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BEUN FARABI CAMPUS XERİSCAPE PROJECT AND IMPLEMENTATION EXAMPLE

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Abstract

Today, with the effects of global climate change being felt intensely, the amount of water used to sustain the life of plants in urban open green areas and to ensure the continuity of these areas has reached serious levels. This situation has brought to the agenda the need for more efficient and strategic management of water. In recent years, droughts experienced in our country as well as in the world have increasingly increased the importance of the xeriscape approach, which is based on the conscious use of water in urban open green areas. In this context, in the study carried out in BEUN Farabi Campus, in order to contribute to the creation of a sustainable urban green texture, it was aimed to redesign three intensively used areas in line with the principles of xeriscape and sample plant design projects were prepared and implemented in this context.

Keywords: Landscape, Xeriscape, Campus

1. İntroduction

With the increase in population, the shift of settlements from rural areas to cities has brought economic developments, but it has also led to the emergence of different environmental problems. The increasing demand for water along with urban life has led to pressure on water resources. Water is one of the most important natural resources. It is the basic building block in different sectors such as health, agriculture, industrial production, and construction. However, with the climate crisis that has emerged in the world in recent years, the pressure on water resources has increased (Müge Çilek, 2022; Karaelmas 2024). Although a large part of the world is covered with water, domestic water is only 3%. Two-thirds of this water is stored in frozen glaciers or is not suitable for our use (Kamer Aksoy et al., 2022).

When the effects of global warming and climate change are predicted to increase, water scarcity is a possible situation in many cities of Turkey. Therefore, it has become inevitable to abandon the use of tap water in meeting the water needs of plants in urban open and green areas. In this context, water saving through methods such as rainwater collection, reuse of wastewater, protection of water resources and arid climate landscape applications has become an important agenda item.

The aim of xeriscaping is to provide landscape spaces that are compatible with nature in areas with arid or semiarid climates and limited water resources. However, today, xeriscaping is not only taking its place in areas with arid climates and limited water resources, but also in all living spaces as landscapes where water is used effectively (Çorbacı and Özyavuz 2024).

In Xeriscape applications, each step is of great importance in terms of creating a quality and sustainable green area. Areas designed according to the basic principles of arid landscaping provide advantages in terms of aesthetics and functionality, as well as reducing water consumption by approximately 30% to 60%. The main thing at this point is to determine how water can be used more effectively and efficiently. Even small-scale arrangements in existing areas will allow for more conscious use of water. With appropriate design methods, it is possible to create qualified landscape areas that are both environmentally friendly and water-saving (Ünal Çilek, 2023).

Xeriscape can be defined as successful and low-water use landscape applications that minimize the need for irrigation in regions that do not have accessible, abundant or reliable freshwater resources or in areas where there is no access to irrigation water and adopt the principle of protecting water resources and the environment (Abacıoğlu Gitmiş, 2020; Çorbacı ve Ekren 2022).

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According to the climate change action plan, it is predicted that Turkey will have a hotter, drier and more uncertain climate regime in terms of precipitation in the near future and that there will be a significant decrease in water resources in particular and that it will be significantly affected by a number of negative effects such as drought, desertification and ecological degradation related to them (İDEP, 2011). According to the xeriscape strategy, taking natural and ecological factors as a basis is to minimize water consumption while providing maximum benefit from existing water resources and to maintain the "protection" balance in nature. With this approach, which is more cost-effective in application and management, the plant groups created; tree leaves and bark, sleepers, gravels, stones, rocks, slag and peat, are used in the compositional integrity together with natural landscape elements, thus strengthening water saving (Çorbacı ve Bayramoğlu, 2021; Kavuran, 2021; Kavuran and Yılmaz 2022).

Green areas created with the basic principles of arid landscaping are areas where water is used 40% to 60% less, in addition to their aesthetic and functionality (Çorbacı vd., 2017). There are 7 basic principles of arid landscaping. One of these 7 basic principles is mulching. Mulching has an important role in arid landscaping. The material laid on the ground reduces evaporation of the soil and allows the ground to remain moist and at ideal temperature balance. In this way, water saving is achieved by efficient use of water, while the need for irrigation is reduced and labor is saved. The added values of mulching are not limited to these. The advantages it provides increase according to the structure and characteristics of the mulch material used (Çorbacı ve Oğuztürk, 2024).

The principles of xeric landscape design, which are planning and design, soil preparation, appropriate plant selection, limiting the lawn to appropriate and functional areas, effective irrigation, use of mulch and proper maintenance, have been evaluated and explained under these headings (Detweiler et al., 2005; Welsh and Welch, 2007).

Planning and design: Before carrying out the xeric landscape design, the ecological and non-ecological characteristics of the area such as location, orientation, sunshine duration, topography, wind direction should be analyzed. The area should be evaluated as a whole. In addition, in the design, areas requiring low and medium water should be determined and plant selections should be made accordingly (Nirmala and Jyothi, 2022; Müge Çilek 2022). Literature study, data collection, survey study, analysis study, creation of a list of requirements, relationship diagram, spot study, preliminary project, final project, detailed project, section view, drainage project, irrigation project, lighting project, surveying, three-dimensional visualization, model, etc. all design processes should be carried out in arid landscape studies (Çorbacı ve Özyavuz, 2024).

Water harvesting: Due to the temperate climate of Zonguldak, high summer temperatures and low rainfall, it is important to collect rainwater in certain areas and then use it for irrigation. Although drought-resistant plant species come to mind first when it comes to xeric landscaping, these plants also need to have their water needs met at certain times.

Soil analysis and preparation: Plants need a growing environment rich in organic matter to grow and develop healthily. At this stage, as in other landscaping arrangements, soil is one of the important components in xeriscape arrangements, as the soil is rich in organic matter and contains the necessary plant nutrients (Müge Çilek 2022).

Selection of appropriate plant species: In xeric landscape design, care should be taken to select plant species from native species. These plant species provide many advantages in terms of environment and economy as they require less irrigation, maintenance and fertilizer. In the selection of plants in the campus area, drought-resistant plant species that grow naturally in the region were generally preferred. Using plant taxa that require little water is not enough on its own. Using plants intensively and taxa with the same water requirements is also effective in water consumption (Çorbacı ve Özyavuz, 2024).

Effective irrigation: One of the basic principles in drylandscape arrangements is to have minimum water consumption. Therefore, the right amount of water should be given to the plants with the right method according to their water needs. Drip irrigation management should be preferred to minimize water loss. Irrigation can be done at any time of the day with the drip irrigation method. However, in some areas, sprinkler irrigation systems should be used. In order to perform effective and efficient irrigation in xeriscaping studies, it is of great importance to use irrigation systems suitable for zoning. Pressurized fully or semi-automatic irrigation, drip irrigation, sprinkler irrigation systems should be used in xeriscaping studies. In very necessary cases, controlled manual irrigation with a hose should be done (Çorbacı ve Özyavuz, 2024).

Mulch use: Mulch, one of the main elements of the xeric landscape, usually consists of materials such as shredded tree bark and wood, natural stones, gravel, stalks and straw. It is a layer of organic and inorganic material that covers the soil surface with a thickness of 3-4 cm. It not only completes the xeric landscape aesthetically, but also provides functional benefits.

The use of mulch prevents the rapid evaporation of water in the soil, keeps the soil moisture and temperature in balance, prevents weed growth, and prevents plant water loss by reducing evaporation from plant roots. Mulch can also reduce soil compaction and salt accumulation (Al- azhari , 2015; Kamer Aksoy et al., 2022; Müge Çilek 2022; Çorbacı ve Özyavuz, 2024).

Proper maintenance: Although the maintenance needs of the areas where xeriscape design is applied are low, it cannot be said that they need "zero maintenance". Meeting the regular maintenance needs such as mowing, weeding, pruning, watering and fertilizing at the right time in these areas is important in terms of maintaining the visual aesthetics of the areas (Nirmala & Jyothi, 2022; Müge Çilek, 2022). Xeriscape means using less water, not a dry and barren appearance. In order to ensure low water consumption, weeds should be cleaned, the irrigation system should be checked periodically, fertilization should be provided, and regular ventilation should be provided in grass areas. With regular maintenance, xeriscape areas consume less water (Müge Çilek, 2022). In plans made with plants compatible with the natural environment, it is possible to perform maintenance using less material and labor. A xeric landscape study made using natural plant taxa reduces maintenance costs by up to half, since chemicals such as fertilizers and medicines are used less. An effective xeric landscape study will also reduce maintenance efforts (Çorbacı ve Özyavuz, 2024).

In addition, maintenance and energy costs are reduced by approximately half. Xeriscape has many aesthetic, functional and economic benefits. These are (Çorbacı et al., 2011; Çorbacı et al., 2017); It allows efficient use of water. By using plants with low water requirements, time and money to be used in irrigation, fertilization, maintenance, etc. are saved. It reduces maintenance costs (less fertilizer, medicine, etc.) and labor. By using water less, it allows more water to be left for fish and wildlife, especially in aquatic ecosystems. It contributes to the sustainability of natural ecosystems by providing more living spaces for plants and animals. It helps to recognize natural plant species. It reveals how important the effective use of water is for people. • It offers aesthetically pleasing designs.

With this research, it is also aimed to pioneer other studies planned to be carried out in line with the transformation to the xeriscape approach in landscape designs where water consumption is intensive and which are under the responsibility of public and local administrations in order to create a sustainable green urban texture in today's conditions where the effects of global warming are felt intensely and to contribute to the country's economy.

In this study, in line with the request of Zonguldak Bülent Ecevit University Rectorate, xeriscape project was prepared and implemented in three areas of the university campus.

2. Material and Method

Zonguldak Bülent Ecevit University (BEUN) Farabi Campus located in İncivez Neighborhood of Zonguldak province. The land area of Zonguldak Bülent Ecevit University Farabi campus covers an area of approximately 205,679 m^2. In its current state, the university includes educational facilities, classrooms, administrative buildings, dormitories, social facilities, sports fields, library and recreational green areas and many other usage areas within the plan border.

In the Zonguldak region, summers are warm and clear and winters are long, cold, rainy and partly cloudy. During the year, the temperature normally varies between 4°C and 26°C, rarely below -1 °C and above 29°C (Url-1).

In this study, three different areas within the boundaries of BEUN Farabi Campus were selected as samples in order to prepare planting design projects in line with the principles of xeriscape. The area selection was made by considering criteria such as user density, existing plant texture, topographic structure, sunlight status and irrigation possibilities. First of all, on-site observation, photography, current plant inventory and land measurements were carried out for the determined areas. Then, planting design projects that are in line with the principles of xeriscape, provide water saving and are based on sustainability were prepared in line with the obtained data. The climate conditions of the region, soil structure and adaptation characteristics of native plant species were taken into consideration in the designs. The drawings of the projects were carried out through computer-aided design programs and applicable, exemplary landscape plans were created for each area. In the final stage of the study, the prepared project was detailed under two main headings as planting and structural. The plant species and reinforcement elements to be used in the design process were determined and the project was completed accordingly. The creation of the project was carried out in February 2025 and the implementation process ended in May 2025. Various proposal projects were developed during the study period, and then the implementation

project and related details were prepared based on the finalized project. AutoCAD program was used in the design process; Lumion and SketchUp software were used in the presentation and visualization stages.

3. Results and Discussion

In order to carry out the design work in the most appropriate way for the space and the current situation, it was first necessary to obtain a detailed survey and elevations of the area. In line with these requirements, the elevation plan and elevation of the area were first obtained by the technical staff of the Department of Construction Works. The plant material and structural elements present in the area were projected to scale. After obtaining the elevation data and elevation of the area, the area was examined in detail on site, photographs were taken, and needs, deficiencies, requirements and existing possibilities were evaluated. Study areas are marked on the campus map (Figure 1).

Figure 1. Display of work areas on a map.

3.1. View From Application Areas

1. Work area (A)

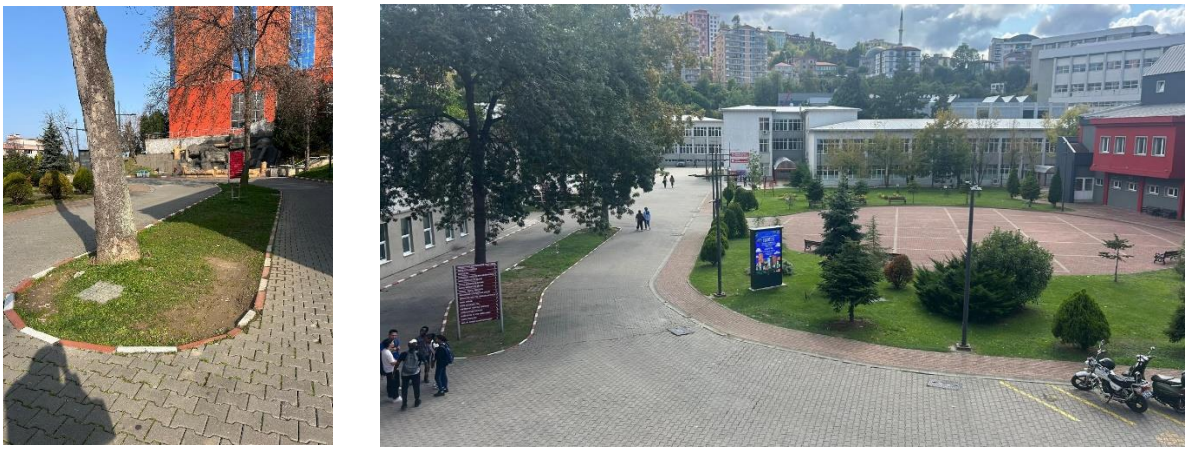

Figure 2. The median area between the sports hall and the IT department

2. Work Area (B)

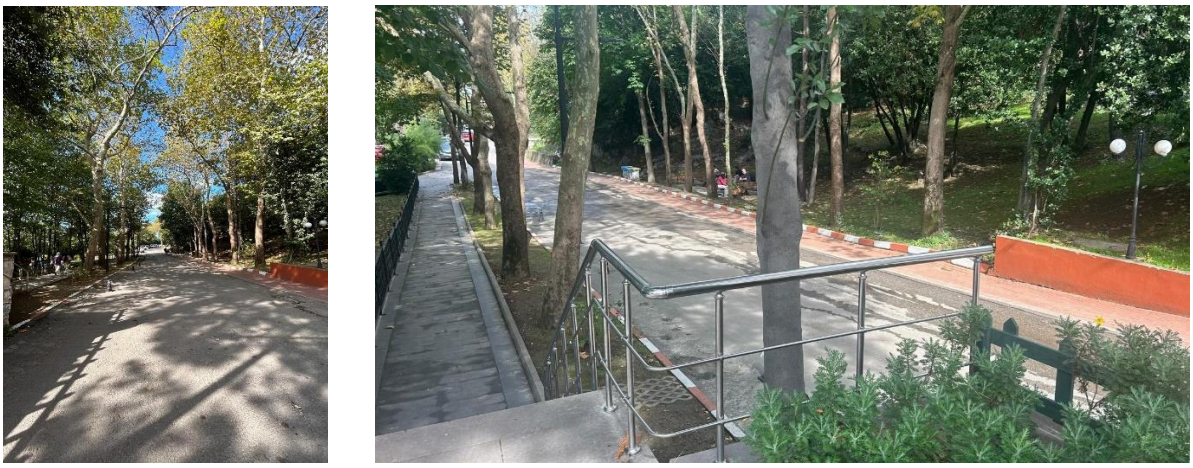

Figure 3. Left median on the axis leading from the front of the Rectorate to the residences

3. Work Area (C)

Figure 4. Upper landscape area of the newly opened vehicle road within the campus

Sketch-up and Lumion drawings of the application areas are given below.

1. **Work area (A)**

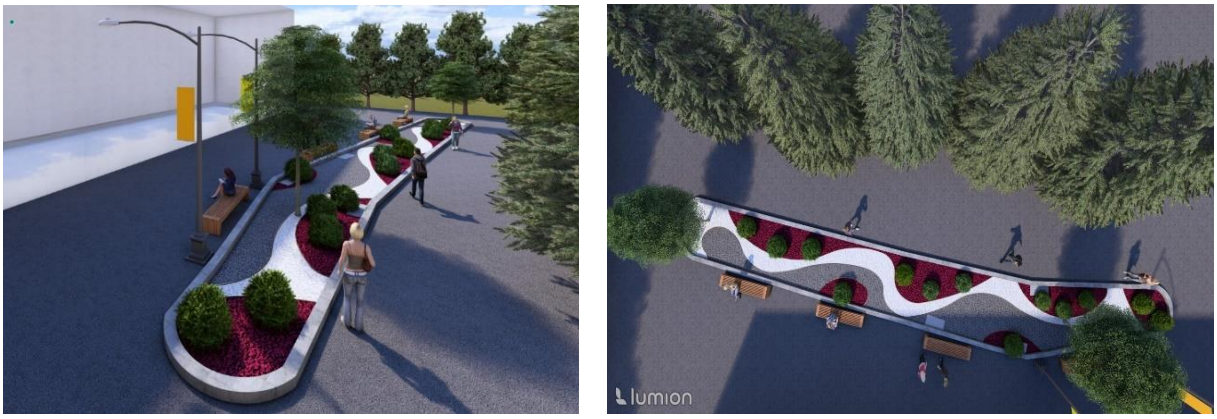

Figure 5. 3D views of the median area between the sports hall and the IT department

2. **Work area (B)**

Figure 6. 3D views of the left median on the axis from the front of the rectorate to the residences

3. **Work area (C)**

Figure 7. 3D views of the upper landscape area of the newly opened vehicle road into the campus

The application stages and finished versions of the application areas are given below.

1. **Working area A**; primarily boxwood plant (*Buxus sempervirens*) was planted according to the project. A total of 15 boxwood plants were used. This variety was chosen because it requires little maintenance and water. *Buxus sempervirens* is a moderately drought-tolerant plant. Studies have shown that *Buxus sempervirens* is physically resistant to drought and partial rainfall deficiency (de jong vd., 2012). Xeriscaping practices are

based on local species that use less water and support ecosystem and biodiversity (URL-2). Afterwards, the top soil was covered with a covering material called jute. The shape drawn in the project was applied to the area with a grass separator. Finally, white dolomite, pumice and dark blue bark were spread on the area. White dolomite was used in 30.8 m^2, pumice stone in 26.65 m^2 and dark blue bark in 8.2 m^2 area (Figure 8).

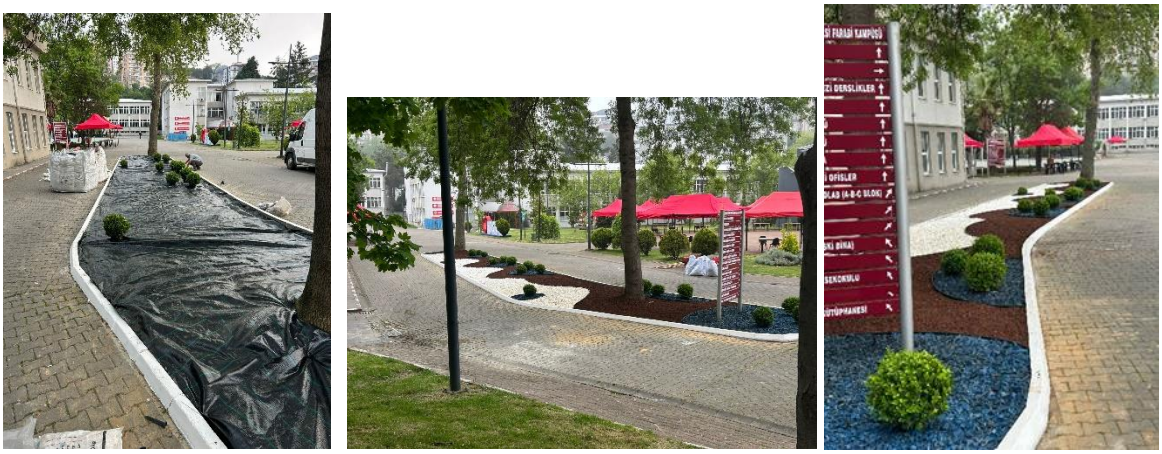

Figure 8. Application state and view of finished state

2. **Working area B**; The curbs on the vehicle road side of the application area were renewed first. 48 m of curb stone was used. First of all, it was hoed and leveled by leaving a margin from the curb height. The cover material was laid on the area and the application was made to the area with the grass separator and the shape drawn in the project. White dolomite stone, pumice stone, tree bark (yellow, red, green, blue, orange and navy blue) were used in this area. Pumice stone was used in an area of 8.5 m^2, white dolomite stone in an area of 13.4 m^2 and tree bark in an area of 21.8 m^2 (Figure 9).

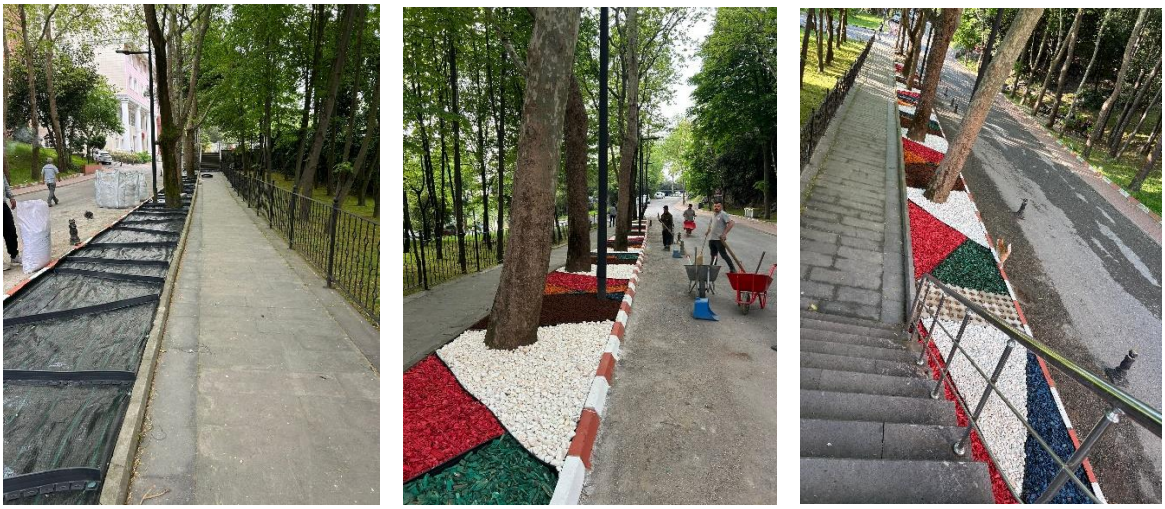

Figure 9. Application state and view of finished state

3. **Working area C**; Since the application area was new, there was a lack of soil, first the soil was brought to the area and the area was leveled. Afterwards, planting studies were carried out according to the project, the plants used here were *Euonymus* sp., *Viburnum licidum*, *Buxus sempervirens*, *Euonymus japonicus bravo*, *Weigela florida*, *Aucuba Japanese variegata* plants were used. 560 *Euonymus* sp. plants were planted. After covering with cover material and placing grass dividers, it was filled with white dolomite, pumice stone and tree bark (Green) according to the colors in the project. 5.42 m^2 dolomite stone, 40.5 m^2 green tree bark and 43.67 m^2 pumice stone were used. Since the application area is a highly visible area, the eyebrow area was covered with rolled grass and an instant image was tried to be obtained. For the night image, 3 wallwasher lighting was

installed on the lighting poles illuminating the vehicle road and the night lighting of the area was provided (Figure 10).

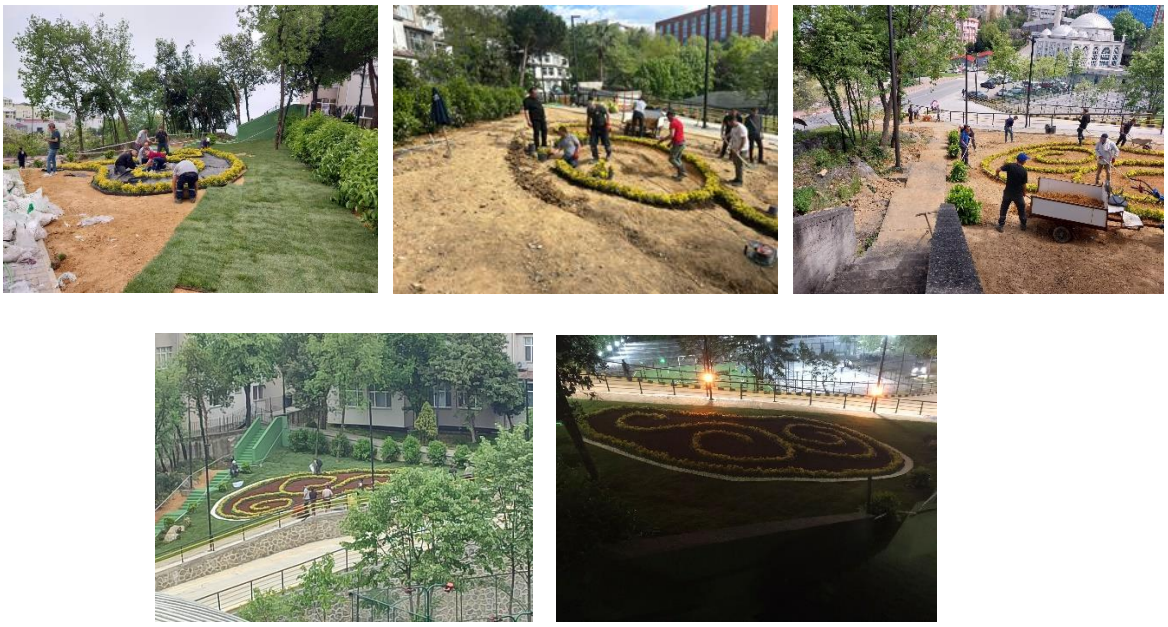

Figure 10. Application state and view of finished state

4. CONCLUSION

With urbanization and population growth, cities' water resources have begun to deplete. Today, this situation is accelerating with climate change due to global warming. While the main purpose of the traditional landscape approach is to improve the qualities and environmental conditions of cities, in a period when resources are depleting so rapidly, efficient use of water and drought-resistant plant practices come to the fore in maintaining and sustaining urban landscapes.

Xeriscape studies implemented on the BEUN campus provide multifaceted contributions in terms of both environmental sustainability and institutional benefit. Xeriscape applications significantly reduce water consumption thanks to the use of plant species that require minimum irrigation. These applications are quite valuable in terms of sustainable water management on university campuses, especially in regions with increasing drought risk. Selecting plants with low water requirements as well as plants that require less shaping, fertilization and pesticide application reduces the landscape maintenance costs of the university administration. Xeriscape applications on the university campus provide ecological awareness for students. It serves as a practical training area especially for students studying in fields such as landscape architecture, environmental engineering and biology. Xeriscape design creates an aesthetic environment with natural colors, textures and arrangement forms. This increases both student satisfaction and the visual quality of the campus. It also builds a corporate identity that emphasizes sustainability.

Xeriscape studies implemented in higher education institutions such as BEUN provide positive and measurable contributions, especially in platforms such as UI GreenMetric and Times Higher Education (THE) Impact Rankings, which are international sustainability rating systems. Xeriscape studies implemented in BEUN campuses are of a nature to provide points increase in prestigious sustainability rankings such as both UI GreenMetric and THE Impact Rankings, and increase the university's international visibility and reputation by documenting its environmental responsibilities.

As a result, xeriscapes are important for future landscape designs in terms of efficient use of water. They not only provide water savings but also create aesthetic areas with high visual appeal. In addition, xeriscape applications do not only include the use of drought-resistant plant species, but also emphasize that an area should be designed and planned with appropriate materials and irrigation techniques. In the study where all these applications are

included, sample visuals of xeriscape design in the BEUN example are included. It is important for future studies that the study findings include suggestions and examples that can be reflected in practice.

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