 0.5g split was digested in Aqua Regia and analysed by ICP Mass Spectrometry to report the precious and base metals. The accuracy, precision and detection limits were established as good for the majority of elements, except Ag, Au, As, Be, Cd, Hg, Mo, Se, Sb, Sn, Tl and W, which were excluded from further discussion.

The normality of the distribution of the data was tested visually from histogram and normal probability plots, with comparisons of the mean, geometric mean and median, the testing of skewness and kurtosis, and Shapiro-Wilk's test, as proposed by Madansky (1988). The data were transformed to a more symmetric distribution with a Box-Cox transformation (Box and Cox 1964). Statistical tests were computed with transformed data for all variables but the descriptive statistics and graphical illustrations with the raw data are presented.

3 Results and discussion

Descriptive statistics for each element in each year are summarised in Table 1.

The dusting event should have resulted in elevated concentrations of elements claimed as toxic, i.e. besides Fe also Mg, Al, Co and Ni. A statistical t-test comparison of the soil geochemistry from both years did not confirm any differences in any elemental concentrations, with the exception of Co, for which even an on average 2 mg/kg lower content was established in 2011. The dusting seems not to influence the chemical composition of the topsoil. For Al_2O_3, MgO and Cr the mean values are similar in both years, but their variability is even less in 2011. After the dusting, the Fe_2O_3, Co, Cu, Pb and Zn mean values decreased, but the variability remained similar.

With respect to the situation before dusting all heavy metals, except Cr, and some major elements, including Fe_2O_3, exhibited somewhat lower mean values (Table 1). Regarding the median values, the differences between both sampling years are even less pronounced as median values are not prone to extreme values i.e. contamination.

Low coefficients of variation (CV) point to natural and high CVs to human-introduced sources of variability. For the majority of elements the CVs dropped between the two sampling years, but even the increased CV values are still only around 10 for Co and Cr, around 20 for Ni and Zn and around 30 for Cu and Pb, which could be interpreted as a natural background with some possible anthropogenic influence.

Although there are no differences between elemental contents of soils sampled in before and after accidental micaceous hematite dusting, they may exist between the sample locations at different distances from the dust source. We divide the area into three zones: < 1.5 km (L2, L3), 3–3.5 km (N1 – N6 and V3 – V6) and 3.5–4 km (K1 – K6 and V1 – V2) distance from the bulk cargo terminal. Analyses of variance showed 95% probable differences in the contents of SiO_2, Na_2O, MnO, LOI, C/TOT and Cr according to their distance from the port.

Figure 2 shows decreasing trends from the port to the inland for SiO_2, Na_2O and Cr and somewhat less persuasive trends for Pb and Zn. For SiO_2, Na_2O and Cr the reason could be their concentration in the sand fraction of alluvium (Zupančič and Skobe 2014). Pb and Zn distribution is masked by rather high variation, probably due to the natural variability of soils, sampling/analytical error or some other reason. Still, the higher values near the port could be attributed to pollution due to exhaust from vehicles, ships and different engines used in port (Fröhling and Ludzay 2002; Kummer et al. 2009). For Cu and Ni the trends are kinked – somewhat lower close to the port than in the 3–3.5 km zone and again dropping in the most distant zone. In the case of Cu, it possibly reflects the somewhat elevated Cu content in vineyards (Baker and Senft 1995; Besnard et al. 2001; Rusjan et al. 2006). For Ni, the reason could be the high natural variability.

Table 1: Descriptive statistics of major elements (%) and heavy metals (mg/kg) for 2008 (the first row), and 2011 (the second row). LOI – loss on ignition, TOT/C – total carbon.

	Mean	Geometric mean	Median	Minimum	Maximum	Standard deviation	Coefficient of variation
SiO_2	53.0	52.8	51.9	44.7	63.2	4.68	8.8
	52.8	52.7	51.4	45.7	64.5	4.59	8.7
Al_2O_3	10.0	9.9	10.0	8.4	11.8	0.99	10.0
	10.1	10.1	10.2	9.0	11.4	0.82	8.1
Fe_2O_3	4.4	4.4	4.3	3.7	5.1	0.40	9.1
	4.3	4.3	4.3	3.8	4.9	0.33	7.8
MgO	1.4	1.4	1.4	1.0	2.8	0.35	24.6
	1.4	1.4	1.4	1.2	1.6	0.11	8.3
CaO	10.7	10.3	11.1	4.1	14.2	2.66	24.9
	10.9	10.6	11.8	4.6	14.0	2.40	22.0
Na_2O	0.9	0.9	0.9	0.7	1.1	0.08	8.2
	1.0	1.0	1.0	0.8	1.1	0.081	8.2
K_2O	1.607	1.7	1.7	1.4	2.1	0.16	9.6
	1.7	1.7	1.8	1.5	2.1	0.16	8.9
TiO_2	0.6	0.6	0.6	0.5	0.7	0.05	8.9
	0.6	0.6	0.6	0.5	0.7	0.04	7.1
P_2O_5	0.17	0.17	0.17	0.13	0.25	0.04	21.1
	0.17	0.17	0.18	0.08	0.24	0.04	23.6
MnO	0.11	0.10	0.11	0.05	0.13	0.017	15.7
	0.11	0.10	0.11	0.06	0.13	0.02	20.8
LOI	16.8	16.6	17.5	11.8	20.5	2.58	15.3
	16.7	16.6	17.2	10.8	20.2	2.20	13.2
C/TOT	4.0	3.8	4.0	1.8	5.7	0.99	24.9
	3.9	3.8	4.0	1.7	4.9	0.77	19.7
Co	18.1	18.0	18.1	14.3	20.9	1.63	9.0
	16.6	16.6	17.0	13.5	18.7	1.56	9.4
Cr	216.6	214.7	212.3	178.1	315.1	30.28	14.0
	221.1	219.6	219.2	184.9	294.5	27.49	12.4
Cu	51.5	46.8	44.9	31.8	180.90	31.66	61.4
	44.4	42.9	40.1	29.8	77.8	12.73	28.7
Ni	80.3	80.0	80.2	64.0	91.8	6.40	8.0
	78.9	76.4	82.5	47.8	95.0	14.65	18.8
Pb	18.6	18.2	17.4	13.4	30.3	4.14	22.2
	16.5	15.6	17.6	7.0	26.2	4.82	29.2
Zn	71.5	67.9	64.0	57.0	212.0	32.91	46.0
	66.7	65.1	67.0	40.0	105.0	14.57	21.8

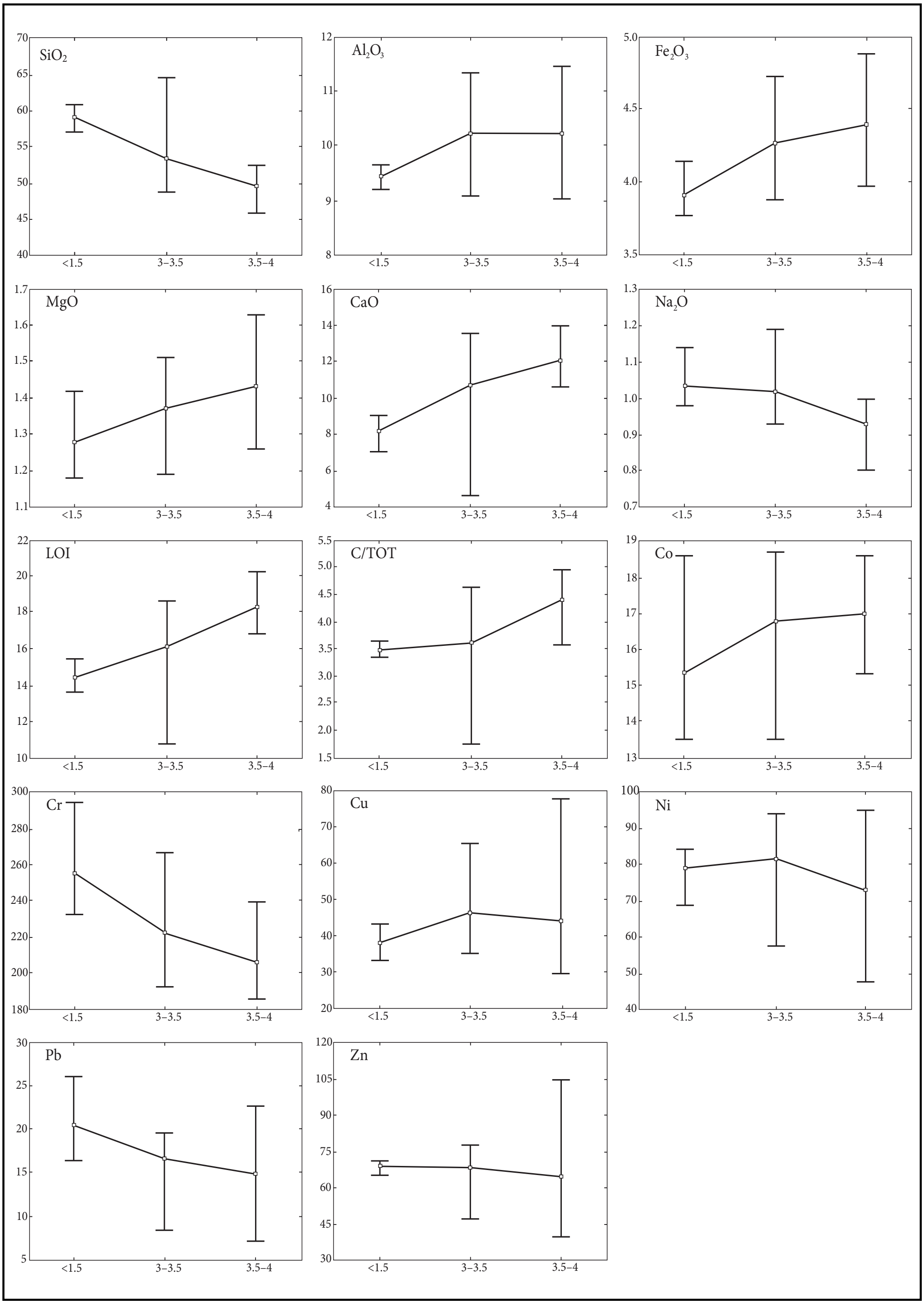

Figure 2: Mean (point) and range (minimum – maximum) values of SiO_2, Al_2O_3, Fe_2O_3, MgO, CaO, Na_2O, LOI, C/TOT (all in %), Co, Cr, Cu, Ni, Pb and Zn (all in mg/kg) in 2011 in three different distance zones (in km) from the port.

Because of the mineral composition of soils (Zupančič and Skobe 2014), which reflects quartz richer sand vs. carbonate richer clay fraction, the trends of Al_2O_3, MgO, CaO, LOI and C/TOT are increasing in the inland direction (Figure 1). The Al_2O_3 variability and mean value are lowest closest to the port so the dusting event as a reason for its content is excluded. Co has the same trend, but in all three zones a very wide range of values. Moreover, the Fe_2O_3 trend is increasing from the port to the hinterland, not proving the influence of the hematite deposition.

Enrichment factors (EF) of »critical« elements (Al_2O_3, Fe_2O_3, MgO, Co, Cr, Cu, Ni, Pb, Zn), calculated as the ratio between the concentrations observed after the dusting in 2011 and before it in 2008 (Manta et al. 2002; Acosta et al. 2009), are presented in Table 2. If EF is greater than one, the concentration of the metal is higher than the local background value, which may be an indication of the influence of anthropogenic inputs on the soils (Luo et al. 2012). An obvious feature is that these elements do not follow the same pattern in different locations. Generally, the depletions are higher than the enrichments and the EFs are so low that they can be attributed to natural or analytical variability and not pollution due to the dusting.

Hematite is mined in the Waldenstein mine in Austria (Internet 3). Vein-type mineralisation is situated in metamorphosed schists of the Koralm Crystalline Complex. Hematite contains > 92% Fe_2O_3, up to 6% TiO_2 and a minor content of MnO and V_2O_3. In chlorite-hematite ore there could be around 6% Al_2O_3, 3.5% MgO, and 4 mg/kg Ni (Prochaska et al. 1995). It is thus not very surprising that some country rock particles in the ore could contribute to the elevated Al_2O_3 and MgO reported in the media as being »dangerous«. Hematite itself is quite inert. Ni and Co could also be present in minor amounts in original ore, substituting for Fe in hematite crystal lattice. In that form, they are also harmless to humans.

Table 2: Enrichment factors for all locations arranged in increasing distance from the port for selected elements. Enriched values are shown in bold.

	Al_2O_3	Fe_2O_3	MgO	Co	Cr	Cu	Ni	Pb	Zn
L1	0.98	0.88	0.44	0.85	**1.21**	0.21	**1.06**	0.62	0.33
L2	**1.10**	**1.11**	**1.15**	**1.14**	1.00	0.77	**1.12**	0.97	**1.07**
L3	**1.03**	0.98	**1.03**	0.97	0.93	0.59	**1.08**	**1.06**	**1.09**
N6	0.96	0.93	**1.13**	0.88	0.83	**1.16**	**1.12**	0.87	**1.26**
V4	**1.02**	0.91	**1.08**	0.76	0.97	**1.40**	**1.16**	**1.12**	**1.23**
N3	**1.04**	**1.02**	**1.02**	**1.04**	**1.07**	**1.17**	**1.05**	**1.07**	**1.10**
N5	0.98	0.93	0.88	0.93	**1.03**	**1.04**	0.93	0.82	**1.02**
V5	**1.05**	0.97	**1.05**	0.92	**1.10**	**1.18**	**1.03**	**1.04**	**1.11**
V6	**1.08**	**1.01**	**1.08**	**1.03**	1.00	0.63	**1.06**	0.80	1.00
N1	0.98	0.91	0.95	0.94	**1.15**	0.91	0.97	0.96	**1.02**
N4	**1.01**	0.98	**1.01**	0.92	1.00	0.77	0.67	0.37	0.62
N2	**1.10**	**1.07**	**1.11**	**1.02**	**1.06**	**1.04**	**1.17**	**1.15**	**1.16**
V3	0.98	0.92	0.98	0.79	**1.08**	**1.09**	**1.02**	**1.12**	**1.11**
V1	**1.02**	0.95	**1.09**	0.79	0.94	**1.36**	**1.05**	**1.08**	**1.16**
V2	**1.05**	0.97	**1.03**	0.91	**1.15**	0.59	0.58	0.52	0.63
K3	0.98	1.00	0.97	0.90	**1.07**	**1.09**	**1.08**	**1.13**	**1.10**
K4	0.95	0.92	1.00	0.88	0.94	**1.02**	0.53	0.67	0.67
K2	0.98	0.95	0.94	0.73	1.00	**1.17**	**1.03**	**1.02**	**1.19**
K1	**1.08**	0.97	**1.08**	0.95	**1.03**	**1.27**	**1.09**	**1.14**	**1.14**
K5	0.97	0.94	0.94	**1.02**	**1.04**	1.00	0.99	0.98	**1.23**
K6	**1.06**	**1.03**	**1.02**	**1.05**	0.97	**1.08**	0.70	0.39	0.79

Combining the data for the two years (location L1 is excluded as 2008 established contamination was obviously sanitized) enables multivariate statistics approach (Swan and Sandilands 1995). Extracting three factors based on principle component analysis explains nearly 70% of all observed variations. Unrotated factor loadings reflect geological vs. anthropogenic influences. The first factor comprises high SiO_2, Na_2O and Cr reflecting high quartz, i.e. sand fraction content closer to the sea. Accordingly, this factor has high negative CaO, LOI, C/TOT loadings due to low calcite amount. The second factor expresses clay minerals content (high positive Al_2O_3, Fe_2O_3, MgO, K_2O, TiO_2). It seems that Co and Ni could at least partly be bound to these minerals. The third factor gathers heavy metals Cu, Ni, Pb and Zn, with Co, P_2O_5 and MnO having negative loadings. The mentioned groups of minerals/elements are presented in Figure 3. Probably anthropogenic Zn and Pb could be a consequence of motor vehicle traffic as some Pb is found in unleaded and diesel fuels (Fröhling and Ludzay 2002; Kummer et al. 2009), and Zn is a component of rubber tyres (US EPA 1979). Cu could have a double source – the use of fungicides in vineyards (Besnard et al. 2001; Rusjan et al. 2006) and as well traffic (Cadle et al. 1997). The high Ni content could be natural (Zupančič and Skobe 2014) or at least partly a consequence of the combustion of fuel in stationary sources (Pacyna et al. 2007).

4 Conclusion

Soils developed on the alluvium of carbonate flysch rocks sampled in 2008 enabled the estimation of the possible heavy metals content increase due to accidental dusting, emitting 1000 kg of material in 2011 when hematite was being transhipped during very strong winds (7.3 m/s) in the Luka Koper. Unofficial results of the chemical analysis of the dust had shown that besides the iron there was some Al, Mg, Co and Ni. Some members of the public claimed that the dust had polluted the environment and was harmful to the population.

According to our research, the sequence of the content of elements is the same in both sampled datasets, and is typical for soils developed on flysch rocks rich in Cr and Ni.

