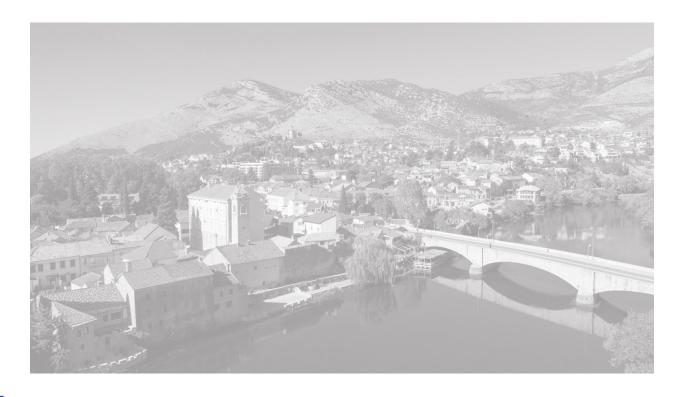




### **GREEN FUTURE OF TREBINJE:**

Sustainable Urban Planning Inspired by the euPOLIS Project







#### INTRODUCTION

**The City of Trebinje** is the southernmost city of the Republic of Srpska and Bosnia and Herzegovina, and it possesses the characteristics of a Mediterranean town. It is located at a significant crossroads, on a route that held major economic importance during the Middle Ages, as it connected Dubrovnik—the largest trading hub on the Adriatic Sea—with other parts of the Balkans.Trebinje lies in the valley of the Trebišnjica River, at the borders of Bosnia and Herzegovina, Montenegro, and Croatia, at the foot of Mount Leotar. The elevation of the urban area of the city is 275 meters above sea level.

The case study that initiated the **euPOLIS project** is called **"Otok"** (meaning *Island*) and is located on the left bank of the Trebišnjica River. It represents an attractive river island formed between the main riverbed and a tributary of the Trebišnjica. The "Otok" site was once a large cherry orchard, and its riverbank area was also used for recreational purposes. In the context of the wider urban area, "Otok" occupies a central position and represents a significant undeveloped green space. The site covers an area of approximately **15.5 hectares**, divided by a city road into two parts: an eastern section of **5.5 hectares** and a western section of **10 hectares**.

The site is entirely covered with vegetation; however, the orchard has been destroyed, leaving no valuable horticultural assets—only low, wild shrubbery remains. The entire area is surrounded by water and offers potential for the development of water-based recreational activities.

On the southern branch of the Trebišnjica River, known as **Ćatovića Branch**, which borders the "Otok" area, riverbed regulation works have been carried out in recent years to protect the settlement from flooding. Solar-powered public lighting has been installed, and plane trees have been planted along this stretch.

In cases of high-water levels, the area is partially flooded. To determine the detailed terrain characteristics and to develop a permanent flood protection system, a **geological survey** must be conducted.







Image 1.: View of the site "Otok" during the flood period

In the city of Trebinje, the most common winds come from the north, northeast, and northwest, followed by winds from the south, southwest, and southeast. Winds from the northern quadrant are predominant, especially in winter, when the bora wind is frequent. The highest average wind speed of 4.2 m/s occurs during north-northeast winds, typically during storms. Calm conditions are relatively rare in Trebinje, accounting for only 12% of all wind occurrences throughout the year.

Regarding the changes in frequency and intensity of climate extremes, statistical analyses indicate that this region can expect a significant increase in upper extremes of climate variables. Specifically, this means that maximum daily air temperatures are expected to more frequently exceed previous climatic records, with increased frequency and longer duration of heatwaves during summer. As for precipitation, more frequent and intense short-term rainfall events are expected, along with an increase in thunderstorms and strong winds, potentially leading to more weather-related disasters.

The climate of the area is Mediterranean, characterized by short, mild winters and hot summers, with abundant sunshine throughout all four seasons. This makes the city of Trebinje a strong candidate for sustainable development of specific forms of urban living. Solar energy would be a significant element for the "Otok" site, particularly if spatial design is approached thoughtfully in the vertical dimension, with an appropriate layout of built and green structures.

The "Otok" location offers the potential for the implementation of advanced planning technologies, which can lead to improvements in the health and well-being of residents in the wider area.





The impact of nature-based solutions is of particular importance, especially those related to shading and evaporative cooling, which are crucial during the predominantly hot summer months. The implementation of solar collectors on newly designed buildings would be of great importance for the entire city. In addition to solar energy, there is a growing global awareness of the importance of water recycling, especially due to its increasing scarcity.

In line with this, when developing detailed technical documentation, it would be essential to plan for water recycling systems. Possible ways to reduce water consumption—aside from limiting usage—include the installation of water recycling systems. This can also be achieved by designing and installing dual water supply systems, where one system is supplied with recycled water collected from rainwater harvesting systems, or through the reuse of greywater or blackwater. In this new area, it is important to plan for the construction of green buildings—structures designed and built to have minimal environmental impact throughout their entire life cycle.

At the time when the euPOLIS project was initiated, the development of an implementation-level spatial planning document for the "Otok" site was a current topic in the City of Trebinje. This process would be preceded by the creation of an urban plan that would define the main guidelines for the development of the "Otok" area. The "Otok" site was envisioned as a new part of the city, entirely based on the application of nature-based solutions, from planning to realization. Since the preparation of an urban plan is a complex process that requires resolving all spatial conflicts, the planned timeline for its development was extended, and it was uncertain whether the plan would be finalized in the near future. After numerous analyses of the "Otok" site, surveys conducted with citizens, and communication with interested stakeholders, it was concluded that for the successful learning and application of methods from the euPOLIS project, it would be desirable to have a constructed site or a site with defined planning documentation.

The "Zasad Polje" area, due to its construction expansion, emerged as an ideal location for the analysis and application of euPOLIS solutions. In recent years, "Zasad Polje" has become the largest construction site in the city of Trebinje. It is desirable to analyze the existing implementation-level planning documentation, both in the areas that have already been developed and in those where development is yet to take place. Accordingly, the second half of the euPOLIS project duration was dedicated to the case study of "Zasad Polje".









Image 2.: "Zasad polje" 2011. year

Image 3.: "Zasad polje" 2025. year

An orthophoto image of the "Zasad Polje" area from 2011 and a "Google Earth" image from 2025 clearly show that significant changes have occurred over the fourteen-year period. In the past, the "Zasad Polje" site was home to an old Austro-Hungarian military barracks with accompanying facilities, as well as production buildings belonging to a oncelarge industrial company. After the company ceased operations and the former barracks were repurposed for educational use, the area became the primary direction for the city's expansion. Construction began, mainly of multi-family residential and mixed-use residential-commercial buildings, shopping centers, public facilities, and office buildings. The 2008 Regulatory Plan for "Zasad Polje" was designed to meet the needs of that time, when there were no indications of a future surge in demand for residential units and commercial space in Trebinje. The 2008 plan reflects a vision of comfort, with numerous public green areas and recreational-sports facilities, while the built structures were secondary in focus.

However, in the following years, there was a rapid increase in interest in city expansion and construction of a larger number of buildings. Accordingly, it became necessary to update the existing regulatory plan, which underwent several amendments up to 2022, adapting to the changes in the city's economic, industrial, and social development. The result is the 2022 Regulatory Plan, prepared in accordance with current legal standards, but significantly different from the 2008 version. The new plan is dominated by multi-





family residential buildings, while public green spaces have been reduced to the minimum legal requirements.

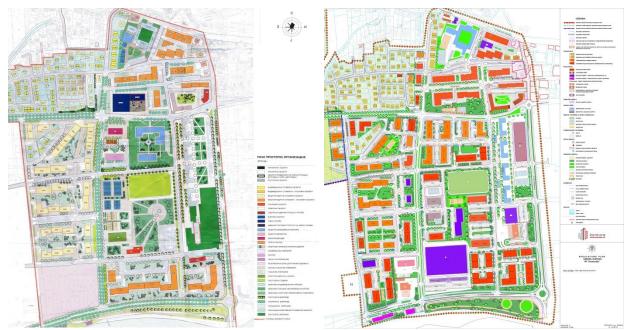


Image 4.: RP "Zasad polje" 2008

Image 5.: RP "Zasad polje" 2022

Planning urban space in this way brings both positive and negative consequences. The positive aspects are reflected in the growth and development of the city, an increased level of urbanization, the arrival of new business facilities, the attraction of a greater number of investors, and the expansion of the city's tourism offer. The negative consequences relate to the lack of green infrastructure, which would otherwise help balance the relationship between built and natural environments, preventing adverse effects on the microclimate within the settlement. Additionally, it reflects a modern-day urban issue common to many cities — a shortage of parking lot or inadequate organization of existing parking areas.

