

CULTIVATED TERRACES IN SLOVENIAN LANDSCAPES

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A terraced olive grove in Krkavče.

Cultivated terraces in Slovenian landscapes

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ABSTRACT: Cultivated terraces distinctively mark the landscape and are a result of human adaptation to steep areas. Terraces were studied with regard to their morphometric qualities, ownership structure, and land use at eight pilot sites in various landscape types in Slovenia. Twenty-six detailed interviews were carried out with local residents and experts. In current agricultural practice, terraces mostly represent obstacles, and for owners they create a loss rather than profit; however, they represented an advantage in the past, when they were cultivated manually. Land use is intensifying on economically profitable terraces. Among those examined, the Jeruzalem terraces stand out because these are the youngest ones (created in socialist Yugoslavia around 1965). Because of their aesthetic value, they are the best known among the public. Profitability in particular will be an important driving force for the future maintenance of terraces.

KEYWORDS: geography, terraces, cultural landscape, terraced landscape, cultural heritage, Slovenia

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1 Introduction

Cultivated terraces are step-shaped relief forms on inclined land (Križaj Smrdel 2010), which ranks them among the distinctive elements of cultural landscapes. They are a response to human adaptation to natural conditions in steep areas. A distinction is made between irrigated and dry terraces (Rivera 2012). Generations of people invested enormous amounts of labor in their construction, and in many places they completely changed the appearance of the landscape. In places, in developed civilizations they appeared in an organized manner over millennia, and in others they were created spontaneously. Slovenia is criss-crossed by terraces to an extent rarely found in other European countries. In certain places they are so important that one can speak of terraced landscapes, whereas in others they are less distinct and can only be discerned through detailed studies (Kladnik et al. 2016).

As a unique landscape system terraced landscapes were recognized at the global level at the conference on terraced landscapes held in Mengzi, China, where the Honghe declaration on the protection and development of global terraced civilizations was adopted (Peters and Junchao 2012). The terraced landscapes of eastern, southeast, and southern Asia have been discussed by various authors: for example, Liu et al. (2004) studied water flow on terraces, and Min and Zhiyong (2012) wrote about the role of women in working terraced areas among the Hani people. Classification of terraced landscapes in Africa was carried out by Rose (2008), and in South America manmade terraces in the Andes were studied by Goodman Elgar (2002) and Kendall (2012), among others; Kendall dedicated special attention to terraces as a method of adapting the land for food production. In Europe, there is a predominance of studies on terrace management (e.g., Stanchi et al. 2012; Tarolli, Preti and Romano 2014) and the consequences of their overgrowth (e.g., Höchtl, Lehringer and Konold 2005). The economic role of cultivating land in terraces in the Alpine countries has been dealt with in Italy (Scaramelini and Varoto 2008), Switzerland (Lavaux 2007), and France (Jeddou et al. 2008). Špulerová et al. (2017) described the qualities of terraced landscapes in Slovakia. Andlar, Šrajter and Trojanović (2017) studied solutions for avoiding the deterioration of the terraced cultural landscape, which is occurring in Croatia due to accelerated deagrarization and rapid tourism development. In Slovenia, cultivated terraces have long been a marginal topic, and they were only investigated in detail in Istria by Titl (1965). The first detailed analyses were made of the Gorizia Hills (*Goriška Brda*) (Ažman Momirski et al. 2008) and the Brkini Hills (Ažman Momirski and Kladnik 2015). Terracing across all of Slovenia was studied by Ažman Momirski and Kladnik (2009) and Križaj Smrdel (2010). Kladnik et al. (2016) offered detailed data on terraced landscapes in Slovenia.

Despite the important role of terraced landscapes in the Slovenian economy and their landscape function, there is still no detailed study at the national level that 1) presents the attitude of owners and experts toward terraces, and 2) examines their multiple importance. This article studies the characteristics of cultivated terraces and their use at selected pilot sites in various Slovenian landscape types. It is hypothesized that the share of privately owned overgrown terraced land is smaller than that of publicly owned land of this type.

2 Methods

Eight pilot sites or settlements were selected (Figure 1) within eight of the nine landscape types according to Perko's (1998, 2007, 2015) classification of Slovenia. The pilot sites have an above-average share of terraced land in comparison to the proportion of terraces in individual landscape types. The final selection was made based on the morphometric characteristics of the terraces (inclination, aspect, and elevation), the researchers' own judgement of their aesthetic value (visual impact), and public awareness of them. No pilot site was selected in the Pannonian plains landscape type, where only 0.05% of the land is terraced.