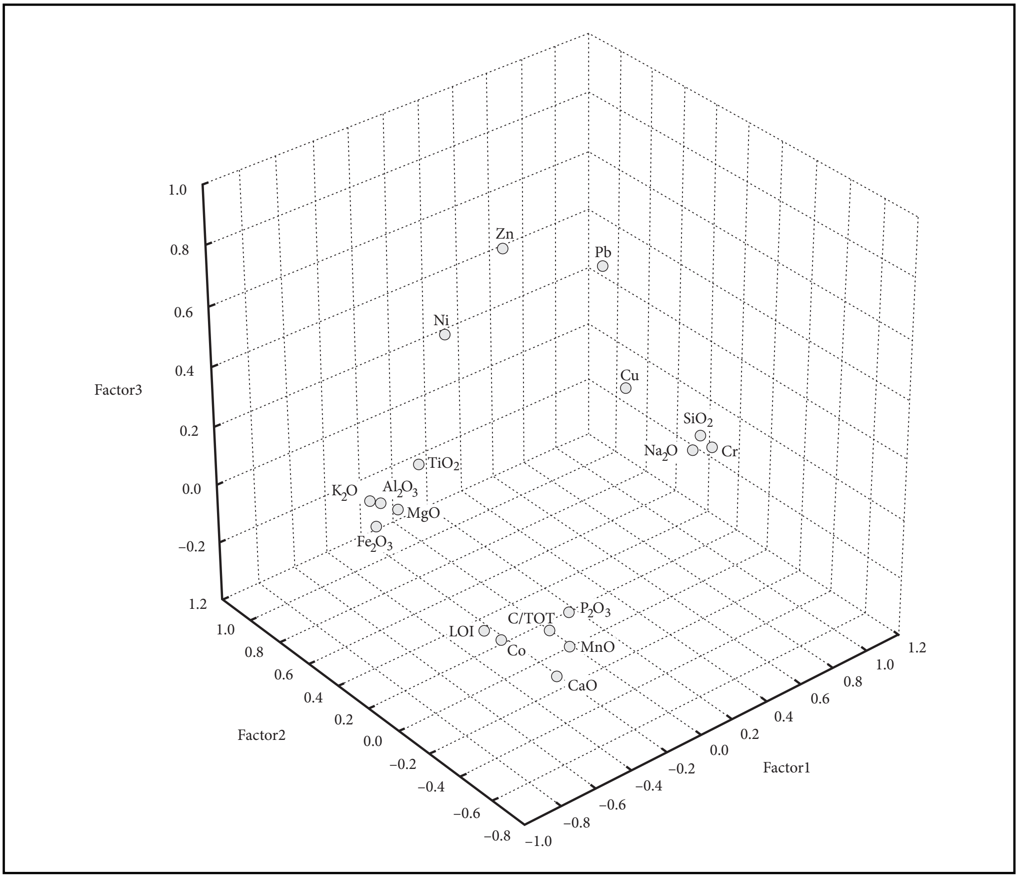

Figure 3: Factor loadings for the major elements and heavy metals of soils from the port hinterland sampled in 2008 and 2011. Location L1 is excluded.

The only element, which shows a statistically different content between the two years, is Co, although its values are even a little lower after dusting than before it. The established mean values of Al_2O_3, MgO and Cr remained similar, and the Fe_2O_3, Co, Cu, Ni, Pb and Zn mean values are lower in 2011. Regarding the median values, the differences between both sampling years are even less pronounced. For the majority of elements (Al_2O_3, Fe_2O_3, K_2O, CaO, MgO, TiO_2, LOI, C/TOT, Cr, Cu, Zn) the CVs dropped between the two sampling years, but for some of them they actually increased (P_2O_5, MnO, Co, Ni, Pb). However, the CV values are still only around 10 for Co and Cr, around 20 for Ni and Zn and around 30 for Cu and Pb, which points to a major geogenic and minor anthropogenic source of heavy metals.

A comparison of three zones at < 1.5 km, 3–3.5 km, and 3.5–4 km distance from the bulk cargo terminal showed differences in contents of SiO_2, Na_2O, MnO, LOI, C/TOT and Cr. The mean values of SiO_2, Na_2O, Cr, Pb and Zn decrease with increasing distance from the port. For SiO_2, Na_2O and Cr the reason could be their concentration in the sand fraction of alluvium and later in the soils developed on it. For Cu and Ni, the values are lower close to the port, higher in the 3–3.5 km zone and again lower in the most distant zone. The Cu distribution possibly reflects the use of fungicides in vineyards. Reasons for the Ni, Pb and Zn variability could be natural, analytical or human. Al_2O_3, MgO, CaO, LOI and C/TOT are increasing in the inland, reflecting more carbonate and clay with respect to quartz. Co follows the same trend, but its variability is huge. The Fe_2O_3 trend is increasing from the port to the hinterland, not proving the influence of the hematite deposition.

Enrichment factors calculated for two sampling locations nearest to the port (L2, L3) indicate that Al_2O_3, MgO, Ni and Zn are slightly enriched, F_2O_3 and Co are enriched in closest location (L2) and depleted in more distant one (L3), and Pb is enriched in L3 and depleted in L2. Cu is depleted and Cr nearly the same with respect to the situation before the dusting. However, where enrichments do exist the enrichment factors are so small that they are more likely natural or analytical variability and not due to the pollution with hematite.

Iron oxide is a natural material – hematite mined in metamorphic rocks. It is thus completely normal that a chemical analysis of dust also detected some Al_2O_3 and MgO, from the country rock. Ni and Co could be present in minor amounts in original ore, substituting for Fe in hematite crystal lattice. In that form, they are harmless to humans.

The factor analysis of the compiled data for both years clearly shows the influence of the parent material and possible contamination. The first factor is interpreted as the »distance from the sea« comprising a high level of SiO_2, Na_2O and Cr closer to the sea due to concentration of quartz and sand, and the dissolution of carbonate (CaO, LOI, C/TOT).The second factor expresses »clay content« with loadings of Al_2O_3, Fe_2O_3, MgO, K_2O and TiO_2. It seems that Co and Ni could be at least partly bound to these minerals as well. The third factor is named »heavy metals« as Cu, Ni, Pb and Zn are positively and Co, P_2O_5 and MnO negatively loaded. The anthropogenic Zn and Pb could be a consequence of motor vehicle traffic, and Cu could have a double source: the use of fungicides in vineyards and traffic. The Ni content could be natural or at least partly a consequence of the combustion of fuel.

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Okoljski vpliv prašenja s terminala koprskega pristanišča za razsuti tovor na kmetijska tla

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IZVLEČEK: Območja okrog pristanišč lahko prizadenejo različni škodljivi vplivi okolja. V pristanišču Koper so ob močni burji pretovarjali hematit, ki je zaradi nenamernega prašenja, prekril širše območje. Ker smo tla koprskega zaledja predhodno že geokemično kartirali, je ponovno vzorčenje omogočilo primerjavo geokemične sestave tal. Onesnaženja nismo ugotovili. Obogatitveni faktorji celo kažejo znižanje vsebnosti večine prvin. Z oddaljenostjo od vira prašenja vsebnosti SiO_2, Na_2O in Cr padajo, Fe_2O_3 naraščajo. Vsebnosti SiO_2 in Cr so pogojene s kopičenjem s kremenom bogatega peska in raztapljanjem karbonata bližje morju. Co in Ni sta verjetno vezana na glinene minerale. Cu, Pb in Zn so lahko delno antropogeno povišani.

KLJUČNE BESEDE: onesnaženje tal, sljudnati hematit, prašenje, pristanišče, severno Jadransko morje, Luka Koper, Slovenija

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1 Uvod

Morska pristanišča so glavna vozlišča gospodarske dejavnosti in hkrati onesnaževanja okolja na poseljenih obalnih območjih (Bailey in Solomon 2004). Pristaniške dejavnosti lahko pomembno vplivajo na lokalne skupnosti ter na morske in kopenske ekosisteme v regiji. Vplivi segajo od povečanega tveganja za nastanek raka, do onesnaženja vodnih teles in tal (Bailey in Solomon 2004).

Glavni onesnaževalci zraka, povezani s pristaniškimi dejavnostmi, so dizelski izpušni plini, trdni delci (PM), hlapne organske spojine (HOS), dušikovi oksidi (NOx), ozon in žveplovi oksidi (SOx). Ostali problematični onesnaževalci zraka, ki izhajajo iz pristanišč, so ogljikov monoksid (CO), formaldehid, težke kovine, dioksini in pesticidi za fumigacijo pridelkov (Bagley s sod. 1996; Bailey in Salomon 2004; Sharma 2006). Večina člankov, ki obravnavajo vplive pristaniške dejavnosti, je usmerjenih v raziskave učinka izpušnih plinov ladij (Saxe in Larsen 2004; Tzannatos 2010) in v raziskave onesnaženja morskih sedimentov ter živih organizmov (Solis-Weiss s sod. 2004; Adamo s sod. 2005; Cukrov s sod. 2011).

Manj je znanega o učinkih prašenja s terminalov za razsuti tovor na tla. Do emisij lahko pride zlasti med prekladanjem tovora. Učinek prašenja je neposredno viden in zato pogosto glavni vzrok preplaha. Nesreče z raznašanjem tovora, ki vsebuje škodljive snovmi, vplivajo na okolje. Resnost onesnaženja je odvisna od narave snovi ter količin in koncentracij sproščenih v okolje (Internet 1).

Severna jadranska obala je bila poseljena že v času Rimljanov. Od nekdaj so bila naselja odvisna od kmetijstva, vinogradništva, ribolova in trgovine. Še danes na tem območju pridelajo precej zelenjave in grozdja. Z razvojem pristanišča se je pojavil nov vir onesnaževanja, ki lahko vpliva na vsebnost težkih kovin v tleh. Številni avtorji (npr. Aubert in Pinta 1977; Kabata–Pendias in Pendias 1984; Alloway 1990; Adriano 2001; Zupan, Grčman in Lobnik 2008; Andjelov 2012) so z različnih vidikov raziskovali onesnaženje tal v Sloveniji in v tujini, a se njihove študije niso osredotočile na pristanišča kot možni vir potencialno toksičnih prvin.

Luka Koper je večnamensko pristanišče v slovenskem delu severnega Jadrana. Je vstopna točke za blago namenjeno v Evropsko unijo. Na terminalu za minerale pretovarjajo minerale, industrijske minerale in ostali razsuti tovor, predvsem boksit, boraks, cement, fosfate, ilmenit, klinker, perlit, magnezitni sinter, odpadke in podobno (Internet 2).

Pristaniške dejavnosti v ozračje izpuščajo različne snovi. V zraku se lahko med pretovarjanjem razsutih tovorov dvigne predvsem koncentracija prahu. Za suho vetrovno vreme zato veljajo posebni ukrepi (internet 3).

Kljub temu je marca 2011 zaradi zelo močne burje, ki je pihala s hitrostjo 7,3 m/s, med pretovarjanjem razsutega tovora prišlo do neželenega prašenja. Zavod za zdravstveno varstvo Maribor je ocenil, da se je v štirih dneh v zrak sprostilo 1000 kg prahu (Žerjal 2011). Prah železovega oksida je prekril Koper z okolico. Družba je objavila varnostni list, ki ga je predložil lastnik blaga, iz katerega je bilo razvidno, da je tovor v skladu z mednarodnimi standardi. Material, s trgovskim imenom MIOX®, je fiziološko neškodljiv naravni sljudnati hematit (α-Fe_2O_3), ki ga uporabljajo v protikorozivnih in dekorativnih barvah, plastiki, gumi in keramični industriji (Internet 4). Kljub temu so nekateri predstavniki javnosti trdili, da je prah strupen, ker so neuradni rezultati analiz pokazali, da ne vsebuje le železovega oksida, temveč tudi magnezij, aluminij, kobalt in nikelj (internet 5).

V letu 2008 smo v zaledju Kopra izvedli študijo ocene vpliva štirih glavnih možnih virov onesnaženja tal: pristaniške dejavnosti, vinogradništva, kemične tovarne in kmetijstva (Zupančič in Skobe 2014). Ti podatki so tako lahko predstavljali vrednosti ozadja vsebnosti težkih kovin v tleh.

V pričujočem prispevku smo ocenili vpliv prašenja iz leta 2011 na geokemično sestavo in onesnaženja tal.

2 Materiali in metode

Za topografijo širšega območja koprskega pristanišča je značilno hribovito zaledje, razvito na eocenskih karbonatnih flišnih kamninah ter holocenski poplavni ravnici Rižane in Badaševice (Pleničar s sod. 1973). Matična podlaga tal izhaja iz preperelih flišnih kamnin, na katerih so se razvila evtrična tla (TIS / ICPVO 1990–2015).

Tla smo po nenamernem prašenju leta 2011 vzorčili na istih lokacijah kot v letu 2008 (slika 1). Zaradi gradbenih del na treh lokacijah v bližini pristanišča, vzorčna mesta žal niso bila več dostopna. V študiji leta 2008 (Zupančič in Skobe 2014) smo vzorčne lokacije določili glede na rabo tal (kmetijstvo (N1 – N6), vinogradništvo (V1 – V6), bližina pristanišča (L1 – L3) in kemične tovarne (K1 – K6)). Mikrolokacije smo izbrali po načelih naključnega vzorčenja (Davis 1986). Analiziranih je bilo 21 vzorcev vrhnjega dela (15 cm) tal, teže 1,5–2 kg. Po pedološki karti (TIS/ICPVO 1990–2015) so tla iz bližine pristanišča gleji (evtrični glej (IUSS 2014)), razviti na naravnih in delno umetno nasutih morskih in rečnih sedimentih lokalnega flišnega izvora. Vzorci vinogradniških tal (V1 – V4) iz lokacij, ki jih upravlja vinarsko podjetje, so odvzeti na pobočjih. Tip tal so globoko obdelana (rigolana) tla (evtrična rjava (arična) (IUSS 2014)), razvita na eocenskem flišu. Tla vzorčena v dveh zasebnih vinogradih (V5, V6) v bližini kemične tovarne in tla vzorčena na kmetijskih zemljiščih so aluvialna, razvita na flišni naplavini (evtrična obrečna tla (IUSS 2014)).

Slika 1: Lokacije vzorčenja tal na območju Kopra. Legenda: 430 – globoko obdelana (rigolana) tla, evtrična, 100 %; 1086 – aluvialna tla, evtrična, globoka, na ilovnatem aluviju, 60 % in aluvialna tla, evtrična, globoko oglejena, na ilovnati naplavini, 40 %; 1186 – glej, evtričen, mineralen, srednje močen, 50 % in glej, evtričen, mineralen, zmerno močen, 50 % (pedološka karta po TIS / ICPVO 1990–2015).
Glej angleški del prispevka.

Vzorce tal smo posušili na zraku, zmleli, četrtinili in presejali na zrnavost < 0,063 mm, tako da smo dobili 20 g posameznega vzorca. Kemično sestavo vzorcev so izmerili v laboratoriju ACME v Kanadi. Vsebnost glavnih oksidov in nekaterih slednih prvin so analizirali z ICP–emisijsko spektrometrijo: 0,2 g vzorca so razklopili z litijevim metaboratom/tetraboratom in razredčenim dušikovim razkrojem. Ognjevzdržne prvine so določili z ICP–masno spektrometrijo po enakem razklopu. Izguba pri žarenju (LOI) je razlika v teži po žarjenju pri 1000 °C. Skupni ogljik (TOT/C) in žveplo so določili z metodo Leco. Vsebnost plemenitih in navadnih kovin so analizirali z ICP–masno spektrometrijo, tako da so 0,5 g vzorca razklopili z zlatotopko. Točnost in natančnost analitike ter meje določljivosti smo ocenili kot dobre za večino prvin, razen Ag, As, Be, Cd, Hg, Mo, Se, Sb, Sn, Tl in W, ki smo jih zato izvzeli iz nadaljnje razprave.

Normalnost porazdelitve podatkov smo testirali vizualno s histogrami in grafi normalne verjetnosti, s primerjavo aritmetična sredine, geometrične sredine in mediane, s preskušanjem zamaknjenosti in koničavosti ter s Shapiro-Wilkovim testom kot ga predlaga Madansky (1988). Bolj simetrične porazdelitve podatkov smo dosegli z Box-Cox transformacijo (Box in Cox 1964). Statistične teste so za vse spremenljivke izračunane s transformiranimi podatki, vendar so opisne statistike in grafične ilustracije prikazane s surovimi podatki.

3 Rezultati in razprava

Opisne statistike za vse prvine in za obe leti vzorčevanja so zbrane v preglednici 1.

Vsebnosti »strupenih« prvin, poleg Fe, tudi Mg, Al, Co in Ni, bi se morale zaradi prašenja zvišati. Vendar primerjava geokemičnih analiz tal s statističnim t-testom, ni pokazala nobenih statistično značilnih razlik v vsebnosti prvin med letoma 2008 in 2011. Izjema je Co, katerega vsebnost je bila leta 2011 povprečno celo 2 mg/kg nižja. To kaže, da prašenje ni vplivalo na kemično sestavo vrhnjih horizontov tal. Povprečne vrednosti Al_2O_3, MgO in Cr so v obeh letih podobne, a je v letu 2011 razpon vrednosti celo manjši. Po prašenju so izmerjene povprečne vrednosti Fe_2O_3, Co, Cu, Pb in Zn nižje, variabilnost vrednosti pa je ostala podobna.

Glede na stanje pred prašenjem vse težke kovine (razen Cr) in nekatere glavne prvine, vključno z Fe_2O_3, kažejo nekoliko nižje srednje vrednosti (preglednica 1). Mediane vsebnosti prvin v posameznem letu so si še bolj podobne, ker nanje ne vplivajo ekstremne vrednosti oziroma onesnaženi vzorci.

Nizki variacijski koeficienti (CV) pomenijo naravno variabilnost, medtem ko visoki kažejo na antropogeno uvedene vire spremenljivosti. Za večino prvin se je vrednost CV v letu 2011 znižala. Tudi v primerih, ko so se vrednosti CV povišale – Co in Cr le okoli 10, za Ni in Zn okoli 20 ter za Cu in Pb približno 30, lahko to razložimo z naravnim ozadjem in delnim antropogenim prispevkom.

