

## Role of Climate in Landscape Design and Applications

Alper SAĞLIK<sup>1\*</sup>

Emre ÖZELKAN<sup>2</sup>

Abdullah KELKİT<sup>1</sup>

<sup>1</sup>Department of Landscape Architecture, Çanakkale Onsekiz Mart University, Çanakkale, TURKEY

<sup>2</sup>Department of Urban and Regional Planning, Çanakkale Onsekiz Mart University, Çanakkale, TURKEY

\*Corresponding Author:

E-mail: alpersaglik@comu.edu.tr

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### Abstract

In time, more conscious studies are being made to increase the liveability of cities. These studies are closely related to the discipline of landscape architecture. Landscape designers, who aim to make quality living spaces sustainable, primarily need to take climate conditions into consideration as well. In the design process, the suitability of the project to the regional climatic conditions is of vital importance. The success of the project's sustainability from the determination of the material to be used to the issuance of the spatial use decisions is possible with correct interpretation of the climatic data of the project area. In this study, the role of climate conditions for landscape design and applications and how climate parameters should be taken into consideration during a project were examined.

**Keywords:** Çanakkale, Landscape Design, Landscape Application, Climate

### INTRODUCTION

The main purpose of landscape architecture, the main objective is to distribute the space usage in the city in a balanced manner and to leave enough open green spaces considering the environmental, topographic and geographical conditions. In this context, the goal is to present high quality landscape spaces in urban environments where the natural structure has been largely altered, especially in terms of design and applications, taking into account the climatic conditions.

#### Landscape Design Concept

The term 'landscaping' was introduced by Alexander von Humboldt in the early 19th century, literary as a scientific geography term. He defined Landscape as 'the total character of a piece of earth'. Russian geographers have introduced the idea of inspecting all available materials as "landscape geography" by inserting inorganic and organic items into the concept of landscape. TROLL, one of the forerunners of the German bio-geographers, has described the landscape concept as "Landscape is the whole of space and the integrity that can be seen". These philosophers have made the landscape a key term for ecological preservation and recreation based on ecological principles [1].

The APS (European Landscape Convention) introduces new social, economic, political and legal approaches to the concept of landscaping, and consequently two important issues are at the forefront. Firstly, landscape is defined as an "object of the earth" with an objective expression, and secondly as a form of comprehension of the whole individual of this piece of earth by a subjective expression [2].

Landscape design can be seen as an art because it creates an emotional response and shape it, on the other hand, and can also be seen as a science because it requires knowledge about the physical components of soil, topography, climate and vegetation cover [3]. As a profession, the primary social task of landscape architecture is to create a strong influence with art and science for the management, planning and design of physical and cultural landscapes from untouched areas to civilized areas [4].

Landscape design, which is a study area on the subscales of landscape architecture, is the shaping of outdoor spaces in accordance with planning decisions. This shaping is a

long-term process and at the end of this process, the usage of the area in line with its needs is revealed. The main aim in landscape design is to create the best possible spatial composition of the study area in the context of sustainability and in the light of design principles [5]. Since landscape design is an outdoor design work, it happens directly within the nature. Therefore, natural conditions directly influence the landscape design work [5].

Landscape design should not only be visual, but also functional. In addition to the color and texture effects of plants, the sustainable landscaping design is also important for plants to be of local or foreign origins, water consumption, climate adaptability and tolerance to drought [6].

#### Factors Affecting Landscape Design Process

Factors affecting landscape design include physical, geographical, topographical, climatic, local vegetation features, and material and available technology [7].

In this context, it is necessary for the designer to identify the land characteristics of the design area, climatic conditions, environmental and human factors by performing field studies before starting work. Thus, the design will be more durable and sustainable.

Landscape design uses a variety of design elements that are presented to the human use and pleasure through outdoor design (Booth, 1983). It is important to note that these design elements, together with their own characteristics, are closely related to all elements of the outdoor and natural surroundings (Table 1) [8].

**Table 1.** Classification of Landscape Design Elements [8].

Landscape Design Elements	
Natural landscape design elements	Artificial landscape design elements
<ul style="list-style-type: none"> <li>• Ceiling element (top plane): Trees - shrubs</li> <li>• Base element (ground cover): grass, meadows, flowers</li> <li>• Vertical area divider: Shrubs</li> </ul>	<ul style="list-style-type: none"> <li>• Base Elements (slab elements, pedestrian paths, stairs, ramps)</li> <li>• Restraint and Enclosure Elements (walls, fences)</li> <li>• Ceiling Elements (top cover elements)</li> <li>• Water Elements (pool, pond)</li> <li>• Accessories (City Furniture)</li> </ul>

The most important natural landscape elements that participate in landscape design and provide space creation and management together with topography are plants. According to Booth (1983), plants participate in landscape design with their unique characteristics with functional, architectural, space creation, visual and aesthetic features [8].

