

URBAN HISTORY, MORPHOLOGY AND ENVIRONMENTAL URBAN DESIGN OF MARITIME SPACES IN THE OLD TOWN OF KOPER

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ABSTRACT

The Mediterranean is facing a massive change, which only should be reverted throughout the restitution of symbiotic processes along the littoral in order to recover its original landscape and environmental capacities. The case study of Koper in Slovenia offers a unique opportunity to explore both the spatial and micro-climatic qualities of traditional public spaces in Mediterranean waterscapes. In doing so, we have selected a representative main street – with alleys, piazzas and gateways – to analyse and provide urban and landscape strategies and guidelines that should be implemented for future interventions and repair the current ‘climatic’ discontinuities between the old city and the industrial belt. The research presented in this article addresses history and urban morphology of old city centres, with correlation to impact of climate change on open spaces or voids in the case of Koper’s public space.

Key words: urban history, urban morphology, climate changes, urban heat island (UHI), Koper, public spaces

LA STORIA URBANA, LA MORFOLOGIA E LA PROGETTAZIONE AMBIENTALE DEGLI SPAZI MARITTIMI NEL VECCHIO CENTRO STORICO DI CAPODISTRIA

SINTEZI

L'area mediterranea viene messa a confronto con grandi cambiamenti, i quali possono essere superati solo con il ripristino dei processi simbiotici lungo il litorale, allo stato primario, ciò significa al suo paesaggio d'origine e alle primarie capacità ambientali. Lo studio del caso della città di Capodistria in Slovenia, è un'opportunità unica per studiare le caratteristiche ambientali e microclimatiche degli spazi pubblici e dei paesaggi acquatici (marittimi) del Mediterraneo. Con ciò, abbiamo scelto la strada principale e più rappresentativa - con i suoi passaggi, le sue piazze e i suoi collegamenti - per analizzare e fornire strategie e linee guida urbane e paesaggistiche che dovrebbero essere attuate con dei futuri interventi e dovrebbero riparare alle attuali discontinuità "climatiche" tra la città vecchia e la zona industriale. La ricerca presentata in questo articolo tratta la storia e la morfologia urbana dei vecchi centri storici, soprattutto in relazione ai cambiamenti climatici sugli spazi aperti o vuoti nelle zone pubbliche di Capodistria.

Parole chiave: storia delle città, morfologia urbana, i cambiamenti climatici, isola di calore (UHI), Capodistria, spazi pubblici

INTRODUCTION

The Mediterranean¹ is facing a massive change, which only should be reverted throughout the restitution of symbiotic processes along the littoral in order to recover its original landscape and environmental capacities. Current observations of this phenomena change are in line with predictions of the average climate change (Van Engelen et al., 2008) that suggest an increase of the annual mean temperature across Europe between 2 and 5 °C by the end of this century, relative to the present day climate and a change of precipitation patterns with drier summer conditions in the Mediterranean area. During the last century, the historic centres of many Europe-

an Mediterranean cities such as Barcelona, Marseille, Thessaloniki or Palermo suffered a systematic process of abandonment of their historical urban tissues leaving an archipelago of residual voids and derelict buildings. The urban deterioration of their public spaces is generally produced by a neglectful planning coordination and the lack of specific urban heritage and environmental agendas that both protect and invigorate their landscape attributes. Mostly the connection between the maritime frontage, old city and industrial zones is poorly attained (Suau, 2013). The current economical scenario of the Mediterranean Region brings new opportunities to explore creative strategies of landscape recovery within port cities, from an inventive reinterpretation of their

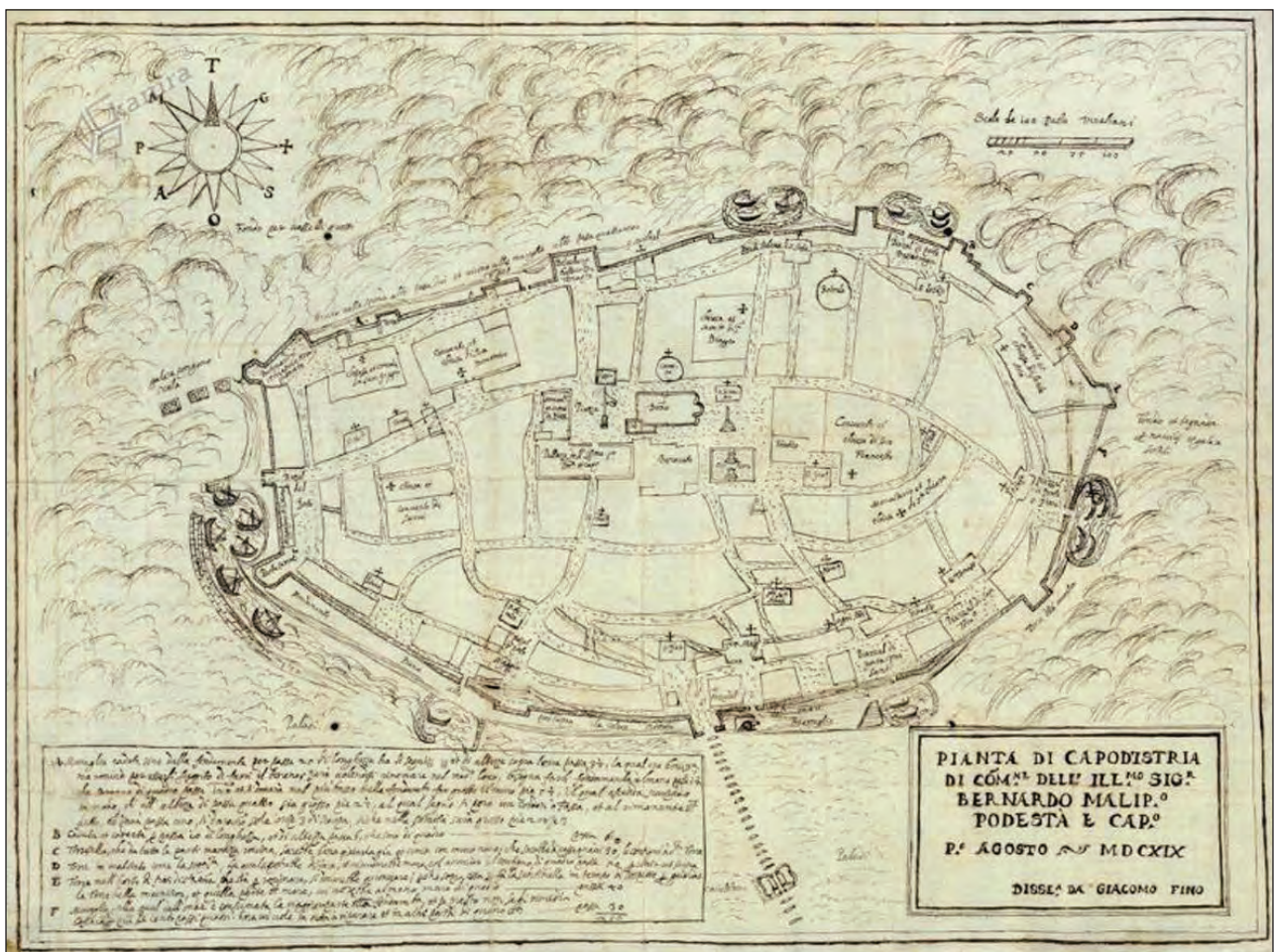


Fig. 1a: Town-plan of ‘Capodistria’ by Giacomo Fino, 1619 (source: HISTRIA. Humanistično društvo – Societa umanistica – Humanističko društvo). An ideal scheme with characteristic morphology which shows the basic organisation of built vs. open structure.
Sl. 1a: Načrt mesta ‘Capodistria’, Giacomo Fino, 1619 (vir: © Humanistično društvo Histria 2009). Zasnova z značilno morfologijo, ki prikazuje osnovno razmerje med grajenim in odprtim prostorom.

1 The most sensitive areas in Europe are Southern Europe and the whole Mediterranean region in general because of the simultaneous effect of higher temperatures and smaller amounts of rainfall in areas that are already dealing with a lack of water (Kajfež Bogataj, 2009, 15).



Fig. 1b: Townscape of ‘Capodistria’ (source: Pokrajinski arhiv Koper, SI PAK KP 344, t. e. 1.). There exist records stating that Koper even had 52 churches (Bernik, 1968, 199). In a rhythmical interchange of vertical elements in a tower-town there was always one dominant – the main tower in Tito’s Square; symbolic value vs. dominant element. **Sl. 1b: Urbana podoba ‘Capodistrie’** (vir: Pokrajinski arhiv Koper, SI PAK KP 344, t. e. 1.). Obstajajo zapisi, da je imel Koper celo 52 cerkva (Bernik, 1968, 199). V ritmični izmenjavi vertikalnih elementov v mestu zvonikov je bila vedno ena dominantna – glavni stolp na Titovem trgu; razmerje med simboličnim pomenom in dominantnim elementom.

initial urban forms and ecologies. For instance, the development and implementation of the European climate change adaptation strategy for 2013 (European Commission, 2014) offers a challenging opportunity to create this joint approach and reflects on key efforts deployed in recent years to be part of related EU policy². The main consequence has been the loss of urban identity and lack of knowledge exchange on how ‘ecological gaps’ could affect positively the inner climate of urban systems. Mediterranean Cities cannot profess being unaware about climate change. Any delay in adaptation actions will probably increase costs at long-term or even worse not be implemented.

How do existing maritime urban settlements effectively respond and adapt to the current climate change of port cities in the Adriatic Region? The modernisation of port infrastructure in traditional cities has generally had a negative visual impact regarding the preservation of the original urban tissue and its maritime attributes.