Čeprav nismo ugotovili razlik v vsebnosti prvin v tleh vzorčenih pred in po naključnem prašenju sljudnatega hematita, bi lahko obstajale razlike v njihovi vsebnosti glede na to, koliko so vzorčne lokacije oddaljene od vira prašenja. Območje smo zato razdelili v tri cone oddaljenosti od terminala za razsuti tovor, in sicer: < 1,5 km (L2, L3), 3–3,5 km (N1 – N6 in V3 – V6) in 3,5–4 km (K1 – K6 in V1 – V2). Analiza variance je pokazala 95 % verjetnost razlik v vsebnosti SiO_2, Na_2O, MnO, LOI, C/TOT in Cr glede na oddaljenost od pristanišča.

Preglednica 1: Opisne statistike glavnih prvin (%) in težkih kovin (mg/kg) za leto 2008 (prva vrstica), in leto 2011 (druga vrstica). LOI – žaroizguba, TOT/C – skupni ogljik.

	aritmetična sredina	geometrična sredina	mediana	minimum	maksimum	standardni odklon	variacijski koeficient
SiO_2	53,0 52,8	52,8 52,7	51,9 51,4	44,7 45,7	63,2 64,5	4,68 4,59	8,8 8,7
AlO_3	10,0 10,1	9,9 10,1	10,0 10,2	8,4 9,0	11,8 11,4	0,99 0,82	10,0 8,1
Fe_2O_3	4,4 4,3	4,4 4,3	4,3 4,3	3,7 3,8	5,1 4,9	0,40 0,33	9,1 7,8
MgO	1,4 1,4	1,4 1,4	1,4 1,4	1,0 1,2	2,8 1,6	0,35 0,11	24,6 8,3
CaO	10,7 10,9	10,3 10,6	11,1 11,8	4,1 4,6	14,2 14,0	2,66 2,40	24,9 22,0
Na_2O	0,9 1,0	0,9 1,0	0,9 1,0	0,7 0,8	1,1 1,1	0,08 0,081	8,2 8,2
K_2O	1,607 1,7	1,7 1,7	1,7 1,8	1,4 1,5	2,1 2,1	0,16 0,16	9,6 8,9
TiO_2	0,6 0,6	0,6 0,6	0,6 0,6	0,5 0,5	0,7 0,7	0,05 0,04	8,9 7,1
P_2O_5	0,17 0,17	0,17 0,17	0,17 0,18	0,13 0,08	0,25 0,24	0,04 0,04	21,1 23,6
MnO	0,11 0,11	0,10 0,10	0,11 0,11	0,05 0,06	0,13 0,13	0,017 0,02	15,7 20,8
LOI	16,8 16,7	16,6 16,6	17,5 17,2	11,8 10,8	20,5 20,2	2,58 2,20	15,3 13,2
C/TOT	4,0 3,9	3,8 3,8	4,0 4,0	1,8 1,7	5,7 4,9	0,99 0,77	24,9 19,7
Co	18,1 16,6	18,0 16,6	18,1 17,0	14,3 13,5	20,9 18,7	1,63 1,56	9,0 9,4
Cr	216,6 221,1	214,7 219,6	212,3 219,2	178,1 184,9	315,1 294,5	30,28 27,49	14,0 12,4
Cu	51,5 44,4	46,8 42,9	44,9 40,1	31,8 29,8	180,90 77,8	31,66 12,73	61,4 28,7
Ni	80,3 78,9	80,0 76,4	80,2 82,5	64,0 47,8	91,8 95,0	6,40 14,65	8,0 18,8
Pb	18,6 16,5	18,2 15,6	17,4 17,6	13,4 7,0	30,3 26,2	4,14 4,82	22,2 29,2
Zn	71,5 66,7	67,9 65,1	64,0 67,0	57,0 40,0	212,0 105,0	32,91 14,57	46,0 21,8

Iz slike 2 je razviden padajoči trend vrednosti SiO_2, Na_2O in Cr od pristanišča proti notranjosti ter nekoliko manj prepričljiv trend padanja za Pb in Zn. Za SiO_2, Na_2O in Cr je razlog lahko njihova visoka vsebnost v peščeni frakciji aluvija (Zupančič in Skobe 2014). Porazdelitveni trend Pb in Zn je težje ločjiv, zaradi precejšnjega razpona vsebnosti, ki je verjetno posledica naravne variabilnosti tal, napake vzorčenja in/ali analitike ali še kakšnega drugega razloga. Višje vrednosti bližje pristanišču tako lahko pripišemo onesnaženju z izpušnimi plini vozil, ladij in različnih strojev, ki jih uporabljajo v pristanišču (Fröhling in Ludzay 2002; Kummer s sod. 2009). Trendi Cu in Ni so lomljeni – vrednosti so blizu pristanišča nekoliko nižje kot v območju 3–3,5 km in znova padajo v najbolj oddaljenem pasu. Porazdelitev Cu morda odraža nekoliko povišane vsebnosti v vinogradih (Baker in Senft 1995; Besnard s sod. 2001; Rusjan s sod. 2006). Pri Ni je lahko razlog njegova visoka naravna variabilnost.

Slika 2: Srednja vrednost (točka) in razpon (minimum – maksimum) vrednosti SiO_2, Al_2O_3, Fe_2O_3, MgO, CaO, Na_2O, LOI, C/TOT (v %), Co, Cr, Cu, Ni, Pb in Zn (v mg/kg) v letu 2011 v treh različnih conah oddaljenosti (v km) od pristanišča.

Glej angleški del prispevka.

Zviševanje vsebnosti Al_2O_3, MgO, CaO, LOI in C/TOT proti notranjosti odraža mineralno sestavo tal (Zupančič in Skobe 2014). Bližje morju je v tleh več s kremenovim peskom bogate frakcije ter manj karbonata in glinene frakcije (slika 1). Variabilnost in srednja vrednost Al_2O_3 sta najnižji najbližje pristanišču, kar potrjuje, da prašenje iz terminala ni vplivalo na izmerjeno vsebnost. Trend porazdelitve Co je enak, a kaže v vseh treh območjih zelo širok razpon vrednosti. Razen tega tudi vsebnosti Fe_2O_3 naraščajo od pristanišča proti zaledju, kar ne potrjuje vpliva prašenja hematita na kemizem tal.

Obogatitveni faktorji (EF) »kritičnih« prvin (Al_2O_3, Fe_2O_3, MgO, Co, Cr, Cu, Ni, Pb, Zn), izračunani kot razmerje med koncentracijami izmerjenimi po prašenju v letu 2011 in pred njim v letu 2008 (Manta s sod. 2002, Acosta s sod. 2009), so predstavljeni v preglednici 2. Kadar je EF večji od ena, je koncentracija kovine višja od lokalne vrednosti ozadja in kaže na antropogeni vpliv (Luo s sod. 2012). Očitno je, da obravnavani elementi na različnih lokacijah nimajo enakega vzorca. Praviloma so osiromašitve večje od obogatitev, EF pa so tako majhni, da jih je mogoče pripisati naravni ali analitski spremenljivosti in ne onesnaženju zaradi prašenja.

Hematit kopljejo v rudniku Waldenstein v Avstriji (Internet 3). Metamorfni skrilavci koralmskega kristaliničnega kompleksa so orudeni z žilnim tipom mineralizacije. Hematit vsebuje > 92 % Fe_2O_3, do 6 % TiO_2 in manjše vsebnosti MnO ter V_2O_3. V kloritno-hematitni rudi je lahko okoli 6 % Al_2O_3, 3,5 % MgO in 4 mg/kg Ni (Prochaska s sod. 1995). Zato ni presenetljivo, da posamezni delci prikamnine v rudi prispevajo k povišanju Al_2O_3 in MgO, ki so ju v medijih označili kot »nevarne«. Hematit sam je precej inerten. Ni in Co sta lahko v manjših količinah prisotna tudi v rudi, kjer nadomeščata Fe v hematitovi kristalni rešetki. V taki obliki sta za ljudi neškodljiva.

Preglednica 2: Obogatitveni faktorji (EF) izbranih prvin za vse lokacije, razvrščene v naraščajoči oddaljenosti od pristanišča. Obogatene vrednosti so označene z odebeljenim tiskom.

	Al_2O_3	Fe_2O_3	MgO	Co	Cr	Cu	Ni	Pb	Zn
L1	0.98	0.88	0.44	0.85	**1.21**	0.21	**1.06**	0.62	0.33
L2	**1.10**	**1.11**	**1.15**	**1.14**	1.00	0.77	**1.12**	0.97	**1.07**
L3	**1.03**	0.98	**1.03**	0.97	0.93	0.59	**1.08**	**1.06**	**1.09**
N6	0.96	0.93	**1.13**	0.88	0.83	**1.16**	**1.12**	0.87	**1.26**
V4	**1.02**	0.91	**1.08**	0.76	0.97	**1.40**	**1.16**	**1.12**	**1.23**
N3	**1.04**	**1.02**	**1.02**	**1.04**	**1.07**	**1.17**	**1.05**	**1.07**	**1.10**
N5	0.98	0.93	0.88	0.93	**1.03**	**1.04**	0.93	0.82	**1.02**
V5	**1.05**	0.97	**1.05**	0.92	**1.10**	**1.18**	**1.03**	**1.04**	**1.11**
V6	**1.08**	**1.01**	**1.08**	**1.03**	1.00	0.63	**1.06**	0.80	1.00
N1	0.98	0.91	0.95	0.94	**1.15**	0.91	0.97	0.96	**1.02**
N4	**1.01**	0.98	**1.01**	0.92	1.00	0.77	0.67	0.37	0.62
N2	**1.10**	**1.07**	**1.11**	**1.02**	**1.06**	**1.04**	**1.17**	**1.15**	**1.16**
V3	0.98	0.92	0.98	0.79	**1.08**	**1.09**	**1.02**	**1.12**	**1.11**
V1	**1.02**	0.95	**1.09**	0.79	0.94	**1.36**	**1.05**	**1.08**	**1.16**
V2	**1.05**	0.97	**1.03**	0.91	**1.15**	0.59	0.58	0.52	0.63
K3	0.98	1.00	0.97	0.90	**1.07**	**1.09**	**1.08**	**1.13**	**1.10**
K4	0.95	0.92	1.00	0.88	0.94	**1.02**	0.53	0.67	0.67
K2	0.98	0.95	0.94	0.73	1.00	**1.17**	**1.03**	**1.02**	**1.19**
K1	**1.08**	0.97	**1.08**	0.95	**1.03**	**1.27**	**1.09**	**1.14**	**1.14**
K5	0.97	0.94	0.94	**1.02**	**1.04**	1.00	0.99	0.98	**1.23**
K6	**1.06**	**1.03**	**1.02**	**1.05**	0.97	**1.08**	0.70	0.39	0.79

Združeni podatki obeh let (lokacija L1 je izvzeta, ker so 2008 ugotovljeno onesnaženje očitno sanirali) omogočajo pristop z multivariatnimi statističnimi metodami (Swan in Sandilands 1995). Trije faktorji, izračunani na podlagi analize glavnih komponent, pojasnjujejo skoraj 70 % celotne variabilnosti. Nerotirane faktorske obremenitve ločujejo geološke in antropogene vplive. Prvi faktor je visoko obremenjen z SiO_2,

Na_2O in Cr ter odraža visoko vsebnost kremena, povezano z višjo količino peščene frakcije v vzorcih bližje morju. Skladno s tem je ta faktor, zaradi nizke vsebnosti kalcita, visoko negativno obremenjen s CaO, LOI in C/TOT. Drugi faktor odraža vsebnost glinenih mineralov (visoko pozitivni Al_2O_3, Fe_2O_3, MgO, K_2O, TiO_2). Kaže, da sta Co in Ni vsaj delno vezana nanje. Na tretjem faktorju so združene težke kovine Cu, Ni, Pb in Zn, pri čemer so Co, P_2O_5 in MnO negativno obremenjeni. Navedene skupine mineralov/prvin prikazuje slika 3. Možen antropogeni vir Zn in Pb je lahko promet, saj je nekaj Pb prisotnega tudi v neosvinčenem in dizelskem gorivu (Fröhling in Ludzay 2002; Kummer s sod. 2009), nekoliko Zn pa vsebujejo tudi pnevmatike (US EPA 1979). Izvor Cu je lahko dvojen: uporaba fungicidov v vinogradih (Besnard s sod. 2001; Rusjan s sod. 2006) in vpliv prometa (Cadle s sod. 1997). Visoka vsebnost Ni je lahko naravna (Zupančič in Skobe 2014) ali, vsaj delno, posledica zgorevanja goriva iz stacionarnih virov (Pacyna s sod. 2007).

Slika 3: Faktorske obremenitve glavnih prvin in težkih kovin v tleh iz zaledja pristanišča vzorčenih v letih 2008 in 2011. Lokacija L1 je izključena.
Glej angleški del prispevka.

4 Sklep

Leta 2008 vzorčena tla, razvita na aluviju karbonatnih flišnih kamnin, so omogočila oceno možne povišane vsebnosti težkih kovin, do katere bi lahko prišlo zaradi nenamernega prašenja. Leta 2011 je namreč pri pretovarjanju hematita ob zelo močni burji (7,3 m/s) iz Luke Koper odpihnilo 1000 kg materiala. Neuradni rezultati kemijske analize so pokazali, da je bilo poleg železa v prahu tudi nekaj Al, Mg, Co in Ni. Nekateri predstavniki javnosti so trdili, da je prah onesnažil okolje in je škodljiv prebivalstvu.

Po naših raziskavah je zaporedje količine prvin enako v obeh vzorčnih nizih in značilno za tla, nastala na flišnih kamninah bogatih s Cr in Ni.

Edina prvina s statistično različno vsebnostjo med obravnavanima letoma je Co, a je njegova vsebnost po prašenju celo nižja kot pred njim. Ugotovljene povprečne vrednosti Al_2O_3, MgO in Cr so ostale podobne, povprečne vsebnosti Fe_2O_3, Co, Cu, Ni, Pb in Zn so v letu 2011 nižje. Glede na mediano so razlike v vsebnostih prvin med obema vzorčenima letoma še manj izrazite. Za večino prvin (Al_2O_3, Fe_2O_3, K_2O, CaO, MgO, TiO_2, LOI, C/TOT, Cr, Cu, Zn) se je vrednost CV med obema letoma znižala, za nekatere od njih se je povečala (P_2O_5, MnO, Co, Ni, Pb). Kljub temu so vrednosti CV za Co in Cr le okoli 10, za Ni in Zn okoli 20 ter za Cu in Pb približno 30, kar kaže na večji geogeni in manjši antropogeni vir težkih kovin.

Primerjava treh con, od terminala za razsuti tovor oddaljenih < 1,5 km, 3–3,5 km, in 3,5–4 km, je pokazala razlike v vsebnosti SiO_2, Na_2O, MnO, LOI, C/TOT in Cr. Srednje vrednosti SiO_2, Na_2O, Cr, Pb in Zn se z večanjem razdalje od pristanišča zmanjšujejo. Za SiO_2, Na_2O in Cr je lahko razlog njihova koncentracija v peščeni frakciji aluvija in posledično v tleh razvitih na njem. Za Cu in Ni so vrednosti nižje blizu pristanišča, višje v 3–3,5 km coni in spet nižje v najbolj oddaljenem območju. Porazdelitev Cu morda odraža uporabo fungicidov v vinogradih. Spremenljivost vsebnosti Ni, Pb in Zn je lahko naravna, posledica analitske napake ali človekovega vpliva. Vsebnosti Al_2O_3, MgO, CaO, LOI in C/TOT se proti notranjosti višajo, kar kaže na relativno večjo količino karbonata in gline ter nižjo količino kremena v tleh. Co sledi istemu trendu, a z veliko variabilnostjo. Naraščajoči trend Fe_2O_3 od pristanišča proti zaledju ne podpira trditve o onesnaženju tal zaradi prašenja hematita.

Obogatitveni faktorji dveh lokacij, vzorčenih najbližje pristanišču (L2, L3), kažejo da so v letu 2011 tla nekoliko obogatena z Al_2O_3, MgO, Ni in Zn. Z Fe_2O_3 in Co so tla obogatena v lokaciji najbližji pristanišču (L2) in osiromašena v bolj oddaljeni lokaciji (L3), Pb pa je obogaten v lokaciji L3 in osiromašen v lokaciji L2. Cu je glede na stanje pred prašenjem osiromašen. Vsebnost Cr je ostala skoraj enaka. Obogatitveni faktorji so tam, kjer smo povišanje zaznali, tako majhni, da gre verjetneje za naravno ali analitsko variabilnost in ne za onesnaženje s hematitom.

Železov oksid je naravni material. Hematit kopljejo v metamorfnih kamninah, zato je povsem normalno, da je kemijska analiza prahu zaznala tudi nekaj Al_2O_3, MgO iz prikamnine. Tudi Ni in Co sta lahko v manjših količinah prisotna v rudi, saj nadomeščata Fe v kristalni rešetki hematita. V taki obliki sta za ljudi neškodljiva.

Faktorska analiza združenih podatkov obeh let jasno loči vpliv matičnega materiala od kontaminacije. Prvi faktor interpretiramo kot »razdaljo od morja«. Visoko pozitivno je obremenjen s SiO_2, Na_2O in Cr, kar je posledica kopičenja kremena in peska ter raztapljanja karbonata (CaO, LOI, C/TOT) bližje morju.

Drugi faktor, obremenjen z Al_2O_3, Fe_2O_3, MgO, K_2O in TiO_2, izraža »vsebnost gline«. Verjetno sta tudi Co in Ni vsaj deloma vezana na te minerale. Tretji faktor smo imenovali »težke kovine«. Tretji faktor je pozitivno obremenjen s Cu, Ni, Pb in Zn ter negativno obremenjen s Co, P_2O_5 in MnO. Antropogeni del Zn in Pb je morda posledica prometa motornih vozil. Vir Cu bi bil lahko dvojen: uporaba fungicidov v vinogradih in promet. Vsebnost Ni je naravna ali, vsaj delno, posledica zgorevanja goriva.

