

## EVALUATION OF SIVAS CITY SELÇUKLU PARK IN TERMS OF PLANT DESIGN PRINCIPLES

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**ABSTRACT.** This studies cover ecological, social, cultural, economic, and technological processes and require an interdisciplinary study. Plants, as the most important elements of landscape design, are living design materials, and the plant design must be made by ecological data in terms of continuity of design. Plant design has aesthetic, ecological, and functional effects on people and places. A good planting design should be functional, ecologically, and aesthetically satisfactory, have a concept, and combine design elements and principles well. In this study, it was aimed to evaluate the Selçuklu Park, which has an area of 35 300 m<sup>2</sup> in the Sivas city square, in terms of plant design principles. Seljuk Park is an important park for Sivas as it is located in an area with many historical buildings. For this reason, it was chosen as the study area. The research method is based on the analysis and synthesis of data obtained from field studies covering four seasons as well as literature research. As a result of the research; It has been determined that most of the plants in the park are exotic species, that most of the plants are suitable for the ecology of Sivas in terms of their ecological demands and tolerances, that fragrant plants, showy flowering plants, and shading plants are very inadequate, that the principle of plant design has been disrupted by subsequent arrangements and that there are inadequacies in care, and suggestions have been developed.

**Keywords:** herbal design, herb, Selcuklu park, Sivas

### INTRODUCTION

The most important element in creating a visual effect in living spaces are design of plants [1]. The professional discipline that uses plant materials by combining them with art and science is the profession of landscape architecture. The main goal of landscape architecture studies is to regulate the relations between humans and nature and to use plant materials in functional and aesthetic designs for this purpose [2]. