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AN ARCHITECTURAL AND URBAN-PLANNING PERSPECTIVE
ON CULTIVATED TERRACES IN NORTHERN ISTRIADarko LIKARUniversity of Ljubljana, Faculty of Architecture, Zoisova 12, 1000 Ljubljana, Slovenia
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ABSTRACT

Cultivated terraces in northern Istria are an ancient feature with millennia of continuity, and have never been thoroughly studied from the perspective of architecture and urban planning or with regard to their development. Terracing was not only carried out on slopes to prevent erosion and to mitigate the effects of droughts and flooding on farmland, but was also used in excavations for houses' foundations in settlements. This article reviews the APIS methodology, based on which a special architectural and urban-planning model was created for the lower part of the village of Glem and a model of the terraced land that belongs to this village. The traditional and modern assessments of terraced landscapes differ significantly. Modern urban-planning and architectural changes to such a valuable landscape must be carried out comprehensively, systematically, and thoroughly so that excessive demand for new land does not cause degradation of the area.

Key words: cultivated terraces, northern Istria, architecture, urban planning, spatial assessment

TERRAZZAMENTI COLTIVATI DELL'ISTRIA SETTENTRIONALE IN UNA PROSPETTIVA
ARCHITETTONICA E URBANISTICA

SINTESI

La coltivazione a terrazze nell'Istria settentrionale è un fenomeno di lunga data, con una continuità plurimillenaria, che però dal punto di vista architettonico-urbanistico e dello sviluppo non è stato ancora studiato a fondo. In passato, non si disponevano a terrazzamenti solo pendii, per prevenire l'erosione del suolo e ridurre gli effetti di siccità e allagamenti in terreni agricoli, ma anche gli scavi per le fondamenta delle case negli abitati. Il saggio presenta l'analisi della metodologia del sistema APIS, in base al quale si sono realizzati uno speciale modello architettonico-urbanistico del centro abitato Spodnji Glem e un modello dei terreni che vi appartengono, disposti a terrazze. La valutazione moderna di un paesaggio a terrazzamenti differisce considerevolmente da quella tradizionale. I moderni interventi urbanistici e architettonici in un paesaggio così prezioso devono essere intrapresi in maniera integrata, sistematica e approfondita per evitare la degradazione dello spazio conseguente a un'eccessiva richiesta di nuovi terreni.

Parole chiave: terrazzamenti coltivati, Istria settentrionale, architettura, urbanismo, valutazione dello spazio

INTRODUCTION

This study deals with the part of Istria that lies in Slovenia; that is, in the municipalities of Koper, Izola, and Piran. The name *northern Istria* is used here for this study area because from the geomorphological perspective it is part of hilly “Gray” Istria (a flysch area), in contrast to the other two parts of Istria — “White” Istria, which is a limestone karst area, and “Red” Istria, which is mostly a lowland area with typical red soil known as terra rossa. It is not known when terraces were first created in this area and this has not been studied in depth, but the terraces are ancient and have existed for millennia. The most recent archaeological studies have confirmed that terraces were found across Istria even before the arrival of the Romans in 177 BC.

Cultivated terraces in northern Istria arose as a response to the unique climate, terrain, soil, and agricultural practice. In the past — specifically, until the end of the nineteenth century — the terraces in northern Istria were the most important feature of the landscape overall, both in the countryside and in settled areas. Because of their millennia of continuity, the terraced landscape of northern Istria is a common phenomenon, and so, aside from individual residents, experts, and specialists that are engaged with terraces because of their work, most residents of northern Istria take note of them only occasionally, and they are not even noticed at an everyday level.

The typically warm, dry Mediterranean climate with its long, dry summers and mild damp winters alternates between being extremely favorable and destructively unfavorable. The people of northern Istria resisted such natural phenomena with great efforts through all periods of development. Destructive droughts and intensive rapid flooding or damaging high water were the reason for seeking a solution to preserve the balance between the exceptionally favorable and exceptionally poor natural conditions. Terraces are the main spatial instrument for solving these problems in Mediterranean areas that are favorable for settlement but demanding for agriculture because of the hilly terrain. Many generations invested great effort in constantly building and maintaining terraces and crops on them, and they gradually accumulated knowledge of how to use terraces to control the microclimate, and to create an surplus of food and an exceptionally well-organized distribution network for selling their produce at home and abroad. Past generations knew how to prevent erosion, how to mitigate floods and droughts and to reduce the damage they caused, how to ensure a sufficient supply of good water above and below ground necessary for sustainable and balanced water consumption, and how to regulate the microclimate for early and late crops.

Terraces were gradually being abandoned and even destroyed for various reasons by the end of the nineteenth century. It is interesting that one of the main reasons for abandoning terraces was newly established industry, which started recruiting its labor force from the countryside after the Second World War, but today has already largely collapsed. The process of people returning to the countryside because of the economic crisis is still not particularly prominent in the terraced landscape.

STUDIES OF CULTIVATED TERRACES IN NORTHERN ISTRIA AND THE LITTORAL TO DATE

Previous studies (Istria, like other parts of Slovenia, was mentioned in written sources from antiquity) merely mentioned the age and traditional character of the terraces, and then they ascribed the introduction of terraces to the Romans. In general, there are no early medieval written sources for Istria and there is little material evidence, and so the rare sources from that period are exceptionally valuable. The entire period of the Middle Ages and the five hundred years of Venetian rule — that is, from 1278 to 1797 — lack useful sources for studying terraces.

Sufficiently precise and useful historical sources for technical research and planning in Istria date back to the Napoleonic period (1811–1814), when the French carried out measurements using the graphic method, and to the period from 1818 to 1827, when the Habsburgs made measurements and produced cadastral plans in a survey under Emperor Francis I.¹

The Franciscan Cadaster was also used by Titl (1965), who studied cultivated terraces in Istria in thorough detail and prepared a topographic map of the area in 1963. Titl’s work is valuable because it was early enough to preserve knowledge of heritage that has already largely disappeared and is still disappearing. Titl also studied why terraces were being abandoned. The majority of causes for their abandonment still apply today.

Between the 1960s and 1990s, geographical studies of terraced landscapes were carried out mostly in other parts of Slovenia (Belec, 1968; Bračič, 1967; Plut, 1977; Drobňak, 1990; Kladnik, 1990).

The interdisciplinary study titled “The Terraced Landscapes of the Alpine Arc” (or ALPTER), carried out by the University of Ljubljana’s Faculty of Architecture as part of Interreg Project III B Alpine Space from 2005 to 2008, is the most comprehensive Slovenian presentation of terraced landscapes in Slovenia to date. The basic goal of the project was to provide information about the spatial elements of terraced landscapes. An important part of the project was developing modern renewal techniques that influence the quality of carrying out renewal or the new

¹ This method was tested for the first time for the Milan cadastral survey of 1718–1760. It was established by the mathematician and astronomer Johann Jacob Marinoni (1676–1755). The cadaster for the town of Koper was created in 1819 by the Milanese geometer Luigi Strada.

construction of cultivated terraces. A pilot project to set up a terraced vineyard was carried out in the village of Medana in the Gorizia Hills. Based on the experience obtained in this project, recommendations were issued for growing perennial crops on terraces. In addition to the traveling exhibition intended to inform the general public and the professional community, the international conference “Living Terraced Landscapes” was held. Some of the results of the project have been presented in research and specialist publications (Ažman Momirski, Berčič, 2007; Ažman Momirski, 2008a, 2008b, 2014, 2015; Ažman Momirski, Kladnik, 2009). Helena Križaj Smrdel studied cultivated terraces in Slovenian landscapes in 2010. However, Slovenian spatial planning still has not recognized terraced regions as a landscape system *sui generis* (Ažman Momirski, Berčič, 2016).

The basic research questions connected with the terraced landscape are how to define terraces and the terraced landscape in terms of their development and how to define their values in the past and present.

METHODOLOGY

In architecture and urban planning, spatial studies are typically carried out using cognitive and physical geometric models. They are used for detailed study of the past and current situation, and to make reference comparisons in order to find solutions to problems that are discovered, to improve the situation, or to create projections for the future.

This research addresses the developmental and urban planning–architectural aspect of terraces, which has not been studied yet. Methodologically, the study is based on a system that was developed at the University of Ljubljana’s Faculty of Architecture for the renovation of old settlement cores. As part of this, a special methodology called APIS (standing for *architectural post-information system*) was created for studying spatial development (Likar, 2009); this instrument makes it possible to detect phenomena involving complex relations between space and time. It was developed by studying the development of historical tools (several millennia old) in architecture and findings regarding the deficiencies of modern instruments in solving issues of effective spatial development. The APIS tool replaces multiple models with a single *spatial integration model* that makes it possible to systematically and comprehensively examine spatial issues. The integration model is a kind of fractal geometric multi-layered and three-dimensional base framework of the existing situation in a particular location. The base model of the situation is used for content-related, comparative, and historical studies, as well as for seeking improvements, planning, and spatial management. Instead of carrying out testing at the actual location, it also makes it possible to test the effectiveness of solutions (in a model) by looking for problems and solutions in an integral model.

The APIS tool contains five systemic transparency model viewing concepts: integral (a view of the whole) and models for geometric-spatial, time, speed, and content-composition viewing. It forms a single uniform information system data bank for interdisciplinary work with five organizational units: basic, cognitive, planning, and managerial bases, and a base for checking effectiveness. The APIS tool designed in this way is intended to achieve uniformity across all disciplines in the joint project.

Even though the APIS tool is not yet established from the interdisciplinary perspective, it has been successfully tested in the field several times; for example, during fieldwork in the settlement of Glem or during desk research and sampling methods in the field at various levels of investigating locations and planning in northern Istria (Likar, 2009). As part of the research, a special spatial architectural and urban planning model of the lower part of the village of Glem was created along with a model of the terraced land belonging to the village. Architectural measurements were carried out in the entire village of Glem, and the structure of parcels of land was also examined. The terraces in Glem were studied in detail with architectural measurements (manual and laser distance meters and theodolites), whereas only sampling methods were used to study the earthen terraces inside the settlement because of the complexity of the issue. To compare and understand the terraces, the entire coastal area was also studied using various sampling methods (measurements, sketches, and photos). The cadastral district of Boršt in the Municipality of Koper was studied most thoroughly through fieldwork and measurements.

In addition to the geometric model, criteria connected with developmental history, content and function, art and aesthetics, and material technology are fundamental for architectural and urban planning assessment. In the study “An Architectural and Urban-Planning Perspective on Cultivated Terraces in Northern Istria”, it is of key importance to seek out the original value of the terraces, especially from the perspective of their functional, cultural, economic, and social significance.

CULTIVATED TERRACES IN NORTHERN ISTRIA

Cultivated terraces are manmade spatial phenomena that are influenced by various dynamic processes. After they are built, terraces are subject to the constant influence of natural forces and the effects of human activities, and so they are changed through constant maintenance and reworking for various reasons: new land use, improvement of their construction, abandonment of farming, and even their intentional destruction due to new spatial development. Even more exposed to dynamic processes are the terrace platforms, which contain a layer of fertile soil and cultivated crops. Until the end of the nineteenth century, terraces with

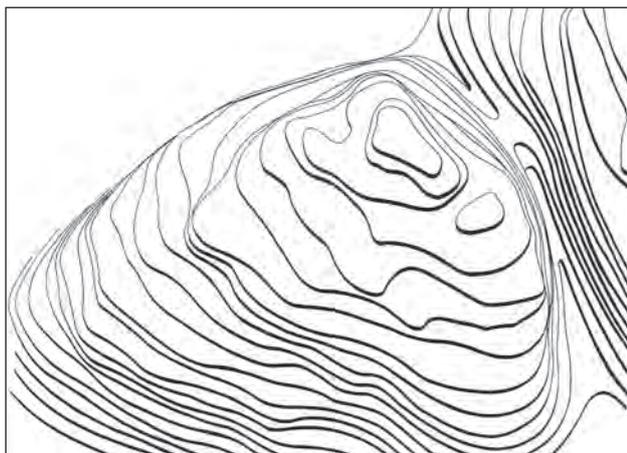


Figure 1: An axonometric hypothetical reconstruction of the original terrain of the promontory where the village of Glem stands clearly shows why it was urgent to solve the problem of settlements and landscapes in northern Istria with terraces (Pikel, 1993, 83)

stone embankments were a characteristic feature in the landscape studied. All of the labor in creating terraces was performed manually, which demanded a large labor force and organized society. Only a well-organized society could so comprehensively reshape the landscape and settlements. After the Second World War, terraces with less expensive grass-covered embankments instead of stone walls started being built. The upper and lower contact points of the slope are also where the terrace starts and ends, and these were always reinforced with sod. The embankments of terraces can be created only under suitable climate and soil conditions. The soil must be moist enough so that sufficiently thick sod can develop.