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5 Literatura

Glej angleški del prispevka.

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SUSTAINABLE SPATIAL DEVELOPMENT IN THE ALPS

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1 Introduction

This special issue of *Acta geographica Slovenica* discusses selected topics in spatial development in the Alps from the perspective of spatial planning legislation, stakeholder engagement in spatial planning decisions, tools that enable the effective flow of expertise and exchange of instruments, and best practices across the Alps, as well as from the economic perspective using the example of Alpine regions' reaction to the economic crisis that affected Europe and the rest of the world at the end of the past decade. By including articles written as part of the WIKIAlps project, which was financed through the EU transnational cooperation program Alpine Space, this special issue seeks to invigorate discussions on sustainable spatial development in the Alps and thus contributes to a greater familiarity with this issue and to more prudent decisions.

2 The articles

In their article »Transnational Needs of Sustainable Spatial Development in the Alps: Results from an Analysis of Policy Documents,« Marzelli and Lintzmeyer present the international needs of Alpine spatial development, analyzing thirty-two documents (i.e., spatial development strategies, plans, and reports) at the transnational, binational, and national levels. Their research includes a quantitative analysis of keywords, in which they draw attention to their interconnections and overlaps, and define the transnational character of individual categories from the viewpoint of how frequently individual topics occur. Their analysis continues by assessing the added value of the documents studied, the obstacles that limit their implementation, and the stakeholders the documents refer to. The results of the analysis show a need for international coordination of individual policies in formulating strategies and governance processes, managing natural resources, and creating an adequate knowledge base to facilitate international decision-making.

Stakeholder engagement in the planning process is one of the increasingly frequently expressed assumptions of sustainable spatial development. In their article »Achieving Sustainable Spatial Development in the Alps through Participatory Planning,« Nared et al. examine spatial planning legislation in seven Alpine countries and analyze how individual stakeholders engage in spatial planning processes. The authors present the planning systems applied in the countries studied and use twenty-seven pieces of legislation to establish that the participatory process is slowly growing in importance, even though it continues to lag behind expectations; it is often viewed as a necessary evil, while at the same time many otherwise interested groups have inadequate expertise and skills to actively participate in the planning process. In this regard, they highlight the need for more active use of the participatory process in formulating documents and the need to train planners in participatory methods and techniques.

Engaging actors at the local and regional levels is relatively simple, whereas within a wider context, such as international challenges like spatial development in the Alps, the participatory process is made difficult due to large spatial distances and language barriers. In this connection, various online tools have recently become commonplace. They use new information and communication technologies to make it possible for all interested parties to become involved in discussions and shaping policies, using a bottom-up approach. In their article »Web-Based Instruments for Strengthening Sustainable Regional Development in the Alps,« Borsdorf, Bender, Braun, and Haller analyze the application of web 2.0 technologies and present the key results of various projects from this field (e.g., GALPIS, DIAMONT, mountain.TRIP, and WIKIAlps). They highlight the fact that, in addition to a general discussion, these types of tools also enable the participation of the general public, not only in the role of passive observers, but also as active joint shapers of spatial planning and development policies.

The last article on sustainable spatial development in the Alps (Brozzi et al. 2015) focuses on the broader developmental aspect of Alpine regions, examining how the NUTS2 and NUTS3 regions covered in the Alpine Space program responded to the economic crisis that affected Europe after 2007. The authors' main attention is directed to regional resilience, examining the reasons for the various reactions of regions in different social, economic, and spatial circumstances, based on which the crisis affects some more and others less. To illustrate the effects of the crisis, the authors compare indicators from before and after the crisis. Their findings show differences between the three groups of regions studied as well as at the national level, which is reflected in a poorer response of individual Italian and Slovenian regions, or a greater impact on these regions.

3 Conclusion

The realization that spatial development in the Alps is an extremely complex process is the common denominator of the contributions in this special issue of *Acta geographica Slovenica*. It is connected with a broad range of institutions at various levels, starting with eight Alpine countries on the one hand and many local communities and inhabitants on the other. Dividing the responsibilities between territorial units and sectors when dealing with shared challenges also calls for joint approaches in overcoming these challenges. From this perspective, it is necessary to have good knowledge of spatial processes, differences in spatial planning legislation, and the principles of engaging the relevant stakeholders in the decision-making processes. In addition, it is also vital to seek new forms of cooperation, such as a shared knowledge base like the WIKIAlps online encyclopedia and other comparable information platforms. The goal is to transcend boundaries and overcome bureaucratic obstacles, and to build on the shared potential and wealth of knowledge that people living in the Alps have acquired through life experience.

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THE ALPS: A PHYSICAL GEOGRAPHY, POLITICAL, AND PROGRAM FRAMEWORK

Janez Nared, Nika Razpotnik Visković, Blaž Komac


JANEZ NARED

Spatial development is a crucial issue in the Alps, where inhabitants and economic activities are concentrated in Alpine valleys: the case of Innsbruck.

The Alps: A physical geography, political, and program framework

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ABSTRACT:
In order to improve the understanding of the concepts featured in this special issue of *Acta geographica Slovenica,* this review article presents the Alps as a geographical concept, the Alpine Convention, and the Alpine Space transnational cooperation program. All three categories have a different spatial scope and thus must be clearly defined and distinguished from one another.

KEY WORDS: geography, spatial development, sustainability, Alps, Alpine Convention, Alpine Space program

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1 Introduction

Due to the vulnerability of the Alps and the interconnection of specific economic, social, and environmental factors in this area, the issue of sustainable spatial development in the Alps has been a concern for experts from all Alpine countries (Cortines, Pecher and Brozzi 2014; Petek 2005; Razpotnik, Urbanc and Nared 2009; Bocco and Zeppetella 2011; Bätzig 2003; Schönthaler, von Andrian-Werburg 2008; Tappeiner et al. 2008; Marzelli, Lintzmeyer and Schwarz 2008; Urbanc, Perko and Petek 2008, Bole and Nared 2010). Because of their rich natural resources, the importance of transport corridors, and exceptional tourism potential, the Alps are exposed to a number of environmental and spatial pressures. The conditions are additionally aggravated by the extremely dynamic terrain, which limits activities and settlement to specific areas. Spatial development is thus torn between the interests of the local population, the business community, environmental protectionists, transport experts, tourism providers, and others that seek opportunities in this attractive mountainous environment.

An analysis of developmental trends at the level of Alpine municipalities (Pfefferkorn 2007) showed that the share of urban municipalities that is, municipalities with high population density, a large number of jobs, and great appeal for workers from neighboring areas has grown considerably over the past decades (it nearly doubled between 1981 and 2001). During the same period, the number of tourism, suburban and peripheral municipalities grew by 41%, whereas the number of balanced and other municipalities decreased by over 60%. Within the EU context, there was an above-average increase in the population and jobs in the Alps, even though despite this growth many workers depend on jobs in major metropolitan regions on the edges of the Alps. In terms of spatial development, the growth in the number of buildings is especially alarming; this increased by a third between 1981 and 2001. This points to strong suburbanization and urban sprawl, which are especially typical of tourism-oriented municipalities, in which the number of buildings increased by 56.6%. The share of rural population decreased by over 40% during the same period. These processes indicate great differences in the Alps between the extremely intensive urban and tourism-oriented areas on the one hand and the less promising peri-urban and peripheral areas on the other (Pfefferkorn 2007).

The processes described have significantly transformed the Alps over the past decades and they indicate a need for responsible spatial planning that takes into account the developmental specifics of the Alps and ensures that the Alpine resources and this area's appeal are preserved in the long run, while also ensuring prosperity and a high-quality living environment for the local population.

2 The Alps: defining the spatial context

When discussing sustainable spatial development in the Alps, one cannot ignore their spatial context. On the one hand, in terms of physical geography, the Alps are a massif that extends across a good portion of central Europe, and on the other hand, through the adoption of the Alpine Convention and the Alpine Space transnational program, the Alps have also gained a political and developmental connotation. Considering that the physical geographical extent of the Alps differs from that defined in the Alpine Convention and the Alpine Space program, and that familiarity with these areas is important for understanding the articles presented in this special issue, short definitions of these three spatial categories are provided below.

2.1 The Alps as a mountain range

The Alps are part of an approximately 1,000 km long and 250 km wide mountain chain, which was formed during the Alpine orogeny in the Neogene, approximately sixty-five million years ago. Because they extend across various European regions, they are important for Europe's spatial and sociopolitical development (Diem 2014). Elevated landscapes influenced settlement and routes, and subsequently the frequency and quality of contacts between inhabitants, and the economy (Gams 2001). In order to understand the role of the Alps in spatial development, one must also take into account the neighboring ranges of hills and mountains, such as the Pyrenees, the Apennines, the Massif Central, the Jura Mountains, the Black Forest, the Carpathians, and the Dinarides, and the intermittent lowlands and basins, such as the Po Plain and the Pannonian Basin.

The Alps stand in the watershed between the Mediterranean Sea and the north Atlantic, rising from 900 m at Vienna to almost 5,000 m in the west, where their highest peak, Mont Blanc (4,810 m), is located. The Alps have a dynamic terrain, which was transformed significantly by glaciers during the Pleistocene and by hydrogeomorphological processes during the Holocene. Hydrogeomorphological processes continue to have a strong impact on spatial development. In mountainous regions, where heavy rains are frequent, (flash) floods, debris flows, and landslides are common. There are also a lot of rockfalls and avalanches, and earthquakes are common on the southern margins of the Alps.

The Western Alps are the highest, but also the narrowest: on the Italian side the distance between the central ridge and the plain is only about 50 km. In the Central Alps, the valleys and plateaus between them have a different orientation, and the Eastern Alps run in an east-west direction. The central and highest part of the Alps is made of igneous and metamorphic rock, whereas sedimentary rock (especially flysch and limestone) predominates in their northern and southern foothills.

Valleys and basins primarily formed along the faults that run across the Alps and, in addition to the infrequent plateaus and low hills, they are the only areas suitable for settlement. The most important valleys in the Eastern Alps are those extending from east to west (along the Inn and Drava Rivers), and the most important valleys to the west are those that cross the Alps in a north-south direction (Susa, Aosta, Osola and Ticino, Valtellina, Adige) and along which there are around forty major mountain passes (Fedele 2011).

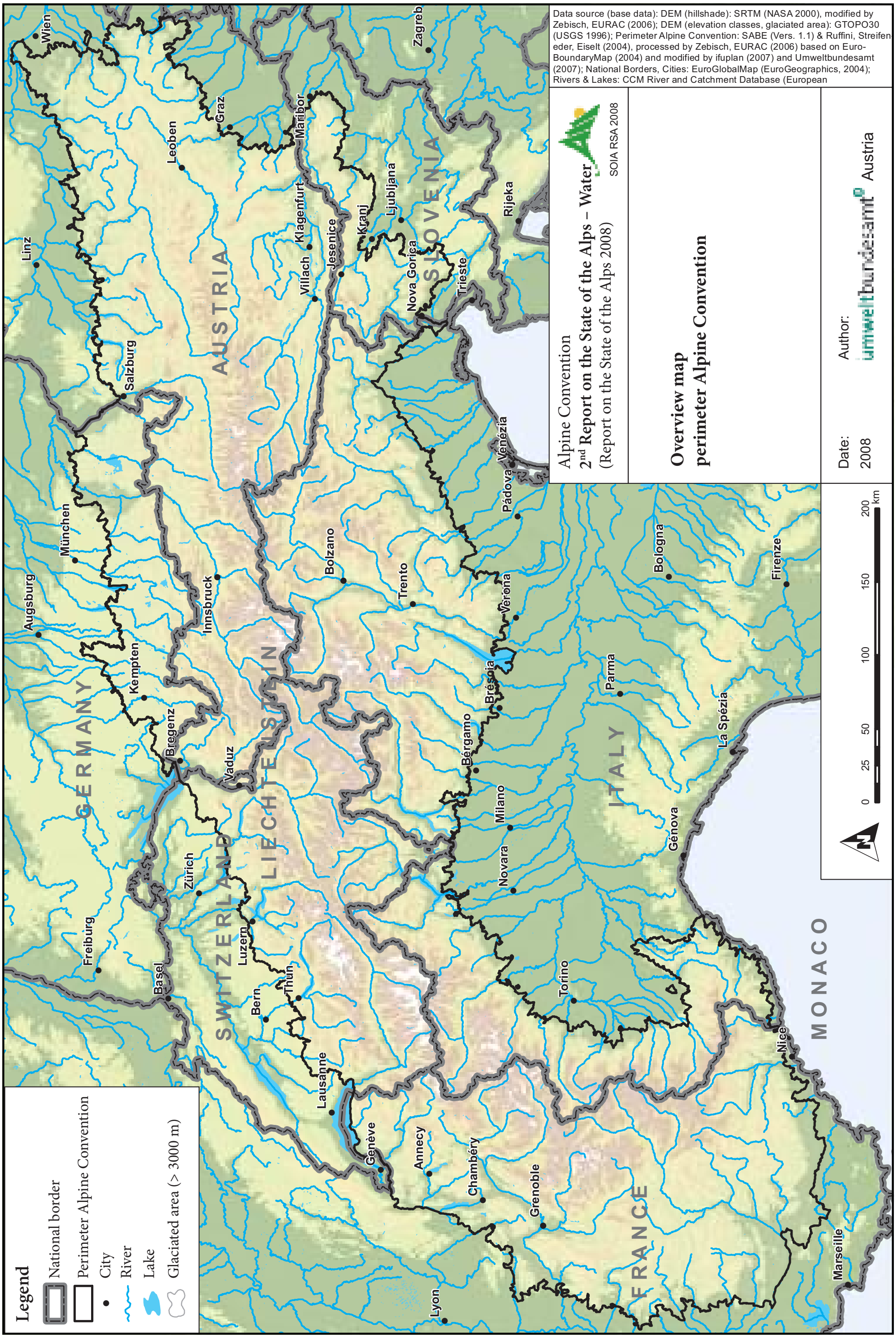
Settlement, thoroughfares, and the economy in the Alps depend on the terrain and the related characteristics of the water resources, climate, and vegetation. The climate is primarily affected by elevation and surface orientation, which is why the Alps are characterized by low summer temperatures and the fact that the temperature amplitude, insolation, heavy rain, and aridity decrease with elevation. The snow line in the Alps lies at 2,500 m in the central part and at 3,000 m on the margins, and the receding glaciers are an important source of fresh water (Gabrovec et al. 2014). Alpine rivers are characterized by different seasonal cycles, great discharge fluctuations, and great transport power, which is why the majority of them have formed extensive plains at the foot of the Alps. The southern side of the Central Alps is drained by the Po River, the Rhine flows to the north, the Rhône is the largest river in the west, and the Danube with its tributaries lies in the east. There are several glacial lakes on the edges of the Alps, which are important for tourism. The most important lake in Switzerland is Lake Geneva, and the most popular lakes for tourism are those in Italy (Lake Maggiore, Lake Lugano, Lake Como, and Lake Garda). Others lie to the north: Lake Neuchâtel, Lake Lucerne, Lake Zurich, Lake Constance, Lake Chiem (*Chiemsee*), and Lake Atter (*Attersee*). The tourism orientation of the Alps is also highlighted by fourteen national parks, the majority of which are found in Austria and Italy (four each). France has three, and Switzerland, Germany, and Slovenia each have one. In addition to the countries mentioned here, the Alpine countries also include Liechtenstein.

2.2 The Alpine Convention

The shared challenges of the Alpine countries and regions, such as spatial planning, transport, the power industry, and tourism, encouraged eight Alpine countries (i.e., Austria, France, Germany, Italy, Liechtenstein, Monaco, Slovenia, and Switzerland) to engage in coordinated international cooperation. In October 1989, ministers from these countries adopted a resolution on preparing a draft treaty governing the protection and sustainable development of the Alps. Based on this, on November 7th, 1991 Austria, France, Germany, Italy, Switzerland, Liechtenstein, and the EU signed the Convention on the Protection of the Alps (Framework Convention 1993; Alpine Convention). Slovenia signed it in March 1993, and Monaco joined it on the basis of a special additional protocol. The Alpine Convention entered into force in March 1995 as the first convention protecting a mountainous region (History 2015).

In terms of organization, the Alpine Convention consists of the following bodies: 1) the Alpine Conference is a political decision-making body composed of the ministers of the member states, of which one assumes the presidency over the convention every two years; 2) the Permanent Committee is the executive body of the Alpine Conference composed of representatives of the member states that ensure that the Alpine Convention's ideas, principles, and aims are carried out in practice; another important body of the Alpine

Figure 1: Perimeter of the Alpine Convention (Report on the State of the Alps 2008). ➤


Data source (base data): DEM (hillshade): SRTM (NASA 2000), modified by Zebisch, EURAC (2006); DEM (elevation classes, glaciated area): GTOPO30 (USGS 1996); Perimeter Alpine Convention: SABE (Vers. 1.1) & Ruffini, Streifeneder, Eiselt (2004), processed by Zebisch, EURAC (2006) based on EuroBoundaryMap (2004) and modified by ifuplan (2007) and Umweltbundesamt (2007); National Borders, Cities: EuroGlobalMap (EuroGeographics, 2004); Rivers & Lakes: CCM River and Catchment Database (European
Alpine Convention
2nd Report on the State of the Alps – Water
(Report on the State of the Alps 2008)
SOIA RSA 2008
Overview map
perimeter Alpine Convention
Date:
2008
Author:
umweltbundesamt Austria
0 25 50 100 150 200 km
Legend
National border
Perimeter Alpine Convention
City
River
Lake
Glaciated area (> 3000 m)
GERMANY
AUSTRIA
SWITZERLAND
LIECHTENSTEIN
SLOVENIA
ITALY
FRANCE
MONACO
Wien
Linz
Graz
Leoben
Maribor
Zagreb
Salzburg
Klagenfurt
Villach
Jesenice
Kranj
Ljubljana
Nova Gorica
Trieste
Rijeka
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Lausanne
Genève
Annecy
Chambéry
Grenoble
Lyon
Marseille

Convention is also 3) the Permanent Secretariat, which supports the bodies established by the convention, provides expert, logistic, and administrative assistance, and helps the member states carry out the activities required by the Alpine Convention and its protocols; other important elements of the convention's organizational structure include 4) the Compliance Committee, 5) the Convention Depository, 6) Working Groups, and 7) Observers (Organization 2015).