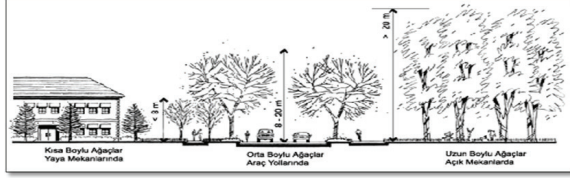


Figure 1. Trees by size (URL1).

Plants are elements that grow, develop and change over time in the landscape [9]. When you look at the general usage of trees that are so dominant and effective in landscape design, tall trees are used in wide areas, urban parks, to reduce the scale of high-rise and large buildings, to determine the space limit, to shade, to break the wind and to change its direction; medium-sized trees are used in road afforestation, in open spaces between buildings, in parks, in recreational areas, in summer to shade, and in winter to prevent wind in temperate climates for heat gain; short-length trees are used as accent elements on pedestrian paths, house gardens, courtyards, garden entrances and also used to support landscaping such as pergola benches [10] (Fig.1). To give an example in order to emphasize the importance of the plant-climate interaction; because of cold, warmth, wind or moisture disturbance, a landscape designer determines the requirements for shade-covered walkways, windscreen curtains and planting (Figure 2,3,4) [6].



Figure 2. Wind filtering of plants [6]

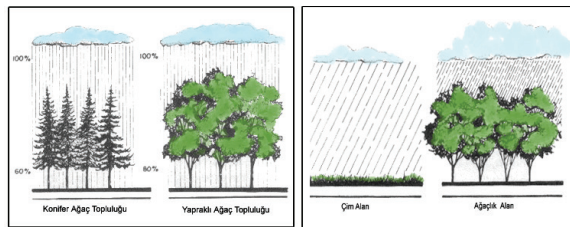


Figure 3. Precipitation permeability according to tree species [6].

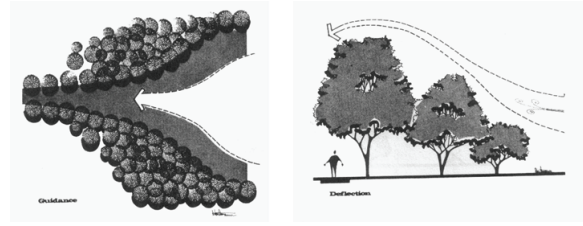


Figure 4. Plant wind directing [6].

### Climate Concept

Climate is the average of many years of weather conditions in a given place over a certain time period [11]. Climate is a series of cyclic events that occur in the atmosphere and are related to each other. Some of the main parameters that make up the climate are temperature, humidity, wind, precipitation, sunshine and pressure [12].

Climate, such as topography, vegetation, water elements, is one of the important parameters that shape the environment [13]. The conditions of different climatic zones have created a distinctive form of separation in the shaping of cities and in the design of constructions [12].

In a planned urbanization; the climate emerges as one of the most important parameters that must be assessed in order to determine the appropriate regions for human health. Because climate is an important factor that affects all activities of the human being on the earth positively or negatively. According to Koçman (2002), it is often under the control of climate to decide on our goals, our settlements, our way of life and many other things we can not count in our life cycle. As seen in Figure 2, the climate integrates socio-cultural processes with natural processes that determine the viability of the geographical environment [14].

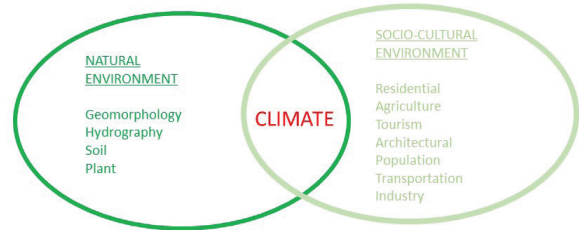


Figure 5. The place of climate in natural and socio-cultural environment [14].

Hoeven (1982) defines mikroklima as the changes that occur in restricted small areas [15]. In other words, the microclimate is basically associated with smaller areas and represents small changes in temperature, wind, humidity, in the countryside or in the same area or city, or even in the same piece of land [16]. Mostly topographic and land use-cover conditions that form the microclimate. For example, at night, the cold weather descends further down; so the temperature at the bottom of the valley is lower and the humidity is higher [17]. For this reason, taking into account insolation, it is best to place a building on the south facing side of the valley skirts. Water also creates a micro-climate

in the summer with a cooler, winter effect. Soil species can also slightly have a microclimatic effect. For example, dry and clay soils can be a factor in microclimate, creating heat and humidity changes. Plants and plant clusters are also able to form areas with microclimate conditions. They create coolness with their shadows, they are effective in the change of wind direction.

Land use and urbanization affect climate characteristics. The paved, hard floors create a micro climate by affecting the temperature degree with its reflective properties. The heights, locations and roof shapes of the surrounding structures also influence the air circulation [18]. Careful positioning, architectural design, landscape design and planting must be brought together to form a viable microclimate [7].