However, the ‘invisible’ forces of heatwaves (Wong, Nichol, To, Wang, 2010) are transforming the existing urban setting. The number, intensity and duration of heatwaves, extreme precipitation events and drought is expected to increase (Barriopedro et al., 2011; Giorgi et al., 2011; Hoerling et al., 2012). The intensity of heatwaves in towns and cities is influenced by the urban tissue and its structure (Oke, 1982; Arnfield, 2003; Wilhelmi et al., 2004). The hottest urban areas are generally those with numerous large buildings; without surface water or green spaces; and densely populated (EEA et al., 2008). Urban areas store more heat during the day than rural areas and release it during the night. Wind plays a crucial role in the interaction between the urban structure and weather, not only regarding wind speed (Oke, 1987; Wilby, 2008) but mainly through “wind paths” that offer great capacities to passively cool cities. So streets that follow the same direction of wind flows channel the air into “urban wind canyons”.

² “Urban Adaptation to Climate Change in Europe”; EEA Report I, No 2/2012. European Environment Agency. Refer to: <http://www.eea.europa.eu/publications/urban-adaptation-to-climate-change>, accessed in 10/07/2014

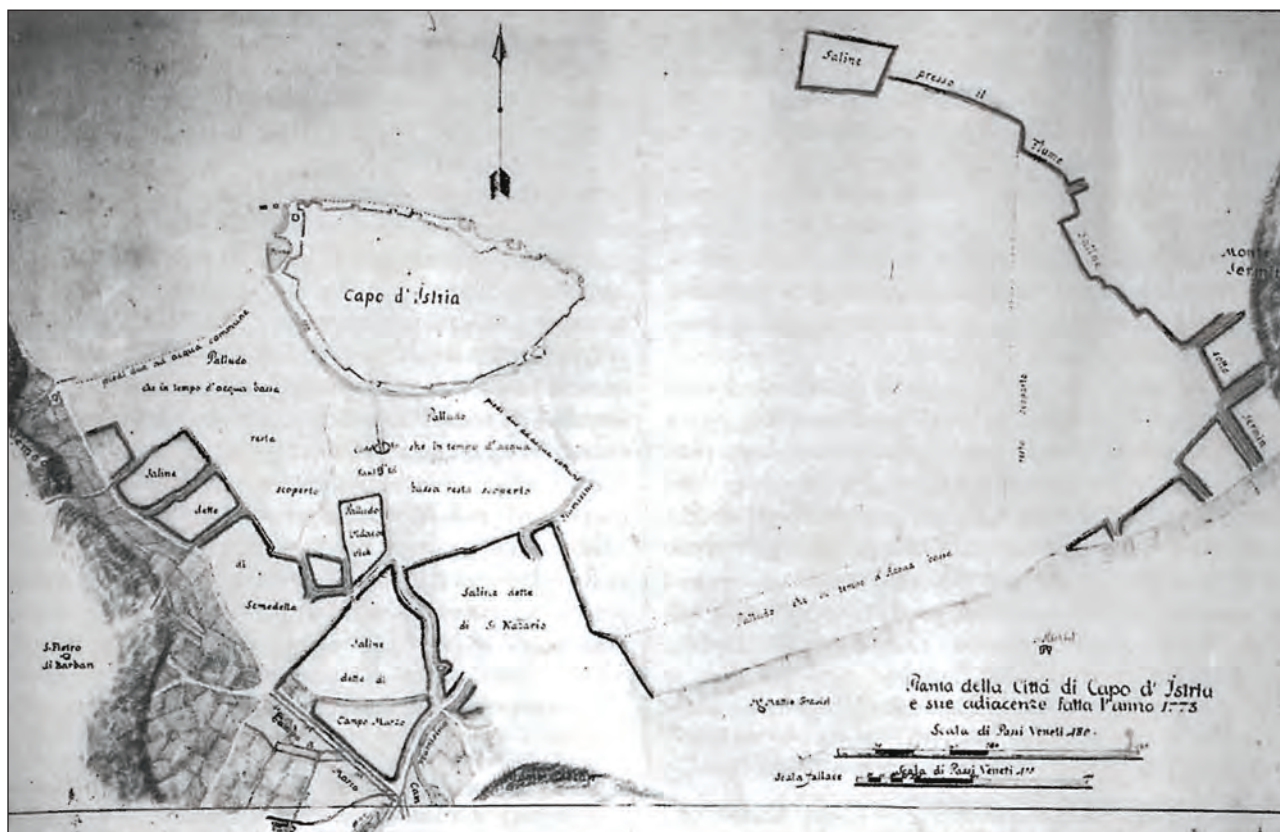


Fig. 1c: 'Capo d'Istria', plan of the town and its surroundings, 1773 (source: Archivio di stato di Trieste). The form of the island can be associated to a convex lens (Bernik 1968, 9) with an "eye to the salt area". The vital idea of agricultural land includes protection of land vs. development.

Sl. 1c: 'Capo d'Istria', načrt mesta in okolice, 1773 (vir: Archivio di stato di Trieste). Oblika otoka spominja na konveksno lečo (Bernik 1968, 9) z enim "očesom na območju solin". Za kmetijske površine je pomembna tako zaščita kot razvoj.

The replacement of natural vegetation with artificial surfaces and large buildings has created unique microclimates altering temperature, moisture, wind direction and even precipitation patterns. For instance, a high amount of artificial surfaces stores heat and cause high temperatures in port cities compared to the surrounding region.

The traditional urban fabrics of Venetian cities along the Adriatic coast offer an exceptional 'maritime urban laboratory' to observe the effects of generic land uses, industrial expansions and frictional urban edges. Even though all Venetian cities were morphologically diverse in sizes and shapes, "the urban form always followed the specific climatic conditions" (Srivani, Kazunori, 2011). The origin and development of coastal urban settlements has been produced by the symbiosis between climate and inhabitation. In fact they were intuitively planned as passive cooling urban systems. These traditional fabrics constitute 'passive' climatic urban systems that provide outdoor thermal comfort through shading, wind tunnelling and light colours applied in surfaces. When the initial urban fabric expands, it generates a

'brownfield' (CABERNET, 2006) that surrounds the old town and replaces the initial maritime and agrarian edge. These new urbanised areas are mostly made of industrial infrastructure, large shopping complexes, parking and vacant lots.

The spatial effects recently caused by speculative urban pressures in the past decades have drastically deteriorated many coastal settlements and their ecologies that are essential for the continuity of bio-geographical corridors and therefore human climate comfort. In addition, the current construction market has inappropriately transformed the formalised urban development in an accumulation of disconnected and fragmented regions or mere mega-objects detached from any urban fluidity. As result the new urban planning has produced profound alterations within the historic urban fabric and boundaries.

The case study of Koper in Slovenia offers a unique opportunity to explore both the spatial and micro-climatic qualities of traditional public spaces in Mediterranean waterscapes. In doing so, we have selected

a representative main street – with alleys, piazzas and gateways – to analyse and provide urban and landscape strategies and guidelines that should be implemented for future interventions and repair the current ‘climatic’ discontinuities between the old city and the industrial belt.

HISTORICAL URBAN DEVELOPMENT OF KOPER

Koper, called in the past also Aegida, Capris, Capritana insula, Caput Ystriae, Justinopolis, Caput Histriae, Capo d’Istria, Capodistria, Koper, Kopar (Valvasor, 1689 in: Rupel, Gerlanc, Justin (ed.) 1977; Bernik, 1968; Guček, 2000; Pokrajinski arhiv Koper old maps, Arhiv v Trstu, old maps, see Fig. 1a, 1b, 1c, 1d, 1e, 1f) was always a constituent part of Slovenian Istria. It was exposed to various invasions, which influenced the form and development of the old town and its immediate surroundings. The town of Koper was developed as an island, a maritime enclave positioned strategically in the North Mediterranean area. In the historical development of Koper, Izola and Piran an important part was played by the Greeks, Romans, Byzantines and Franks, by the patriarchs of Aquileia, the Venetians, French, Austrians and Italians, right up to the time when the towns were annexed to Yugoslavia in 1954 and thus finally organically united with their natural hinterland, where the Slovenes had already begun to settle in the sixth century (Bernik, 1968, 209). Nowadays we can vividly observe the influence on the old Koper’s urban morphology by the Venetian republic. Stele (1940) defined the Slovene coast together with Friuli as the sea-front zone, architecturally characterised by Italian and Central European elements. Koper remained under Venetian domination until 1797 (Grubb, 1986, 47) when the Venetian Republic fell. It means that the old city shared a common route-map with Venice for more than four centuries. Its territory of influence was always in relationship with the city of Trieste, which was since 1382 under the protection of Habsburg monarchy. Trieste was a “free trade port” from 1867, the second port of Habsburg monarchy (Kreuzer, 2008). The important role in the region was played by the railway link between Trieste and Vienna, which was reinforced by other parallel infrastructure called “Porečanka”, a new railway line that connected Trieste with Poreč (nearby Pula) via Koper. After the end of WW2 – ratified by Osimo treaty in 1975 – the political border between Italy and Yugoslavia was definitively established where Koper was Yugoslavian territory and Trieste was annexed by Italy. During the last decades, littoralization – a process of concentration of the population and economic activities in the coastal strip – is becoming an increasingly distinctive trend (UNEP/MAP, 2008, 13). The period between 1945 and 1967 is important for the development of the coastal area. In 1967 the railway was finished, which connected



Fig. 1d: Un saluto da ‘Capo d’Istria’: Le saline. Greetings from ‘Capo d’Istria’: The salt marshes (source: Kamra – Digitalised cultural heritage of Slovenian regions). Photo made in 1898. After the end of the Republic of Venice the salt pans started to deteriorate and were closed in 1912. Since 1998, only the Škocjanski zatok Nature Reserve is a protected. The vital nature productive area vs. today’s built environment.

Sl. 1d: Pozdrav iz ‘Capo d’Istrie’. Soline (vir: Kamra – Digitalna kulturna dediščina slovenskih pokrajin). Slika iz leta 1898. Po propadu Beneške republike so območje solin začeli opuščati in jih leta 1912 dokončno ukinili. Edino zaščitenno območje po letu 1998 je Škocjanski zatok. Razmerje med pomembnim območjem z naravno proizvodnjo in današnjim grajenim okoljem.

the port of Koper to inland. In the same year there was a first open critique by the civil society and experts to the Urban programme for Koper, Izola and Piran from 1966, which was developed by Investbiro, and the most significant architect of that period Edo Mihevc (Čebren, Lipvec, 2012). Building construction in this period was very complicated due to lack of the knowledge in construction and also because of the influence and involvement of politics with strong pressures from the local government.

The port of Koper is situated on the Fifth Pan-European Transport Corridor (V). On one hand, it is increasingly a competitive trade hub and strategic infrastructure for maritime and land traffic routes in the Gulf of Trieste. On the other part, through the use of the sea, the present activities influence each other, compete and impose various legal regimes, thus provoking conflicts in the sea use in relation with the protection of habitats, natural ecosystems and the landscape, as well as with regard to granted water rights and a decrease in economic performance of some activities (UNEP/MAP, 2008, 31).

Since 1991 the Slovenian coastal area has undergone rapid land-use transformations throughout diffuse urbanisations that turn into a conurbation scheme of three cities: Koper, Izola and Piran. The



Fig. 1e: 'Capodistria', cadastral map, the Franciscan Cadastre, 1819 (source: Archivio di stato di Trieste). The first exact map, the organic structure of the urban medieval agglomeration in line with the terrain. The map reveals that the wall had typical medieval characteristics with the course of the wall adjusted to the configuration of the area (Bernik, 1968, 199).

Sl. 1e: 'Capodistria', katastrski načrt, Franciscejski kataster, 1819 (vir: Archivio di stato di Trieste). Prvi natančen načrt, organska struktura srednjeveške aglomeracije v smeri razgibanosti terena. Načrt nam prikazuje vlogo zidu, ki ima tipični srednjeveški značaj – potek zidu se prilagaja obliki območja (Bernik, 1968, 199).

historical urban structure of each settlement was exposed to a speculative land pressure, which has generated a generic architectural character of voluminous buildings – depots, supermarkets and malls, which have not only caused negative visual impact in the urbanised coast but located in a nature reserve Škocjanski zatok have altered and increased the outer temperature of old Koper and beyond.

Urban History

At a glance the urban condition of today's Koper seems quite similar to other traditional towns in Slovenia: a. abandonment of buildings; b. discontinuous

traffic accessibility; c. deprived social structure; d. 'seasonalisation' of dwellers in residential units (summertime overcrowded with incoming tourists and depopulated in wintertime) and e. manipulation with land and built environment by local politics. Nonetheless Koper has historically concentrated a unique cultural, urban and economical legacy towards resilient strategies on urban climate and landscape recovery. The key factors that highlight both its traditional urban tissue and current dynamics are:

1. Geography and location. The predominant element is the land-form: Koper as an island (Fig. 1a, 1b, 1c, 1d, 1e, 1f). The shape of the former island was elliptical in shape and resembled a convex lens (Fig. 1c). It



Fig. 1f: ‘Capodistria’ e le ex saline viste dall’alto, around 1900 (source: Kamra – Digitalised cultural heritage of Slovenian regions). On the postcard from 1930 – Koper and former Semedela salt marshes from the air. The contrast between openings to the mainland and the sea vs. closed inner area of squares.

Sl. 1f: ‘Capodistria’ in pogled na nekdanje soline z višine, okoli 1900 (vir: Kamra – Digitalna kulturna dediščina slovenskih pokrajin). Na razglednici iz 1930 – Koper in območje nekdanjih solin Semedela, pogled z višine. Kontrast med odprtostjo proti notranjosti in morju ter zaprtostjo notranjih trgov.

is the junction of the two symmetry lines of the highest terrain (Bernik, 1968, 9). Then the isle was a suitable and safe place for the initial occupants to build a maritime settlement. It offers a distinctive medieval urban structure, which consists of multi-patterns with different forms and functions.

2. Influences of maritime cultures. Koper’s identity is defined by a Venetian urban heritage. Gregorič (1940) affirms: “The towns situated within reach of the Venetian cultural influence reveal a design of the town organism based on the municipal social system that is characterized by a forum – a public square, following the example of S. Marco’s Square in Venice, surrounded by municipal buildings, towers and open loggias. Such are the towns of the Western Istrian coast.” Its urban core is listed. Nowadays the recent urban interventions follow – in some degree – the existing spatial organisation of squares, inner courtyards and streets as a general composition of organic structure, even though they do not implement site-specific urban attributes taken from the Mediterranean urbanity.

3. Population and local identity. During the time of the consolidation of Yugoslavia, especially in the traditional bordertowns nearby Italy and Austria, cities experienced a radical demographic change as well as social,

economic and ethnic ones. Koper – initially with an Italian predominant population – was replaced by workers coming with the purpose to work in new factories and port in the time of Yugoslavia, predominantly people from Croatia, Bosnia and Herzegovina and Serbia. Due to the official bilingual policy in the area, the Italian language and all other cultural values of the Italian national minority were preserved and today it remains more vivid than during the past. But there was a big exodus of Italian population and the city lost the primal bourgeois culture. Many cultural content disappeared and was replaced for the needs of the working class population.³

4. Urban structure on the “top hill”. The first important transformation occurred when the agglomeration was formed – the island was overcrowded and this aspect had a strong impact on the definition of the organic structure over centuries. Bernik (1968) defines Koper as an “outwardly amorphous urban structure, interwoven with a disorganised and inappropriate system of communication lines (...)”. Then he states “a carefully planned composition of the urban organism is then revealed to us.” A medieval urban concept of individual developed organised street lines (mainly from W-E direction), which support the grid together with the circular array to the centre and the “top hill” – both tower and formation – that supports the key features of the urban scenes and vistas. Today the historical town is listed as urban heritage and its urban form remains the same today. But from the new “ring” or extension, the establishment of shopping centres at the edge of the old town has caused an “urban trench”, a transport gap full of car park lots, gated marinas and cruise docks. Hence the urban typology of medieval nucleus with liveable public spaces in urban voids is lost.

URBAN FORM

In the traditional urban fabric of Koper one of the key organisational elements were (and continue in today everyday life) the vertical and horizontal main axis. The “coordinate cross”, above all, should be preserved for the future as the most important town-planning figure of the old core. It should be left intact together with the background part of its structural composition (Bernik, 1968, 201). This urban composition is not important by itself but it has to be preserved in terms of pulse, rhythm, meaning and urban life. Historically the urban form was activated with churches where “the possession of a church was a status signal.” The morphology of the old Koper’s urban voids represents the horizontal urban structure whilst the symbols of campaniles express the verticality. For instance, if we observe from the viewpoint of a dweller inside of core, the sense of protection

³ The content of the city changed a lot, after the II WW. If we for example look at the cinema situation in Koper as a result of this period of working class changes of the city in the 80s, we realize that mostly male visitors visited the cinema as they were playing mostly adult movies.

and appropriation of public places still persist because of the main landmarks.

By comparing the current situation with the past, we can observe that both the reorganisation of the social life and the centrality of the main square have changed (Fig. 1a, 1b, 1e) whilst its form and structure remains intact. Is it important just “to protect and preserve the Tito’s Square as the representative centre of the town” (ibid.) Critics of the new development in the surrounding of Koper affirm that the new expansion (“first ring zone”) has had a direct negative impact in the old urban fabric. Construction activities threaten the overall image of vulnerable landscape throughout massive and uncontrolled physical interferences along the coastal strip; poorly built developments in environmentally sensitive areas; changes of the overall maritime image of the city-island; blocking and reducing the natural contact between sea and shoreline of the island; new expansion zones in reclaimed lands (refer to port zone, marinas, shellfish farms and associated facilities) causing a negative visual impact regarding maritime, architectural and townscape vistas; chaos resulting from excessive commercialization of space, ever increasing built-up areas of the coastal strip and loss of spatial identity (UNEP/MAP, 2008, 33). The development of Koper was visibly influenced by the Mihevc period in post-war Yugoslavia and the neoliberal dispersion of capital during the Slovenian economic transition (Bugarič, 2010, 83). The duality between the new development outside the old town of Koper and the “small” quality changes inside the historical urban centre is the primal challenge in terms of urban form’s preservation and enhancement (refer to Fig. 1e, which was the first detailed plan with the definition of squares, courtyards and important buildings). This part is clearly documented from the comparative urban evolution (Fig. 2a, 2b, 2c, 2d) and overlapping (Fig. 3) of the selected historical maps.

The political and economic transition of Slovenia in the 90s represents the period of the fast inflow of capital into the city, which leads to a complex situation of urban design of the city. A mayor changed the protection regime of the historical city in 2007 when he dismissed a decree of preservation of the area. From then on the area was under pressure of constructing mostly the shopping infrastructure.

1. Built vs. open structure. The built structure was organised as a planned medieval town, with the main axis from W-E and a series of small closed narrow and winding streets (passive urban cooling). More detailed view on the plans indicates that most of the streets originated at the border of the island with a closed square (inner side of the old town) and ramified through a series of small open spaces towards the main square so-called *Platea Communis* (now Tito’s square). The linear structured blocks were organised from the open public space to the inner common courtyard, which were open to the South. The array

of the urban structure on the North axis was not so clearly organised. The sea-frontage line was opened to the North. Another key feature of the urban composition of open spaces is the organisation in horizontal lines, which represent the organic connections of small open spaces inside the crossing lines to the main square. As synthesis of the core elements we can distinguish: a. communicational axis and lines; b. the centre and main square; c. the frame of the urban composition; and d. starting-points and small squares on the periphery of the island. They characterise the introverted structure of the maritime urban morphology.

2. Symbolic value vs. dominant element. Tito’s Square with the Revolution Square represents the essence of an imaginary circle, followed by eight peripheral squares that had formed within the walled town (Bernik, 1968, 198). Six of the squares had their own ports (according to a town-plan by Fini, of 1619; Fig. 1a; Koper even had fifty-two churches). Each square consists in a similar ground plan template (ibid.). The organisation of most peripheral squares had a very similar design as a rectangular ground space with a church and oriented to the wall. The town-wall of Koper is abstractly represented as a symbol on the map of Mediterranean sea (Sejjida Nüha, 1648-1850; source: Bernik, 1968, 22). Only a fraction of the wall has been preserved nowadays. The structure of buildings was a composition of vertical, horizontal and slanting lines that create a dynamic roofscape based on movement of shadows and colourful day-lighting games in all facades and pavements. The vertical landmarks like the *cittadella* tower (Fig. 1b); the rhythmical defence towers and motional roofs (Fig. 1d) make the townscape of Koper a dynamic but centre-oriented settlement (Fig. 1f). Summarizing we can highlight the *cittadella* tower, main *piazza*, roofs, the wall and churches as predominant symbolic components even though the old town has lost its sacral dimension.

3. Agricultural land include protection vs. new developments

In the past Koper was surrounded by the sea. After the attack of Austro-Hungarians, the walled town was destroyed circa 1820. The urban structure was opened and the wetland between the island and mainland was turned into saline area (Fig. 1a, 1b, 1c, 1d, 1e, 1f, slowly growing of saline area at the south). In the interwar period, the island was connected with the mainland. The modified geographical conditions have opened the possibility to large urban development. In the past, the Koper’s urban economy was mainly oriented to farming and fishing followed by a large expansion of the Port of Koper with residential areas, crafts and industry after the WW2. In the last 20 years shopping areas and tertiary business have been created. On one hand the town has reclaimed

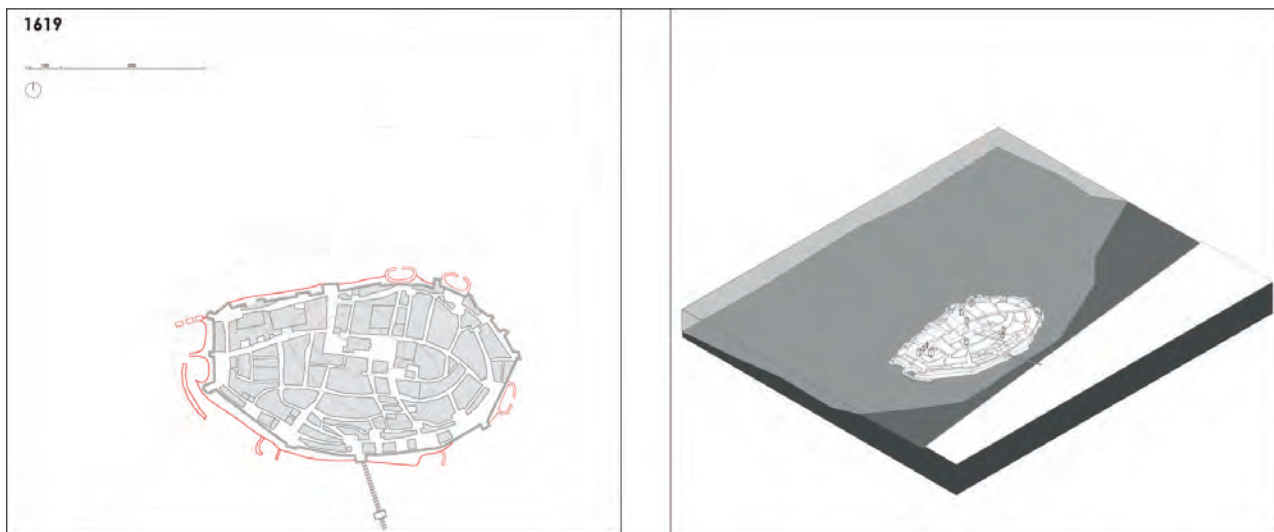


Fig. 2a: Interpretation of town-plan made by Giacomo Fino, 1619. (Archiv: Suau, Fikfak, Grom, 2014)

Sl. 2a: Interpretacija mestnega načrta, Giacomo Fino, 1619. (Arhiv: Suau, Fikfak, Grom, 2014)

land but on another hand its has signified the loss of urban vision and sense of maritime identity. Negative effects of shopping centres location in the vicinity of town centres are visual degradation, loss of land for urban creative activities and consequently malfunctioning of the town centre (UNEP/MAP, 2008, 32). The only area that stopped the urban growth is the

natural reserve of Škocjanski zatok⁴. But the natural reserve is in an absurd way connected with the biggest shopping area built in the last decade. Here we can observe inappropriate planning process and manipulation processes of local politics and commercial capital⁵. As an abstraction of the urban figures we can refer to: saline area, Port of Koper, farming

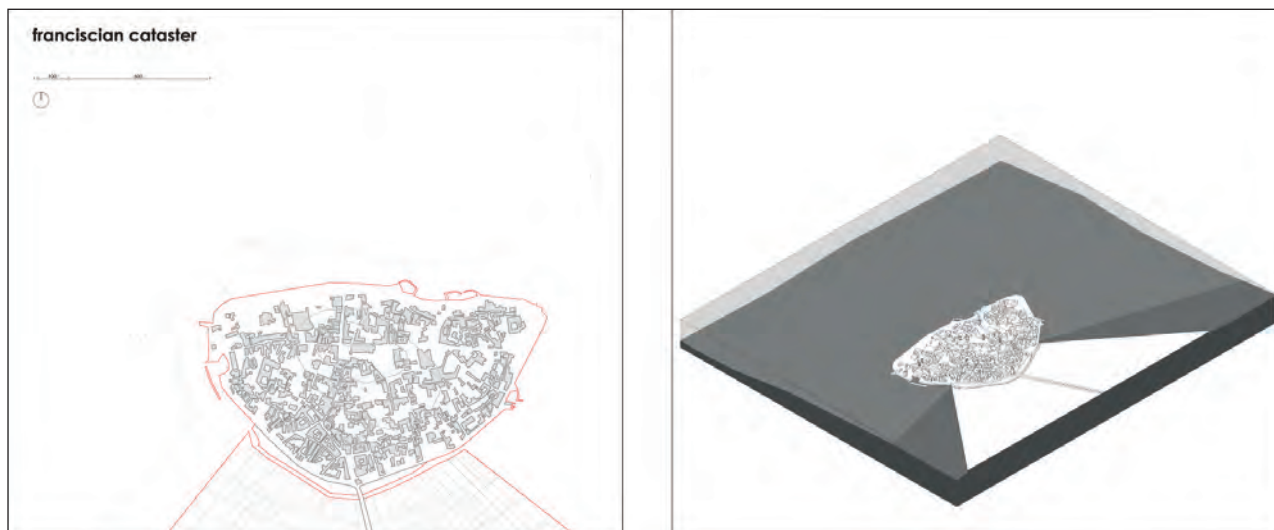


Fig. 2b: Interpretation of catastral plan, caled 'Franciscian cataster', 1819. (Archiv: Suau, Fikfak, Grom, 2014)

Sl. 2b: Interpretacija katastrskega ančrta, imenovanega 'Franciscejski načrt', 1819. (Arhiv: Suau, Fikfak, Grom, 2014)

⁴ Škocjanski zatok comprises a large lagoon with low water level and the Bertoki Bonifika. It is of special significance because of its location close to the urban tissue of the city of Koper (UNEP/MAP, 2008, 25).

⁵ The prison which was planned according to 1984 plans was finished in the 90s on the fringes of the city, just next to the natural reserve, same time when a lot of land just around it was sold because of the change of land use by the mayor in 2007. Now we are facing a situation where the shopping mall and the prison share the same parking area in front of them.

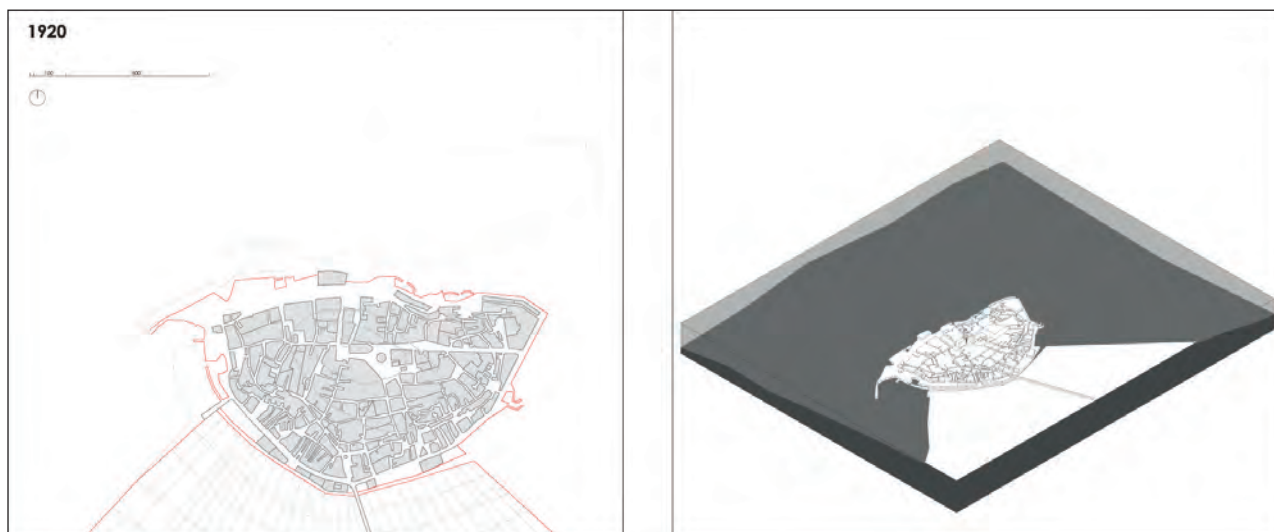


Fig. 2c: Interpretacija of catastral plan from 1920. (Arhiv: Suau, Fikfak, Grom, 2014)

Sl. 2c: Interpretacija katastrskega načrta 1920. (Arhiv: Suau, Fikfak, Grom, 2014)

and fishing, shopping centres and other programmes (including prison, construction waste and other brownfields). The resilience of the land has offered the possibility of survival for centuries but nowadays, due to speculative development⁶, it has turned into degraded urbanised areas. Not only commercial structures had negative influence on the city core but also architectural interventions in the last ten years. Demolition of modernistic building from the 60s as for example a school on the edge of the historical city and construction of a new school is a typical example of the manipulation with space and society⁷. There is a huge unfinished structure, built for the use of city municipality offices combined with a huge swimming pool, sport activities and hotel just next to the new built school and it will never be finished because of collapse of construction companies in 2008. There is no idea and no future prediction for the site. The construction collapse gave time to the planning processes so there was nothing built since then. Otherwise another wrong investment would be made; just next to the prison in the shopping area the university planned to build a big university campus. There was a contest in 2010 for building of a new campus instead of using spaces in the historical city. And the project would not negatively affect the city of Koper only in terms of climate but also in terms of the use

of the spaces in the historical city. Instead of trying to set the university programme in the abandoned buildings according to the model of the city university, a potential new campus takes the programme out from the historical city centre.⁸

MORPHOLOGY ANALYSIS AND DESIGN METHODS

An in-depth assessment of urban morphology and climate within Koper's old town and its surroundings requires diversified information sources and effective tools at different scales. The phenomenon of urban climate must be defined and comprehended also at the urban and regional contexts, in which all dynamics and impacts are undertaken in relationship with the expansion of urban sprawls (geographic territory). Coonop and Nash in *"Transitioning Towards Urban Resilience and Sustainability"* (TURAS, FP7 EU research 2014, 5) are suggesting that the key first step to maximising the resilience and sustainability in such a process is ensuring that design is based on regional context both in terms of being current climate and climate adaptation resilient and relevant to regional biodiversity, specifically that of national and international conservation value.

This study articulates elements of urban morphology, landscape and environmental design strategies found in Koper as a part of the maritime urban legacy of Venetian

6 The development of Koper is still today based on 3 plans: 1964 – Proposal for remediation of the old town of Koper; 1965, 1968 – Urban programme of Slovenian coast 1983 – Investbiro, Masterplan for the area of Vojkovo nabrežje. Since 1988 much written documentation of the old Koper has been published – 18 (<http://www.koper.si/index.php?page=documents&item=1001757>) as well as many partial documents for different locations.

7 On the main facade of the new constructed school there is about a 6 m caption '63,3 hvala' (63.3 thank you) which is the percentage of the votes the recent mayor got in the referendum for the construction of the new school. There is no comments from the public or profession on such a political manifesto on the public building.

8 More see Bugarič (2006).

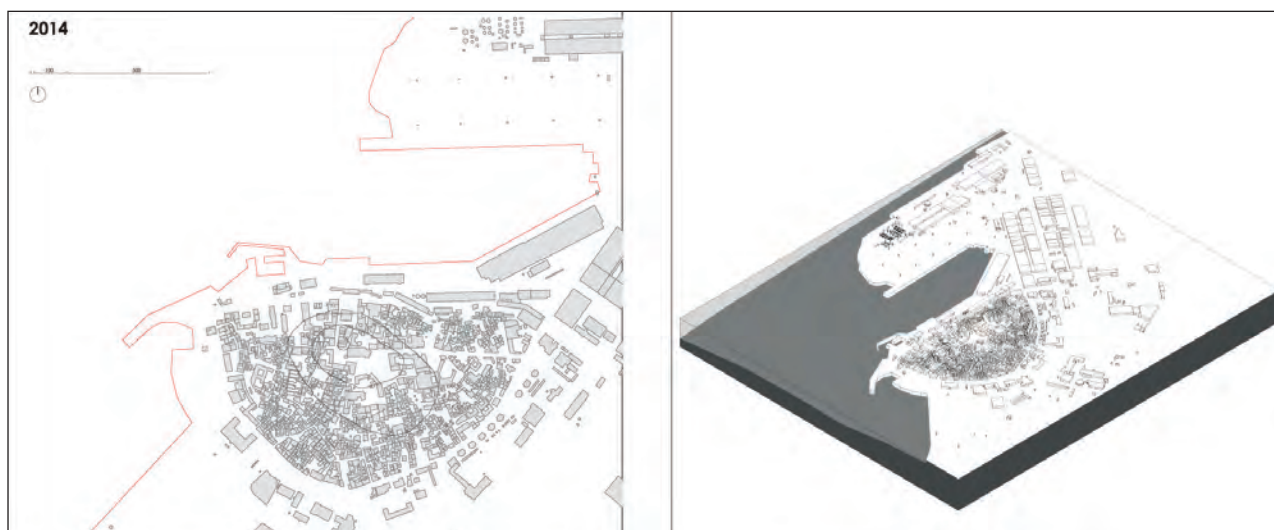


Fig. 2d: Interpretation of 'Digital cadastral plan (DKN)', 2014. (Archiv: Suau, Fikfak, Grom, 2014)
Sl. 2d: Interpretacija 'Digitalnega katastrskega načrta (DKN)', 2014. (Arhiv: Suau, Fikfak, Grom, 2014)

cities. In doing so, it implements the following research methods of climatic and urban morphological analysis:

a. Compilation of historical maps (unique inventory of urban history and morphological evolution of Koper).

– Town plan of “Capodistria” by Giacomo Fino, 1619 (source: HISTRIA. Humanistično društvo - Societa umanistica - Humanističko društvo) (Fig. 1a, 1c, 1e).

– “Capo d’Istria”, plan of the town and its surroundings, 1773 (source: Archivio di stato di Trieste).

– “Capodistria”, Catastral plan, caled “Franciscian cataster”, 1819 (source: Archivio di stato di Trieste).

– “Koper”, digital municipal plan (DKN), 2014.

b. Digital imagery of historical urban views as relevant data of urban history and morphology survey: Pokrajinski arhiv Koper; Kamra (Digitalised Cultural Heritage of Slovenian Regions) and Archivio di Stato di Trieste (Fig. 1b, 1d, 1f).

c. CAD drawing and planar/axonometric representation via digital simulations and graphic-based computer programming (i.e.: CAD, 3D Max) (Fig. 2a, 2b, 2c, 2d, 2e, 2f, 3).

d. Thermal satellite imaging. It encompasses complex digital simulations such as: Esri, DigitalGlobe, GeoEye, I-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, Swisstopo and the GIS User Community. Global Land Survey (GLS) sets from Landsat⁹ images (5ETM+, 2011, code 191/028. Date and time: 23.8.2011

at 9:40 am). GLS permits the study of landscape change including land use change, deforestation/reforestation, urbanisation, disaster assessment and water level change (Fig. 4).

e. Analysis on the level of regional development of urban sprawls (Corine 2000 and Natura 2000 data).

f. Open source climatic data: Climate Consultant 5.5¹⁰; Energy Plus; and Weather Data and bioclimatic charts.

g. Fieldwork and photographic recording: Site-specific visits and panorama street views through i-Phone (app Panorama) dated on May 9th 2014 (Fig. 5).

h. Typology of open spaces in the old town of Koper (Žakelj, Koderman, Bugarič, Cotič, 2014).

i. Simulations of urban landscape scenarios (through in time cross-sections) with interconnecting urban morphology and climate’s design recommendations (Fig. 6).

A combination of methods utilised is explained through the interconnectivity of all above listed methods of urban morphology (and climatic) analysis. This part of the survey is focused on the evolution of urban morphology in open spaces or voids (referred to elements of understanding about the micro-scale of climatic urbanism) as visual analysis. **This section** interweaves various data from climatological, topological, geographical and urban sources and observes them as pictorial phenomena (including history of urban morphology and image):

⁹ Landsat represents the world’s longest continuously acquired collection of space-based moderate-resolution land remote sensing data), /.../ high-quality data that meet both NASA and USGS scientific and operational requirements for observing land use and land change (<http://landsat.usgs.gov/>).

¹⁰ *Climate Consultant 5.5 (Build 4)*, May 15, 2014 uses format climate data that is made available at no cost by the Department of Energy for thousands of weather stations around the world. Climate Consultant translates this raw climate data into dozens of meaningful graphic displays. The purpose is not simply to plot climate data, but rather to systematize and represent this information in easy-to-understand ways that show the subtle attributes of climate, and its impact on built form. Each simulation has employed ASHRAE Book of Fundamental Comfort Model – 2005. Refer to: <http://www.energy-design-tools.aud.ucla.edu/>



Fig. 3: Historical interconnection of town plans: 1618, 1918, 1920 and 2014. (Archiv: Suau, Fikfak, Grom, 2014)
Sl. 3: Prekrivanje zgodovinskih načrtov mesta: 1618, 1918, 1920 and 2014. (Arhiv: Suau, Fikfak, Grom, 2014)

– Regional interconnections between urbanisation, rural zones and climate. The knowledge of the climate inside a city can be developed from observations either in-situ (ground-based, fixed or mobile) or by remotely sensed measurements (Srivanit, Kazunori, 2011) (thermal satellite imaging; Fig. 4). We used both methods, but for more detail the ‘observations in situ’ were used by discovering the details on the scale of morphology in open spaces,

– Comparisons between surface of open spaces vs. mean outer temperatures in hot seasons (data from the weather station Trieste and Portorož; combination with Climate Consultant 5.5 [Build 4], article: Topoclimatic map of the littoral zone in Slovenian Istria [Vysoudil, Ogrin, 2011] and wind rose [Port of Koper¹¹]),

– Modelling through specification of land cover distributions (data from the Corine 2000; GIS User Community; GLS; 3MAP/PROSTOR; and inventory of urban land uses),

– Surface urban heat islands in urbanised areas.

URBAN MORPHOLOGY DESIGN RESULTS AND RECOMMENDATIONS

When investigating urban morphology, climate impacts, and the correlation thereof in the sequential perception of space, we explored the impacts of the phenomena identified in the first part of the research (mapping) at the micro level of spaces within the urban areas of the old town of Koper, and the impact of changes of the expanding service activities at the salt-pans’ site (impact of the site on the changes in the town centre). As Gobakis et al. (2013) explored, building materials currently used in the construction of buildings have low solar reflectance, leading to an increase of surface temperature of the building. Increased urban temperatures, exacerbate the peak electricity demand for cooling and decrease the efficiency of air conditioners, while it reduces considerably the cooling potential of natural and night ventilation techniques (Geros, 2005) and increases the

11 http://meteo.arso.gov.si/uploads/probase/www/climate/table/en/by_variable/wind/en_Port_of_Koper.html (20.5.2014).

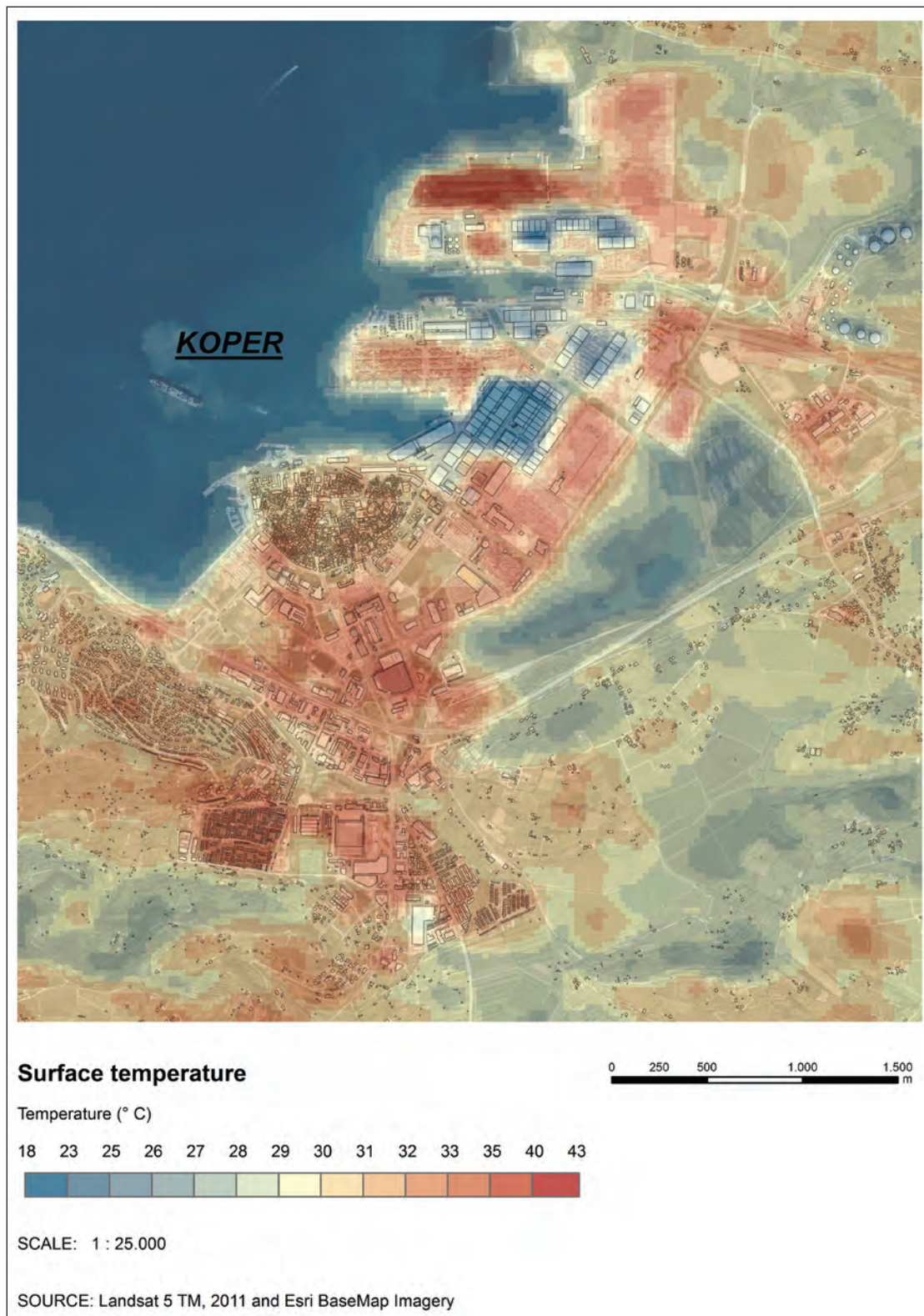


Fig. 4: Koper thermal map, 2014 (Archiv: Konjar, 2014; Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community).

Sl. 4: Koper – termalna karta, 2014 (Arhiv: Konjar, 2014; Vir: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community).

Table 1: Key indicators regarding the “Urban Heat Island” (UHI) effect in the Adriatic settlements.

Meteorological indicators	Morphological indicators	Human indicators
Radiation Temperature Wind speed/direction	Geographical location and topography Vegetation and water areas Building mass Artificial surfaces Structures that block ventilation	Population density Lack of shading Urbanisation with a high share of built-up land and impervious areas Insufficient building insulation Additional heat production (internal gain)

urban ecological footprint. Exploration of the phenomena of open sequences was historically, culturally and indeed subjectively contingent; these were compared with historical images (Fig. 1b, 1d, 1f). On the other hand, this stage of research was necessary to understand the sense of presence, lighting, temperature on the skin, humidity, impact of solar orientation, etc. (examples on Fig. 5) in open spaces of the old town of Koper: open parking areas have a high impact on the visual and UHI effect. Several areas around the old town centre (SW–E orientation), produce overheating of open spaces and have a direct impact on the urban fabric of old town; the openness of urban tissue (dimensions of the buildings and the spaces between them, street widths and spacing) in the direction towards the coast increases air flow, which is, in combination with proper orientation (the sea and direction), favourable to the surroundings; in small open spaces, i.e. squares in the inner part of the old town, the ventilation is affected with the urban morphology organisation of indirect open spaces; large open areas have no impact on the decrease of the UHI effect – on the contrary, the small open spaces with their shadows and openness orientation to the sea are favourable to the lower surface temperature (fractions of built-up, paved, vegetated, bare soil and water); in the town centre, the UHI effect increases towards the main square – in this case we can observe the combination of openness of the site and higher elevation, i.e. greater exposure of spaces and buildings; the outdoor thermal environment and ventilation condition within the climate below the roof tops in the spaces between buildings with natural ventilation and greenery have substantial benefits for the quality of life in open spaces, particularly during increased solar exposure; impact of high-rise buildings on other buildings, open spaces, air flow (ventilation, solar exposure, shadows) and orientation of urban historical spaces (heat, water, and pollutants due to human activity) affect heat absorption, etc.

Regarding the “Urban Heat Island” (UHI) effect in the Adriatic settlements, it is likely that the length, frequency

and/or intensity of heatwaves will increase. Both the diminishing of green urban areas and the increasing of artificial surfaces are aggravating the impact of heatwaves by increasing nocturnal temperatures¹² within Koper. A sign of climate change is rising of the sea level along the Slovenian coast, estimated at 1 mm/year. In the next hundred years, greater risk may be expected and more frequent flooding of low-lying parts of coastal towns (Koper, Izola and Piran), particularly where flooding has already been occurring repeatedly every year (UNEP/MAP, 2008, 28). The main urban climate indicators (Tab. 1) are:

Based on the aforementioned methodological approach of interconnecting urban morphology with the data of climate impacts and changes we made a synthesis (result of the research made) of the urban morphology of open spaces investigated in the old town of Koper:

- **urban morphology** – *density and openness of*: built area, size of structures, “spacing between” buildings, height of the built structure, dimension and orientation of open spaces, uses of the ground floor in the built structure, presence of voids in the built area and decay of the houses in the historical centre due to the lack of content and their emptiness, pedestrian roads and their size, traffic system, etc;
- *connections between physical elements in space*: built-up areas and open spaces (demolishment of the gardens and greenery in the historical centre that provided a natural microclimate), parking areas, green surfaces. etc., population density decreasing from inside out, greenery and trees to open spaces, density of parking places (parking spaces in the historical centre at the location covered in green areas in the 1960s);
- *surfaces and materials*: pavements (concrete instead of stone for the main pedestrian area), buildings, glass-facades, roofs, slopes; **and**

- **climate** – *ventilation (wind speed and orientation)* / indirect natural ventilation which supports the presence of population (air flow in the open spaces);
- *temperature (Mediterranean)* / depending on the exposition, orientation and presence of shadow;
- *humidity (season and presence of rain)* / openness to the water, air humidity, possibility of natural ventilation;
- *orientation (of the built structure or open area)* / possibility of wind flows,

12 Between 2001 and 2030 air temperature in Slovenia will most likely rise by 0.5 °C to 2.5 °C, in the time period from 2031 to 2060 by 1 °C to 3.5 °C and between 2061 and 2090 by 1.5 °C to 6,5 °C (Kajfež Bogataj, 2009, 14).

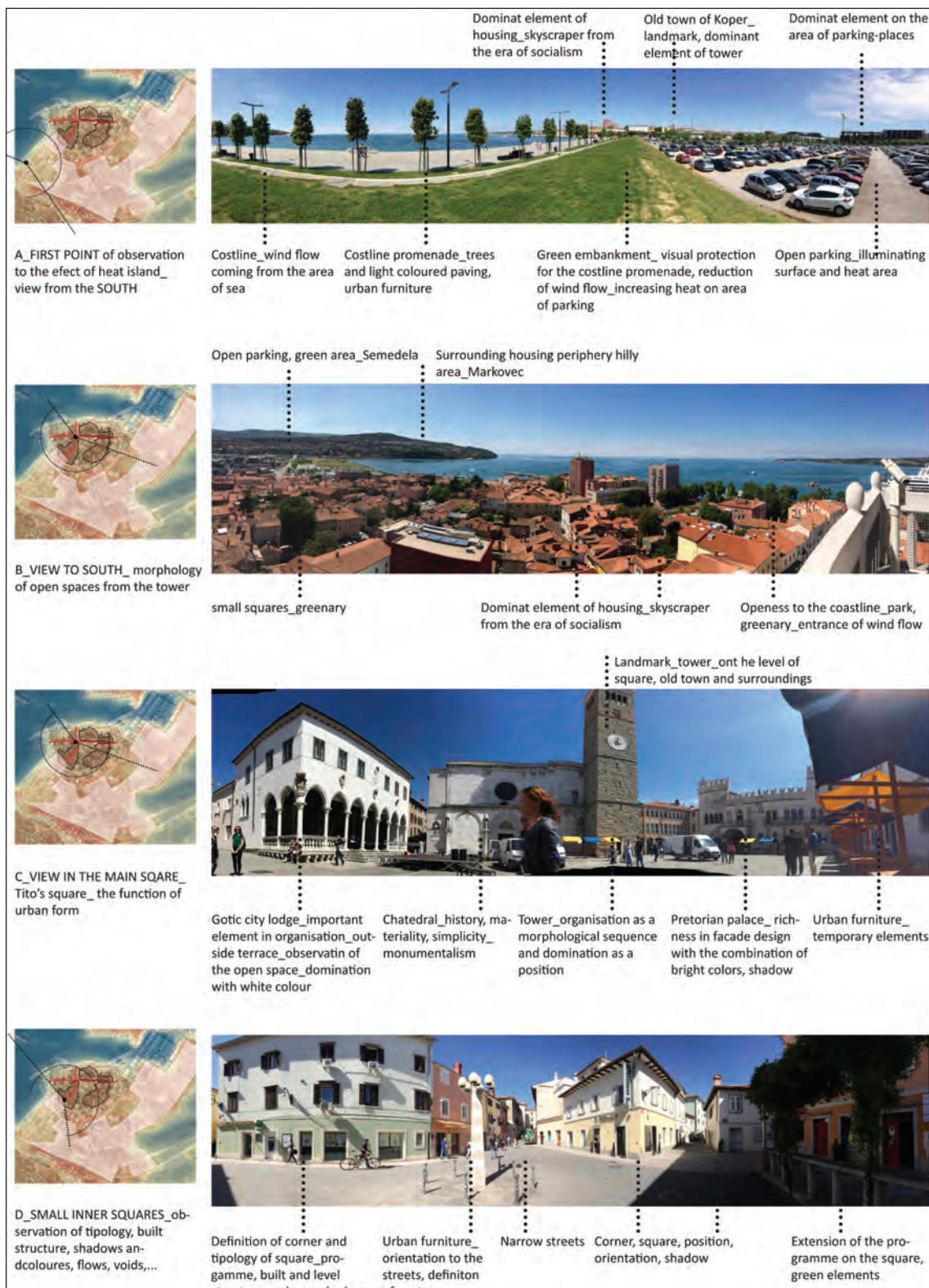


Fig. 5: Urban structures of open spaces - town Koper. Observation of urban morphology on 9th of May 2014, from 12.00-15.00. (Archiv: Suau, Fikfak, 2014)

Sl. 5: Urbane strukture odprtih prostorov - mesto Koper. Opazovanje urbane morfologije 9. maja 2014, od 12.00-15.00. (Arhiv: Suau, Fikfak, 2014)

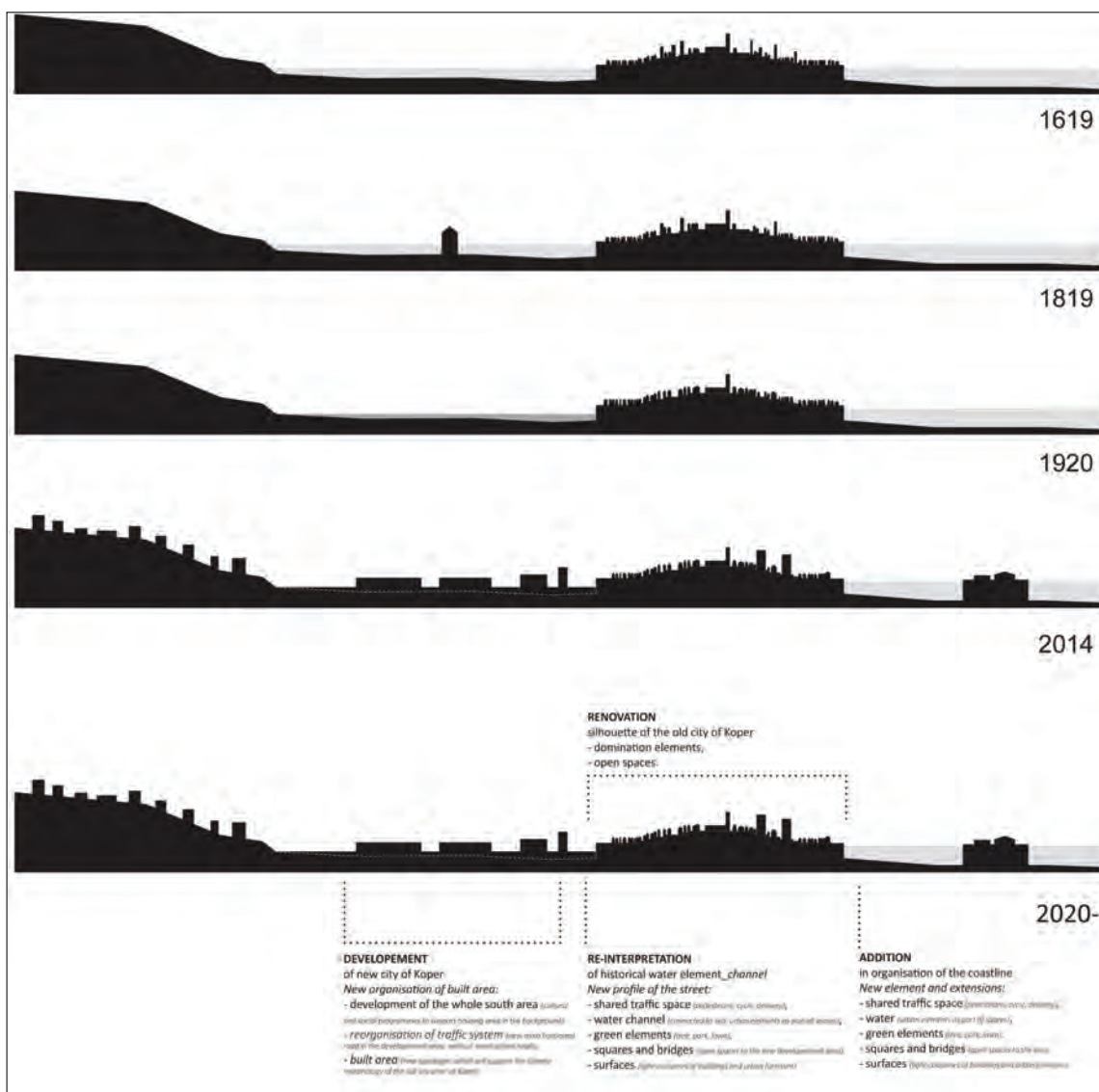


Fig. 6: Schematic sections - development of the town silhouette in relation to the surrounding. (Archiv: Suau, Fikfak, Grom, 2014)

Sl. 6: Shematski prerezi - razvoj mestne silhuete v odnosu do širšega prostora. (Arhiv: Suau, Fikfak, Grom, 2014)

humidity, sun; – insolation (impact of sun orientation) / play of light and shadows during the day, – presence of natural elements (connection to the landscape) / water, vegetation, topography, wind, radiation.

Morphology and urban climate scenario of the old town of Koper

The proposed urban climate system is the result of introducing a new value to **three elements in the open spaces** of built areas – water, green and white surfaces: a new water channel, extension of green areas, and light surfaces (Fig. 6). In the micro-ambience the urban climate system is supported by different elements of streets

and squares, organised as a vertical extension from the coastline to the inner landscape. With these new natural-built axes of flows we introduce a strong vertical connection from Tito's Square in several new directions with sequences of exchanges between openness vs. closeness through streets, squares and the channel – presented as a pedestrian street, an open square to the inner side of the old structure and a main pedestrian street directly connected to the open space of the old part. The traffic system is reorganised – the first ring which is present as a ring to the old city centre of Koper – is removed to the inner part. The connection to the town is organised by new vertical axes: reinterpretation of the salt structure. With the reorganisation of the traffic

system, the extension of the growth is organised as a new closed structure. The main importance in reducing UHI, by introducing these elements, is the section of the new channel and the connection of the surrounding open spaces: canal crossing (bridges), parking surface (light colours or greenery), public transport (new type of mobility), walkways and bikeways, navigation in the channel, anchorage places, etc. The exploration of urban morphology indicators suggests that the impact of urbanization can be mitigated not only by balancing the relative amounts of various urban canopy cover features, but also by optimizing their spatial configuration. In addition to this we can discover the importance of three effects related to urban morphology:

– **Blue = Water channel.** The meaning and the presence of water: as an element of survival, vitality, freshness, vivacity of sound, etc. One of the main reasons to initiate an urban water rehabilitation/reinsertion process: to rehabilitate the urban area around the new line of water, hence referring to the historical evolution of the settlement. The insertion of a new water element, i.e. the channel, is a historical interpretation of the salt area. Reinsertion of water as an intervention in urban re-organisation: to improve urban climate and to introduce new typologies in the use of open spaces. What are climate elements of the canal? Typology (size, width, stream); morphology (dynamics, shapes, elements inside the canal); biological components (diversity, vegetation); natural and technological hazards and solutions. What is the appropriate size of the canal? A size that can impact the urban space quality: visual permeability, density of landmarks, built space quality, public utility of the coastline, a "front canal", intensity of construction. The canal represents a structure of water with sequences of bridges surrounded by built structures or green flat and vertical elements. To the north, the channel in some parts disappears (as a non-visible structure); in some parts the channel is replaced by parking spaces or a mixture of greenery, water and urban pavement: a new urban park connected with the tourist terminal (port) area from the main Tito's Square.

– **Green = Vegetation.** The 'green' elements follow the idea of the water channel and introduce the vertical element of shading in the public space. Different typologies of green elements help to alleviate the problems of stormwater amelioration and pollution, UHI mitigation and energy conservation, as a resource of urban biodiversity (Connop, Nash, 2014), and contribute to the provision of ecosystem services. The single places have to be organised in a way that the green elements produce shading during the most exposed hours (block-

ing sunlight). By adding the 'green' in the open spaces, the space available for development at the ground level will be reduced. The main criteria for the re-organisation of the green spaces are: orientation, wind flows and openness to water elements. For this reason in the vicinity of the old town of Koper it would be productive to introduce green elements as 'mobile' greenery, i.e. as a re-interpretation of green roofs. What are climate elements of the green/vegetation? Typology (size, width, position); morphology (green space, trees, park, locality); biological components and natural circulation (ecological pathway). The green system will introduce the supporting regionally important biodiversity and associated ecosystem services.

– **White = Light colours.** Here, our intention is not to discuss the elements of building renovation, but how the materials, colours and surfaces of the urban morphology fabric interact with open spaces. To introduce the elements of climate urbanism in built structures it will be important to use light colours, matt and non-reflective structured surfaces, connected to the urban history as a reflection of the old town of Koper. As we discovered in this research, the impact of surrounding structures is important. In the case of Koper this represents large shopping and storage buildings with flat roofs. For the existing structure it will be appropriate to use the described materials and light colours not just for roofs, but also for parking surfaces. For the development of new built structures, the idea of green roofs could be applied (Connop, Nash, 2014).

CONCLUSIONS

The research presented in this paper mainly addresses the importance of changes in composition and configuration of urban morphology in the old town of Koper, with the aim of recognizing the relationships between urban history, morphology, development changes in the recent decades, and the impact of urban sprawl; moreover, we investigated how these factors were connected from the regional level to the local old structure. This research expands our scientific understanding of the relationship between urban morphology features and urban climate indicators. Research results are supported by the urban climate scenario. The improvement or restoration of three elements, namely the vegetation cover, a water channel and light colours, could significantly decrease surface temperatures, and thus help to mitigate (and control) excess heat in urban areas. We discovered that the adaptation action should involve the '**Green Infrastructure**¹³ Approach', which contributes to the increase of

13 "Green infrastructure is the network of natural and semi-natural areas, features and green spaces in rural and urban, and terrestrial, freshwater, coastal and marine areas, which together enhance ecosystem health and resilience, contribute to biodiversity conservation and benefit human populations through the maintenance and enhancement of ecosystem services. Green infrastructure can be strengthened through strategic and co-ordinated initiatives that focus on maintaining, restoring, improving and connecting existing areas and features as well as creating new areas and features." (Naumann *et al.* 2011).

ecosystems resilience and can halt biodiversity loss, degradation of ecosystems and restore water cycles in the regional context. In this context, further research must include: flood risk and the natural solutions that can be employed to mitigate this risk (integrated coastal management); improvement of links between territories that share a natural area (separated by regional and national boundaries); planning guidance for open spaces (quantity and character of open spaces); migration needs related to transport corridors and surrounding programmes (the port); energy generation, water and waste recycling, the use of environmentally-sensitive building materials.

By exploring the specific situation of the old town of Koper (as an island) over time we open a comparative research topic: the specific urban morphology of cities such as Koper, Izola, and Piran in Slovenia, and Primošten and Trogir in Croatia, with the same specific traditional urban fabric of Venetian cities along the Adri-

atic coast, provide the potential for an in-depth study, including the relationships of all the elements discussed in this research, to make urban planning indicators (economic, environment and social) more specific, measurable, achievable, realistic, and timed.

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URBANA ZGODOVINA, MORFOLOGIJA IN OKOLJSKO URBANISTIČNO OBLIKOVANJE OBMORSKEGA PROSTORA V STAREM MESTNEM JEDRU KOPRA

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POVZETEK

Trenutni ekonomski scenarij v sredozemski regiji prinaša nove priložnosti preučevanja ustvarjalnih strategij za obnovo krajine v obmorskih mestih, ki izhaja iz inventivne in nove interpretacije njihovih prvotnih urbanih oblik in ekologije. Razvoj in izvajanje evropske strategije prilagajanja podnebnim spremembam za leto 2013 tako ponuja posebno priložnost za vzpostavitev skupnega pristopa in odraža glavne napore, katerih cilj je postati del povezane politike EU. Za sredozemska mesta ne moremo trditi, da se podnebnih sprememb ne zavedajo.

Študija primera mesta Koper v Sloveniji je edinstvena priložnost za raziskovanje okoljskih in mikroklimatskih lastnosti tradicionalnih javnih prostorov v sredozemskih vodnih krajinah. Pri tem smo izbrali reprezentativno glavno ulico – s prehodi, trgi in povezavami – za analizo in zagotavljanje urbanističnih in krajinskih strategij in smernic za izvajanje posegov v prihodnosti in popravilo trenutnih »podnebnih« prekinitev med starim mestom in industrijskim pasom. Na prvi pogled je urbani položaj današnjega Kopra dokaj podoben kot v drugih tradicionalnih mestih po Sloveniji, saj ga zaznamuje: a. opuščanje objektov, b. prekinjena prometna dostopnost, c. ogrožena socialna struktura, d. sezonskost in e. manipuliranje z zemljišči in grajenim okoljem s strani lokalne politike. Dualnost med novim razvojem zunaj starega mestnega središča Kopra in »majhnimi« kakovostnimi spremembami v zgodovinskem me-

stnem jedru je poglavitni izziv v smislu ohranjanja in izboljšanja urbane oblike. Ta del je jasno dokumentiran z vidika primerjalne urbane evolucije in s prekrivanjem izbranih zgodovinskih kartografskih prikazov.

Poglobljena ocena urbane morfologije in podnebja znotraj starega jedra Kopra in okolice zahteva raznolike vire informacij in učinkovita orodja na različnih ravneh in v različnih merilih. Pojave urbanega podnebja je treba opredeliti in razumeti tudi znotraj urbanih in regionalnih okvirov, v katerih je vso dinamiko in vplive treba obravnavati v povezavi s širjenjem razpršene urbanizacije (geografsko ozemlje).

Raziskava opredeljuje elemente urbane morfologije, krajine in strategij okoljske zasnove v mestu Koper kot delu pomorskega urbanega izročila beneških mest. Pri tem uporablja naslednje raziskovalne metode urbane morfološke in podnebne analize. Kombinacijo uporabljenih metod razložimo s povezovanjem različnih metod urbane morfologije in podnebnih analiz. Ta del raziskave se osredotoča na dve ravni, ki se navezujeta na elemente razumevanja na mikroravni, s povezavo urbane morfologije in podnebnih sprememb v odprtih ali praznih prostorih: 1. povezovanje urbane morfologije in podnebnih vplivov prek kartografskih prikazov in prostorske analize; 2. opazovanje in metoda projektiranja odprtih prostorov. Raziskovalni rezultati vključujejo »urbani podnebni scenarij starega mestnega jedra Kopra« s pripisom novih vrednosti trem elementom odprtih prostorov na pozidanih območjih – vodi, zelenim in belim površinam: nov vodni kanal, razširitev zelenja in svetlih površin.

Ključne besede: zgodovina mest, urbana morfologija, podnebne spremembe, mestni toplotni otok, Koper, javni prostori

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