In addition to the Framework Convention, protocols and declarations are also important instruments ensuring harmonized spatial development. Protocols provide guidelines in the following areas: spatial planning and sustainable development, conservation of nature and the countryside, mountain farming, mountain forests, tourism, energy, soil conservation, and transport.

Two additional protocols have been adopted: the Protocol on the Solution of Litigations, and the Protocol on the Principality of Monaco's Membership to the Convention. In 2006, two declarations were adopted in addition to these protocols: the Declaration on Population and Culture (2006) and the Declaration on Climate Change (2006).

The joint instruments (i.e., the Framework Convention and its protocols) contribute to the sustainable development of the Alpine region via a uniform development concept, the goal of which is to prevent competition to the detriment of nature and people (The Convention … 2015). Through this, the Alpine Convention has become a role model for other (mountain) macro-regions around the world, such as the Carpathians and the Andes.

2.3 The Alpine Space transnational cooperation program

The Alpine Space transnational cooperation program is carried out as part of the EU cohesion policy. The program connects not only the regions in the geographic macro-region of the Alps (i.e., the mountain chain), but also the surrounding hilly regions and lowlands in the peri-alpine belt, and parts of the Mediterranean coast and the Danube, Po, Adige, Rhône, and Rhine Valleys. Specifically, the program covers the whole of Austria, Liechtenstein, Slovenia, and Switzerland; the Rhône-Alpes, Provence-Alpes-Côte d'Azur, Franche-Comté, and Alsace regions in France; Lombardy, Friuli-Venezia Giulia, Veneto, South Tyrol, the Aosta Valley, Piedmont, and Liguria in Italy; and the Freiburg, Upper Bavaria, Swabia, and Tübingen administrative regions in Germany (Internet 1).

The program covers a total area of 450,000 km², which is home to approximately seventy million people (Internet 2). The region's exceptional diversity is first and foremost the result of the terrain, with mountains forming a physical divide between local communities, which has led to their unique cultural development in the past (Gams 2001). On the other hand, political and economic processes have led to the abandonment of hilly areas, the formation of agglomerations in lowlands, and improved transport accessibility of the Alpine region (Tappeiner, Borsdorf and Tasser 2008). The Alpine Space program brings together regions based on their functional interconnection, which is a necessity for following its basic objectives: directing sustainable spatial development and encouraging spatial cohesion of the entire region, especially by enhancing its competitiveness and attractiveness. The program follows these objectives via projects, in which regions, local communities, and other stakeholders from this area can participate (Strategy Development … 2013). The essential principle of these projects is the »transnational approach,« which means that they primarily resolve not only local problems and are not limited only to one country, but focus on challenges that demand broader solutions (Internet 2). The project partners from various countries or regions exchange information, knowledge and best practice examples, thus ensuring a higher-quality resolution of problems. The activities within the European territorial cooperation, including the Alpine Space program, are funded by the European Regional Development Fund.

The priorities of the call for project proposals change slightly with each program period. During the 2000–2006 period, the program focused on promoting sustainable development, enhancing accessibility in the Alps, and protecting natural and cultural heritage. During the 2007–2013 program period, the cohesion policy focused on meeting the objectives of the Lisbon and Gothenburg strategies: enhancing economic growth, increasing competitiveness, providing new jobs, and ensuring sustainable and balanced development (Strategy Development … 2013). These were also the topics of the calls for project proposals within the Alpine Space program. The new program period (i.e., 2014–2020) will continue to promote sustainable development, but the main priorities will include developing an innovative and low-carbon society, sus-

Figure 2: Regions included in the Alpine Space transnational cooperation program.

tainable use of natural and cultural heritage, conserving and developing the ecological connectivity of Alpine ecosystems, and promoting multilevel governance.

A critical assessment of the results of the Alpine Space program to date show that for now their impact remains intangible and that their implementation in the local environment is insufficient. Therefore, only projects with tangible results in the local environment will be selected and financed in the new 2014–2020 program period (Strategy Development … 2013, Internet 3).

3 Conclusion

According to Onida (2010, 17), »the enlarged EU-27 faces considerable new challenges compared to the past years. Challenges increased in number and complexity. This has led to … new political constructions aimed at facilitating the implementation of EU regional policy objectives and priorities, such as 'regional strategies', in particular in areas where common problems are clearly identified and so are the potential benefits of better coordinated interventions.« What the former Alpine Convention secretary-general had in mind was both the Alpine Convention and the Alpine Space transnational cooperation program, each of which contribute to sustainable development in the Alps in its own way. Shared challenges are an important reason for seeking shared solutions, in which national borders are no obstacle. This is also what this special issue of *Acta geographica Slovenica* aims to contribute to.

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WEB-BASED INSTRUMENTS FOR STRENGTHENING SUSTAINABLE REGIONAL DEVELOPMENT IN THE ALPS

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Sustainable regional development in the Alpine Inn Valley, Austria, requires direct citizen participation.

Web-based instruments for strengthening sustainable regional development in the Alps

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ABSTRACT: Web-based information and communication technologies enable the inclusion of all stakeholders in sustainable regional development and raise hopes that these processes will be accomplished from the bottom up and with broad public participation. This article synthesizes, presents, and critically discusses solutions for the Alps that use web 2.0 technologies, in particular: (a) GALPIS and DIAMONT with databases and an interactive webGIS, (b) mountain.TRIP as an efficient communication and information system to link research with practice, and (c) mountain wikis as tools for collaborative regional planning and development. The results indicate that new information and communication instruments enhance the implementation, promotion, assessment, and steering of sustainable regional development in the Alps.

KEYWORDS: geography, regional development, web 2.0, social media, Alps

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1 Introduction

At the first Alpine conference in Berchtesgaden in 1989, the Alpine countries, together with the European Economic Community, the precursor to the European Union, declared their intent to create a framework convention for development in the Alps. The convention was signed by the ministers of the environment of the Alpine countries in Salzburg in 1991. This was the start of the Alpine Convention, which was ratified by the eight Alpine countries in subsequent years.

The basic ideas of the nine implementing protocols to date are cross-border support for sustainable regional development in the Alps under conditions of climate change and globalization, as well as increasing international competitiveness and the attractiveness of the Alps. Despite the successes of the Alpine Convention, the slow ratification of the protocols by the member states and the protracted negotiations demonstrate the difficulties of implementing these ideas at a political level. In 2000 a structural fund was therefore created to support transdisciplinary research projects within INTERREG IIIB: the Alpine Space Programme. In 2014 it entered its third funding period.

This article focuses on the results of selected projects (from the Alpine Space Programme or other funding sources) that have made use of the rapidly improving options provided by modern internet information and communication technologies. These projects are presented below and their scope for promoting sustainable regional development is discussed. The aims are to synthesize and present research projects carried out from 2000 to 2014 and, based on the authors' experiences, critically discuss their scope for promoting sustainable regional development.

The central hypothesis of this article is that new information and communication tools based on web 2.0 technologies may increase valuable bases for implementing, promoting, and steering sustainable regional development in the Alps.

The presentation is mainly based on the publications created within these projects, available documentation on the internet, and the products, complemented by general literature on these technologies. The study uses inductive logic: it first discusses the challenges to sustainability within the Alps, then presents individual solutions, and concludes with an overview.

2 Sustainable regional development: A challenge for the Alps

Soon after the publication of the report *Our Common Future* by the World Commission on Environment and Development (the Brundtland Commission) in 1987 (WCED 1987), sustainable development became a new paradigm, including in the Alps. Since then, the policy of the Alpine Convention has been dedicated to this overall goal based on environmental compatibility, social coherence, and economic growth for long periods of time. In response to critical discussions (Spehr 1996; Bergstedt 2005), some authors added a cultural dimension (safeguarding cultural diversity) and a political dimension (safeguarding political stability) to the three pillars (Hodge 1997). In the German-speaking countries, the alternative term *Zukunftsfähigkeit* ('future-proof'; BUND and Misereor 2002) came into use, not least of all under the influence of the German parliament study commission titled Protecting mankind and the environment.

The pairing »global change and regional sustainability« evolved from the impression that global developments (climate change and globalization) represent a particular threat to sustainable development (Hahne 2010; Coy and Stötter 2013). It included the realization that sustainability strategies could primarily succeed at the local and regional levels. In contrast, concepts of »glocalization« seek to understand globalization and localization as complementary processes on a micro-meso-macro scale (Robertson 1998). For the Alps, this means that regional sustainability must take into account factors of global change. To this end, new globally available information and communication technologies can be effectively used to exchange data, insights, best practices, and research results. Sustainable regional development is thus based not only on political programs but also on research and close communication between researchers and practitioners. The multiannual program of the Alpine Convention and the research strategy of the International Committee on Research in the Alps (ISCAR; see Borsdorf et al. 2008) defined sustainability as the main challenge for development in the Alps, and Braun and Borsdorf (2014) added capacity building, governance, and management. This objective includes powerful information and communication instruments.

3 Applying web-based information and communication technologies

Before 1990, scientifically validated information was mostly available in research volumes, journal articles, or encyclopedias. Communication among researchers was limited to team discussions, postal correspondence, and (more rarely) replies published in journals. In the early 1990s, almost concurrently with the emergence of sustainable regional development as an objective, the development of the World Wide Web (WWW) created a basis for new options. The WWW allowed faster multilateral communication by e-mail, increasingly more journals were published online (some of them with open access), and data and maps could be published on the web as databases or via map servers; interaction by the users, however, was limited to data searches and modification of visualization. Examples are the Tirol Atlas (http://tirolatlas.uibk.ac.at/; regional scale), the ÖROK Atlas (http://www.oerok-atlas.at/; national) in Austria, and the ESPON mountain regions maps of Europe (http://atlas.espon.eu/).

It was only at the beginning of the twenty-first century that new options were created for citizen–public involvement, user-steered webGIS instruments for generating content, and dynamic communication between researchers, practitioners, and the public. Figure 1 provides an overview on the appearance and functionality of information and communication over the course of time.

Within spatial planning and development, three main web-based technologies are currently in use – and accessible via the internet and a browser – to support the generation, provision, and exchange of information to enable sustainable regional development. The first is the individual query, analysis, and graphic representation of spatial data and information from databases via browser-based applications (webGIS). The second is leveraging new options emerging from the creation of digital social networks (social media), and the third is the increased use of wiki technology (a content management system) for providing and managing information relevant to a particular theme.

What makes webGIS applications particularly promising in the context of the public's participation and regional development is the fact that they allow users to call up geographical information via a browser and internet access, and to analyze and display it in line with their individual interests without having to purchase expensive geodata or costly GIS software. The frequently emphasized distinction between web mapping as focusing on data display and webGIS as focusing on data analysis (Neumann 2008) is becoming increasingly blurred because newer applications often combine cartographic and analytical functions. In collaborative planning and development, the combination of webGIS and traditional forms of participatory decision-making (Dragićević and Balram 2004) has proved to be a very promising approach to sustainable development.

Social media are also beginning to play a larger role in spatial planning and development (Deddens 2011), both as a source of geographical information (Massa and Campagna 2014) – just think of localizing digital photographs or analyzing user-generated texts by geographical content (social media geographic information, SMGI) – and as a tool for identifying, including, and involving all stakeholders in decision-making processes (Bizjak 2012). Krätzig and Warren-Kretzschmar (2014) list the advantages offered by social networks as the opportunity to define the topics that matter most to the public, to gather local knowledge

Table 1: Matrix of information and communication systems over the course of time (source: authors)

	Scientific information	Personal communication	Data inquiry and map display	Unlimited communication	Participative content generation
Books, Articles	×				
Encyclopedias, Atlases, Static Map Server	×				
Emails		×			
Databases, Dynamic Map server			×		
Social media, Wiki				×	×
(Interactive) WebGIS					×
	before 1990	1990–2000		after 2000	

about the current state of a region, to identify opinions and development alternatives, and to encourage direct exchange between the people involved.

Another possibility of using web-based technologies for sustainable regional development is the creation of wikis on specific themes. Here the focus is on the joint creation, arrangement, and linking of written entries. Wiki technology (Leuf and Cunningham 2001) offers a comparatively simple content management system to do this. The concept aims to encourage as many users as possible to contribute to wiki entries, to categorize them, and to link them to other entries. The knowledge shared on wikis should in theory not be evaluated by chosen experts, but rather the quality of the entries should be secured by the participants themselves, who will immediately correct wrong information and discuss controversial material on a dedicated discussion page.

These digital tools are often mentioned in connection with buzzwords such as *e-democracy* or *geocitizenship* (Rotondo and Selicato 2011; Atzmanstorfer et al. 2014). Fredericks and Foth (2013) sum up their potential as the opportunity to:

- Integrate people that are physically unable to attend civic meetings in regional development processes;
- Engage younger people through new media to participate in decision-making processes;
- Offer stakeholders that decline personal contact with experts an option for participation;
- Monitor, analyze, and enhance public participation in planning processes.

In this context, Mandarano et al. (2010) speak of a new, digital, social capital that is evolving through the use of web-based information and communication technologies in collaborative regional planning and development. At the same time, critical voices are being raised about the unthinking application of web-based technologies in spatial planning and development. Elwood (2010) lists the main points of criticism in the current debate as the social and political constructedness of geodata, the knowledge policy concerning spatial information, and the role of geotechnologies and social media in monitoring and influencing »geocoded« citizens that continuously leave traces in digital space. Moreover, far too little is still known about how effectively the results from web-based public participation are being integrated into actual spatial development concepts and later implemented in practice (Mandarano et al. 2010). From their own experience, Kelly et al. (2012) therefore rightly point out that most web-based approaches to collaborative planning and development are still top-down measures. They do not stem from the public's desire for participation, but from a political order issued to experts to involve as many parties affected as possible.

4 Solutions based on web 2.0 technologies

4.1 DIAMONT and GALPIS

The first georeferenced database in the world with GIS functionality for the Austrian part of the Alps, which allowed web-based use of free calculation and free map design, was the GALPIS-Web System (Bender and Pindur 2003; Bender et al. 2010), implemented in 2003. It contains 1,300 variables, is thematically free, and follows an inductive-explorative logic. It includes data on ecology, biodiversity, demography, agriculture, tourism, cultural landscapes, and the human habitat. The data from 1971 to 2001 were temporally and spatially harmonized. Raster and real-space data were recalculated at the municipal level (LAU 2). The real strength of GALPIS-Web is its analytical functionality: through the free combination of all variables, the system even allows multitemporal (time section or change maps) and multithematic analyses: examples include location optimization, complex analyses (e.g., degree of urbanization of a municipality), and the creation of indicators (e.g., sustainability index or provision index). One highlight is the free choice of map design (Figure 2) in terms of color and signature, labeling, zooming, shading, or reference space (municipality or permanent settlement area). Examples can be found in Borsdorf (2005).

DIAMONT offers a similar database for the entire Alps (Borsdorf et al. 2008). Here, too, the municipality is the spatial unit of reference. Themes include natural space, the environment, society (including demography, education, and participation), and the economy. Complex indicators can be calculated from these basic data. However, this is purely a database linked to further data on spatial control instruments at the international, national, regional, and local levels, as well as to best-practice examples. The DIAMONT team created an atlas of the Alps (Tappeiner et al. 2008), and the mountain.TRIP project provides a tutorial on simplified use of the DIAMONT database (mountain.TRIP 2014).