The pilot sites were studied using a combination of desk work and fieldwork. The sites were first studied using digital orthophotos (Digitalni ortofoto posnetek 2015), and then shaded relief, which was created with the help of laser scanning data (LIDAR 2015). Because laser scanning can also detect relief formations if the site is covered by vegetation, it can provide data for very accurate digital elevation model (DEM)

Figure 1: Map of landscape types and pilot sites. ►

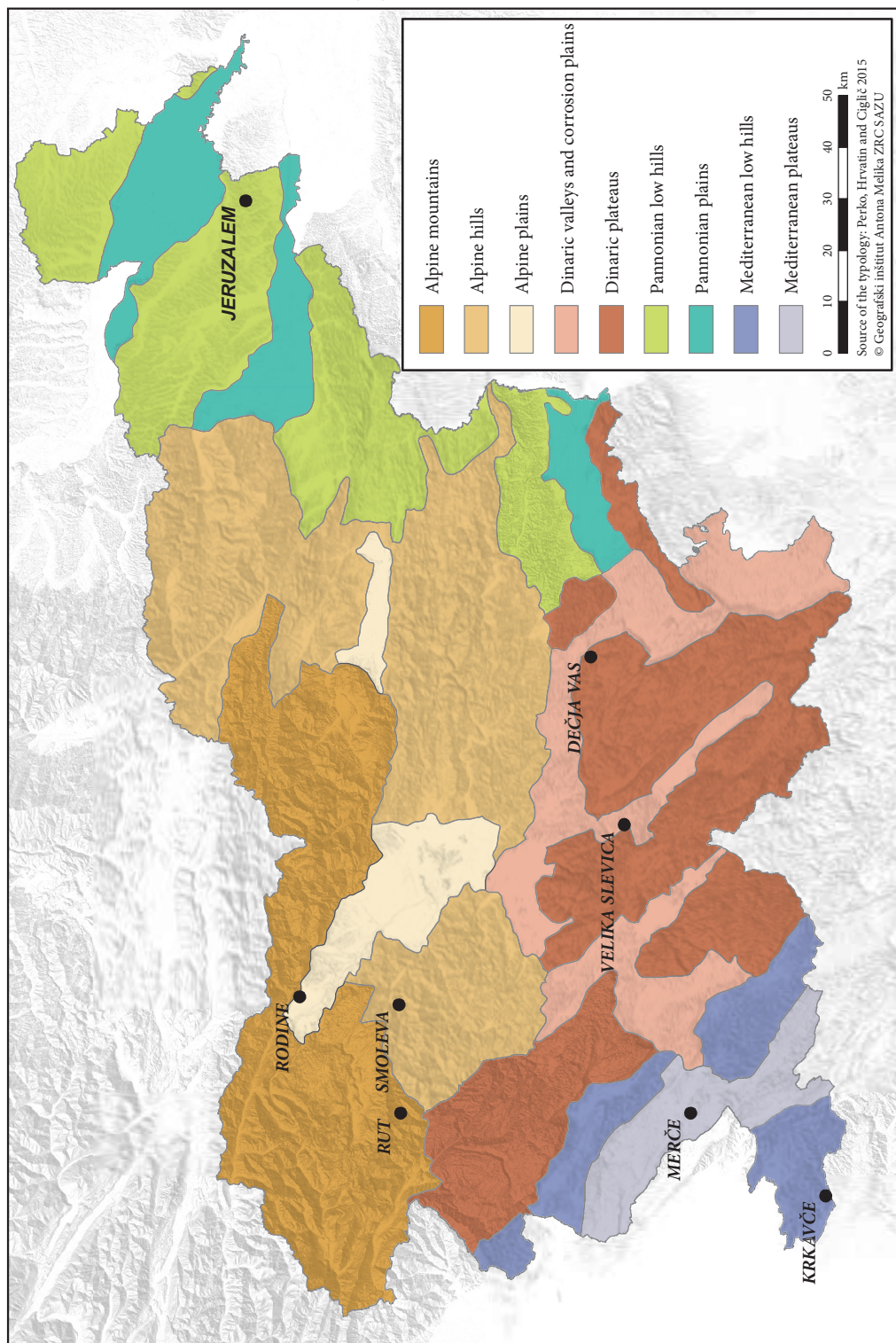




Figure 2: Comparison of a digital orthophoto (left) and shaded relief based on laser scanning (right) for the Krkavče site. Shaded relief makes it possible to also identify terraces under vegetation.

generation. This is very important in determining the layout of terraced landscapes because it makes it possible to register terraces that are overgrown or even covered by forest (Figure 2). The terraces that were identified were then digitized, and overlapping data layers were used to study their morphometric properties (elevation, inclination, and aspect), ownership structure, and land use.

