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A STUDY ON THE APPLICATION OF XERISCAPE IN ZONGULDAK BÜLENT ECEVİT UNIVERSITY

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Abstract

Xeriscape is a landscape design approach used in regions where water is limited and vegetation must adapt to these conditions. This approach, which is based on water conservation and low maintenance costs, is of great importance in arid regions or areas where water resources are scarce. Rock gardens, as an example of xeriscape, offer sustainable solutions in both aesthetic and ecological terms. In this context, a rock garden project was produced in the garden of the Engineering Building at the Farabi Campus of Zonguldak Bülent Ecevit University (BEUN). This project was designed and implemented using AutoCAD and Lumion programs. In the first stage, detailed plans and project drawings of the rock garden were made with the AutoCAD program. At this stage, stone placement, plant selection and layout plans were created in accordance with the topography of the area. Then, 3D modeling of the design was made using the Lumion program and the visualization phase was started. Lumion provided fast high-quality visuals and was presented to the university administration. The project drawing and implementation took approximately 4 months. The conversion of a heavily used area into a Xeriscape in order to contribute to the creation of a sustainable urban green texture on campus is an example of climate-compatible practices and future practices that have been addressed within the scope of sustainable campuses.

Keywords: BEUN, Xeriscape, Rock Garden, Landscape Design

1.Introduction

In today's world, as water resources deplete rapidly due to global warming and climate change, drought and water scarcity have become critical issues. The use of plant species that require high amounts of water in landscaping increases the need for irrigation, leading to even greater water consumption. Therefore, in recent years, there has been a growing need for xeriscape design in landscaping areas. Xeriscaping focuses on drought-resistant plants and water-efficient practices, helping to conserve water and support environmental sustainability, offering a crucial solution to mitigate the impact of climate change on water resources (Gemici, 2023).

With the intensifying impact of global climate change, water consumption for maintaining plant life and sustainability in urban green spaces has reached critical levels. This situation has highlighted the need for more effective and strategic water management practices (Cengiz, 2013; Açıksöz et al., 2014). In recent years, water problems experienced in our country as well as all over the world have increasingly increased the importance of the arid landscape approach, which aims at the effective use of water in urban open green areas. Especially in conditions where water resources are limited, the preference of arid landscape applications and the implementation of sustainable landscape designs aimed at creating areas with low maintenance costs contribute to the formation of a nature-compatible and high-quality vegetation (Sezen et al., 2018; Çorbacı & Ekren, 2022, İlhan et al., 2024).

In recent years, design strategies that prioritize efficient water use have become favored, particularly in urban landscaping, to help reduce water consumption. One such strategy is arid landscape design. This approach is typically defined as a landscape design method that focuses on minimizing water usage and preserving both water resources and the environment (Sezen et al., 2018; Gemici, 2023). Utilizing natural vegetation is one of the prominent principles within the xeriscape approach (Ismaeil and Sobaih 2022). In the process of climate change, some regions experience water scarcity and drought, while some regions are exposed to floods due to irregular rainfall regimes. With the increase in impermeable surfaces in urban areas, groundwater cannot be fed sufficiently

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and dries up. The increasing demand for water and the threats faced by water resources have drawn attention to the use of water in every area (Ünal Çilek, 2022).