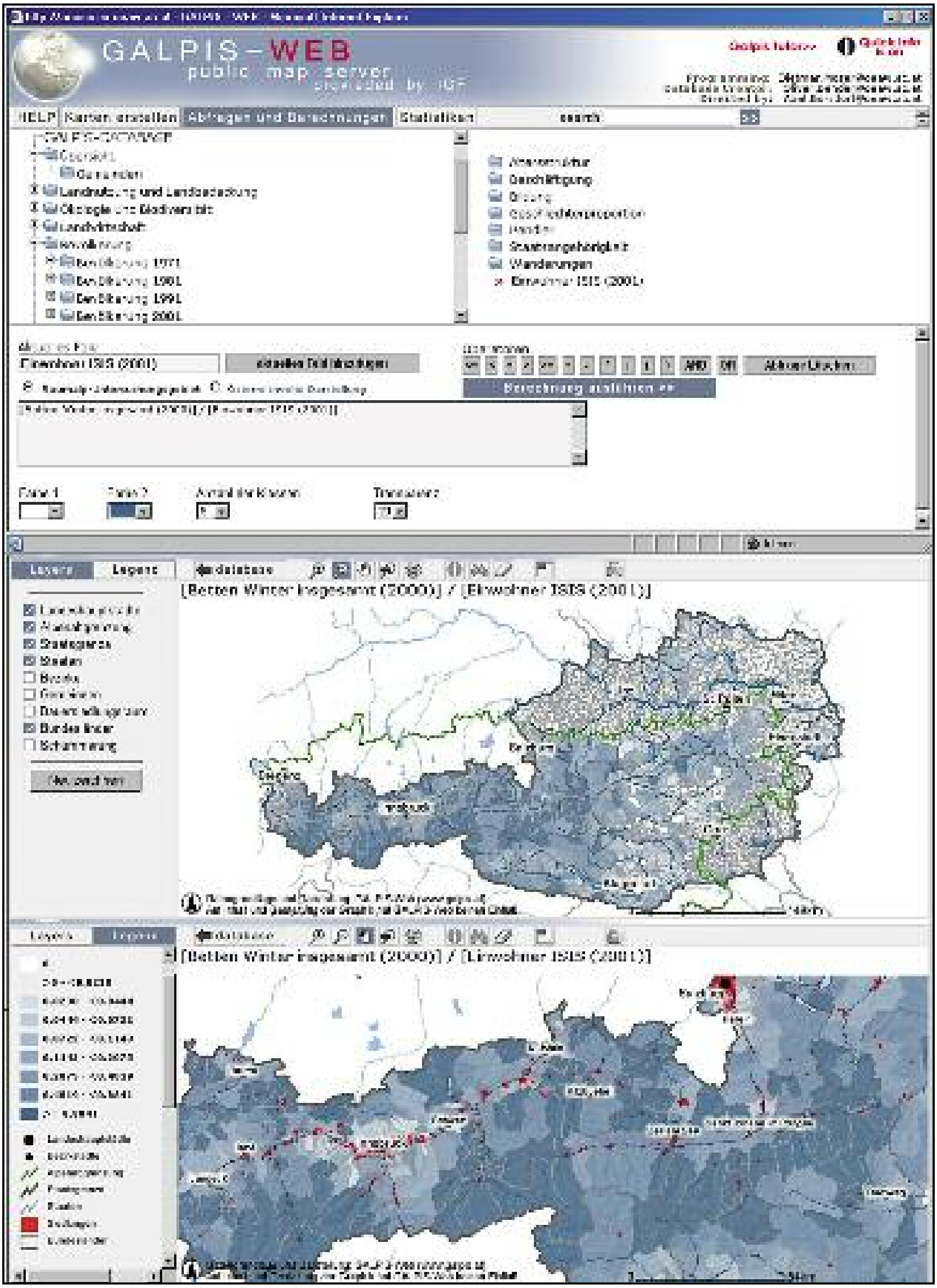

Figure 2: GALPIS-Web allows the graphic display of user-generated indicators (http://www.galpis.at) (Source: Galpis 2014).

4.2 Mountain.TRIP

The EU 7FP project mountain.TRIP (Mountain.TRIP 2014) used the entire spectrum of web 2.0–based technologies to link research with practice and to create an efficient communication and information system (Braun 2010). It includes short videos (published on YouTube; mountain.TRIP 2011), a communication platform, web-based posters and leaflets, tutorials, manuals, teaching tools, news flashes, a project database with an interactive map, a researcher database, job announcements, and a wiki-type information set. The manual is available in five languages and seeks to show practitioners and researchers how to find results and data on European mountain areas on the internet (Borsdorf et al. 2011). However, the wiki developed there (mountain.WOCUR) does not yet offer full wiki functionality.

5 Examples of mountain wikis

Within the context of sustainable regional development, wikis are particularly well suited to providing transformation knowledge because the information offered is not just consumed by practitioners but also generated and checked. Research results find their way to users, but users' insights also find their way back to researchers. In this way an enhanced exchange between research and practice is taking place that is urgently needed to achieve sustainable regional development.

Within mountain research, examples already exist on how wikis can be built as tools for collaborative regional planning and development. The Mountain.TRIP project, funded in the EU's Seventh Framework Programme from 2009 to 2011 (Braun 2010), is already completed. It included the information and communication platform mountain.WOCUR (a wiki for capitalizing useful research). In 2013 and 2014, another wiki was implemented within the Alpine Space Programme's WIKIAlps project (Marzelli 2014), also EU-funded. It makes Alpine research results available in a brief and easily comprehensible format.

The web platform mountain.WOCUR aims to support researchers in communicating their findings to selected stakeholders. The content is divided into four categories. Entries in the »Guidelines« category help in developing a communication strategy, offer orientation in defining a target audience, and show researchers how to assess the success of their communication. Entries in the »Examples« and »Lessons Learned« categories illustrate possible approaches and offer options for making one's own experiences useful for others. The »Background Knowledge« category in mountain.WOCUR contains explanations of terms for better understanding of technical or methodological terms.

In contrast, WIKIAlps aims to support the transnational application of national research results to make results from individual Alpine countries easier to understand and usable for political decision-makers, researchers, and businesspeople throughout the Alps. To this end, WIKIAlps applies three different perspectives: first, the project perspective, which analyses and reorganizes the results of research projects; second, the policy perspective, which identifies and tries to understand political and planning challenges and needs on the basis of transnational and national documents; and, third, the stakeholder perspective, which identifies and analyses institutional stakeholders.

Although both projects use wiki technology in their technical implementation, they differ in their intended usage. The mountain.WOCUR project offers communication knowledge in an attempt to improve the exchange of insights between science and practice. This instrument cannot be changed by users; rather, it is a kind of online encyclopedia. In contrast, WIKIAlps focuses on preparing concrete project results on sustainable development within the Alps and promoting their use. It is a genuine wiki and relies on its content not just being read but also updated, amended, and expanded by its users.

6 Conclusion: The contribution of web-based instruments to promoting sustainable regional development in the Alps

From the insights gained so far with web-based information and communication technologies within the Alps (Figure 3), it can be said that they represent a major step forward on the path to including all stakeholders in sustainable regional development. So far the central hypothesis of this article appears to be proved: new information and communication instruments enhance the implementation, promotion, assessment, and steering of sustainable regional development in the Alps. Web 2.0 technologies greatly expand the options for disseminating information and for communication between researchers, practitioners, and the public. Another considerable advantage is improved participation in decision-making processes: with the aid of the new instruments, non-experts can now not only gain information but also process data themselves and become involved in improving available information. Technologies that allow stakeholders to not only consume information but also generate it raise hopes that these processes can be carried out bottom-up and with broad public involvement. Approaches like that of WIKIAlps may thus be considered a milestone in the ongoing enhancement of collaborative regional planning and development. However, the possibilities have by no means been fully explored yet. Future challenges will mainly be to maintain the new participation tools beyond the development phase, to improve them further, and to ensure their usefulness for the wider public in the longer term.

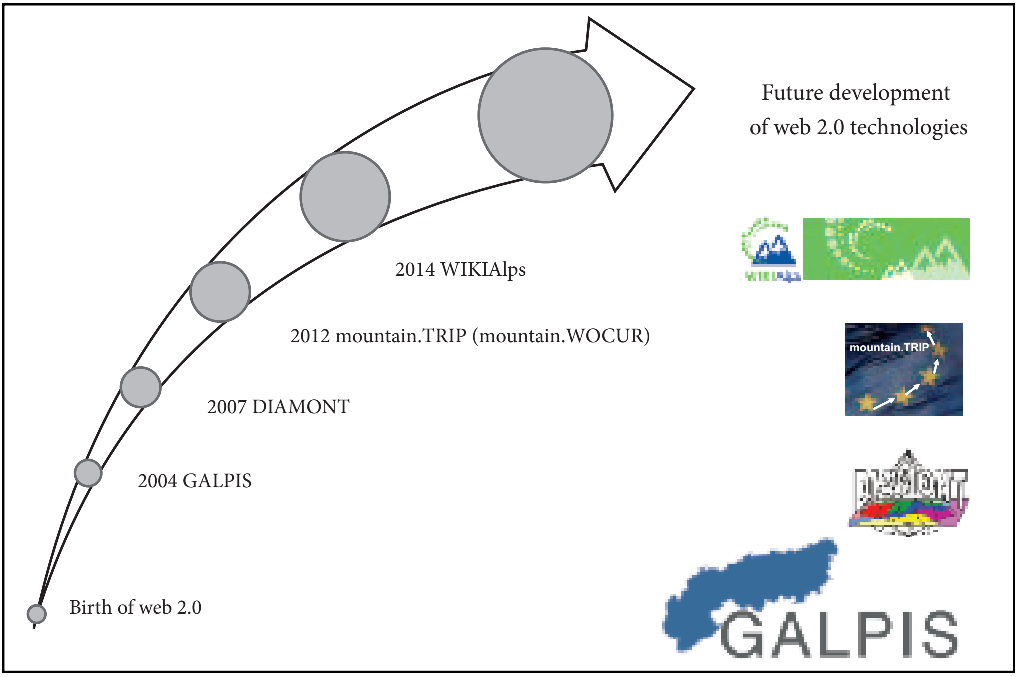

Figure 3: Development of instruments based on web 2.0 technologies in the Alps.

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Guidelines for Contributing Authors in Acta Geographica Slovenica – Geografski Zbornik

1 Aims and scopes

Acta geographica Slovenica – *Geografski zbornik* is the main Slovenian geographical scientific journal published by the Anton Melik Geographical Institute of the Research Centre of the Slovenian Academy of Sciences and Arts.

The journal is aimed at presentation of scientific articles from the fields of physical, human and regional geography. Review scientific articles are published, e.g. review and synthesis of already published articles on specific topic, and original research articles, e.g. first publication of original scientific results that allows repetition of the study and examination of results.

The journal was first published in 1952, and fourteen issues appeared periodically until 1976. Granted more permanent government funding, it has been published annually since 1976. From 2003, it is published twice a year. The journal is subsequently published in print and on the Internet in both Slovenian and English since 1994 (http://ags.zrc-sazu.si/). Each year, it is distributed in exchange for 200 scientific journals from around the world. The articles on the internet are read in more than 100 countries.

Acta geographica Slovenica – *Geografski zbornik* welcomes articles from all geographers in Slovenia, South-Eastern and Central Europe, as well as articles from those in related fields whose scientific and research work can enrich the overall view of the geographical environment.

Acta geographica Slovenica publishes articles in Slovenian and English. If one of the authors is from Slovenia the article has to be in English and Slovenian. The articles of the authors from abroad and the articles of special issues are only published in English. The articles in Slovenian have to be translated to English after a positive peer-review. If the article is translated by the editorial board the cost for authors is 500 €. If the authors provide a professional translation of the article it has to be lectored; the cost of lectoring for authors is 200 €. Slovenian articles are lectored by the editorial board. The articles that are submitted for publication in English need to be lectored after a positive peer-review. Lectoring is organized by the editorial board; the cost for authors is 200 €.

2 Article components

The articles published in the scientific journal *Acta geographica Slovenica* – Geografski zbornik should be arranged according to the IMRAD scheme: Introduction, Method, Results and Discussion. The articles must contain the following elements:

- article's main title in both English and Slovenian;
- abstract (up to 800 characters including spaces);
- up to eight key words;
- article in English (up to 20,000 characters including spaces) and identical article in Slovenian;
- reference list.

Text of the article should be equal in Slovenian and English.

The titles of chapters and subchapters in the article should be marked with ordinal numbers (for example, 1 Introduction, 1.1 Methodology, 1.2 Terminology). The division of an article into chapters is obligatory, but authors should use subchapters sparingly. It is recommended that the article includes Introduction, Conclusion and References chapters. The titles should be short and comprehensible. Authors should avoid using footnotes and endnotes.

3 Quoting

When quoting from source material, authors should state the author's last name and the year, separate individual sources with semicolons, order the quotes according to year, and separate the page information from the author's name and year information with a comma, for example »(Melik 1955, 11)« or »(Melik, Ilešič and Vrišer 1963; Kokole 1974, 7 and 8)«.If the source material has more than three authors only the first one should be listed (Melik et al. 1956).

The References' units should be listed according to the alphabetical order of the authors' second names. If there are more units from the same author in the same year, letters should be added to the citation (for example 1999a in 1999b).

Every unit consists of three sentences. In the first Author's name, publishing year and article's title are listed in front of the colon while the title is listed after it. The surnames of the authors and the initials of their names are separated by commas. The subtitle is separated from the title by a comma.

If the unit is an article, the name and number of the journal is indicated in the second sentence. If the unit is a monograph, there is no second sentence. The name of the publisher and number of pages are not listed. If the unit is not printed the type (e.g. diploma thesis) should be listed in the second sentence, separated from information of the institution by a comma. Laws should be qouted by a title, publication name and its number (e.g. Official gazette 56-2), separated from the publication year in the last part of the quotation.

In the third sentence the place of publishing or the place where the publication is kept are stated.

The Digital object identifier (DOI) has to be included to the quotes if available. For more details please visit webpage of the *Crossref* company (www.crossref.org; http://www.crossref.org/guestquery; http://dx.doi.org/).

Few examples:

1) for articles in journals:
- Melik, A. 1955a: Kraška polja Slovenije v pleistocenu. Dela Inštituta za geografijo 3.
- Melik, A. 1955b: Nekaj glacioloških opažanj iz Zgornje Doline. Geografski zbornik 5.
- Perko, D. 2002: Določanje vodoravne in navpične razgibanosti površja z digitalnim modelom višin. Geografski vestnik 74-2.
- Fridl, J., Urbanc, M., Pipan, P. 2009: The importance of teachers' perception of space in education. Acta geographica Slovenica 49-2. DOI: http://dx.doi.org/10.3986/AGS49205

2) for chapters in monographs or articles in proceedings:
- Lovrenčak, F. 1996: Pedogeografska regionalizacija Spodnjega Podravja s Prlekijo. Spodnje Podravje s Prlekijo, 17. zborovanje slovenskih geografov. Ljubljana.
- Mihevc, B. 1998: Slovenija na starejših zemljevidih. Geografski atlas Slovenije. Ljubljana.
- Komac, B., Zorn, M. 2010: Statistično modeliranje plazovitosti v državnem merilu. Od razumevanja do upravljanja, Naravne nesreče 1. Ljubljana.

3) for monographs:
- Natek, K., Natek, M. 1998: Slovenija, Geografska, zgodovinska, pravna, politična, ekonomska in kulturna podoba Slovenije. Ljubljana.
- Fridl, J., Kladnik, D., Perko, D., Orožen Adamič, M. 1998: Geografski atlas Slovenije. Ljubljana.
- Perko, D., Orožen Adamič, M. 1998: Slovenija – pokrajine in ljudje. Ljubljana.
- Oštir, K. 2006: Daljinsko zaznavanje. Ljubljana.

4) for expert's reports, diploma, master and doctoral thesis:
- Richter, D. 1998: Metamorfne kamnine v okolici Velikega Tinja. Diplomsko delo, Pedagoška fakulteta Univerze v Mariboru. Maribor.
- Šifrer, M. 1997: Površje v Sloveniji. Elaborat, Geografski inštitut Antona Melika ZRC SAZU. Ljubljana.

5) for sources with unkwnown authors and cartographic sources:
- Popis prebivalstva, gospodinjstev, stanovanj in kmečkih gospodarstev v Republiki Sloveniji, 1991 – končni podatki. Zavod Republike Slovenije za statistiko. Ljubljana, 1993.
- Digitalni model višin 12,5. Geodetska uprava Republike Slovenije. Ljubljana, 2005.
- Državna topografska karta Republike Slovenije 1 : 25.000, list Brežice. Geodetska uprava Republike Slovenije. Ljubljana, 1998.
- Franciscejski kataster za Kranjsko, k. o. Sv. Agata, list A02. 1823–1869. Arhiv Republike Slovenije. Ljubljana.
- Buser, S. 1986a: Osnovna geološka karta SFRJ 1 : 100.000, list Tolmin in Videm (Udine). Zvezni geološki zavod. Beograd.
- Buser, S. 1986b: Osnovna geološka karta SFRJ 1 : 100.000, tolmač lista Tolmin in Videm (Udine). Zvezni geološki zavod. Beograd.

6) for internet sources with known authors and/or titles:
- Vilhar, U. 2010: Fenološka opazovanja v okviru Intenzivnega spremljanja stanja gozdnih ekosistemov. Internet: http://www.gozdis.si/impsi/delavnice/Fenoloska%20opazovanja_Vilhar.pdf (19. 2. 2012).
- eGradiva, 2010. Internet: http://www.egradiva.si/ (11. 2. 2012).

7) for internet sources with unknown authors, titles or institutions:
- Internet: http://giam.zrc-sazu.si/ (22. 7. 2012).

8) for more internet sources with unknown authors
- Internet 1: http://giam.zrc-sazu.si/ (22. 7. 2012).
- Internet 2: http://ags.zrc-sazu.si/ (22. 7. 2012).

In case 7) the author is quoted in the text, for example (Vilhar 2010), while in case 8) only internet is quoted, for example (Internet 2).

The laws are cited as follows (name of the law, number of the official gazzette, place of publishing), for example:
- Zakon o kmetijskih zemljiščih. Uradni list Republike Slovenije 59/1996. Ljubljana.
- Zakon o varstvu pred naravnimi in drugimi nesrečami. Uradni list Republike Slovenije 64/1994, 33/2000, 87/2001, 41/2004, 28/2006 in 51/2006. Ljubljana.

If amemdments were proposed to the law they have to be quoted. In the text whole title of the law has to be quoted or its first few words if the title is a long one, for example (Zakon o kmetijskih zemljiščih 1996) ali (Zakon o varstvu … 1994).

All the quoted contributions have to be listed in the chapter References.

The authors should consider copyright rules of data owners, for example: the rules of the Geodetic survey of the Republic of Slovenia are available at http://e-prostor.gov.si/fileadmin/narocanje/pogoji_uporabe_podpisani.pdf.

4 Tables and figures

Authors should submit photographs and other graphic materials in a form suitable for scanning or in digital raster form with a resolution of 300 dpi, preferably in TIFF or JPG format formats in the printing size. If authors cannot deliver articles or graphic supplements prepared using the specified programs, they should consult the editorial board in advance: rok.ciglic@zrc-sazu.si.