A DEM (with a resolution of 1×1 m) derived from laser scanning data was used to analyze the pilot sites. For the land use analysis, data from Ministry of Agriculture, Forestry and Food (Grafični podatki RABA ... 2015) were used. Information on the owners of individual parcels was obtained from the Land cadastre (Zemljiški kataster 2014). Owners were sorted into ten different categories (private individuals, legal entities, the state, the Slovenian Farmland and Forest Fund, agriculture communities, municipalities, parishes, property in public domain, general-use public property, and unknown), and the influence of ownership structure on land use was analyzed.

The fieldwork was based on observations and 26 structured interviews that were carried out at the pilot sites in 2014 with 16 local residents that owned terraced land, 5 residents that were not owners, and 5 experts in nature conservation, cultural heritage protection, history, archaeology, and agriculture, respectively. The questionnaire for owners contained 22 questions about the influence of terraces on the settlement, their use, their significance, and their preservation. Non-owners were asked about the same issues, except for questions connected with cultivating and maintaining the terraces. Experts were asked 10 questions regarding challenges connected with terraces, their possible protection and future development, and 1 specific question connected to their field of expertise. The audio recordings and transcriptions of the interviews are kept at the Archives of the ZRC SAZU Anton Melik Geographical Institute.

3 Results

The history, time, and reason connected with the creation of the terraces, and their position, appearance, current status, and dominant processes differed greatly between landscapes. Some cultivated terraces were shaped centuries ago, and the most recent were created in the 1960s. The characteristics of the terraced landscape are connected with the shape of the terrain, as well as lithological, pedological, climatological, and other natural and social characteristics of the landscape. In order to highlight their variety, the pilot sites, which were selected based on the criteria in Chapter 2, are briefly presented. Their basic characteristics were identified with the help of spatial analyses, in-depth interviews, and field visits (Figures 3, 4, and 5; Table 1).

At the **Rut** site (Alpine mountains) the terraces were created following the settlement of Tyrolean farmers from the vicinity of San Candido (Germ. *Innichen*) in the Puster Valley in the 13th century (Torkar 1994).

Near the village, cleared stones were laid into dry walls that support the terraces. Originally they contained small cultivated fields, known as *flančniki*, or seedling plots, and *repniki*, or plots for turnips and other vegetables. The former fields are now predominantly meadows and pastures, and the small plots have fallen into disrepair and are overgrown. All of the non-terraced land in Rut is being intensively overgrown, but the terraced land is not. Therefore in a few decades the terrace site in Rut will be the only land that has not undergone afforestation.

In **Smoleva** (Alpine hills) the terraces were created during medieval colonization of hilly areas (Blaznik 1928; Ilešič 1938). The steep slopes and the bottoms of two ravines that open to the southwest were terraced in order to facilitate cultivation of fields and reduce soil erosion. In the past, they contained fields with all sorts of cultivars for subsistence farming, but they have now been replaced by meadows. Because of the strong incline of the slope, the terraces are narrow and have high earthen embankments. Their maintenance is encumbered by the landslide-prone slopes.

In **Rodine** (Alpine plains) the terraces are in a warm zone at the foot of the hills. The terrace platforms are several dozen meters long and at least five meters wide, and the embankments are low, gently sloping, made of earth, and overgrown with grass. A special feature among the embankments is two relatively well-preserved dry stone walls. In the past, more than half of the terraces were used as cultivated fields, whereas today meadows and pastures predominate.

In **Jeruzalem** (Pannonian low hills), the information gathered in the interviews indicates that vineyard terraces were created around 1965 on land that had been nationalized after the Second World War (Pipan and Kokalj 2017). Due to the lack of manual labor, the terraces were built to accommodate the mechanical cultivation available at the time. The terracing was so intense that it was carried out all the way to the houses at the top of the ridge. In 2015, 89.8% of the terraced land was used for vineyards.

In **Dečja vas** (Dinaric plateaus) the terraces are characterized by reddish-brown soil. Terraced land is surrounded by the clustered village on all sides. The terraces in Dečja vas are marked by a predominance of cultivated fields, which cover more than half (51%) of all terraced land, which is noteworthy not only among Slovenian terraced landscapes, but also among agricultural landscapes in general.

The terraces in **Velika Slevica** (Dinaric valleys and corrosion plains) represent the Lower Carniolan type of terraces (Križaj Smrdel 2010). Old agricultural terraces extend along the full length of slopes, especially those facing the southeast. They have recently been subject to grass overgrowth. All of the embankments are earthen and overgrown with grass, and in places one can notice the first signs of overgrowth with bushes. The greatest danger threatening their long-term existence is ownership fragmentation, which encumbers economical and intensive cultivation.