Xeriscape principles stand out with their environmentally friendly approach as well as water saving and contribute to the protection of freshwater resources lost as a result of global warming in the long term by reducing water consumption (Cengiz vd., 2011). There are 7 principles in xeriscape applications. 1) Planning and design 2) Soil preparation 3) Appropriate plant selection 4) Creation of grass areas 5) Effective irrigation 6) Use of mulch 7) Maintenance and pruning stages affect success. To briefly explain these, *Proper Planning and Design*; Creating a landscape that uses water efficiently starts with a well-thought-out planning and design. For this, first of all, the current situation and environmental uses should be determined, the structural and plant materials in the area should be determined, shading conditions, and expectations from the area should be determined on a plan (Hersek and Korkut, 2021; Selim et al., 2021). *Soil analysis and preparation*: Plants need a growing environment rich in organic matter to grow and develop healthily. At this stage, as in other landscape arrangements, in arid landscape arrangements, the soil, the richness of the soil in organic matter and the presence of the necessary plant nutrients are one of the important components (Ünal Çilek, 2022). *Appropriate plant selection*; In arid landscape studies, it should be preferred to use the existing plants on the area by protecting them. For this reason, designs that will be suitable for the development of developed and healthy plants to remain in the area should be made with the plant survey study to be carried out. At the same time, the use of natural vegetation is one of the important design strategies (Cengiz et al., 2021). *Creation of Lawn Areas*; Lawn areas are the plant element that needs water the most due to their physical structure. For this reason, when creating lawn areas in arid landscape applications, if they are suitable for the region, warm climate grass plants should be selected and placed in areas where recreational activities are carried out intensively in a way that they will take up less space (Çetin and Mansuroğlu, 2018). *Effective Irrigation*; There are three methods in irrigation, which is one of the most important parameters that determine the success of arid landscape applications. These methods are drip and sprinkler irrigation methods. In order to provide the most effective irrigation in the area, pressurized irrigation systems and drip irrigation systems should be used, and irrigation should be programmed to control the time and amount of irrigation (Kavuran and Yılmaz, 2022; Ayanoğlu and Demirel, 2023). *Use of mulch*; mulch is generally organic (branch, needle, trunk bark, root pieces, crushed leaves, etc.) or inorganic (rock, gravel, gravel, dolomite stone, pumice, marble pieces, etc.) materials used to cover the soil surface and maintain soil moisture and temperature. Mulch is not a fertilizer or compost. Therefore, it is not mixed into the soil, it is spread (Ministry of Agriculture and Forestry, 2024). *Maintenance and Pruning*; As with all landscape areas, maintenance is crucial for preserving the characteristics of the area and ensuring its long-term sustainability. Based on climatic conditions and the specific traits of the plants used, maintenance tasks like pruning, fertilization, weed removal, and pest and disease control must be performed in a timely and technical manner. Additionally, careful attention to the irrigation system is essential to maintain and enhance the quality of the arid landscape (Çorbacı and Ekrem, 2022).

2.Materials and Methods

2.1 Material

Zonguldak is a province in the Western Black Sea Region, with a western and northern coast to the Black Sea. With a surface area of 3,310 km², it covers six per thousand of Turkey's land. The provincial lands, starting from the Black Sea coast, are surrounded by the Black Sea to the north, Bartın to the northeast, Karabük to the east, Bolu to the south, and Düzce to the west. Zonguldak has a very rugged terrain; 56% of the provincial area is covered with mountains, 31% with plateaus, and 13% with plains (Url-1).

56% of the provincial lands are forested (194,075 ha), 88% of which are groves and 12% are coppice forests. Fagus forests are in the regional forests, which are a natural arboretum with their rich vegetation within our country's forests. *Carpinus Betulu , Castanea sativa , Platanus orientalis L., Tilia L., Alnus 70% broad-leaved, mainly glutinosa ; Pinus nigra Arnold., Pinus silvestris L., Pinus brutia Ten. and Pinus Pinaster.* There are 30% needle-leaved forests, including Aiton. The region, which has rainfall in every season, is covered with needle-leaved species at higher altitudes, while the lower areas are covered with leafy species. This main green tissue is *Rhododendron ponticum, Quercus ilex, Ilex aquifolium, Laurus nobilis, Arbutus unedo, Cornus mas, Prunus avium, Erica Arborea, Arctostaphylos uva-ursi, Rosa canina, Rubus fruticosus*. It is complemented by understory vegetation such as vesca (Url-1).

The main material of the study is BEUN Farabi Campus. Approximately 12,090 students study on the campus located in the city center. The campus has a total area of 200,917 m^2 of this area is the building area. There is a total of approximately 79,600 m^2 of green space (Fig. 1).