All ***tables*** in the article should be numbered uniformly and have their own titles. The number and the text are separated by a colon, the caption is ended by a full stop. Example:
Table 1: Number of inhabitants of Ljubljana.
Table 2: Spreminjanje povprečne temperature zraka v Ljubljani (Velkavrh 2009).

The tables should contain no formatting and should not be too large – one-page tables are appreciated.

All ***illustrative material*** – Figures (photographs, maps, graphs, etc.) in the article should also be numbered uniformly and have their own titles. Example:

Figure 1: Location of measurement points along the glacier.

The journal has an established 16.5 cm × 23.5 cm format to which all graphic materials must be adapted. In the case of graphic illustrations for which the authors do not have the copyright, the authors must acquire permission to publish from the copyright owner. Authors must include the author's name with the title of the illustration.

Illustrative material should be precisely 134 mm wide (one page) or 64 mm wide (half page, one coloumn), height should not exceed 200 mm. If the figure is to be the size of the page, its size should be 134 × 192,3 mm (the subtitle is written in one line) or 134 × 200 mm (the subtitle is on the facing page).

Maps should be done in digital vector form using the Corel Draw program, and charts done using *Corel Draw* or *Adobe Illustrator* programs, especially if they contain text. They can also be done in digital raster form with resolution at least 300 dpi, preferably in TIFF or JPG formats in the printing size.

For maps made using CorelDraw or Adobe Illustrator programs,two separate files should be prepared; the original file (format .cdr or .ai) and the file with representation of the image (format .jpg).

For maps made using ArcGIS where raster layers were used next to vector layers (for example .tif of relief, airborne or satellite image), three files should be submitted: a file with vector image with not transparency used together with a legend and colophone (export in format.ai), the second file with raster image (export in .tif format), and the third one with vector and raster image together showing the final version of the map (export in format .jpg). Please use template files from the journal internet page.

No title should be printed on maps as they are written below them.

The colors should be saved in CMYK and not in RGB or other formats.

The *Times new roman* font, size 8, should be used to write the legend, as well as for colophon (size 6). In the colophon author, scale, source and copyright should be listed. The colophone should be written in both, English (and Slovenian), if space is available on the map. Example:
Scale/merilo: (grafično, tekstovno)
Author of contents/avtor vsebine: Drago Perko
Author of map/avtorica zemljevida: Jerneja Fridl
Source/vir: Statistical office of the Republic of Slovenia, 2002
© Anton Melik geographical institute ZRC SAZU, 2005

Graphs should be done in digital form using *Excel* program. Graphs should be done on separated sheets and accompanied by data.

Photographs have to be in raster format and in resolution 240 dots per cm or 600 dots per inch, preferably in.tif or .jpg formats, that is about 3200 dots per page width of the journal.

Figures showing **computer screen** should be prepared at the highest possible screen resolution (Nadzorna plošča\Vsi elementi nadzorne plošče\Zaslon\Ločljivost zaslona oziroma Control Panel\All Control Panel Items\Display\Screen Resolution). The figure is done by *print screen*, the data are pasted prilepi to the selected graphic programme (e.g. Paint) and saved as .tif. The size of the image or its resolution should not be changed.You can find templates of maps in cdr and mxd files for a whole page map in landscape view and an example of correct structure of files for a submission of a map made with ESRI ArcGIS on the journal webpage.

5 Article admission

Only original and new articles will be accepted for publication. Upon acceptance of your chapter, you will be required to sign a warranty that your article is original (contents–wording and formatting) and has not been submitted for publication or published elsewhere.

Authors must submit their contributions in digital form written in *Word* format using the template.

Supplementary files (figures) can be submitted packed in one zip file.

The text file should be unformatted, except for text written in bold and italic form. As the article is subject to changes during the review process it should first be submitted in either English or Slovenian language, and translated to the other language only after the acceptance for publication. The translation is an expense of the author.

The entire text should be written in lowercase (except for uppercase initial letters, of course) without unnecessary abbreviations and contractions. The text should be plain and only bold and italic formatting is allowed. Please use no other formatting, such as chapter or page numbering. Use sentence case in titles.

If a text is unsatisfactorily written, the editorial board can return it to the author to arrange to have the text proofread professionally or reject the publication of the article.

Date of acceptance of the article for publication is published after the abstract and key words. Authors should send articles using the editorial sistem of the journal at: ags.zrc-sazu.si.

6 Review process

All articles are examinated by one of the editors upon receipt. Afterwards the authors are usually asked to correct or change the article. After the articles have been corrected they are sent to two anonymous reviewers. The reviewers receive an article without the author's name, and the author receives the review(s) without the reviewer's names. If the reviews do not require the article to be corrected or augmented, the review will not be sent to the author.

If the size of the text fails to comply with the provisions for publication, the author shall allow the text to be appropriately modified according to the judgment of the publisher. The article may be rejected for publication by the reviewers or by the editors until it is finally accepted for publication.

7 Copyright

For articles sent for publication to *Acta geographica* Slovenica – *Geografski zbornik*, all the author's moral rights remain with the author, while the author's material rights to reproduction and distribution in the Republic of Slovenia and other states, are for no fee, for all time, for all cases, for unlimited editions, and for all media shall be unexclusively ceded to the publisher. The authors allow publication of the article or its components on the internet.

Author has to provide a professional translation. The name of the translator should be quoted. Authors should cooperate in the reviewing and editorial process.

Author gives permission to the publisher to change the article in order to be in accordance with the Guidelines, including the length of the article.

The publisher shall see to it that all accepted articles are published in *Acta geographica Slovenica – Geografski zbornik* and on the internet in accordance with the submission time and with the arrangement according to the themes discussed. Ordered contributions can be published regardless of the submission time.

No honoraria are paid for articles appearing in *Acta geographica* Slovenica – *Geografski zbornik* nor for the reviews.

The author shall receive one (1) free copy of the publication.

8 Submission preparation checklist

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 that do not adhere to these guidelines.

1. The submission has not been previously published, nor is it before another journal for consideration (or an explanation has been provided in Comments to the Editor).
2. The submission file is in Microsoft Word document file format.
3. Where available, URLs for the references have been provided.
4. The text is single-spaced; uses a 12-point font; employs italics, rather than underlining (except with URL addresses). All illustrations' and figures' locations within text are marked (illustrations and figures are not inside text!). Illustrations and figures are provided as supplementary files (cdr, ai for maps and illustrations; tif for photographs). Tables are placed within the text at the appropriate points. Supplementary files must not excess 50 MB.
5. The text adheres to the stylistic and bibliographic requirements outlined in the Author Guidelines, which is found in About the Journal.
6. **If submitting to a peer-reviewed section of the journal, the instructions in Ensuring a Blind Review have been followed.**
7. Supplementary files do not exceed 50 MB.
8. I agree for this article to be translated into English / Slovenian (if at least one of the authors is from Slovenia) or for the English grammar and spelling to be copyedited at my expense (see Guidelines for details) AFTER the article is accepted for publication.

9 Privacy statement

The names and email addresses entered in this journal site will be used exclusively for the stated purposes of this journal and will not be made available for any other purpose or to any other party.

10 Ordering

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The journal can be bought in the Azil bookshop, Novi trg 2, SI – 1000 Ljubljana, Slovenia or borrowed in the libraries (www.cobiss.si).

11 Acta geographica Slovenica Editorial review form

Acta geographica Slovenica editorial review form

1 The paper is an original scientific one – the paper follows the standard IMRAD scheme and is original and the first presentation of research results with the focus on methods, theoretical aspects or case study.)
Yes
No

2 The paper's content is suitable for publishing in the AGS journal – the paper is from the field of geography or related fields of interest, the presented topic is interesting and well presented. In case of negative answer add comments below.)
Yes
No

3 Editorial notes regarding the paper's content.

4 Length of the paper is acceptable for further processing (20.000 characters including space). If longer, the paper has to be shortened by the author and resubmitted.
- The paper has less than 20.000 characters.
- The paper has more than 20.000 characters, but less than 25.000.
- The paper has more than 25.000 characters.

5 The style and formatting of the paper is according to the AGS guidelines – the paper is prepared in plain text, no other text formatting is used than bold and italic. See the Guidelines of AGS journal for details.)
Yes
No

6 Notes regarding style and formatting.

7 Citing in the paper is according to the AGS guidelines and style, including DOI identificators.
Yes
No

8 The reference list is suitable (the author cites previously published papers with similar topic from other relevant scientific journal).
Yes, the author cited previously published papers on similar topic.
No, the author did not cite previously published papers on similar topic.

9 Scientific language of the paper is appropriate and understandable.
Yes
No

10 Supplementary files (ai, cdr, pdf, tif, jpg, xlsx etc.) that were added to the paper are in proper format and resolution (including the introductory photo), maps are prepared according to the AGS Guidelines. (In this step contact the technical editor ærok.ciglicᴀzrc-sazu.siÁ for assistance if needed).*
- Supplementary files are correct.
- Supplementary files are not appropriate and need a major correction.
- Some supplementary files need corrections.

11 Describe the possible deficiencies of the supplementary files:

12 DECISION OF THE RESPONSIBLE EDITOR*
The paper is accepted for further processing and may be sent to the reviewer.
The paper is accepted for further processing but needs technical improvements (see notes).
The paper is accepted for further processing but its content needs additional improvements (see notes).
The paper is not accepted for publication because:

- It is more suitable for a specialized journal.
- Does not fit the aims and scopes of the AGS journal.
- Is not an original scientific paper.
- The presentation of the results is poor.
- The paper is of very low quality.
- The paper has already been published elsewhere.
- Other (see comments below).
- Other reasons for rejection of the paper.

12 Acta geographica Slovenica review form

1 RELEVANCE

1a) Are the findings original and the paper is therefore a significant one?*
yes
no
partly

1b) Is the paper suitable for the subject focus of the AGS journal?*
yes
no

2 SIGNIFICANCE

2a Does the paper discuss an important problem in geography or related fields?*
yes
no
partly

2b Does it bring relevant results for contemporary geography?*
yes
no
partly

2c What is the level of the novelty of research presented in the paper?*
high
middle
low

3 ORIGINALITY

3a Has the paper been already published or is too similar to work already published?*
yes
no

3b Does the paper discuss a new issue?*
yes
no

3c Are the methods presented sound and adequate?*
yes
no
partly

3d Do the presented data support the conclusions?*
yes
no
partly

4 CLARITY

4a Is the paper clear, logical and understandable?*
yes
no

4b If necessary, add comments and recommendations to improve the clarity of the title, abstract, keywords, introduction, methods or conclusion:*

5 QUALITY

5a Is the paper technically sound? (If no, the author should discuss technical editor [rok.ciglic@zrc-sazu.si] for assistance.)*
yes
no

5b Does the paper take into account relevant current and past research on the topic?*
yes
no
Propose amendments, if no is selected:

5d Is the references list the end of the paper adequate?*
yes
no
Propose amendments, if no is selected:

5e Is the quoting in the text appropriate?*
yes
no
partly
Propose amendments, if no is selected:

5f Which tables are not necessary?

5g Which figures are not necessary?

6 COMMENTS OF THE REVIEWER

Comments of the reviewer on the contents of the paper:
Comments of the reviewer on the methods used in the paper:

7 RECOMMENDATION OF THE REVIEWER TO THE EDITOR-IN-CHIEF

My recommendation is:
Please rate the paper from 1 [low] to 100 [high]:
Personal notes of the reviewer to editor-in-chief.

Navodila avtorjem za pripravo člankov v *Acti geographici Slovenici* – Geografskem zborniku

1 Uvod

Acta geographica Slovenica – Geografski zbornik je osrednja slovenska znanstvena revija za geografijo, ki jo izdaja Geografski inštitut Antona Melika Znanstvenoraziskovalnega centra Slovenske akademije znanosti in umetnosti.

Revija je namenjena predstavitvi znanstvenih dosežkov s področja fizične, družbene in regionalne geografije ter sorodnih ved. Objavlja pregledna znanstvena besedila, to je pregled in sintezo že objavljenih najnovejših del o določeni temi, ter izvirna znanstvena besedila, to je prvo objavo originalnih raziskovalnih rezultatov v takšni obliki, da se raziskava lahko ponovi, ugotovitve pa preverijo.

Revija je prvič izšla leta 1952 in je do leta 1976, ko je bila natisnjena štirinajsta številka, izhajala občasno. Leta 1976 je zaradi trajnejše finančne pomoči države začela izhajati redno, od leta 2003 pa izhaja dvakrat letno v tiskani in elektronski obliki na medmrežju. Od leta 1994 izhaja enakovredno v slovenskem in angleškem jeziku (http://ags.zrc-sazu.si). Vsako leto jo razpošljemo v izmenjavo na več kot 200 naslovov po celem svetu. Članke na medmrežju berejo v več kot 100 državah sveta.

Acta geographica Slovenica – Geografski zbornik v objavo sprejema geografske članke iz Slovenije ter Jugovzhodne in Srednje Evrope. Objavljamo tudi članke geografiji sorodnih ved, katerih znanstveno in raziskovalno delo lahko obogati geografske poglede na pokrajino.

Acta geographica Slovenica objavlja članke v slovenskem in angleškem jeziku. Članki, pri katerih je vsaj eden od avtorjev iz Slovenije, morajo imeti tudi slovenski prevod. Članki avtorjev iz tujine in članki posebnih izdaj so objavljeni samo v angleškem jeziku. Članke, ki prispejo v slovenskem jeziku, je po pozitivni recenziji treba prevesti v angleščino. Če za prevod poskrbi uredništvo, je strošek prevoda za avtorje 500 €. Če avtorji sami poskrbijo za profesionalni prevod članka, je treba članek lektorirati, strošek lekture v višini 200 € pa nosijo avtorji. Za lekturo slovenskega dela članka poskrbi uredništvo. Članke, ki prispejo v angleškem jeziku, je po pozitivni recenziji treba nujno lektorirati. Za lekturo poskrbi uredništvo, strošek v višini 200 € pa nosijo avtorji.

2 Sestavine članka

Članki, objavljeni v znanstveni reviji *Acta geographica Slovenica* – Geografski zbornik so urejeni po shemi IMRAD (uvod, metoda, rezultati in razprava; angl.: *Introduction, Method, Results And Discussion*).

Članki, poslani v objavo, morajo imeti naslednje sestavine:
- glavni naslov v slovenskem in angleškem jeziku;
- izvleček dolžine do 800 znakov skupaj s presledki;
- do osem ključnih besed;
- članek v angleškem ali slovenskem jeziku, ki naj skupaj s presledki obsega do 20.000 znakov.
- seznam uporabljenih virov in literature, urejen skladno z navodili.

Besedilo člankov mora biti enakovredno v angleškem in slovenskem jeziku.

Članek naj ima naslove poglavij in naslove podpoglavij označene z vrstilnimi števniki (na primer: 1 Uvod, 1.1 Metodologija, 1.2 Terminologija). Razdelitev članka na poglavja je obvezna, podpoglavja pa naj avtor uporabi le izjemoma. Zaželeno je, da ima članek poglavja Uvod, Sklep in Literatura. Naslovi člankov naj bodo jasni in čim krajši. Avtorji naj se izognejo pisanju opomb pod črto na koncu strani in naj bodo zmerni pri uporabi tujk.

3 Citiranje v članku

Avtor naj pri citiranju med besedilom navede priimek avtorja, letnico ter po potrebi številko strani. Več citatov se loči s podpičjem in razvrsti po letnicah, navedbo strani pa se od priimka avtorja in letnice loči z vejico, na primer: (Melik 1955, 11) ali (Melik, Ilešič in Vrišer 1963, 12; Kokole 1974, 7 in 8). Če ima citirano delo več kot tri avtorje, se citira le prvega avtorja, na primer (Melik s sod. 1956, 217).

Enote v poglavju Viri in literatura naj bodo navedene po abecednem redu priimkov avtorjev, enote istega avtorja pa razvrščene po letnicah. Če je v seznamu več enot istega avtorja iz istega leta, se letnicam dodajo črke (na primer 1999a in 1999b). Zapis vsake citirane enote skladno s slovenskim pravopisom sestavljajo trije stavki. V prvem stavku sta navedena avtor in letnica izida (če je avtorjev več, so ločeni z vejico, z vejico sta ločena tudi priimek avtorja in začetnica njegovega imena, med začetnico avtorja in letnico ni vejice), sledi dvopičje, za njim pa naslov in morebitni podnaslov, ki sta ločena z vejico. Če je citirana enota članek, se v drugem stavku navede publikacija, v kateri je članek natisnjen, če pa je enota samostojna knjiga, drugega stavka ni. Izdajatelja, založnika in strani se ne navaja. Če enota ni tiskana, se v drugem stavku navede vrsta enote (na primer elaborat, diplomsko, magistrsko ali doktorsko delo), za vejico pa še ustanova, ki hrani to enoto. V tretjem stavku se za tiskane enote navede kraj izdaje, za netiskane pa kraj hranjenja. Pri navajanju literature, ki je vključena v sistem DOI (Digital Object Identifier), je treba na koncu navedbe dodati tudi številko DOI. Številke DOI so dodeljene posameznim člankom serijskih publikacij, prispevkom v monografijah in knjigam. Številko DOI najdete v samih člankih in knjigah, oziroma na spletni strani http://www.crossref.org/guestquery.

Nekaj primerov (ločila so uporabljena skladno s slovenskim pravopisom):

1) za članke v revijah:
- Melik, A. 1955a: Kraška polja Slovenije v pleistocenu. Dela Inštituta za geografijo 3. Ljubljana.
- Melik, A. 1955b: Nekaj glacioloških opažanj iz Zgornje Doline. Geografski zbornik 5. Ljubljana.
- Perko, D. 2002: Določanje vodoravne in navpične razgibanosti površja z digitalnim modelom višin. Geografski vestnik 74-2. Ljubljana.
- Fridl, J., Urbanc, M., Pipan, P. 2009: The importance of teachers' perception of space in education. Acta geographica Slovenica 49-2. Ljubljana. DOI: 10.3986/AGS49205

2) za poglavja v monografijah ali članke v zbornikih:
- Lovrenčak, F. 1996: Pedogeografska regionalizacija Spodnjega Podravja s Prlekijo. Spodnje Podravje s Prlekijo, 17. zborovanje slovenskih geografov. Ljubljana.
- Mihevc, B. 1998: Slovenija na starejših zemljevidih. Geografski atlas Slovenije. Ljubljana.
- Komac, B., Zorn, M. 2010: Statistično modeliranje plazovitosti v državnem merilu. Od razumevanja do upravljanja, Naravne nesreče 1. Ljubljana.

3) za monografije:
- Natek, K., Natek, M. 1998: Slovenija, Geografska, zgodovinska, pravna, politična, ekonomska in kulturna podoba Slovenije. Ljubljana.
- Fridl, J., Kladnik, D., Perko, D., Orožen Adamič, M. (ur.) 1998: Geografski atlas Slovenije. Ljubljana.
- Perko, D., Orožen Adamič, M. (ur.) 1998: Slovenija – pokrajine in ljudje. Ljubljana.
- Oštir, K. 2006: Daljinsko zaznavanje. Ljubljana.

4) za elaborate, diplomska, magistrska, doktorska dela ipd.:
- Richter, D. 1998: Metamorfne kamnine v okolici Velikega Tinja. Diplomsko delo, Pedagoška fakulteta Univerze v Mariboru. Maribor.
- Šifrer, M. 1997: Površje v Sloveniji. Elaborat, Geografski inštitut Antona Melika ZRC SAZU. Ljubljana.

5) za vire brez avtorjev in kartografske vire:
- Popis prebivalstva, gospodinjstev, stanovanj in kmečkih gospodarstev v Republiki Sloveniji, 1991 – končni podatki. Zavod Republike Slovenije za statistiko. Ljubljana, 1993.
- Digitalni model višin 12,5. Geodetska uprava Republike Slovenije. Ljubljana, 2005.
- Državna topografska karta Republike Slovenije 1 : 25.000, list Brežice. Geodetska uprava Republike Slovenije. Ljubljana, 1998.
- Franciscejski kataster za Kranjsko, k. o. Sv. Agata, list A02. 1823–1869. Arhiv Republike Slovenije. Ljubljana.
- Buser, S. 1986a: Osnovna geološka karta SFRJ 1 : 100.000, list Tolmin in Videm (Udine). Zvezni geološki zavod. Beograd.
- Buser, S. 1986b: Osnovna geološka karta SFRJ 1 : 100.000, tolmač lista Tolmin in Videm (Udine). Zvezni geološki zavod. Beograd.

Avtorji vse pogosteje citirajo vire z medmrežja. Če sta znana avtor in/ali naslov citirane enote, potem se jo navede takole (datum v oklepaju pomeni čas ogleda medmrežne strani):

- Vilhar, U. 2010: Fenološka opazovanja v okviru Intenzivnega spremljanja stanja gozdnih ekosistemov. Medmrežje: http://www.gozdis.si/impsi/delavnice/Fenoloska%20opazovanja_Vilhar.pdf (19. 2. 2010).
- eGradiva, 2010. Medmrežje: http://www.egradiva.si/ (11. 2. 2010).

Če avtor, naslov ali ustanova niso poznani, se navede le:

- Internet: http://giam.zrc-sazu.si/ (22. 7. 2011).

Če se navaja več enot z medmrežja, se doda še številko:

- Internet 1: http://giam.zrc-sazu.si/ (22. 7. 2011).
- Internet 2: http://zgs.zrc-sazu.si/ (22. 7. 2011).

Med besedilom se v prvem primeru navede avtorja, na primer (Vilhar 2010), v drugem primeru pa le medmrežje, na primer (Internet 2).

Zakone se citira v naslednji obliki (ime zakona, številka uradnega lista, kraj izida), na primer:

- Zakon o kmetijskih zemljiščih. Uradni list Republike Slovenije 59/1996. Ljubljana.
- Zakon o varstvu pred naravnimi in drugimi nesrečami. Uradni list Republike Slovenije 64/1994, 33/2000, 87/2001, 41/2004, 28/2006 in 51/2006. Ljubljana.

Če ima zakon dopolnitve, je treba navesti tudi te. Med besedilom se zakon navaja s celim imenom, če gre za krajše ime, ali pa z nekaj prvimi besedami in tremi pikami, če gre za daljše ime. Na primer (Zakon o kmetijskih zemljiščih 1996) ali (Zakon o varstvu … 1994).

V poglavju *Viri in literatura* morajo biti navedena vsa dela, citirana v prispevku, ostalih, necitiranih del pa naj avtor ne navaja.

Avtorji naj upoštevajo tudi navodila za navajanje virov lastnika podatkov ali posrednika, če jih le-ta določa. Primer: Geodetska uprava Republike Slovenije ima navodila za navajanje virov določena v dokumentu »Pogoji uporabe geodetskih podatkov« (http://e-prostor.gov.si/fileadmin/narocanje/pogoji_uporabe_podpisani.pdf).

4 Preglednice in grafične priloge v članku

Priloge morajo prav tako oddati natisnjene v digitalni obliki v ustreznem formatu. Fotografije in druge grafične priloge morajo avtorji, če je le mogoče, oddati v obliki, primerni za skeniranje, sicer pa v digitalni rastrski obliki z ločljivostjo vsaj 300 pik na palec ali 120 pik na cm, najbolje v formatu TIFF ali JPG in končni velikosti slike. Če avtorji ne morejo oddati prispevkov in grafičnih prilog, pripravljenih v omenjenih programih, naj se predhodno posvetujejo z uredništvom (rok.ciglic@zrc-sazu.si).

Vse ***preglednice*** v članku so oštevilčene in imajo svoje naslove. Med številko in naslovom je dvopičje. Naslov konča pika. Primer:

Preglednica 1: Število prebivalcev Ljubljane po posameznih popisih.

Preglednica 2: Spreminjanje povprečne temperature zraka v Ljubljani (Velkavrh 2009).

Vse ***grafične priloge*** – slike (fotografije, zemljevidi, grafi in podobno) v članku so oštevilčene enotno in imajo svoje naslove. Med številko in naslovom je dvopičje. Naslov konča pika. Primera:

Slika 1: Rast števila prebivalcev Ljubljane po posameznih popisih.

Slika 2: Izsek topografske karte v merilu 1 : 25.000, list Kranj.

Avtorji morajo za grafične priloge, za katere nimajo avtorskih pravic, priložiti fotokopijo dovoljenja za objavo, ki so ga pridobili od lastnika avtorskih pravic.

Grafične priloge naj bodo široke točno 134 mm (cela širina strani) ali 64 mm (pol širine, 1 stolpec), visoke pa največ 200 mm. V primeru, da želimo imeti celostransko sliko ali zemljevid, mora biti njuna velikost 134 × 192,3 mm (podnapis h grafični prilogi je enovrstičen) ali 134 × 200 mm (podnapis h grafični prilogi je naveden na sosednji strani).

Slikovno gradivo (zemljevidi, sheme in podobno) naj bo v formatih .ai ali .cdr, fotografije pa v formatih .tif ali .jpg.

Zemljevidi naj bodo izdelani v digitalni obliki. Zaželeno je, da so oddani v vektorski obliki, pripravljeni s programom *Corel Draw* ali *Adobe Illustrator*, zlasti če vsebujejo besedilo. Možno jih je oddati tudi v rastrski obliki z ločljivostjo vsaj 300 pik na palec ali 120 pik na cm, najbolje v formatu TIFF ali JPG in končni velikosti slike.

Pri tistih zemljevidih in shemah, izdelanih s programom ArcGIS, kjer so poleg vektorskih slojev kot podlaga uporabljeni tudi rastrski sloji (na primer .tif reliefa, letalskega ali satelitskega posnetka in podobno), oddajte tri ločene datoteke. V prvi naj bodo samo vektorski sloji z izključeno morebitno prosojnostjo poligonov skupaj z legendo in kolofonom (izvoz v formatu .ai), v drugi samo rastrska podlaga (izvoz v formatu .tif), v tretji, kontrolni datoteki pa vektorski in rastrski sloji skupaj, tako kot naj bi bil videti končni zemljevid v knjigi (izvoz v formatu .jpg). To je nujno, da tudi natisnjeni zemljevid ohrani ustrezno kakovost.

Zemljevidi naj bodo brez naslova, ker je naveden v podnapisu. Za izdelavo zemljevidov uporabite predloge s spletne strani revije.

Pri izbiri in določanju barv za slikovne priloge uporabite zapis CMYK in ne RGB oziroma drugih.

Za legendo zemljevida je potrebno uporabiti tip pisave *Times new roman* velikosti 8 pik, za kolofon pa isto vrsto pisave velikosti 6 pik. V kolofonu naj so po vrsti od zgoraj navzdol v angleškem in slovenskem jeziku navedeni: merilo (grafično ali besedilno), avtor vsebine, avtor zemljevida, vir in ustanova oziroma nosilec avtorskih pravic. Kolofon mora biti v angleškem in slovenskem jeziku razen kjer to zaradi prostorskih omejitev ni možno. Primer:
Scale/merilo: (grafično, besedilno)
Author of contents/avtor vsebine: Drago Perko
Author of map/avtorica zemljevida: Jerneja Fridl
Source/vir: Statistični urad RS, 2002
© Geografski inštitut Antona Melika ZRC SAZU, 2005

Pri zemljevidih in shemah, izdelanih v programih CorelDraw ali Adobe Illustrator, oddajte dve ločeni datoteki; poleg originalnega zapisa (format .cdr ali .ai) dodajte še datoteko, ki prikazuje, kako naj bo videti slika (format .jpg).

Grafikoni naj bodo izdelani s programom *Excel*. Na posameznem listu naj bodo skupaj z grafom tudi podatki, na podlagi katerih je bil izdelan.

Fotografije mora avtor oddati v digitalni rastrski obliki z ločljivostjo vsaj 240 pik na cm oziroma 600 pik na palec, najbolje v formatu .tif ali .jpg, kar pomeni približno 3200 pik na celo širino strani v reviji.

Slike, ki prikazujejo računalniški zaslon, morajo biti narejene pri največji možni ločljivosti zaslona (ločljivost uredimo v: Nadzorna plošča\Vsi elementi nadzorne plošče\Zaslon\Ločljivost zaslona oziroma Control Panel\All Control Panel Items\Display\Screen Resolution). Sliko se nato preprosto naredi s pritiskom tipke print screen, prilepi v izbran grafični program (na primer Slikar, Paint) in shrani kot .tif. Pri tem se slike ne sme povečati ali pomanjšati oziroma ji spremeniti ločljivost. Po želji lahko uporabite tudi ustrezne programe za zajem zaslona in shranite sliko v zapisu .tif.

5 Sprejemanje prispevkov

Za objavo v reviji *Acta geographica Slovenica* sprejemamo le izvirne oziroma nove znanstvne članke. Avtor s podpisom potrdi izjavo o izvirnosti vsebine in podobe članka ter dejstvo, da članek še ni bil posredovan v objavo drugam oziroma drugje še ni bil objavljen.

Avtorji morajo besedilo prispevkov oddati v digitalni obliki prek spletne strani ags.zrc-sazu.si. Prispevki morajo biti izdelani v programu Word.

Zaradi morebitnih sprememb v postopku recenzije in urejanja naj članek najprej oddajo v slovenskem jeziku, po sprejemu za objavo pa še v angleškem. Prevod je strošek avtorja.

Digitalni zapis besedila naj bo povsem enostaven, brez zapletenega oblikovanja, samodejnih naslovov, poravnave desnega roba, deljenja besed, podčrtavanja in podobnega. Avtorji naj označijo le mastni (krepki) in ležeči tisk. Besedilo naj bo v celoti izpisano z malimi črkami (razen velikih začetnic, seveda), brez nepotrebnih krajšav, okrajšav in kratic.

Če besedilo slovnično ali vsebinsko ni ustrezno napisano, ga uredniški odbor avtorju lahko vrne v popravek, zahteva lektoriranje ali članek zavrne. Datum prejetja članka je objavljen za angleškim prevodom izvlečka in ključnih besed.

Avtorji naj prispevke pošiljajo prek sistema OJS na naslovu ags.zrc-sazu.si.

6 Recenziranje člankov

Članke najprej pregleda eden od področnih urednikov. Avtorji člankov so potem običajno pozvani, da članek ustrezno dopolnijo ali popravijo. Sledi recenzentski postopek, ki je praviloma anonimen. Recenzenta prejmeta članek brez navedbe avtorja članka, avtor članka pa prejme recenzijo brez navedbe recenzenta. Če recenzija ne zahteva popravka ali dopolnitve članka, se avtorju članka recenzij ne pošlje. Avtor dovoljuje, da uredništvo prispevek krajša ali drugače prilagodi, da bo primeren za objavo. Na predlog uredništva ali recenzenta se lahko zavrne objavo prispevka.

7 Avtorske pravice

Za avtorsko delo, poslano za objavo v *Acti geographici Slovenici* – Geografskem zborniku, vse moralne avtorske pravice pripadajo avtorju, materialne avtorske pravice reproduciranja in distribuiranja v Republiki Sloveniji in v drugih državah pa avtor brezplačno, enkrat za vselej, za vse primere, za neomejene naklade in za vse medije neizključno prenese na izdajateljico. Avtor dovoljuje objavo članka ali njegovih delov na medmrežju.

Avtor sam poskrbi za profesionalni prevod članka ter obvezno navede ime in priimek prevajalca. Avtorji so dolžni sodelovati v procesu lektoriranja besedila in urejanja članka.

Če obseg avtorskega dela ni skladen z navodili za objavo, avtor dovoljuje izdajatelju, da avtorsko delo po svoji presoji ustrezno prilagodi.

Izdajatelj poskrbi, da se vsi prispevki s pozitivno recenzijo, če so zagotovljena sredstva za tisk, objavijo v *Acti geographici Slovenici* – Geografskem zborniku in na medmrežju, praviloma skladno z vrstnim redom prispetja prispevkov in skladno z enakomerno razporeditvijo prispevkov po temah. Naročeni prispevki se lahko objavijo ne glede na datum prispetja.

Prispevki v reviji *Acta geographica Slovenica* – Geografski zbornik niso honorirani niti niso honorirani recenzenti.

Avtorju pripada 1 brezplačen izvod publikacije.

8 Priprava kontrolnega seznama v sistemu OJS

Kot del postopka oddaje članka morajo avtorji preveriti skladnost članka in navodil. Uredništvo si pridržuje pravico, da avtorjem vrne članek v popravek, če ta ni pripravljen skladno s temi navodili. Avtorji morajo upoštevati naslednja navodila:

1. Članek ni bil predhodno objavljen niti ni v postopku objave v drugi reviji oziroma je to razloženo v komentarju uredniku).
2. Datoteka je shranjena v formatu Microsoft Word.
3. Če so na voljo, so predloženi URL-ji in DOI referenc.
4. Besedilo ima enojne razmike s pisavo velikosti 12 točk; za poudarjanje vsebine uporablja ležeč ali krepki format brez podčrtovanja (razen URL naslovov). V besedilu je s podnapisi označena lega slik, ilustracije in slike pa niso vnesene v besedilo, temveč so oddane v posebnih datotekah (.cdr, .ai za zemljevide in ilustracije; .tif za fotografije). Preglednice so na ustreznih mestih besedilu. Velikost posamezne dodatne datoteke ne sme preseči 50 MB.
5. Besedilo je pripravljeno skladno z oblikovnimi in bibliografskimi merili za pripravo člankov za objavo v reviji *Acta geographica Slovenica*, ki so objavljene v poglavju *About* na spletni strani http://ojs.zrc-sazu.si/ags.
6. Pri oddaji članka so bila upoštevana navodila za zagotavljanje anonimne recenzije članka.
7. Velikost dodatnih datotek ne presega 50 MB.
8. Če je vsaj eden od avtorjev iz Slovenije, se strinjamo, da bomo dali članek na naše stroške prevesti v angleški / slovenski jezik oziroma dali lektorirat angleški del članka (za podrobnosti glej navodila), POTEM ko bo sprejet za objavo.

9 Izjava o zasebnosti

Imena in e-poštni naslovi, vneseni v tej reviji mestu se bodo uporabljali izključno za navedene namene te revije in ne bodo na voljo za kakršne koli druge namene ali za katero koli drugo stranko.

10 Naročanje

Acto geographico Slovenico – Geografski zbornik lahko naročite na naslovu založnika:
Založba ZRC
Novi trg 2, p. p. 306
SI – 1001 Ljubljana, Slovenija

telefon: +386 (0)1 470 64 64
faks: +386 (0)1 425 77 94
e-pošta: zalozba@zrc-sazu.si

Revijo je mogoče tudi kupiti v knjigarni Azil na Novem trgu 2 v Ljubljani ali si jo sposoditi v knjižnicah (www.cobiss.si).

11 Obrazec za uredniški pregled člankov

Obrazec za uredniški pregled člankov v reviji Acta geographica Slovenica – Geografskem zborniku je zaradi uporabe uredniškega sistema *Open journal system* (OJS) zaenkrat dostopen samo v angleškem jeziku. Glej angleški del navodil.

12 Obrazec za recenzijo člankov

Obrazec za recenzijo člankov v reviji Acta geographica Slovenica – Geografskem zborniku je zaradi uporabe uredniškega sistema *Open journal system* (OJS) zaenkrat dostopen samo v angleškem jeziku. Glej angleški del navodil.

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