The characteristic landscape on soft carbonate rock (marls and sandstones) in northern Istria has a typical cross-section. To the north it consists of very steep and diagonal terrain, which ends in a slightly rounded and more or less broad ridge, from which it falls gently toward the south, where this typical cross-section terminates with a watercourse and a new cross-section begins. The very steep associated rim, which is even cliff-like in form, is mostly overgrown with forest. Many villages are located on ridge (e.g. Šmarje and Marezige), in the more gently inclined parts there are cultivated areas, and at the bottom of the gentle slope, transitioning into a new rise, is the border of the inversion layer (Stritar, 1990, 94, Fig. 13).

The first Austrian dominion over Istria (1797–1805) followed that of Venice, and during the second period of

Austrian rule (1813–1919) the administration carried out the Franciscan cadastral survey (in 1819) and started to determine the yield per cadastral hectare, which did not correspond to the yields in other parts of the province. It was almost twice as much as elsewhere. After inquiries and field investigations, they determined the reason for the deviation: under favorable conditions, northern Istria produced two annual crops, whereas other parts of the province produced only one. This illustration is a clear and instructive indication of why people invested such great effort into terracing the landscape in the past and protecting the slopes against major erosion, and what kind of contribution the favorable Mediterranean climate provides.²

Reasons for Creating Terraces

The reasons for creating the terraces that form the most important landscape characteristic of northern Istria are explained by Titl (1965) and Stritar (1990). The dynamic hilly terrain with a pedosequence on soft carbonate rock contains high-quality soil for agricultural and ecological conditions, with an exceptionally high-quality but sensitive Mediterranean climate, with variation between a dry period and frequent heavy rainfall, which can be especially calamitous in the summer, when it is possible for all of the dry layer of arable soil to be washed away from the flysch slope in only a few hours, causing catastrophic damage. “Man can fight such natural disasters only with great effort” (Titl, 1965, 47). A comparison with similar landscapes (dynamic hilly terrain with flysch slopes), such as in the Gorizia Hills, shows similar opportunities for modifying the landscape in slanting areas only by creating terrace platforms (Ažman Momirski, 2008, 99).

The exceptionally favorable climate and high-quality soil create good conditions for agriculture. Because there were few flat areas and the terrain was dynamic and hilly (Figure 1), the land had to be reworked into a terraced landscape suitable for cultivation in settlements’ functional rural area and into the terraced land of clustered settlements with platforms and connecting ramps where houses, gardens, streets, and squares are located today (Figure 2).

THE DEVELOPMENTAL DEFINITION OF TERRACES

The Ancient Beginnings of Creating Terraces in Northern Istria

Newer but nonetheless still sparse studies of Istria’s prehistoric hillforts indicate that already in pre-Roman times people were building platforms and terraces reinforced with stone walls in order to erect houses on

² The comparative advantage and attractiveness of the northern Istria region was illustrated well in a lecture by Albin Stritar, a Slovenian soil specialist.



Figure 2: The axonometry of terraces and terraced excavations for houses' foundations in the village of Glem shows that all old settlements in northern Istria were built in a terraced manner (Pikel, 1993, 112)

slopes. There are many prehistoric hillforts from Bronze Age and Iron Age fortified settlements on strategic hill-tops in Istria. Older researchers (e.g. Carlo Marchesetti) listed about 445 hillforts in Istria and the Soča Valley in 1903 (Mihovilić, 2009, 30). Building such fortified settlements, defending them, and producing a sufficient quantity of food demanded a sufficiently developed, organized, and unified community. Even though there has been little research on these hillforts, material finds and studies of the types of spatial changes that were made, together with the large number of such settlements, indicates that, in order to produce a sufficient quantity of food (for a relatively large population living in the specific conditions of a hilly Mediterranean environment), people were compelled to build terraces for agricultural production. Based on finds, more recent studies of the hillforts in Istria have shifted the boundary of features that were until recently ascribed to the Romans. One such example is the grapevine. At the Monkodonja hillfort near Rovinj (based on studies from 1953 and further studies in 1997), the material remains point to the skill and technique of creating stone walls and basic terraces for the village foundations (houses, platforms, and communication routes) and enclosure walls. At the beginning of the second millennium BC, around 1800 BC, a newly settled community began extensive work to

reshape the peak (Mihovilić, 2009, 55). The last excavations in the hillfort Monkodonja in 1997 revealed grape seeds, indicating that grapevines were already present before the arrival of the Romans.

At another partially studied hillfort at Albucan (269 m) above the village of Korte (excavations took place in 1956/57 with a probe led by the archaeologist Elica Boltin-Tome), the profile of the section studied and the entire shape of the area potentially delimiting the hillfort and the nearby surroundings also give indications that terraces existed (the steep shape of the terrain, which cannot be utilized without at least partial modification), both for the needs of the settlement as well as laying out the hillfort's functional area. The culture of the hillforts indicates a demanding form of social organization, upon which the creation of these fortified and well-protected settlements depended. Even though there have been few studies of ancient periods in Istria (the ones that were conducted largely focused on settlements only), the terraced basis of the settlement foundations makes it possible to also work out the type of spatial modifications made.

The technology for creating terraces inside settlements and in the landscape are the same; the difference is in their purpose. Terraces in settlements were excavated down to the bedrock for houses' foundations. The

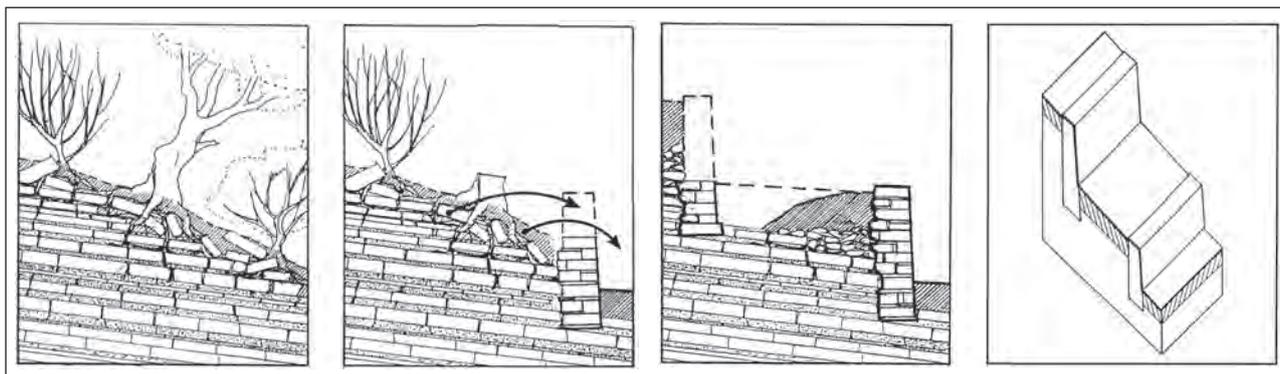


Figure 3: Four representations showing hypothetical stages of building traditional terraces in northern Istria. Three cross-sections and an axonometry of the terrace are shown (Pikel, 1993, 46)

excavated and broken-up stone was used to build stone houses, and the soil that was excavated was moved from the site and used for a garden around the house. For cultivated terraces the procedure was similar, only that the wall served to border the farmed area (Figure 3).

The soil was sorted and returned to the excavated area, which provided a high-quality area for growing various crops. Such an arable area was also higher-quality than the original area before excavation.

Old terraces were built using completely different methods than for new ones because the terrace wall was first built and then soil was backfilled behind it. Newer terraces are less durable than old terraces. Old terraces were leveled by excavating the entire terrace to the desired slope and sorting the material. Using dry-wall construction, they then stabilized the fronts of the terrace platforms and created suitable drainage using rubble. After the walls were built, the place was backfilled with excavated sorted material. Dry stone wall construction was more demanding because of the need for firm and durable of such walls, controlling the flow of water and calibrating the desired soil moisture, minor settling of the terrace surface, less-frequent maintenance, and obtaining all of the material in one place (stone, rubble, soil, and loam), together with less transport of the material and greater service life and durability of the terraces.

The method of removing and transporting material was generally used in areas with soft carbonate rock (marls and sandstones) until machinery replaced manual labor. When there started to be a lack of available and sufficiently cheap labor, the traditional method of creating terraces completely changed. A stone wall was built at the top of the terrace and the terrace was created by backfilling behind the wall. These terraces start settling more quickly, they do not withstand the effects of erosion, and they are poor at maintaining soil moisture. They are less durable and they require regular maintenance. During the same period, a new innovation started being introduced: green terraces with gently sloping embankments at an angle of 45° or less. In addition

to better protection of the terraces, this also increased the cultivated area and reduced maintenance. On such slopes, the fronts of the terraces can be used to grow vegetables and olives, depending on their insolation.

Antiquity and the Roman Era in Istria

The description of Istria by the Roman writer Pliny the Elder in book three of his *Natural History*, and especially his ranking of Istrian olive oil in third place in terms of esteem in the first century AD (Mihovilić, 2009, 101) and the mention of wine, led many researchers to credit the Romans with introducing new cultivars (olives and grapes) to Istria. However, more recent studies have indicated that wine was already present in Istria in pre-Roman times (e.g. finds at Monkodonja). Based on comparisons of the location of Roman settlements and other finds and hillforts in the coastal area, it has been determined that the center of Roman settlement started to move from hill ridges toward the coast.

More recent studies indicate smaller Roman influence on spatial changes in the northern Istrian area outside the colonies, and only in the most essential and least extensive changes to older spatial arrangements. The Romans established control in Istria in 177 BC, when they conquered the Istrians. The defeated Istrians were permitted to continue living in their traditional manner (Mihovilić, 2009, 85–86).

No official Roman settlements can be found in Istria before the mid-first century BC, and no concrete material remains from the Romans date from before this time. It was only more than a century later that the Romanization process started. However, even in the periods of slow colonization the inhabitants of the conquered areas were allowed to retain their traditional culture and structure as long as this did not interfere with the operation of the Roman authorities (Mihovilić, 2009, 93).

Even though the Romans introduced a series of innovations through colonization—from the creation of colonies, roads, waterworks, planning and building

settlements, mortared stone walls, and new techniques for cultivating the soil to new eating habits and other changes—they established colonies only where there was enough fertile and high-quality arable land for Roman settlers. This was especially done where it was possible to carry out centuriation³ completely or in part: on plains, in large parts of gently sloping areas, or on large gently rising contiguous complexes and ridges that were not too steep. In short, they chose only the best land that was easiest to cultivate. In northern Istria, this was mostly the few valleys and terrain with a small slope and broad, low terraces. Other areas were left to the native settlers.

The Medieval Rural Landscape in Istria

Following the ancient era of the hillforts and the Roman conquest, life in Istria continued to run its old course with some Roman influence relatively removed from the major events recorded in historical sources. The lack of sources about important events in Istria after Antiquity should not, however, lead one to consider it an insignificant area. On the contrary, because of its remoteness Istria gained considerable significance in the transition from Antiquity to the Middle Ages. Already Pliny the Elder mentioned the olive tree as an important cultivar in Istria through which the region gained recognition.

In AD 489 the Ostrogoths established their state on the Apennine Peninsula. “Theodoric’s dominion also included Istria. His minister Cassiodorus, surnamed Senator, described Istria in his letter of AD 537 as a happy land of the Italian city of Ravenna and as a breadbasket and storehouse of food for the royal town. Istria is described as covered in olive trees and fields of grain” (Kramar, 2003, 30). The source clearly illustrates the true significance of the northern Istria in the transition from Antiquity to the Middle Ages. It shows it as a valuable and significant territory that was at the center of events in the western world at that time. The treaty of 932 between Capodistria (now Koper) and the Republic of Venice (led by Doge Pietro II Candiano) promised one hundred amphorae of the best wine at the time of the grape harvest in the Koper area every year and the town’s participation in protecting Venetian merchants in its territory.

Two sources from 489 and 932 indicate the main crops in the area before it was taken over by Venice. Grapevines and olive trees also attest to the existence of the terraced landscape because both of these cultivars can be grown only on terraces in the dynamic Mediterranean terrain.

From 1279 to 1797, Koper was ruled by Venice and was the capital of Venetian Istria. In the rural regions

of Koper and the coastal area, the Venetians permitted local continuity in spatial development and adhered to the principle of “division of (our and your) customs” (*secundum consuetudinem nostram et vestram*). Such a principle is understandable because the Venetians did not have experience with hilly terrain with rocky soil and good bearing capacity and with stone construction, but they did have good experience with creating various types of embankments on ground with poor bearing capacity and stabilizing it.

During the five hundred years that the Venetians ruled northern Istria, they left their greatest influence on settlement structure. This primarily involves the architectural style, the Venetian Gothic, the specific ambient layout of public spaces, and especially the Venetian layout of private urban parks with the introduction of geometry, characteristic fountains, walking paths bordered by square stones, and pergolas on the edge of the parks. Especially this last element, the pergola, also known locally as a *latnik*, is probably a Venetian contribution that spread into the rural environment.

Pergolas were once common on southwest-facing terraces, where their latticing served to reduce excessive sunlight, but today they are rare in terraced areas of northern Istria. Pergolas are mainly preserved only on the entrance sides of rural buildings. The late period of Venetian rule (the Renaissance and Baroque eras) is seen in the characteristic terraced landscape of northern Istria with rough traces of Palladian style villas in Istria, also known locally as *stancie*.

The Appearance of Northern Istria in 1830

The ancient and medieval landscape of northern Istria has not been sufficiently studied because the graphic and written sources are scant and inaccurate. Therefore the appearance of the landscape during these periods is still unclear. The first useful, sufficiently precise, and systematic representation of the coastal area dates from the time of the Austrian administration, when the Franciscan cadastral survey was produced in 1819 at a scale of 1:2,880 for cadastral districts and 1:1,440 for settlements, and in 1830 large-scale 1:28,000 maps were produced for larger areas. The earliest detailed complete graphic representation for all of northern Istria in the form of a land-use map dates from 1830 (Figure 4). These maps, combined with today’s situation on the ground, offer an excellent basis for more detailed research on the development of the landscape. Analyzing them shows that the area of today’s northern Istria was relatively bare in 1830, without forest cover, which means that the landscape was nearly entirely cultivated at that time.

³ One hundred plots of land arranged in a square measuring approximately 700 × 700 m. The centuriation procedure (i.e., creating one hundred units): 1) selecting a starting point, known as the *umbilicus*; 2) defining the main orientation with the two main directions, perpendicular through the *umbilicus*. The *decumanus maximus* was the main east-west street, and the *cardo maximus* the main north-south street; 3) applying the units to the main rectangle. The units are the *actus quadratus* (the smallest, 35 × 35 m), two of which created a *jugerum* (35 × 70 m), two of which created a *heredium* (70 × 70 m, or about 0.5 hectares). Every *centuria* contained one hundred *heredia*.



Figure 4: A detail from the large-scale 1:28,000 map of the Franciscan cadaster of 1830 shows land use in northern Istria (Pikel, 1993, 291)

Many years of systematic study of northern Istria from 1980 to 1990, old settlement cores of towns and villages, old dispersed construction, old architecture, and the landscape (the Sečovlje saltworks, the terraced landscape, the mills in the Rižana Valley, etc.) make it possible to put together a relatively precise, comprehensive, and complete mental reconstruction of what the landscape in northern Istria looked like in 1830. The entire territory was crisscrossed by an exceptionally thin green line of hedges. This network of hedges is the only partial remnant of the region's original overgrowth, and it runs through cultivated landscapes and settlements. Narrow and thick hedgerows surrounded groups of fields in flat areas and the ends of terraces, whereas the terraces in between had hedges along their long sides.

This green network included the banks of watercourses (rivers, creeks, and flashy streams) and other bodies of water (springs, ponds, catchwaters, etc.). All of these green elements (bushes, plantations, orchards, tree-lined avenues, etc.) were connected into larger (more or less) elongated patches of groves and woods. They were located on steep overgrown cliffs and slopes, at the bottoms of some flood valleys (or ravines), on poor-quality land that was difficult to cultivate or less fertile, in areas that were most remote from the coast, and at higher elevations.

The terraces and this green network made it possible to retain sufficient moisture in the soil and prevent the damage caused by extreme rainfall. In addition to water erosion, they also prevented wind erosion. In 1830 the extent of maquis and Mediterranean woods was at its smallest, and the landscape was mostly cultivated. The green network of hedgerows in the landscape not only played a protective role in maintaining the fertility of the soil against water and wind erosion, and had a moderating effect on insolation and heat, but also created a safe shelter for animals within the network, which helped reduce and balance the number of pests affecting cropland. All of the work in creating and arranging terraces during this period was carried out manually because there was a sufficient labor force available.

Cultivated terraces in the Koper area in 1963

Julij Titl's 1965 work *Socialnogeografski problemi na koprskem podeželju* (Sociodemographic Issues in the Koper Countryside) offers a quality and detailed examination of cultivated terraces in the area investigated. Titl divided the types of terraces in the coastal area by slope inclination as follows:

- Terraces on slopes with an inclination of less than 20°;
- Terraces on slopes with an inclination from 20° to 40°;
- Terraces on slopes with an inclination from 40° up to 54°.

The width of terraces also depends on the inclination of the slopes. The gentler the slope is the wider the terraces are, and the steeper it is the narrower they are.⁴ Terraces with an inclination less than 20° are usually located at the base of rises and on rounded hills. Terraces on very steep slopes, around 54°, are very narrow and usually short, with high, steep embankments. They are usually reinforced with walls, and the walls are diagonally banked with earth and sod at their base because frequent downpours on steeper slopes also have greater destructive power. The embankments must therefore also be carefully and resourcefully reinforced with plants that have strong root systems. This combination of additional supports prevents parts of the terraces and embankments from being carried down the slope.

Titl further divided terraces based on their elevation into the following three zones:

- Terraces up to 250 m in elevation;
- Terraces in a range between 250 m and 400 m and
- Terraces between 400 m and 450 m in elevation.

Terraces at an elevation between 400 and 450 m were already long abandoned by 1965 because of their colder climate.

⁴ Terraces with an incline less than 20° are so similar to ordinary tilled fields that many observers do not include them among terraces.



Figure 5: The northern hillside of Šmarje as shown in 1820 contributed to the characteristic terraced landscape of the Koper area. The current satellite image shows the previously terraced area overgrown with forest. As in the case of Šmarje, most of the northern hillsides of the coastal area are now overgrown with forest, showing little resemblance to the characteristic terrace landscape (Register of Intangible Cultural Heritage of the Republic of Slovenia, 2016)

Toward the end of the nineteenth century, terraces with grass-covered embankments started being built in northern Istria because of the lack of labor force and resources:

- The usual incline of the embankments was 45°;
- A gentler incline, used for planting crops on the embankment, was less than 45°;
- A steeper incline often bordered on traffic routes and was usually created as an excavation or temporarily stabilized with vegetation until fortification with sod, with an inclination up to 75°.

Titl also divided terraces based on their crops:

- Terraces with vineyards and tilled fields (fields with grapevines on their edges or in rows between other crops);
- Combined orchard and vegetable-garden terraces and
- Purely vegetable-garden terraces.

He divided contemporary terraces by crops as follows:

- Purely viticultural terraces;
- Purely orchard terraces;
- Terraces with grapevines or olive trees on their embankments and
- Terraces with single rows of various fruit trees on their embankments.

Due to the effects of both world wars (reduction of the population and migration, new industries in

the economy, etc.) there was a decrease in the available workforce. Old terraces therefore started being abandoned and new forms being introduced. Instead of walls, the sides of the terraces started being finished with two types of grass-covered embankments: terraces with a slope of 45° and more gently sloped terraces with moderately inclined embankments, where people started planting fruit trees and grapevines. Maintaining the new terraces was cheaper. The root system of the trees and sod on the embankments protected the soil against erosion. With the introduction of various forms of terraces, it was also possible to regulate insolation: depending on the position and orientation of the terraces, the incline of the slope increased or decreased insolation. Greater insolation was desired on north-facing terraces, but not on south-facing terraces, and so south-facing terraces were built more steeply (insolation was adjusted through shade) or single rows of fruit trees were planted on the embankments, creating shade that varied its position. The rich and precise folk expressions and designations for various techniques of planting crops are surprisingly uniform across all of the winegrowing area of western Slovenia (Ažman Momirski, 2008, 110). Both of these methods helped slow down and prevent soil desiccation during the greatest and most intense summer insolation.

According to Titl (1965, 66), over half of the visible terraces in the landscape had already been abandoned by 1963⁵ (Figure 5). In observing the development process of the agricultural landscape in northern Istria, the author clarifies the dominance of various causes for the deterioration of cultivated terraces in various periods.