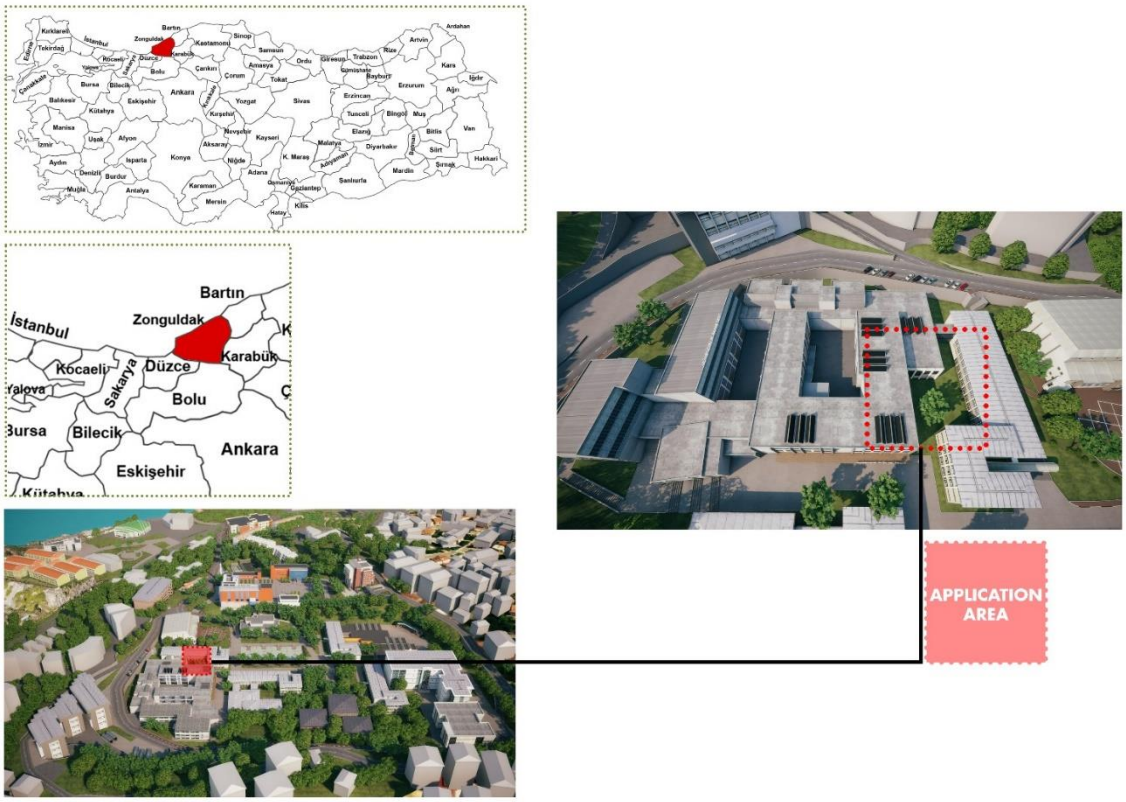

Fig 1. Zonguldak Bülent Ecevit University Farabi campus application area.

The study started with the emergence of the need for landscaping of the engineering building garden located in the Farabi campus and the creation of a demand in this regard with the decision of the rectorate. The method of the study consists of three stages: planning and area analysis, landscape design project and implementation stage.In the planning and area analysis phase, area needs and environmental research were conducted to determine the design approach. Within the scope of the climate compatible design approach, written and visual resources were researched and data were evaluated in line with their suitability for the area.

In the landscape design project phase, a rock garden design project was created as an arid landscape approach within the scope of the determined needs and requirements. In addition, it was emphasized that it was in an approach that also provided opportunities for daily use. In line with the determined needs, 3 draft projects were created and presented to the rectorate unit. As a result of the evaluations, the determined project was finalized and detailed. In the final stage, the detailed project was handled in two separate sections, plant and structural. The final stage was completed by determining the accessories and plants to be used within the scope of the design. The project was created in May 2024 and its implementation was completed in September 2024. During the study, proposal projects were prepared and in line with the finalized project, the implementation project and details were created. Auto-Cad was used in the design stage and Lumion and sketch-up software were used in the presentation and visualization stages.

3.Results and Discussion

Within the scope of the study method, firstly the site plan of the research area was obtained and current situation analyses were made. It was determined that the area was surrounded by buildings, had insufficient vegetation and poor soil in terms of organic matter.