The terraces in **Krkavče** (Mediterranean low hills) are believed to date back to Antiquity (Gaspari 1998). In the past they were used to cultivate vineyards, fruit trees, and vegetables, but today olive groves predominate because of their profitability and mechanical cultivation. Nearly one-third of the terraces are already afforested. The trend of overgrowth is continuing, whereby the terraces where olives do not thrive are being abandoned first. An important factor in their abandonment is the protected status of the Dragonja River region, which is an obstacle to use. Dry stone walls have largely been replaced by earthen embankments.

In **Merče** (Mediterranean plateaus) there are no terraces at all on karstified soil (Jurkovšek et al. 1996; Jurkovšek, Cvetko Tešovič and Kolar-Jurkovšek 2013); they are found on dolomite and are laid out concentrically around the central village depression. They are bordered by multifunctional dry stone walls (Panjek 2015). Once cultivated fields predominated on the terraces, and there were also many meadows and pastures. Today these are in the majority, one-fourth of the terraces are afforested, and overgrowth continues to be intense.

The pilot areas also differ in terms of land use (Figures 4 and 5). Vineyards are almost exclusively found in Jeruzalem, where they account for 89.8% of the terraces, and a very small portion can also be found in Krkavče (6.8%). Olive groves are found only in Krkavče and account for 30.7% of terraced land. There are few orchards; the largest share (9.5%) is found in Velika Slevica. In Dečja vas there is a mix of cultivated fields (51%) and meadows and pastures (40.7%), whereas meadows and pastures dominate in Merče (64.9%), Rodine (83.5%), Rut (83.2%), Smoleva (59.4%), and Velika Slevica (85.4%). One of the basic characteristics of land use on agricultural terraces is the abandonment of intensive use for cultivated fields or meadows,