5 This is significant in comparison to 1830.

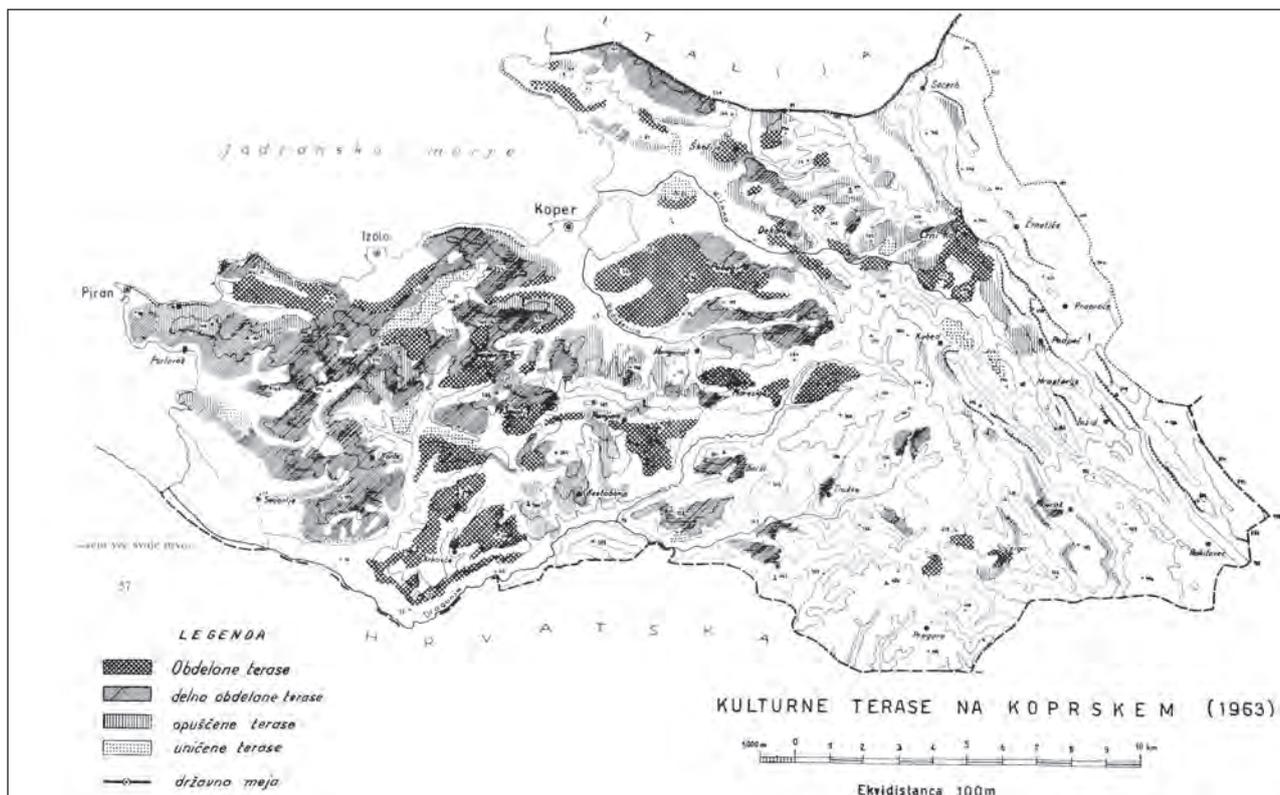


Figure 6: Julij Titl's valuable map shows the condition of terraces in northern Istria in 1963 (Titl, 1965, 57)

Insufficient knowledge for planning large cultivated areas and a lack of vision oriented many small farmers toward fragmentation of their crops and seeking market niches to sell their products. The yields per hectare fell, which is why small farmers were no longer competitive and started abandoning terraces. At the same time, the exceptional fragmentation of plots of land on terraces and mixed crops, which are typical for small agricultural producers, prevented the use of draft animals for plowing. The terraces on steep slopes had no access roads. Small farmers, dependent on sales and borrowing, and unable to make large investments, were incapable of modernizing the terraced landscape (Figure 6).

The current condition of the terraced landscape in northern Istria

The abandonment of terraces continued between 1963 and 1990 mostly because of a lack of labor. Younger people left the countryside for towns, where they found jobs more easily, most often in industry. Older people remained in the countryside, where they maintained the farms as well as they could.

After 1990 and the independence of Slovenia, there were significant changes with the opening of European borders. The influence of the global economic crisis and

the transition from communism in Slovenia caused a collapse of industry in northern Istria and reduction in the number of jobs. The new conditions partially halted and reversed out-migration from the countryside and re-awakened interest in farming. The strategic importance of supplying oneself with food and the importance of quality food for the population's health started becoming significant, and the once-abandoned terraces started being cultivated again. However, the terraces continued to disappear because of unplanned intensive development in the landscape, including leveling terraces into uniform hillslopes, transforming terraces into broader terraces with a smaller number of levels, and transforming traditional terraces into a single (minimal) terrace with a high, deep, and steep embankment.

Agriculture and its advising services recommend thinking thoroughly about long-term earthen structures or modifications that were created for multiple generations of use. For today's times, experts are recommending optimal types of terraces that have grassed-over embankments and regulated drainage. They are also recommending that, where possible, owners of existing terraces preserve stone terracing and dry stone wall construction as much as possible. Unplanned spatial development with the aid of expert consulting can be successful for small spatial units of a terraced landscape.



Figure 7: The map of the old Boršt cadastral district clearly shows the influence of natural features on shaping parcels of land and their ownership network (Pikel, 1993, 66)

However, large terrace complexes, access routes, managing microclimates, and regulating water flows require careful planning.

THE SPATIAL INFLUENCE OF TRADITIONAL AND NEW VALUES IN NORTHERN ISTRIA

Old values

In the past, good farmland for producing food was one of the most valuable assets. For this very reason, terraced landscapes were a basic life necessity for the survival of individuals and society as a whole. A terraced landscape demanded great effort to preserve people's basic living conditions. Terraces made it possible to accumulate and retain water, to ensure suitable soil moisture, and to regulate the natural water flow across the surface of the land. The investment and effort of people in the past, manifested in the form of a terraced landscape, is important heritage and the

materialization of activity that past generations handed down to future ones. They did their utmost to build upon and improve what already existed. In principle, this is the contribution of an individual's labor to shared human heritage.

These values were a fixed feature of civilization until the end of the nineteenth century. Each culture carried them out in practice more or less successfully in line with its level of development. At first glance, it seems that they are still present. However, under new social circumstances the lifestyle no longer follows the main traditional values of society.

New values

New technological means influenced the traditional valuation in society. Today, land as a value, or farmland, is preserved only by legal protection because otherwise it would quickly turn into land zoned for construction. Land is still seen as a value only by certain enlightened



Figure 8: Traditional terraces in northern Istria (Strunjan) with dry stone embankments (Photo: Darko Likar)

individuals, enthusiasts, and farmers that live with this heritage and awareness of its continuity. For “new farmers” that are returning to the countryside because of the international economic crisis, the land is only a means and not a value in and of itself.

Today there is a dual relationship toward water as a value. On the one hand, there is an awareness that water is a strategic natural resource, and at the same time today people do not know how to economically manage or obtain water. Society and people also have a similar relationship to nature and natural features.

Awareness of the future and understanding past experiences have largely disappeared from people’s awareness.⁶ Without this awareness, all of the heritage is disappearing and society often experiences it as an obstacle rather than an opportunity for people’s personal and collective development.

These values are key for the existence of the terraced landscape. The built and shaped environment reflects

the life of past and present communities, and especially the investment of past generations that helped create a historical process (i.e., continuity) through this as well as the profile of a particular community in a specific environment (i.e., identity). In this, building and shaping the environment is also a means (or resource) and tool for creating a new community, and at the same time a resource for people’s participation in building a modern community.

Adopting a decision on changing spatial resources must urgently be dealt with based on a comprehensive analysis of the values of available space in the cultural, architectural, technical, economic, and historical contexts. An instrument for comprehensive analysis in order to evaluate and plan available space is vital for activities intended to make a long-term contribution to community development and have effective results, so that incorrect decisions do not block or prevent possible development.

⁶ Awareness of values based on which people act following their own convictions and not due to some sort of legal obligation.