The research area was directly connected to the users of the Faculty of Engineering, indirectly connected to the users of the Medico social unit, and it was determined that it was an area for the use of all campus users.The needs of the users of the area, the functions to be used in the project and the objectives of the landscape (Fig. 2).

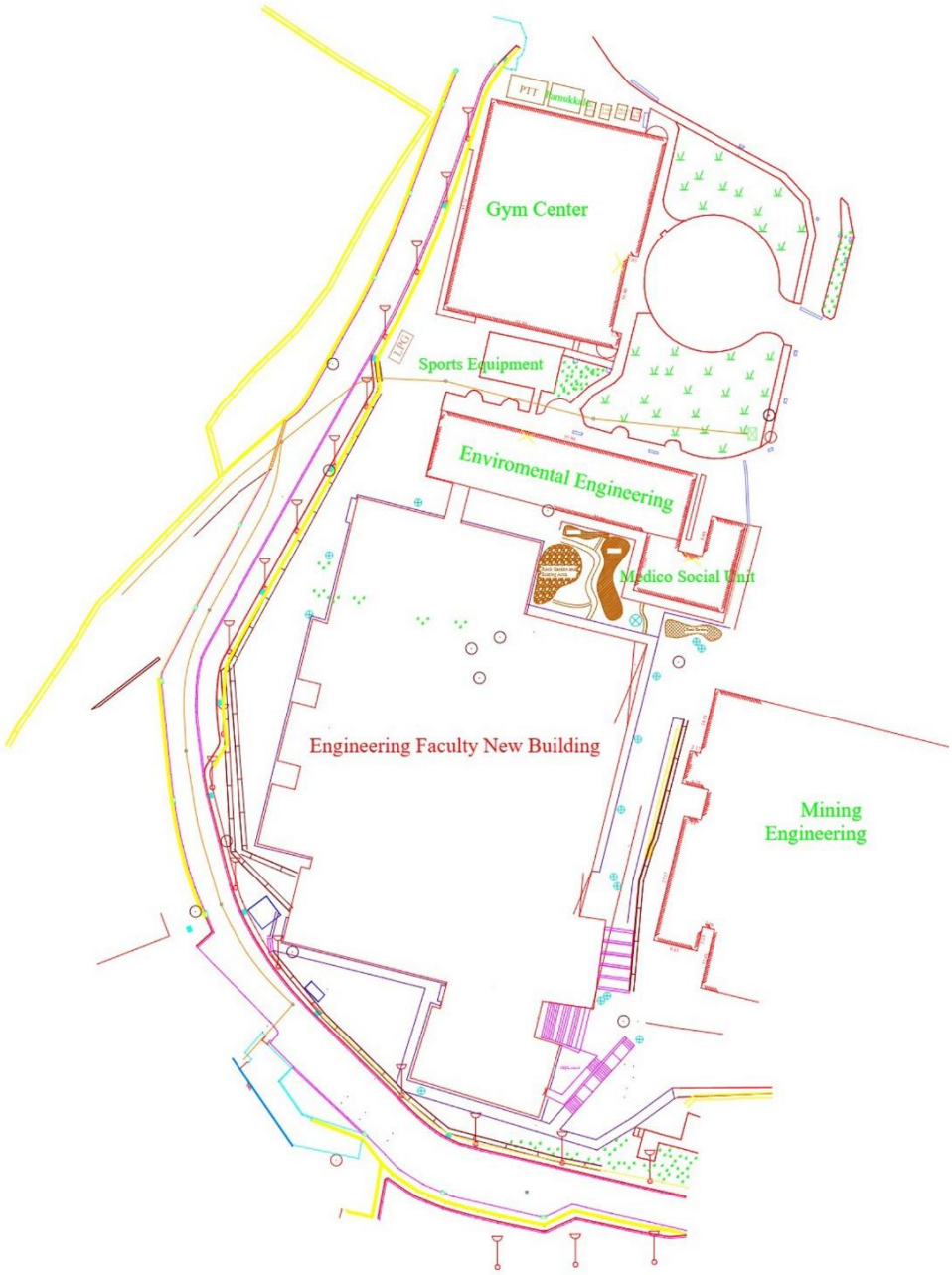

Fig. 2 View of the area from the concept project

Of the area where xeric landscaping will be done, main roads, plant areas, seating areas and lighting locations have been determined. After the technical details such as the clarification of plans, sections and detail drawings, planting intervals of the plants, and the properties of the materials were determined, the quantities of all materials to be used, the number of plants and other needs were calculated.