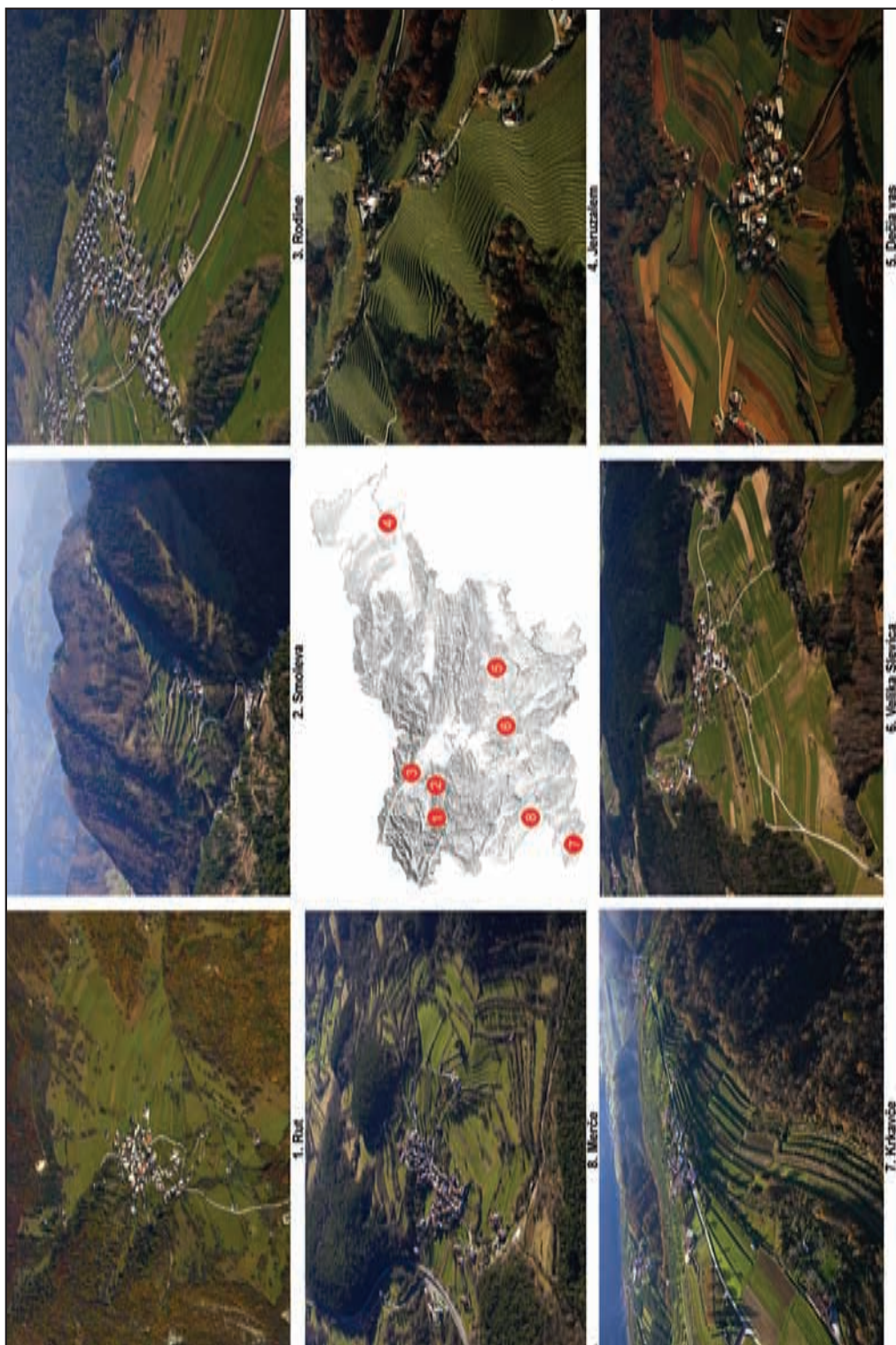


Table 1: A comparison of terrace characteristics at eight pilot sites (Source: Grafični podatki: RABA ... 2015; Register prostorskih enot 2016; interviews, field inspections).

Pilot site	Area (ha)	Share of terraced land in settlement (%)	Predominant use (> 20%)	Predominant embankment type	Special features	Difficulties/challenges
Rut (1)	43.8	4.3	Meadow and pasture	Dry wall	Dry walls	Clearing overgrown embankments
Smoleva (2)	20.2	11.0	Meadow and pasture, woods	Earthen	The terraces have their own microtoponyms, which are generally known by local residents; the embankments often have fruit trees on them	Landslide-prone area; potential abandonment of mowing and brush removal on small farms
Rodine (3)	22.3	12.4	Meadow and pasture	Earthen	Two dry-wall embankments	Land use change from cultivated fields to meadows and pastures; removal of dry walls
Jeruzalem (4)	24.4	40.9	Vineyard	Earthen	The terraces undulate along the contours of small hills	Landslide-prone area
Dečja vas (5)	61.0	20.0	Cultivated field, meadow, and pasture	Earthen	Reddish-brown loamy soil; mix of cultivated fields and meadows	Owners' negative attitude to terraces; need to conserve arable land
Velika Slevica (6)	27.1	23.9	Meadow and pasture	Earthen	The terraces extend along the entire slopes following the contours	Overgrowth of individual embankments; smallness and spatial dispersion of land ownership; owners' negative attitude to terraces
Krkavče (7)	231.3	35.9	Olive grove, woods	Earthen	Few dry walls; olive groves have not only economic value but also distinctive aesthetic value	Dry walls not maintained; overgrowth due to abandonment of farming and unsettled ownership
Mežce (8)	52.0	13.3	Meadow and pasture, woods	Dry wall	Dry-wall system; concentric arrangement of terraces around a central depression where the village houses stand	Overgrowth; mowing only on terraces where farmers receive subsidies

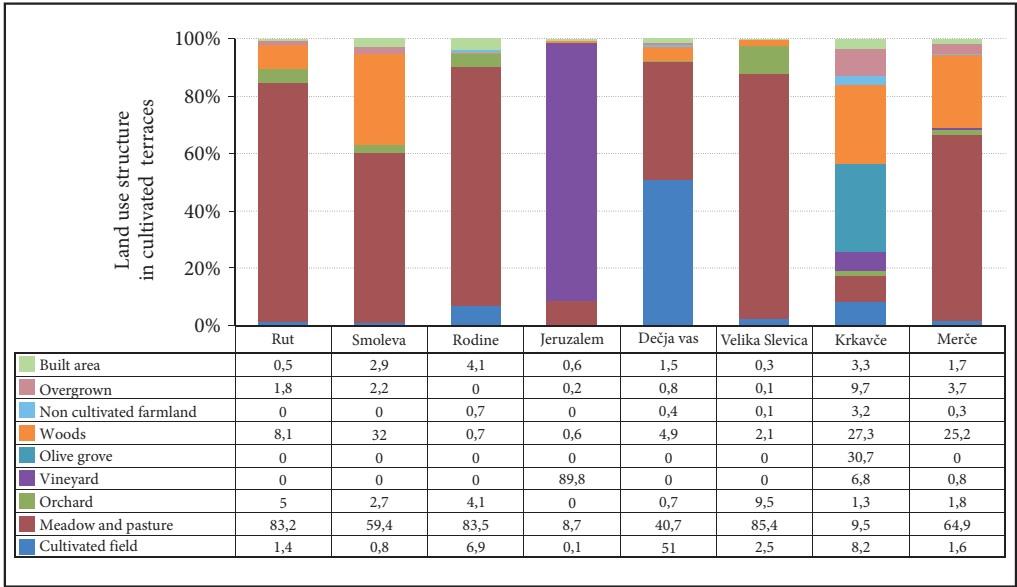


Figure 4: A comparison of terraced land use at pilot sites in % (Grafični podatki RABA . . . 2015).