Figure 9: Building new terraces in northern Istria (Polje, Izola) (Photo: Darko Likar)

Under market economy conditions, unrecognized resources⁷ are exposed to the operation of the free market because the existing system of management and planning, as well as the spatial and environmental laws and regulations, do not recognize or take them into consideration as strategically useful. Only when important resources like the terraced landscape are recognized will it be possible to change the law and use resources in a suitable manner.

Evaluating terraced landscapes in northern Istria

Cultivated terraces are a phenomenon of transforming the natural landscape into a shaped and adapted landscape. Stone terraces accumulated heat during winter days and returned it to the surrounding environment during the night. Under such circumstances it was possible for plants to survive damaging frost. The effect of accumulating heat was augmented on some

terraces by water channels that also returned heat to plants at night. People further improved this necessary accumulation of heat in walls by banking the bottoms of walls or exposing them. The same effect was achieved by collecting water in channels or by opening channels so that the water could flow away. This principle is still used today for some crops. Thus, around olive trees, in the summers a funnel-shaped channel is opened so that water can flow to the plants, and in the winter the bases of the trees are mulched in a cone-like manner so that water runs away from the tree. In this way, the olive trees do not freeze during cold winters. Once the first and last produce of the season was especially important for the locals and the foreign market because they commanded the highest prices. Today this significance has been lost because of globalization, although such fruit and vegetables are not as healthful as local products.

Traditional society was also adapted to a different lifestyle than today. People lived in high-quality, dura-

⁷ For example, the millennium-old terrace heritage on the coast and heritage in general.

ble, permanent buildings intended for generations of descendants. Life's activities took place at a slower pace, and because of shorter life expectancies and poorer technological development people had to economize their activities in order to achieve a greater effect. The most important values in society were the transfer of knowledge, important information, tradition, and skills to one's successors, community cooperation, caring for members of the community, respect for the work and achievements of one's predecessors, and similar. All of this had an important effect on the creation of the terraced landscape.

A proposal for solving issues connected with development of the terraced landscape in northern Istria in the future

Slovenia possesses most maps and information connected with spatial development in electronic form; however, these are incomplete and organized by thematic areas. A single spatial integration model would make possible a better organizational level of the existing incomplete approaches. A spatial integration model would include five separate levels that are connected in steps. The first level would include a spatial integration model in the form of processed initial data for a location, which would serve as a basis for the remaining levels. In the next step of interdisciplinary work, this spatial model would serve for research on the location. The next step would use the findings of the research and recommendations for planning and design, and this would be followed by a managerial step with adopted plans, guidelines, and measures. The concluding step is dedicated to checking and determining the effectiveness of all of the previous steps.

The majority of proposed parts of the model have partly already been implemented in digital technology, and due to technological capacities they can also be combined into a new whole with simple modifications. The new model is created by the basic spatial information from the geodesic and cadastral base, with excess information geometrically and mathematically removed.

In such a model, only the network of microlocations (boundaries of land parcel groups) evident from the drawings of the Franciscan land register is lacking for easier spatial application.

The spatial integration model would provide an overview of the situation and an overview of past situations, determine differences between situations (i.e., development), and allow improvements to be planned. The integration model, which makes sense only if it operates and is stored in a single location, could solve the problem of storing multiple geodesic terrain measurements for monitoring construction, which today are deleted after they have been stored for a few years by the developer.

Such a model would especially be a good instrument for preparing measures to mitigate climate changes in the terraced Mediterranean landscape, where ensuring a sufficient supply of quality surface water and groundwater is necessary for sustainable and balanced water use.

CONCLUSION

In the past people built terraces primarily to create favorable conditions for growing crops, ensure food production, protect the land from erosion, and ensure a microclimate for crops. Today terraces also have the function of protecting new settlements against landslides, and their exceptional appearance offers a competitive advantage in marketing tourism destinations.

The phenomenon of terraces in northern Istria is therefore just as important as it was in the past. It is incorrect to conclude that the millennia of experience of past generations, which are etched into the terraced landscape, are outdated. Such a valuable landscape must first of all be dealt with comprehensively, systematically, and in detail before they are damaged too greatly as a result of excessive desire and enthusiasm for new land. As long as modern methods of working with terraces are insufficiently developed to match the traditional ones in quality, developments in this landscape must be carried out cautiously and holistically.

ARHITEKTURNO-URBANISTIČNI POGLED NA KULTURNE TERASE NA OBMOČJU SEVERNE ISTRE

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POVZETEK

Kulturne terase v severni Istri so nastale kot odgovor na tamkajšnje podnebje, relief, prst in kmetijske kulture. Novejše, čeprav še redke raziskave istrskih kaštelirjev (prazgodovinskih naselbin), nakazujejo, da so ljudje že v predrimskih časih gradili s kamnitimi zidovi utrjena zemljišča in terase za postavitev hiš na pobočjih. Teraso so se ohranile v obdobju rimske kolonizacije in še kasneje. V pričetku devetnajstega stoletja je bila kulturna krajina v severni Istri najbolj razširjena, ko pa se je zmanjšalo število prebivalcev in s tem delovna sila, je pričela propadati tudi terasirana pokrajina. V dvajsetem stoletju so kmetovalci uvedli nove oblike teras, ki niso imele več suhozidnih brežin. Terasirano pokrajino je potrebno pred posegi vanjo najprej razumeti. Posebna metodologija APIS (arhitekturni postinformacijski sistem), s katero raziskujemo posege v prostoru, je instrument za celovito zaznavanje prostorskih pojavov. Metodologija omogoča celostno, sistematično in poglobljeno raziskovanje stanja in delovanja v terasirani pokrajini, njen integracijski model pa združuje vse informacije potrebne za interdisciplinarno delovanje. Raziskava z arhitekturno-urbanističnega vidika opozarja na pridobivanje kakovostnih izhodišč za načrtovanje in oblikovanje obravnavanega prostora, pri čemer so pomembne tudi pretekle in sodobne družbene vrednote. Vpliv slednjih je ključen za obstoj terasirane pokrajine v severni Istri.

Ključne besede: kulturne terase, severna Istra, arhitektura, urbanistično načrtovanje, prostorsko vrednotenje

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