Plants planted in this area: *Hypericum calycinum, Prunus laurocerasus, Euonymus japonicus 'Variegata', Buxus sempervirens, Festuca glauca, Lavandula angustifolia, Buxus sempervirens, Thuja occidentalis 'Pyramidalis', Pyracantha coccinea, Spiraea japonica, Ligustrum vulgare, Berberis thunbergii, Hydrangea macrophylla, Cotoneaster horizontalis , Syringa vulgaris, Lavandula angustifolia, Gaura sp., Phormium tenax , Phormium tenax 'Variegatum' and Calluna vulgaris* .

There are 2 covered benches and a pergola in the area. The paths connecting the reinforcement elements are paved with grass stone. 45 m^2 of grass stone was used. 7 pieces of 10 cm daylight wallwasher were used for lighting (Fig. 3).

Fig. 3 Lumion views of the area

First, rock stones were brought to the area from Elvanpazarcık-Zonguldak district and placed in their places according to the plan. Plants were brought from Yalova and planted in the area. After planting, lighting locations were determined, wall washers were placed in their places and the laying of grass stones began. Finally, the 4-grass mixture was planted in the area. The finished state of the area is shown in Fig. 4, day and night views.

Fig. 4 Day and night views of the area after application

Conclusions

The implementation of arid landscape arrangements in areas with high density use such as university buildings is important in terms of managing the water crisis in landscape studies and developing regional recommendations. In this context, this study, unlike previous studies, aimed to determine how water consumption in areas containing landscape arrangements in BEUN changes with the increase in the arid landscape design rate.

In response to changing climate conditions and rising drought levels, it has become essential to adopt certain measures. Conserving water and safeguarding water resources are now more important than ever. Among natural disasters, drought is seen as one of the most critical threats to humanity. The supply of water, a vital and irreplaceable resource, is diminishing with each passing day. When the climate data of Zonguldak province is examined, it is stated that the province is under the influence of the mild Black Sea climate and that there is no dry season in Zonguldak, which is rainy and warm in every season. However, global warming and climate change are creating serious changes in the climate of Zonguldak, as in many cities of our country. There have been decreases in the annual rainfall amount of the city and high temperature values have started to be recorded in recent years.

BEUN has aimed to create green and environmentally friendly campuses, and it is important to see the results of investments in energy saving, projects related to waste management, and elective courses for environmental awareness in all educational units, social responsibility projects and other efforts in terms of sustainable campus designs and applications. Quality is a priority in the services that BEUN offers to its students and all stakeholders. As an indicator of this understanding, initiatives to increase the quality of life in the campuses and the city continue. Creating environmental awareness and providing livable environments to students and staff is an indicator that a culture of respect for the environment has been established at BEUN.

The project and its objectives proposed in the study are important not only for campus areas but also for the management of limited water resources in urban landscape arrangements. Future studies should be carried out by considering irrigation zones and water resources used in irrigation. In a world where water problems are increasing and water wars and migrations are predicted, it is an inevitable fact that studies should be increased to raise public awareness on this issue. Lessons and information meetings should be held on the importance of water in all education and training processes starting from primary school.

Rock gardens have an important place in today's landscape design with their aesthetic contribution and low maintenance requirements. These gardens, which provide both an aesthetic appearance and an environmentally friendly solution, increase the quality of recreational areas when designed correctly. Thanks to drought-resistant plants and durable rocks, rock gardens both save water and create a long-lasting landscape. Rock gardens are considered a sustainable alternative that can be integrated into both modern and traditional landscape designs.

“Note” This study was carried out in 2024, in line with the request of the Zonguldak Bülent Ecevit University Rectorate, with the landscape project studies prepared by Asst. Prof. Dr. Deniz Karaelmas.

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