which is best seen in afforestation and farmland that is being overgrown. Overgrowth is seen at all pilot sites except Rodine; it is greatest in Krkavče (9.7%) and Merče (3.7%). In general, it is true for all pilot sites that northern orientations are being overgrown more than southern ones, and that slopes with an inclination greater than 27° (50%) are being overgrown more than those with less of an incline. The greatest share of woods is in Smoleva (32%), and just under this in Krkavče (27.3%) and Merče (25.2%).

Based on information from the Land cadastre (Zemljiški kataster 2014), the largest number of parcel owners in terraced areas is in Krkavče, followed by Merče, and the smallest number is in Smoleva. Comparing the number of owners with the size of the terraced areas, the greatest fragmentation of property is in Rodine and the least in Velika Slevica. With the exception of Jeruzalem, the highest share of owners in terraced areas are private individuals, followed by the state (especially in Krkavče at 34.4%), and the remainder of other categories is negligible. For a total of 6% of land in the register the owner is unknown. In Jeruzalem the largest ownership share is held by the Farmland and Forest Fund (58.4%). The smallest ownership shares are held by agriculture communities, municipalities, legal entities, and parishes. In terms of ownership, the majority of land that is being overgrown is privately owned (Figure 6). The largest share of such land is found in Krkavče (9.7%), Merče (3.7%), and Smoleva (2.2%). Elsewhere overgrown land accounts for less than 2%.

4 Discussion

One of the greatest problems for the continued existence of cultivated terraces is abandonment of their use and subsequent overgrowth, which is especially the case in Krkavče, Smoleva, and Merče. Although overgrowth of steep slopes is readily apparent at most of the pilot sites, the overgrowth of land by aspect varies much more. One reason for this is also the fact that certain pilot sites have very little or almost no land with particular aspects (Figure 4). The same is true regarding the influence of elevation and relative elevation differences within the pilot site: overgrowth of higher-elevation areas is characteristic of pilot sites with greater elevation and greater relative elevation differences (e.g., Smoleva and Rut), whereas elsewhere this tendency is not observable. It was also surprising that land that is being overgrown, especially in Smoleva, Merče, and to some extent in Krkavče, is largely privately owned and not state-owned, as was first expected. It is likely that more meaningful reasons for the overgrowth of cultivated terraces should

Figure 5: Overgrowth of cultivated terraces at individual pilot areas by aspect in % (Grafični podatki RABA... 2015; LIDAR 2015).

	Rut			Smoleva			Rodine			Jeruzalem			Dečja vas			Velika Slevca			Krkavče			Merče										
	S	W	OWG	OT	S	W	OWG	OT	S	W	OWG	OT	S	W	OWG	OT	S	W	OWG	OT	S	W	OWG	OT	S	W	OWG	OT				
	S, SE, SW	82,7	8,9	2,1	89,0	60,9	18,0	2,9	79,1	82,9	0,4	0,0	99,6	61,1	0,7	0,3	99,0	41,1	3,4	1,0	95,6	54,6	1,3	0,2	98,5	61,0	17,2	9,9	72,9	30,0	27,8	4,5
E	4,6	5,9	0,3	93,8	8,6	98,5	0,0	1,5	1,0	6,2	0,0	93,8	22,9	0,5	0,1	99,4	12,9	4,0	1,1	94,9	27,5	2,4	0,0	97,6	6,8	22,4	8,5	69,1	20,7	27,9	4,7	67,4
W	12,1	3,2	0,5	96,3	14,8	7,9	2,5	89,6	12,3	0,6	0,0	99,4	5,1	0,7	0,1	99,2	8,7	4,2	0,0	95,8	0,7	16,9	0,0	83,1	12,3	46,1	10,1	43,8	8,8	15,3	2,3	82,4
N, NE, NW	0,6	14,6	1,1	84,3	15,7	73,1	0,6	26,3	3,8	4,0	0,0	96,0	10,9	0,5	0,0	99,5	37,3	7,0	0,8	92,2	17,2	3,5	0,0	96,5	19,9	48,1	9,2	42,7	40,5	24,1	2,8	73,1

S – share (in %) of aspect categories; W – woods (in %); OWG – overgrown farmland (in %); OT – other (in %)

Figure 6: Share of terraced land at pilot sites by ownership type, with an emphasis on wooded land and farmland being overgrown (Zemljiški kataster 2014).