### Climate Conditions

Climate and microclimate are the design factors of landscape architecture. Climatic conditions become descriptive in the form of architectural forms and landscapes by shaping the physical environment and influencing the use of outdoor spaces [12]. Climate can be extremely effective on social and economic activities [19, 20]. As a consequence, climate does not only show determining characteristics in the outdoor recreational activities, but also climate is handled as a limiter and controller [20,21].

Making designs that are suited to climate conditions is more rational than taking a improper/opposite attitude, and structuring and planting should be done in such a way that while the positive effects of climate are being exploited, they should be avoided by estimating negative effects. The temperature and air flow inside and outside the building can be adjusted positively by orientation, positioning, construction techniques and afforestation. As a result, the environmental designer has to deal with natural climatic conditions and design in a way that these conditions required to be [16].

### Landscape Design and Climate Relation

People live their lives in the physical environment. The characteristics of this environment have an important influence on people and all the activities that people do [13]. As a result of all the researches carried out, it has been determined that climate is the most influential factor in people's life [22]. The temporal and spatial change of climate influences socioeconomic activities and nature, as well as shaping people's way of life, quality, comfort, culture and even their character [23]. Considering all these factors of climate, the main design goal of landscape architects is to enable people to spend time in more comfortable and livable spaces.

Due to geographical location and features, harsh terrestrial climatic conditions in high and offshore areas limit outdoor recreational activities in winter and in the coastal and arid regions, outdoor recreational activities are limited in summer because of hot weather conditions [19,20]. Thus, there are intense heat stresses on people outside, and therefore people have to be trapped in closed areas in certain parts of the year according to the regions' climate conditions they live in [20]. People, who have to work or stay where they live (i.e. urban life with low salary), have to do their recreational activities indoors when climate comfort is not available, and of course, this situation affects work efficiency and the human psychology negatively [19, 20, URL2]. While the provision of climate comfort is highly necessary, thermal comfort is partially or completely ignored in the design of

urban areas. The way of the creation of thermal comfortable urban environments is making planning and design with sufficient green spaces. Unfortunately, in urban areas natural structure of which has been largely changed, green areas are able to compensate climate by providing shade effect and maintaining humidity [20]. Moreover, one of the most important role of the green areas are to be able to prevent the formation of extreme hot and cold environments and to regulate climate [20, 24]. Throughout history, certain climate parameters such as temperature, precipitation, wind direction, power and frequency and insolation have been necessarily taken into consideration in the landscape design and applications. In cold climate areas, it is best to use south facing positioning to make the best use of the sun with narrow openings in order to preserve the heat [25]. On the other hand, in temperate and warm climatic regions, artificial structures are made from lighter and lighter colored materials and ventilation is provided by wide openings [20]. Especially in extreme hot summer conditions, if there is a water source, the fountains or small pools in the built high-walled courtyard create a natural air flow by cooling the air by means of water droplets or evaporation (Fig.6,7)[20].



Figure 6. Mardin Houses, Courtyard House [URL3].



Figure 7. Mardin Houses, Courtyard House [URL4].

Where the water is inadequate, the strong wind at the upper level is transferred through a high chimney (wind tower) to provide cool air for living spaces (Fig.8) [20,26]. In areas where there is a lot of rainfall, the buildings are placed on a platform built on the ground in order to reduce the effect of the soil (i.e.moisture), and also at places where snow is heavy, buildings with high sloping roofs close to each other have been constructed for making it easy to clean the snow cover [20,27].





Figure 8. Wind Towers of Yazd [URL5].



Figure 9. Black Sea Houses [URL6].



Figure 10. Buildings with high sloping roofs [URL7].

However, technological developments of recent years have allowed in some cases to be avoided from adverse effects of climate conditions. For example, it is possible to improve the human climate comfort with artificial ventilation and the development of long span structures instead of making completely closed shopping malls.

## SCOPE

In this study, the importance of climate in landscape design and applications of climate has been researched. Landscape design, design elements; the climate and its conditions have been taken into consideration and the interaction with these concepts has been tried to be revealed.

## METHOD

In this study, a literature search on landscape design-elements and climate concept was carried out, and theoretical explanations and conclusions were given. In the light of the literature reviews, the importance of landscape design and application of climate has been conveyed.

## CONCLUSION

One of the main criteria taken into consideration in landscape design, which aims to create comfortable and enjoyable environments for citizens in all conditions, is climate. It is possible to say that there is a mutual interaction between all natural and artificial elements participating in landscape design and climate.

This interaction has always been taken into account not only today but throughout history. As a result of this, designs that have been redesigned and renewed according to the changing climate have emerged. Although there are many striking examples of design that are now living or forgotten about design performed by taking into account climate, the lack of involvement of these traditional beneficial knowledge in contemporary space design has led to a rise and augmentation in energy costs and poor living environments in terms of climate comfort that cause to low quality life and leads to ugly, distorted and unidentified urban areas that are far from both traditionality and modernity. As a result, climate comfort is of the utmost importance for the creation of landscape areas and for all outdoor designs, and must be taken into account at every stage of landscape project design.

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