By analyzing the urban matrix of the city of Trebinje, it can be concluded that over the past 30 years, both the quantity and quality of green infrastructure have been in a disadvantaged position. The expansion of construction has led to an imbalance between the natural and built environment, reaching a point where this issue must be addressed seriously. It is essential to act now so that in the next 30 years and beyond, the residents of Trebinje do not experience the negative effects of microclimatic changes that could arise if the issue of the city's green matrix continues to be neglected. Through the analysis of the current condition of specific locations, targeted interventions can be made at the micro-location level, ultimately resulting in benefits for the entire city and its broader surroundings. Horticultural features are also elements of cultural and historical heritage. Their spatial form, manner, and intensity of use within the city are indicators of the city's uniqueness. As structures with distinct and special characteristics, they continuously transform and evolve over time. The degradation of green infrastructure is a phenomenon





that highlights a conflict within the urban development process but also serves as evidence of the diminishing ecological value of the city of Trebinje.

#### SITE ANALYSIS: "ZASAD POLJE"

#### 1. Park "Luč"

The park in the Luč neighborhood was a priority site for analysis within the euPOLIS project. It is located within the scope of the regulatory plan "Zasad Polje," which envisions the development of the park and the construction of a primary urban road on its southern side.



Image 6.: Excerpt from the RP "Zasad polje" 2008, park site.

The park site represents a significant green area with a dense arrangement of trees and has been recognized as a space that should be preserved and enhanced. The basic structure of the park consists of cypress trees (Cupressus sempervirens var. horizontalis and C. s. var. pyramidalis) and Aleppo pines (Pinus halepensis), while among the deciduous species, the London plane (Platanus × acerifolia) and paulownia (Paulownia) are present. In the previous period, a conceptual design for the park was developed, which evaluated and preserved the existing green structure.





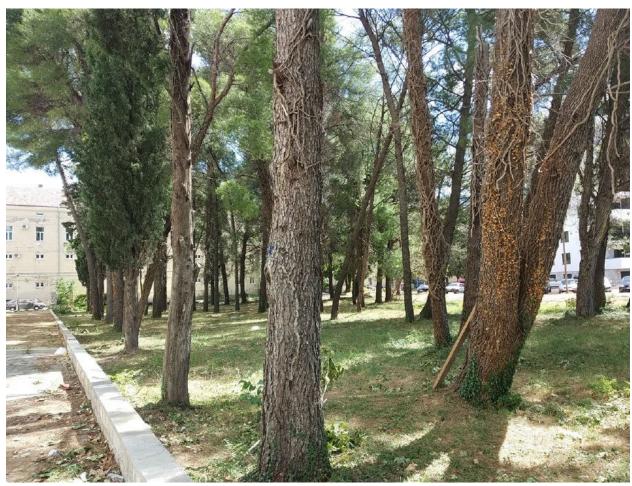


Image 7.: Existing condition of the green structure at the "Luč" park site.

Through the conceptual design, the park has been enhanced with new elements to harmonize the height and form of the green structure and to achieve an attractive spatial appearance. Within the euPOLIS project, we aim to explore modern nature-based solutions that, in addition to the selection of plant species, also include natural approaches to the design and development of urban furniture, planning of public lighting, and the design and construction of irrigation systems. Particular attention is given to the careful selection of plant species with respect to allergens, maintenance requirements, seasonal transformation, and adaptability to the specific site conditions. In addition to the planned development of the park as a green area, the regulatory plan also includes the construction of a children's playground and a sports field. The playground has already been built, but it can be further improved by replacing worn-out elements with components made of up to 95% post-consumer recycled materials, such as ocean waste, used textiles, and plastic bags. These products result in approximately 50% lower carbon emissions compared to standard products.

The conceptual design shows the eastern side of the planned park, which has been detailed based on a geodetic survey of the existing trees. Pedestrian surfaces within the park are planned to be made from permeable materials, primarily permeable concrete





with a porous surface composed of concrete, pavers with open pores, or asphalt with an underlying stone reservoir. This is also considered a green solution, as it allows water to pass through it, instead of accumulating on the surface or running off. Precipitation and water are stored in the reservoir, from where they slowly infiltrate the soil below or are drained through drainage tiles. Stone or gravel acts as a natural filter and cleans the water from pollutants. Some advantages of using permeable concrete include: It does not create a "heat island" — an area significantly warmer than its surroundings. It can be produced using recycled materials, which reduces the environmental impact during the manufacturing of construction materials. New techniques allow manufacturers to use byproducts, such as slag cement from iron production, to create concrete that can serve as a green component, also helping to reduce landfill space. Water and precipitation penetrate the surface, and ice does not form on it even at low temperatures, making the surface safe for walking.

Permeable concrete surfaces help manage stormwater efficiently by reestablishing the natural hydrological balance and reducing runoff volume. They slowly release stormwater into the ground instead of allowing it to flow into storm drains, which would otherwise represent a significant loss.



Image 8.: Conceptual design of the "Luč" park.

Irrigation of park areas can be addressed by implementing solutions aligned with the principles of the euPolis project. Given the site's proximity to the Trebišnjica River and previous research indicating the presence of certain reserves of groundwater, the construction of a well is proposed as a sustainable source of water for irrigation.

The system would include the installation of a submersible pump to draw water from the well. The pump would be powered by electricity generated from solar panels. This





approach ensures an energy-efficient, environmentally friendly, and long-term sustainable solution for irrigating green areas.

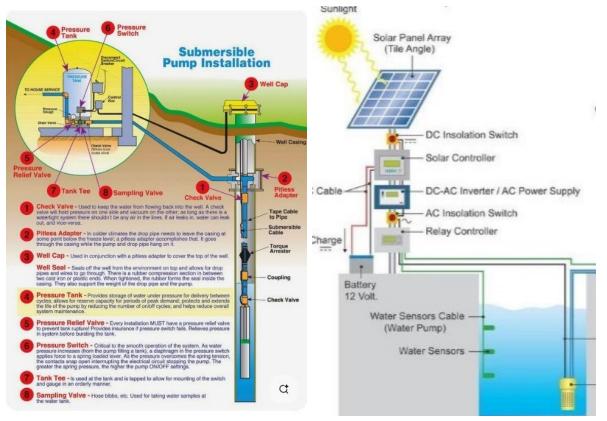


Image 9.: Groundwater extraction with a submersible pump

Image 10.: Powering the pump with a solar panel

Water distribution would be carried out through a drip irrigation system, which enables precise and efficient watering of plants with minimal water loss due to evaporation or runoff. The pipeline network would be extended throughout all relevant areas of the park, with particular focus on the root zones of plants, shrubs, and trees that require regular and controlled moisture levels.



Images 11, 12. i 13.: Underground "drip" irrigation





The system would approximately include:

-A main supply pipeline from the pump to primary distribution points, secondary pipes that deliver water to individual plants or plant groups, drip tapes or hoses with integrated emitters to ensure uniform water delivery, filters and pressure regulators to protect the system from clogging and ensure stable operation, the possibility of automation via programmable controllers, which further increases the system's efficiency and reduces the need for manual intervention.

Such a system contributes to the rational use of water, reduction of operational costs, and preservation of natural resources, fully aligning with sustainable and nature-based approaches defined within the euPolis project.

Despite its numerous advantages and undeniable impact on energy efficiency, this system also has certain limitations that must be taken into account during the development of the main project:

clogging of emitters (result: uneven irrigation; this issue can be addressed by installing filters at the system inlet, along with regular cleaning and maintenance), over- or underirrigation (can be mitigated by using pressure regulators, proper system planning, and potentially automation through soil moisture sensors), Dependence on solar power may present certain challenges during periods of insufficient sunlight (however, given that Trebinje is known for its high number of sunny days – over 260 per year – the likelihood of this issue occurring is very low).

It is recommended to regularly monitor the quality of the water used for irrigation. In terms of system maintenance, it is important to provide staff training in parallel and to ensure that the installation allows easy access to key components.

Technical Equipment for the Irrigation System from a Borehole (Approximate Specifications): well/borehole(approximate depth 10–20 meters);casing Pipe: PVC or steel, Ø110–160 mm – prevents borehole collapse;filter Pipe (lower section): prevents water turbidity;manhole Cover ;Pump and Accessories approximate (Flow rate: 2–4 m³/h;pressure: 3–5 bar;power: 0.75–1.5 kW),check valve – 1 unit, dry-run protection device,electrical control cabinet, flexible hose – connects pump outlet to filter; Filtration and Control Components(particle filter (disc or mesh type),pressure regulator-manometer,filter flushing valve

Water Distribution System:primary pipeline: (PE pipe Ø25–40 mm), length 50–100 m; secondary pipeline (PE pipe Ø16 mm), length 100–300 m,drip tapes/hoses(2–4 l/h) emitters;other installation materials Power Supply.

Note: The exact selection of the pump and pipe dimensions depends on the following factors: Depth of the borehole, distance between the irrigation system and the borehole, required pressure and flow rate

All these parameters must be carefully considered during the development of the detailed (main) design.





New horticultural elements have been successfully integrated into the layout of the existing trees. During the development of the conceptual design, the main idea was to achieve a layered (multi-tiered) green structure, which brings several benefits:

- Sensory Experience: By integrating variations in height, the landscape can
  engage our senses more fully. This interaction is particularly emphasized in
  sensory gardens, where height differences can intensify the experience of
  smell, sight, and touch. For example, raised beds with fragrant plants can
  bring the flowers closer to nose level, enhancing their aroma.
- Play of Light: Height variations influence how light and shadow interact throughout the day. A strategically designed vertical structure can maximize natural light or create dramatic shadow effects, which not only enhance aesthetics but can also impact plant growth patterns.
- Height Variation for Functionality: Changes in elevation serve not only aesthetic purposes but also practical ones. Elevation differences can help manage water flow in gardens, preventing erosion and improving drainage. This is especially important in areas prone to heavy rainfall.

Planned green elements in the conceptual design are divided into:

- Ground covers Ajuga, Vinca, tussock grass
- Ornamental grasses pampas grass (lat. Cortaderia selloana)
- Shrubs Aucuba (lat. Aucuba japonica), Pittosporum (lat. Pittosporum tobira), Honeysuckle (lat. Lonicera japonica), Bottlebrush (lat. Callistemon citrinus)
- Evergreen small tree Photinia x fraseri Red Robin
- Avenue trees Betula alba, Acer rubrum 'October Glory', London plane tree (lat. Platanus × acerifolia), and Paulownia (Paulownia)





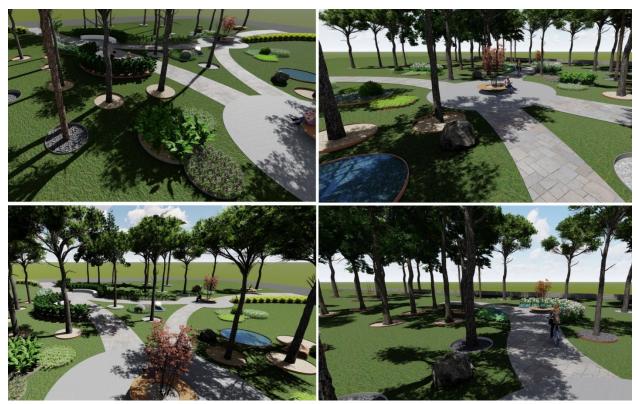


Image 14.: 3D Presentation of the conceptual design of the "Luč" park



Image 15.: Photinia froseri Red Robin



Image 16.: Paulownia









Image 17.: Cortaderia sellona

Image 18.: Aucuba japonica

#### 2. "Building for Young Married Couples"

The building for young married couples is a project by the City of Trebinje, where young married couples had the opportunity to purchase residential units under favorable conditions. Due to the presence of installations in the green areas of the site, planting deep-rooted green structures is not possible. The plan is for the green structure to develop vertically on the floors. In this way, the negative impacts of air pollution and the heating of residential units would be reduced, and it would also be possible to influence the microclimate of the site.





Image 19.: Building for Young Married Couples

The arrangement of three façades is planned: eastern, southeastern, and southern. When selecting the green structure, care was taken to ensure they are adapted according to sunlight conditions. Accordingly, the plant species are divided into three groups:

- Eastern orientation Impatiens (watermelon balsam), Begonia (lat. Begonia semperflorens), Fuchsia (lat. Fuchsia × hybrida)
- Southeastern orientation Desert rose (Ice plant) (lat. Delosperma cooperi)
- Southern orientation Lantana (lat. Lantana), moss rose (lat. Portulaca grandiflora)







Image 20.: Delosperma cooperi

21. Begonia

22. Lantana





The specificity of this type of green façade lies in the fact that it is not planned as a classic green wall, where the structure is attached to the existing façade and a drip irrigation system is installed. The implementation of the green façade is planned as a collaboration between the City of Trebinje and the building's residents, so that through joint efforts they can achieve a unique solution for greening the space. By presenting similar implemented solutions, the residents were encouraged to actively participate in the realization of this project and set an example for others in the region. Through multiple conversations and meetings with the residents, we received maximum support and willingness to participate in this project, as well as information regarding possible allergies. With encouragement from the city, the residents will take care of maintaining the greenery assigned to them according to the orientation of their apartments, which will be more or less challenging to maintain. This project, inspired by the euPolis project, brought together residents, the City Administration, and high school students who, under the expert supervision of engineers from the Agrarian Fund, will grow plants in a greenhouse that citizens will plant and maintain on their balconies.





Images 23. i 24.: The expert team of the City of Trebinje and the residents of the building for young married couples

Studies have also shown that nature can reduce negative behaviors, such as aggression and anxiety. Moreover, it has been found that connection with nature reduces stress and alleviates mental fatigue. This is due to our body's automatic response to seeing and being near natural elements.

#### 3. Parking lot "Stepe Stepanovića" Street

The parking lot in Stepe Stepanovića Street plays a significant role in the city's stationary traffic. The regulatory plan "Zasad Polje" envisions the construction of a public garage at this location, with a maximum of basement, ground floor, and one upper floor (Su+P+1),





and approximate dimensions of  $100m \times 30m$ . However, constructing a garage of these horizontal and vertical proportions would disrupt the ambient value of the site.

The area was formerly an Austro-Hungarian military barracks, and the original buildings have been preserved and reconstructed; today, they serve as educational institutions. Therefore, the public garage should be planned at another location, while the existing parking area should be arranged and greened in order to reduce the negative effects of the large asphalt surface and excessive heat during the summer months.



Image 25.: Parking in "Stepa Stepanović" Street, existing condition

The planned works will not negatively affect the number of existing parking spaces. The asphalt surface at the parking spots will be replaced with grass-concrete pavers. The currently marked horizontal islands will be transformed into green areas for planting tall trees that provide adequate shade. Tree species suitable for the conditions of this location include plane tree (lat. Platanus acerifolia) and European nettle tree (lat. Celtis australis), both of which have airy, wide canopies, require minimal maintenance, provide ample shade and visual appeal, and are highly resistant to pollution. In addition to these spatial interventions, a section of the parking lot is planned to include canopies with green curtains. Plant species suitable for forming green curtains include: evergreen jasmine (lat. Trachelospermum jasminoides), which has dense foliage and fragrant, attractive flowers, ivy (lat. Hedera helix), a perennial woody evergreen plant that is highly adaptable due to its rapid growth and low maintenance needs. It tolerates low temperatures and climbs trees, walls, fences, and other surfaces, attaching itself with aerial roots that develop on





the shaded side of the stem. These roots do not extract nutrients from living trees but use them as support. Ivy is an excellent solution for covering old walls or fences and for creating visual barriers.



Image 26.: Celtis australis



Image 27.: Celtis australis









Image 29.: Platanus acerifolia







Image 30. Parking, existing condition

Slika 31. Parking, planned condition

Given that the parking lot includes buildings constructed over 100 years ago, as well as a large, functioning parking area in front of them, this space should be treated with special care, aiming to achieve the greatest possible effect on minimal interventions. Since the buildings are of large dimensions, their roof surfaces are also substantial enough to allow for the implementation of one of the sustainable and environmentally friendly methods of providing water for irrigation—cisterns or rainwater collection tanks, which would collect and store rainwater from the roofs.

This approach represents an example of a nature-based solution, aligned with the principles of sustainable urban development and the euPolis project. Rainwater is collected from the buildings' roof surfaces through gutters and downpipes, which direct the water into a cistern (rainwater tank). The system should be additionally equipped with prefilters that remove larger debris (leaves, twigs, dust). Water level sensors can be installed inside the cistern to monitor water volume. For irrigation purposes, water is distributed using an electric pump, which can be powered by solar energy, further reducing environmental impact. The water is delivered to the plants through a piping system.

It is recommended to use a drip irrigation system, which allows for precise and efficient watering with minimal water loss by directing water directly to the plant roots. The system can be automated with the use of timers and soil moisture sensors, optimizing water consumption even further. The advantages of a cistern-based irrigation system are





numerous:it reduces pressure on the municipal water supply, utilizes natural rainwater, minimizes soil erosion and stormwater runoff into the sewage system, and represents an environmentally friendly and economically sustainable long-term solution. It is ideal for use in urban parks, courtyards, public spaces, and buildings.

#### Technical Specification:

- 1. Water Collection System:Roof Surface: the roof is in an excellent condition, having been reconstructed 5 years ago;gutters and downpipes: existing downpipes are new, made of metal with a diameter of 75 mmL;first flush diverter- installed to discard the initial, potentially contaminated portion of rainwater;coarse debris filter:-mesh filter with 1–5 mm openings, easy to clean and maintain.
- 2. Cistern (Rainwater Tank)Recommended Materials:reinforced concrete, HDPE (high-density polyethylene), PE (polyethylene), polyester or metal (inox) cisterns Given that the average annual precipitation in Trebinje is approximately 1600 mm, and the roof surface area is 500 m², it is recommended to consider constructing two or more cisterns, each with a capacity of 20,000 liters, positioned along the eastern side of the building. This storage capacity would allow for the irrigation of both existing and planned greenery in the parking area, ensuring an efficient and sustainable water supply for landscape maintenance throughout the year.
- 3. Pump Specification -Flow Rate: 1.5 3.0 m³/h (1500-3000 liters per hour),pressure: 2-4 bar (sufficient for drip irrigation systems),power: 400-800 W (depending on distance and elevation difference),power supply: solar-powered. Additional Features:Recommended pump should include:automatic start/stop function and dry-run protection (to prevent damage when the cistern is empty)
- 4.Solar Panels: 1–2 units, with a total output of 200–400 W, charge controller: MPPT, rated 10–20 A, Batteries: capacity 100–150 Ah (12V); more can be added in parallel, depending on energy demand and autonomy requirements
- 5. Drip Irrigation System Specification ("Kap po kap"):Main Line:PE (polyethylene) pipe, diameter Ø 25–32 mm;Distribution Pipes:PE pipe, diameter Ø 16 mm;Drippers (Emitters): flow rate: 2 l/h or 4 l/;Spacing: 20–30 cm between drippers; Pressure Regulator: Operating pressure: 1–2 bar;Filter (Microfilter);Mesh size: 100–150 mesh (prevents clogging);valves and faucets: Installed on each irrigation branch (section).

It is mandatory to ensure the following maintenance routines:regular cleaning of filters and inspection of the cistern once a month, pump servicing once a year, visual inspection of drippers and pipes throughout the irrigation season





The irrigation system using a cistern represents an efficient, sustainable, and environmentally sound solution, especially in urban areas striving for self-sufficient water resource management. This approach enables the efficient use of available natural resources, helps preserve soil quality and vegetation, and makes a significant contribution to the goals of green infrastructure. For these reasons, it is an ideal solution for the subject location.



Image 32.: Presentation of the idea to stakeholders, the expert team of the City of Trebinje, representatives of the relevant city departments, and the Public Utility Company "Komunalno"

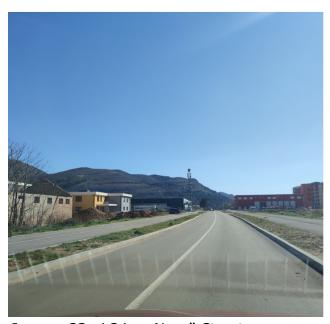
#### 4. "Nova"Street

Nova" Street is a primary urban road constructed in 2024, designed and built in accordance with the "Zasad Polje" regulatory plan. To promote bicycle traffic, bike lanes were planned parallel to the primary urban roads, designed to provide continuous and safe cycling routes. In line with the recommendations from the previous Urban Plan, and considering that the surrounding area remains largely undeveloped, bike lanes were designed as separate surfaces, clearly differentiated from both road and pedestrian





traffic. A tree-lined avenue was not planned along the roadway as the placement of infrastructure facilities was taken into account during the design phase, and the width of the planned green area is 1.50 m, which is not sufficient for accommodating linear infrastructure facilities and a tree-lined avenue. On the eastern side of the road, there are stormwater drainage installations, and on the western side, electrical installations. During the construction of the road, an error in the planning documentation was identified as 'Nova' Street has become an urban heated island. Tree-lined avenues, as part of the green space system, serve to reduce climate extremes during the summer period, as well as to reduce noise levels, dust, and harmful gases, which are significant pollutants in urban ecosystems. Tree-lined avenues also represent the backbone of the green space system, as they connect other categories within this system. Trees improve the quality of life, provide aesthetic appeal to any area, and enhance the design of any street landscape





Images 33. i 34.: "Nova" Street

It is necessary to find a solution to mitigate the impact of the urban heat island effect along the subject roadway. An analysis of the potential relocation of existing utility installations has shown that such an intervention would require significant financial resources and a lengthy construction period. The situation is further complicated by the fact that relocating the stormwater drainage route would involve two technically demanding operations: placing the pipeline within the structure of the newly constructed roadway or installing it beneath the sidewalk. Both options would require complete reconstruction of the newly built street, which would significantly increase the overall project costs. Given the above, it is recommended to consider alternative greening solutions along the street that would not involve the relocation of existing infrastructure.





Trees planted in planters represent a modern trend that has become increasingly widespread in urban landscape design in recent years. These are strong aesthetic and functional elements that can be placed in outdoor spaces either temporarily or permanently. An additional advantage of planters is their mobility, they can be relocated as needed, which can be extremely practical in certain contexts. This method of greening is especially suitable for locations where, due to complex underground infrastructure, it is not possible to plant trees directly into the ground. In this way, planters enable the integration of green elements even in highly urbanized areas, without the need for radical construction interventions. There are numerous possibilities for implementing trees in planters. However, in the context of the subject location, spatial organization must be carefully considered, particularly regarding the separation of pedestrian and bicycle paths, as placing planters occupies a portion of the corridor. Therefore, it is essential to find a functional compromise that does not compromise traffic safety or flow.

The types of trees suitable for planting in planters at this micro-location include:

- Ornamental Plum (Prunus cerasifera 'Pisardi') A decorative tree known for its red foliage. Pink flowers appear as early as in late March. During May, fruits about 2 cm in diameter develop. The tree reaches a height of 7–8 m. The crown is regular and dense, spreading up to 5 m wide. It is frost-resistant and tolerant to low temperatures.
- **Glossy Privet** (Ligustrum lucidum) A tree that typically grows 1.5–3.5 m tall. It has attractive evergreen leaves. In spring, small white flowers grow in large clusters 12–20 cm long. The flowers produce a scent that is not particularly pleasant, as well as large amounts of pollen. The flowers develop green berries that ripen black during winter and usually remain on the tree for most of the year.
- **Crape Myrtle** (Lagerstroemia indica) An extremely decorative small tree that blooms from July through October. It grows up to 3.5 m tall and has an annual growth rate of 30−60 cm. It prefers sunny or partially shaded locations and tolerates temperatures down to −15°C.
- **Mulberry** (Morus alba 'Fruitless') One of the best options for rapid growth and providing shade, requiring minimal maintenance.









Images 35. i 36.; Examples of greening using planters, Bergamo, Italy

Planters can be with or without water reservoirs: especially during dry periods, trees in planters must be properly monitored and given the right amount of water at the right time. Irrigation must correspond to the tree's needs at any given moment, so attention should be paid to the required water quantity and fixed schedules. Since root growth is limited, the tree will also have difficulty absorbing the proper amount of nutrients. Therefore, the application of measured amounts of fertilizer is recommended. Despite good care, a tree or shrub in a planter will always remain smaller, and its lifespan will be shorter than if planted directly in open soil. Finally, for a visually attractive result, the size of the planter and the size of the tree or shrub must be proportional. All these elements should be considered when preparing the main greening project. When preparing the project documentation, it is recommended to consider property and legal relations on the outer side of the sidewalk, on both sides of the roadway. It is also proposed to plan the formation of tree-lined avenues with tall tree species, which would further improve the ambient quality of the space and enhance microclimatic conditions within the project area. The irrigation system can be implemented through a borehole and installation of a drip irrigation system. The pump's power supply can be provided by installing solar panels, given the favorable climatic characteristics of the site. At the subject location, groundwater reserves exist at a depth of approximately 20 meters, while the City of Trebinje records an average of about 260 sunny days per year, making this option technically and energetically sustainable.

#### 5. Canopy in front of the "Bingo" Shopping Center

Worldwide, there are current examples of parking canopies based on natural solutions. In addition to green curtains and green roofs, solar canopy systems are designed to utilize new or existing parking areas and generate energy without sacrificing space, transforming the canopy into a solar energy production system.





The presentation of the euPolis project to the director of the 'Bingo' shopping center in Trebinje represents a continuation of the good practice of cooperation between the public and private sectors. This meeting provides an opportunity for the exchange of knowledge and experiences gained through the implementation of the project, as well as the possibility of applying them at a specific location to improve the quality of urban life. The involvement of local business entities in such initiatives contributes to the sustainable development of the community, creating a foundation for innovative and environmentally responsible solutions in the planning and management of urban spaces.

At the existing parking lot in front of the shopping center, there is a canopy that provides adequate shade for half of the parking area. The canopy is not constructed using green solutions; it is a metal structure covered with panels. On the remaining part of the parking lot, the construction of a new canopy is planned, which will be designed in accordance with green solutions to provide a higher quality service to the shopping center visitors and to prevent the formation of a heat island during the summer months.



Image 37.: Presentation of the euPolis solution to the director of "Bingo" llc Trebinje (Expert team of the City of Trebinje and management of "Bingo" d.o.o.)









Images 38. i 39.: Examples of green solutions for parking canopies

Solar canopies are adapted to outdoor structures equipped with solar panels that capture sunlight and convert it into useful electrical energy. They serve as overhead roofs or shelters, providing shade and protection from weather conditions, while simultaneously generating clean, renewable energy on-site. This type of energy production is known as distributed solar generation, as it does not occur at centralized power plants. Instead, it enables facilities to produce their own energy. Their primary function is to maximize the available space for renewable energy production while offering practical benefits such as shade and shelter. This is a key advantage, allowing these canopies to stand out compared to other solar panel installation methods, such as ground-mounted arrays. Solar canopies can be combined with green curtains that act as partitions between parking spaces. Green curtains play an important role in lowering temperatures and reducing pollution. Living curtains are formed from climbing plants such as star jasmine (Trachelospermum jasminoides) and honeysuckle (Lonicera halliana), which are evergreen species. They help cool the air through water evaporation, while simultaneously providing natural shade and reducing carbon emissions. Besides these benefits, both climbing species are known for their pleasant fragrance.







Image 40.:Trachelospermum jasminoides

Image 41.: Lonicera halliana

For irrigating the seedlings, it is proposed to use a well as the primary water source. Water would be pumped from the well into a reservoir placed on the roof of the building.



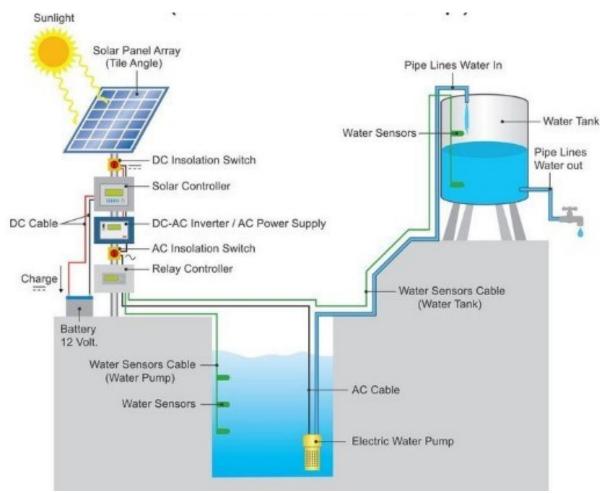


Image 42.: Roof-mounted tank

From that reservoir, using gravity and an installed drip irrigation system, uniform and efficient watering of the plants would be enabled. The water pump would be powered by solar energy, which additionally contributes to the energy efficiency and sustainability of the entire system. This solution allows for automated, economical, and environmentally friendly irrigation without the need for connection to the electrical grid or using water from the public supply system. Technical description of the system: 1. Well: depth: 15–30 m, capacity: approx. 1-3 m<sup>3</sup>/day (sufficient for irrigating up to 30 planter boxes per day)water quality: analysis required due to possible limestone, iron, and other impurities (filtration as needed) 2. Pump:type: submersible pump Power: 0.5–1.0 kW,Flow rate: 1,000–2,000 liters/hour Power supply: solar panels (DC pump) 3. Solar system:  $2 \times 250$ W solar panels; Charge controller: MPPT regulator (for efficient charging) Batteries: 12V, 100Ah (at least 1 unit, depending on autonomy); Inverter (if AC pump is used): 1000W, pure sine wave 4. Reservoir: Capacity: 1,000 – 2,000 liters; Material: PVC, stainless steel, or polyethylene; Location: roof of the building (for gravity feed); Protection: cover to prevent evaporation and contamination, UV protection 5. Drip irrigation system: Pipe type: HDPE, 16 mm diameter; Drippers: 2 liters/hour per seedling; Automation: timer for turning





the system on/off;Distribution: main line + branch tubes to each planter box; System advantages:Sustainability: use of renewable solar energy;Autonomy: no need for connection to electrical or water supply networks;Water saving: precise water dosing according to plant needs;Minimal human intervention: system can operate automatically During the design, special attention should be paid to the roof's load-bearing capacity since the reservoir carries significant weight; a structural assessment of the roof is necessary. It should also be emphasized that water from the reservoir can be used as technical water within the building, while the risk of water shortage in the well is mitigated by having a connection to the city potable water supply, which automatically activates in case of well water interruption.

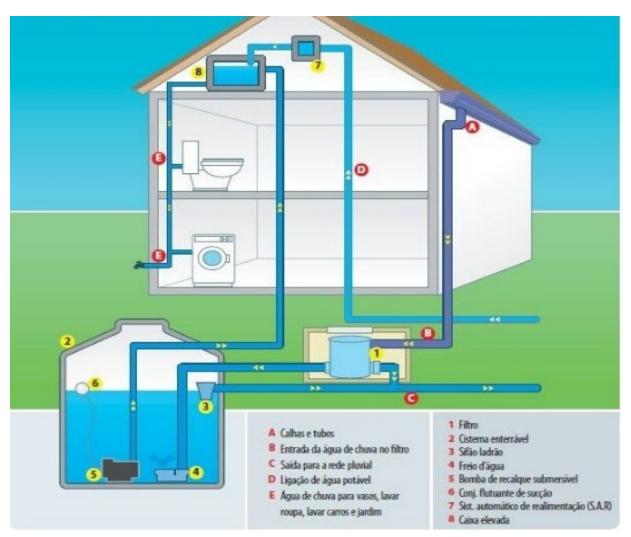


Image 43.: Groundwater extraction system for irrigation and technical water in the facility





## APPLICATION OF SUSTAINABLE SOLUTIONS IN URBAN LANDSCAPE PLANNING — COMPLETED PROJECTS INSPIRED BY THE EUPOLIS METHODOLOGY

#### 1. Project "A Thousand Plane Trees for a More Beautiful Trebinje"

By increasing green areas and selecting appropriate plant species, it is possible to create new pleasant urban environments, which contribute to air purification and improve quality of life. In 2022, at the "Zasad Polje" site, a city project inspired by the euPOLIS project was launched under the name "A Thousand Plane Trees for a More Beautiful Trebinje", which was presented to entrepreneurs, investors, and representatives of city departments. The project involved planting seedlings of the London plane tree (Platanus acerifolia), while among native species, recommended are species such as European nettle tree (Celtis australis), holm oak (Quercus ilex), and others. Other proposed species are non-native but well suited to our climate zone, including cedars (Cedrus deodara, Cedrus atlantica with their cultivars), southern magnolia (Magnolia grandiflora), Japanese cherry (Prunus serrulata), and silk tree (Albizia julibrissin).



Image 44: Project presentation to the citizens ( Document preparation team and citizens)



Image 45. Planting, citizens, and the public sector

#### 2. Urbana akupunktura u ulici "Vuka Karadžića"

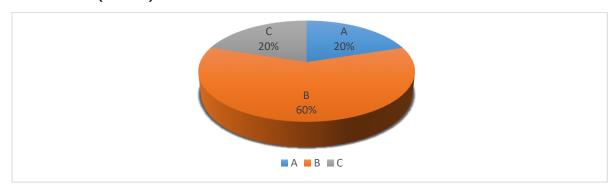
The City Administration of Trebinje, based on an initiative submitted by residents living in Vuk Karadžić Street, conducted a survey to assess the quality of green spaces and ways to improve these green areas. The survey contained 4 questions where respondents were asked to express their opinion on the quality of green spaces in the mentioned neighborhood, how the public green areas in the neighborhood could be improved, and whether the residents of Vuk Karadžić Street were willing to participate in a tree-planting campaign.



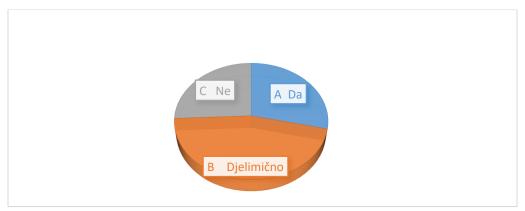


After analyzing 35 anonymously completed questionnaires conducted in Vuk Karadžić Street, the following was established:

- 1. Age groups:
- A. 15-25 (total 7),
- B. 25-60 (total 21),
- C. Over 60 (total 7).



- 2. Are you satisfied with the quality of green spaces in your neighborhood?
- A. Yes (total 10),
- B. Partially (total 16),
- C. No (total 9).

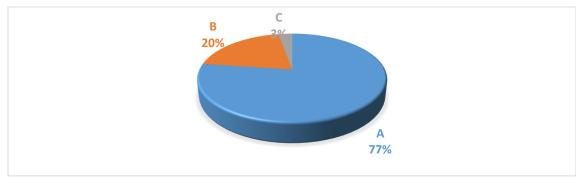


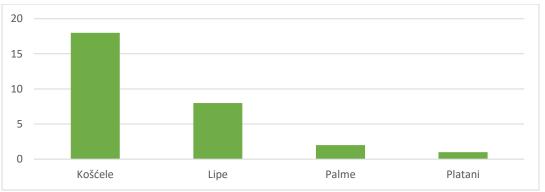
- 3. In what way could the public green spaces in your neighborhood be improved?
- A. Replacement of existing trees (please specify which type you would prefer) Total 27
  - Mediterranean hackberry (Celtis australis) (total 18),
  - -Lindens (total 8),



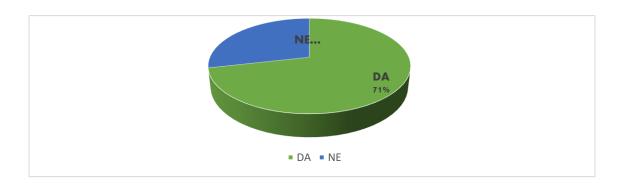


- -Palms (total 2),
- -Plane trees (total 1).
- B. By introducing new plant species (e.g., flowering, fragrant types that are non-allergenic) Total 7
- C. Better maintenance of the existing green structure (total 1)





- 4. Would you participate in a joint tree-planting campaign?
- A. Yes (total 25),
- B. No (total 10).







Based on the survey conducted and detailed consultations with experts, the space was transformed where Lagestremia trees were replaced with Mediterranean hackberry trees. Although the Lagestremia saplings were in good condition, they did not provide the significant shade required from a tree line in the distinctly warm climate of Trebinje. Mediterranean hackberry (Celtis australis) is an indigenous Mediterranean deciduous tree species that will provide the best shade in the mentioned street. The "Košćela" tree grows up to 25 meters, is resistant to plant diseases, and bears edible fruits. The new saplings have been cultivated to develop a central root system that grows deep and will not cause damage to the surrounding pavements.



Image 46.: Replacement of seedlings in "Vuk Karadžić" Street, 2024





Image 47.: Illustration of tree transformation

#### 3. Development of the plaza in front of the entrance to the 'Old Town'

The subject site is located within the scope of the spatial planning implementation document, the regulatory plan "Old Town," where the reconstruction of the moat surrounding the Old Town is planned. Temporary structures such as kiosks were previously installed at this site and served as focal points for gatherings of Trebinje residents. After some time, these temporary structures were removed, and the area became a place for illegal parking and traffic congestion. Since the reconstruction of the moat has been an ongoing topic in recent years, little attention was paid to the temporary arrangement of the plaza in front of the Old Town entrance. The moat reconstruction project has been postponed, creating an opportunity to suitably enhance the space. Inspired by the euPOLIS project and the longstanding use of the plaza as a gathering place, city services decided to temporarily transform the plaza into a small, greened square. We tested this idea through a survey of passing citizens and received a clear response regarding the intended use of the space. After consultations with experts and considering the characteristics of the site, it was decided that olive trees would be planted. The olive tree (Olea europaea L.) is an evergreen shrub characterized by an asymmetrical crown and oval-shaped fruits. It is a typical Mediterranean species that thrives in sunny and bright environments. Given the karst soil of rocky Herzegovina and the large number of sunny days, this plant is well-suited to the area. We expect that the olive tree, which is also a symbol of peace and stability, will become one of the iconic symbols of our city.







Image 48.: Entrance to the Old Town, previous condition



Images 49. i 50.: Improvement of the plaza at the entrance to the Old Town, 2025





#### 4. Reconstruction of green spaces in Trebinjskih Brigada Street

Trebinjskih Brigada Street, one of the busiest city roads in Trebinje, represents an important urban axis characterized by a developed tree avenue with 223 trees approximately 50 years old. Until now, this road had a distinctive visual identity thanks to the tree rows and palm trees planted on the central dividing islands. However, an analysis of the conditions revealed that the micro-location was not suitable for the longterm development of the palms, resulting in uneven growth and a reduction in the aesthetic and functional value of the green areas. During the planning of the reconstruction of the traffic infrastructure, in accordance with the principles of participatory planning, a survey was conducted among citizens. The results showed that 65% of respondents supported replacing the existing green structures with new saplings that are more resilient and adapted to local conditions, with particular attention to the problem of limited light penetration caused by the existing tree rows. Based on citizens' opinions and expert analysis, a conceptual design was developed and discussed with representatives of the Public Utility Company and relevant departments of the city administration. After reaching an agreement, the project for the reconstruction of the central reservation was launched with the aim of improving the ecological and aesthetic function of the space. The new landscape design is based on the principles of naturebased solutions, using species adapted to the local climate, soil, and sunlight conditions. One of the key components of this intervention was the implementation of a sustainable irrigation system. Since there was previously no functional irrigation system for the green areas, experts recommended the introduction of a drip irrigation system using technical water. A primary pipeline was constructed, with infrastructural preparation for future secondary connections in the side streets, enabling system scalability. Additionally, a drip irrigation system was installed in the green islands to ensure an adequate water supply for the newly planted vegetation.









Image 51.: Previous condition

Image 52.: In progress



Image 53.: Presentation of the Conceptual Design (representatives of city departments, the Public Utility Company, decision-makers, and the Document Preparation Team)

The reconstruction of green spaces in Trebinjskih Brigada Street represents an example of an integrated approach to urban planning in line with the goals of the euPOLIS project: improving quality of life through inclusive, environmentally responsible, and sustainable interventions in public spaces.





# 5. Collaboration between students of the Public Institution Center of Secondary Schools in Trebinje — majoring in Agro-Tourism Technician — and the Agrarian Fund

Students of the Secondary Agro-Tourism School from Trebinje carry out practical training once a week, lasting six school periods, in a greenhouse owned by the City of Trebinie, as well as in a nursery where engineers employed by the Agrarian Fund train them in seedling production and cultivation of fruit crops such as pomegranate and fig. During their practice, students acquire knowledge about plant cultivation while respecting the principles of ecology and sustainable development. Every year, between 3,000 and 4,000 fig and pomegranate seedlings are produced in the Agrarian Fund nurseries. Inspired by the euPOLIS project, the City of Trebinje has decided to provide greater support for cooperation between the Public Institution Center of Secondary Schools and the Agrarian Fund, a collaboration that has lasted for four years, to expand production to crops suited to the local climate – the sub-Mediterranean to Mediterranean climate. The most representative species include: cypress, maritime pine, Aleppo pine, black pine, Munika (an endemic species of this region), thuja, cedar, boxwood, wild rosehip, evodia, laurel, lavender, Cyphophoenix palm, black ash, and Euonymus. The benefits of strengthening this cooperation are reflected in the production of planting material for the needs of public and private spaces within the city, which also represents support for the local economy. At the same time, students gain useful knowledge and skills that will help them in their future life and work, enabling them to truly understand the importance of greening urban areas.



Image 54.: Students of the Trebinje Secondary Agrotourism School are conducting practical training





### 6. The Impact of the euPOLIS Project on the Preservation and Improvement of Urban Greenery

Through the implementation of the euPOLIS project, efforts were made to influence urban planning policies and practices with the aim of preserving and improving green spaces in the city. The focus of the project was, among other things, on encouraging city services and large investors to include greening as an essential element when planning and constructing new buildings and urban areas. This approach is especially important during the summer months when temperatures in the city reach high levels, and green systems can play a key role in mitigating the urban heat island effect. However, an analysis of the existing plantings revealed that mistakes were made in some parts of the city regarding the selection of tree species, particularly concerning their root systems and suitability to urban conditions.

Case study : Herceg Stefan Kosača Street, Bregovi Neighborhood

As an illustrative example, the tree line on Herceg Stefan Kosača Street, within the Bregovi city neighborhood, is cited, where the following were planted:

- 25 trees of the species Tilia argentea (silver linden)
- 1 tree of the species Celtis australis (European nettle tree)

Field analysis determined that 13 Tilia argentea trees developed surface root systems which, to a greater or lesser extent, damaged the pedestrian pathway, i.e., the concrete pavement of the sidewalk. Mechanical damage caused by pressure and lifting of the pavement slabs poses a safety risk for pedestrians and negatively affects the functionality and aesthetics of the area.

For the reasons stated above, it is recommended to:

- 1. Perform controlled reduction of the surface roots with the involvement of expert personnel (horticultural engineer and arborist),
- 2. Assess the health condition of the trees and the potential need for removal of individual specimens (in case of instability),
- 3. Reconstruct the damaged part of the pedestrian path using adapted technical solutions (e.g., more flexible materials, raising the level of pavement slabs),
- 4. Consider the use of species with deep or neutral root systems suitable for urban conditions in future plantings (e.g., honey locust, hornbeam, ornamental cherry, lilac tree, etc.).









Images 55. i 56.: Example of inappropriate tree selection

#### CONCLUSION

Application of Experiences from the euPOLIS Project in Urban Planning of the City of Trebinje

The City of Trebinje has adopted the experiences from the euPOLIS project as a standard used in spatial planning, as the experiences of other larger and more developed communities have been of great importance, showing concrete improvements they achieved within their neighborhoods. The goal is to bring nature into the city and create comfortable, urban open public spaces—places for citizens to reconnect. Increasing the proportion of green areas and carefully selecting plant species can positively influence air purification and improve the quality of life. Proper management of wastewater will prevent soil pollution and thereby preserve the quality of arable land.

Local experts believe that the euPOLIS project will also impact other aspects, such as the construction of individual septic tanks for wastewater in parts of the city lacking a sewage system. This mainly concerns the construction of new weekend settlements in the Orjen Nature Park area, where special wastewater treatment is needed to prevent soil and groundwater pollution. The experiences from euPOLIS can help in the development of new zones and infrastructure projects. This especially applies to the industrial zone, where emphasis is placed on wastewater treatment and proper waste disposal, the planned airport complex and the surrounding economic zone, the highway construction where environmental protection from air pollution must be considered, and the new hospital nearing project completion. Moreover, it is believed that citizens have come to understand the importance of landscaping and greenery at the micro-level through this project and will strive to increase green structures on their own plots by carefully selecting plant species. Through the euPOLIS project, efforts have been made





to influence major investors in Trebinje to preserve and improve greenery around new buildings. In the near future, consideration can be given to ecologically connecting the city with the Trebišnjica River to create an attractive waterfront.

The ultimate goal of applying the knowledge gained through the euPOLIS project is to raise awareness through sustainable development, use of renewable energy sources, and ecosystem preservation in urban planning. A harmonious relationship between the built and natural environment will create conditions for improving life in the city in terms of socio-economic, health, and psycho-physical well-being of all citizens. The aim is to prevent the negative impacts of climate change that may occur in Trebinje, such as rising average annual temperatures and the occurrence of frequent storm winds and floods.

This document, the ideas stemming from the euPOLIS project, as well as the knowledge and skills we have gained and applied at specific locations, have been presented to interested parties, resulting in an agreement on the elaboration and implementation of future activities in accordance with the values and principles promoted by the euPOLIS project.

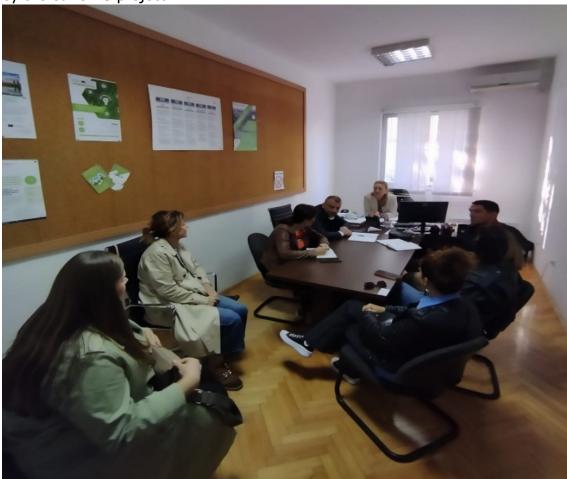


Image 57.: Activity plan for the implementation of ideas – Expert team of the City of Trebinje and representatives of relevant departments and the Public Utility Company "Komunalno"







#### Image 58. Expert team :

- 1. Tijana Kozić, spatial planning expert City of Trebinje
- 2. Slađana Prcović, spatial planning expert City of Trebinje
- 3. Jelena Ćuk, greenery expert City of Trebinje
- 4. Dragomir Brnjoš, hydrology expert– external associate, master's degree
- 5. Nataša Tučić, spatial planning expert City of Trebinje
- 6. Aleksandra Lozo, document translator City of Trebinje
- 7. Slobodan Vulešević -external associate for communication and event organization



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Images:

Image 1 – Author: Slobodan Vulešević

Image 2 – Orthophoto image, Department of Spatial Planning, City of Trebinje

Image 3 – Google Earth image

Image 4 – Regulatory Plan "Zasad Polje" (6/8), Department of Spatial Planning, City of Trebinje

Image 5 – Regulatory Plan "Zasad Polje" (7/22), Department of Spatial Planning, City of Trebinie

Image 6 – Regulatory Plan "Zasad Polje" (7/22), Department of Spatial Planning, City of Trebinje

Image 7 – Author: Slobodan Vulešević

Image 8 – Conceptual landscape design – Park reconstruction in Trebinje (Expert Team, City of Trebinje)

Image 9 – Source: <a href="https://www.michianawelldrilling.com/well-maintenance.html">https://www.michianawelldrilling.com/well-maintenance.html</a>

Image 10 – Source: <a href="https://www.istockphoto.com/vector/solar-energy-water-pump-qm697222088-129165469">https://www.istockphoto.com/vector/solar-energy-water-pump-qm697222088-129165469</a>

Image 11 – Source: <a href="https://mojedvoriste.in.rs/uredjenje-dvorista/sistem-kap-po-kap-u-dvoristu">https://mojedvoriste.in.rs/uredjenje-dvorista/sistem-kap-po-kap-u-dvoristu</a>

Image 12 – Source: <a href="https://www.navodnjavanje-zalivanje.com/sr/vesti/2021/05.10.html">https://www.navodnjavanje-zalivanje.com/sr/vesti/2021/05.10.html</a>

Image 13 – Source: <a href="https://www.rainbird.com/root-watering-system">https://www.rainbird.com/root-watering-system</a>

Image 14 – Conceptual landscape design – Park reconstruction in Trebinje (Expert Team, City of Trebinje)

Image 15 – Source: <a href="https://big-win.hr/proizvod/photinia-fras-red-robin/">https://big-win.hr/proizvod/photinia-fras-red-robin/</a>

Image 16 – Source: <a href="https://www.heckenpflanzen-heijnen.de/blauglockenbaum-">https://www.heckenpflanzen-heijnen.de/blauglockenbaum-</a>

paulownia-tomentosa-hochstamm-stammumfang-10-12-t

Image 17 – Source:

https://www.gardencentrekoeman.co.uk/plants/cortaderia/cortaderia-selloana-white-feather.html

Image 18 – Source: <a href="https://www.plantea.com.hr/aukuba/">https://www.plantea.com.hr/aukuba/</a>

Image 19 – Author: Slobodan Vulešević

Image 20 – Source: <a href="https://www.agropack.in/agropack-plant-for-sale-">https://www.agropack.in/agropack-plant-for-sale-</a>

<u>details.php?item=Purple%20Ice%20For%20Sale&catid=91-163&itemid=1666</u> Image 21 – Source: https://plantsam.com/begonia-semperflorens-cultorum/

Image 22 - Source: https://vrtlarica.hr/lantana-sadnja-uzgoj/

Image 23 – Author: Slobodan Vulešević Image 24 – Author: Slobodan Vulešević Image 25 – Author: Slobodan Vulešević

Image 26 – Source: <a href="https://www.deepdale-trees.co.uk/trees/trees/celtis-australis.html">https://www.deepdale-trees.co.uk/trees/trees/celtis-australis.html</a> Image 27 – Source: <a href="https://laforetcomestible.org/plante/celtis-australis-micocoulier/">https://laforetcomestible.org/plante/celtis-australis-micocoulier/</a> Image 28 – Source: <a href="https://www.thuilleaux.com/arbres-forme-conique-large-2/platanus-trees/">https://www.thuilleaux.com/arbres-forme-conique-large-2/platanus-trees/</a>

x-acerifolia-125.html





Image 29 — Source: <a href="https://www.urbantreefarm.com/wp-content/uploads/2023/12/Platanus-acerifolia-Yarwood.jpg">https://www.urbantreefarm.com/wp-content/uploads/2023/12/Platanus-acerifolia-Yarwood.jpg</a>

Image 30 – Orthophoto image, Department of Spatial Planning, City of Trebinje Image 31 – Conceptual design of parking space, Expert Team, City of Trebinje

Image 32 – Author: Slobodan Vulešević Image 33 – Author: Slobodan Vulešević Image 34 – Author: Slobodan Vulešević Image 35 – Author: Slobodan Vulešević Image 36 – Author: Slobodan Vulešević Image 37 – Author: Slobodan Vulešević

Image 38 - Source: <a href="https://ecoinventos.com/aparcamiento-incorpora-una-nueva-piel-">https://ecoinventos.com/aparcamiento-incorpora-una-nueva-piel-</a>

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Image 39 – Source: <a href="https://tfsolar.en.made-in-">https://tfsolar.en.made-in-</a>

china.com/product/zsEmJKbhTQYx/China-Solar-Canopy-Mounting-Structures-

<u>Customized-Solar-Carport-with-solar-panels.html</u>

Image 40 – Source: https://www.pracbrown.co.uk/product/trachelospermum-

jasminoides-star-jasmine/

Image 41 – Source: <a href="https://planthouse.hr/wp-content/uploads/2025/04/LAGERSTROEMIA.jpg">https://planthouse.hr/wp-content/uploads/2025/04/LAGERSTROEMIA.jpg</a>

Image 42 – Source: <a href="https://dyjhsolar.com.cn/solar-water-pump-system">https://dyjhsolar.com.cn/solar-water-pump-system</a>

Image 43 – Source: https://es.pinterest.com/pin/59180182596342891/visual-

search/?x=16&y=16&w=532&h=650&surfaceType=flashlight

Image 44 - Source: https://trebinje.rs.ba/pocela-realizacija-projekta-1-000-platana-za-

ljepse-trebinje/?script=lat Image 45 – [No data provided]

Image 46 – Source: <a href="https://trebinjelive.info/2024/04/23/ciscenjem-grada-i-sadnjom-stabala-koscele-obiljezen-medjunarodni-dan-planete-zemlje/">https://trebinjelive.info/2024/04/23/ciscenjem-grada-i-sadnjom-stabala-koscele-obiljezen-medjunarodni-dan-planete-zemlje/</a>

Image 47 – Conceptual design, Expert Team, City of Trebinje

Image 48 – Source: <a href="https://trebinjelive.info/2022/07/12/sta-mislite-o-novoj-stand-razglednici-na-ulazu-u-stari-grad-foto/">https://trebinjelive.info/2022/07/12/sta-mislite-o-novoj-stand-razglednici-na-ulazu-u-stari-grad-foto/</a>

Image 49 – Author: Slobodan Vulešević Image 50 – Author: Slobodan Vulešević

Image 51 – Source: <a href="https://trebinjelive.info/2018/05/28/ulica-trebinjske-brigade-dobija-">https://trebinjelive.info/2018/05/28/ulica-trebinjske-brigade-dobija-</a>

aleju-palmi-foto?lang=lat

Image 52 – Author: Slobodan Vulešević Image 53 – Author: Slobodan Vulešević Image 54 – Archive, Agrarian Fund

Image 55 - Source: https://trebinjelive.info/2019/11/30/korijenje-lipa-unistilo-trotoare-

najveci-problem-za-roditelje-sa-kolicima-i-starije-trebinjce?lang=lat

Image 56 – Source: <a href="https://trebinjelive.info/2019/11/30/korijenje-lipa-unistilo-trotoare-">https://trebinjelive.info/2019/11/30/korijenje-lipa-unistilo-trotoare-</a>

najveci-problem-za-roditelje-sa-kolicima-i-starije-trebinjce?lang=lat

Image 57 – Author: Slobodan Vulešević