Pilot site	Rut			Smoleva			Rodine			Jeruzalem			Dečja vas			Velika Slevca			Krkavče			Merče													
	S	W	OWG	OT	S	W	OWG	OT	S	W	OWG	OT	S	W	OWG	OT	S	W	OWG	OT	S	W	OWG	OT	S	W	OWG	OT							
	Number of owners	91,4	6,1	3,5	90,4	98,2	30,9	3,6	65,5	75,6	0,8	0,1	99,1	38,9	0,4	1,6	98,0	89,8	5,0	1,1	93,9	88,0	1,1	1,2	97,7	57,2	18,4	18,0	63,6	95,1	16,5	12,9	70,6		
Private individual	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
Legal entity	1,2	69,2	2,9	27,9	–	–	–	–	0,2	–	–	100,0	0,0	–	–	100,0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
Republic of Slovenia	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
The Slovenian Farmland and Forest Fund	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
Agriculture community	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
Municipality	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
Parish	4,7	0,0	4,5	95,5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
Property in public domain	1,0	3,5	9,9	86,6	0,9	12,0	29,6	58,4	0,3	–	–	100,0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
General-use public property	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Unknown	1,7	0,0	0,1	99,9	0,2	–	–	100,0	23,9	–	–	100,0	2,7	–	–	100,0	6,3	0,1	0,5	99,4	10,0	0,1	0,2	99,7	4,8	0,2	12,2	87,6	2,2	–	–	–	–		

0,0 category exists, but its value is less than 0,05 %, – category does not exist; S – share (in %) of owners; W – woods (in %); OWG – overgrown farmland (in %); OT – other (in %)

be sought in the socioeconomic development of the pilot areas: in unfavorable demographic development and deagrarianization of a large part of the rural population and the related abandonment of intensive cultivation, in the growing market orientation of farming, and, especially in eastern Slovenia, in the planned construction of new vineyard terraces for easier and better cultivation. Based on interviews and fieldwork, it has been established that the abandonment of terraced land results from the following:

- Aging of the population and younger generations moving away (Krkavče, Merče, and Rut);
- Redirection of residents from farming to other activities (Krkavče, Merče, Rodine, Smoleva, and Velika Slevica);
- Fragmented and small holdings, which often impede or completely prevent mechanical cultivation (Smoleva and Velika Slevica); and
- Conflicts arising from joint ownership and incapacity for uniform management (Merče).

In some cases, these reasons for abandoning terraces are comparable to those in other terraced areas in Europe. In the Alps these especially include natural limiting factors (Höchtel, Lehringer and Konold 2005), in southern Europe poor accessibility to these areas and socioeconomic changes (Stanchi et al. 2012), in Slovakia a lack of successors and young people moving away (Špulerová et al. 2017), and in Croatia decline of traditional agricultural production and diversification in modern agriculture techniques, which rarely include terracing (Andlar, Šrajer and Trojanović 2017). Abandonment due to the expansion of construction areas if terraces are located near large settlements was not observed in Slovenia, as Špulerová et al. (2017) reported for Slovakia. In individual areas, the continued existence of terraces is also threatened by other factors. One of these is the transformation of terraces into vertical vineyards – for example, in the broader area of the Jeruzalem Hills – which allows a greater number of grape vines per area unit (Urbanc 2002; Pipan and Kokalj 2017). Terraces are also indirectly threatened by changes in land use from cultivated fields to meadows and pastures because grazing livestock gradually level terraced land, as has started to occur in Velika Slevica. The preservation of terraces is also impeded by the lack of special subsidies for maintaining them. Subsidies are available only for cultivating farmland and cultivating areas with »limited agricultural potential«, and so narrow terraces on large slopes are deteriorating, and in places the embankments are becoming overgrown (e.g., in Velika Slevica) because the steep incline necessitates mowing by hand. In contrast to the past, terraces represent more of an obstacle than an advantage to modern agriculture.

In addition to the Jeruzalem terraces, only the terraces in Krkavče are also officially recognized as cultural heritage (Register nepremične kulturne ... 2015; Kladnik, Šmid Hribar and Geršič 2017). Among the local residents, terraces as cultural heritage or as part of tradition that must be respected, are also recognized in Merče, and by their owners also in Smoleva and to some extent in Velika Slevica.

One of the more important qualities of terraces is their aesthetic value, which is also cited by UNESCO as one of the criteria for defining world heritage (Internet 1). Despite the subjective judgment, perhaps precisely aesthetic attractiveness is a key quality that can aid terrace preservation. Aesthetic value is further added to terraces by an evenly structured, harmonious, orderly, and cultivated surface, along with individual elements such as trees and dry stone walls. As external observers, we can highlight the mix of terraced cultivated fields and meadows in Dečja vas, which, together with the reddish-brown color of the soil, create a unique landscape. More or less all of the local residents interviewed were aware of the aesthetic values of terraces—except, interestingly, for those in Dečja vas, where the farmers viewed terraces as merely time-consuming and demanding extra work. It is interesting that the locals ranked the Jeruzalem terraces highest in terms of aesthetic value; these are the youngest terraces and were created mechanically. They emphasized that terraces are more attractive than vertical plantations, and because of their colorfulness they are especially attractive in the autumn. This confirms Kant's point of view that beauty is the capacity to experience beauty, which is created in the subjective experience of the observer, which is highlighted by Šmid Hribar (2011) with regard to the aesthetic evaluation of trees and by Smrekar, Polajnar Horvat, and Erhartič (2016) with regard to landscape forms.

In the case of the Jeruzalem terraces it turned out, similar to what Erhartič (2009) had already ascertained, that it is precisely the aesthetic value of the terraces that influenced the development of tourism as an important branch of the economy. This is well appreciated by both wine producers, who designated the wine from the area with the label *Terase* (eng. *terraces*), as well as advertising campaigns, which use the Jeruzalem vineyard terraces to promote landscape beauty. Among the general Slovenian public, it is the Jeruzalem terraces that are best known among all of the pilot sites because of their picturesque character, which should also be taken into account in defining aesthetic criteria for assessing terraced landscapes.

In addition to all of this, due to difficult natural conditions in many steep landscapes, terraces must also be protected for the following reasons:

- Protecting soil fertility;
- Protection against erosion;
- Maintaining soil moisture; and
- Safeguarding traditional knowledge about terrace construction, especially regarding how and where it is possible to obtain flat areas on slopes in order to make farming possible (e.g., for vineyards, olive groves, cultivated fields, meadows, and pastures).

Based on the observations and interviews, it has been determined that only those terraces will be preserved that allow mechanical cultivation and that are economically profitable, similar to those in Alpine valleys in Italy (Scaramelini and Varoto 2008), Switzerland (Lavaux 2007), and France (Jeddou et al. 2008). In order to preserve other interesting terraces (but only to a smaller extent), it will be necessary to apply appropriate protection, new practices, and financial resources. This could, for example, prevent overgrowth near settlements in Istria by encouraging residents to engage in hobby production of fruit and vegetables. This should be put in place through systematic measures and setting up appropriate shared places for tool storage. This would also encourage socialization and the exchange of knowledge and experience.

5 Conclusion

Construction and maintenance of cultivated terraces is a demanding task. In the past, terraces were connected with subsistence farming and represented an advantage, but with modern machinery they mostly hinder owners and generate a loss for them. This leads to two opposing trends. On the one hand, terraces are being abandoned and overgrown on a large scale, but where production on them has proven to be economically attractive modern farm equipment is being used to convert them into land adapted for mechanical cultivation. This has intensified their use; for example, in Jeruzalem and Krkavče. Both of these contribute to fundamental changes to traditional terraced landscapes. It is therefore concluded that primarily profit will be an important driver for the future maintenance of terraces.

Because of the steep inclines in Jeruzalem, despite the greater production costs in comparison with vertical vineyards, the terraces have maintained their original viticultural function. The reason for this also lies in their majority ownership by the Farmland and Forest Fund, which rents the land to a large wine-producing company. These terraces, in addition to their primary production function, also promote the development of tourism and other activities. The high profile of the terraces there and their aesthetic importance for tourism will also be important driving forces for their maintenance in the future. In Krkavče, which ranks second among the pilot sites studied in terms of the share of cultivated terraces, the main driver of their preservation in recent times has been the economically profitable production of olive oil. At other pilot sites studied, terraces are preserved solely where the only (flat) farmland can be found on terraces.

In addition to economic value, many terraces also have heritage value, with an emphasis on their aesthetic importance and traditional knowledge and practices used for making a living in a particular landscape. In this respect as well, the Jeruzalem terraces stand out: even though they are the youngest, having been created around 1965 in socialist Yugoslavia, their aesthetic value makes them the best known among the general public.

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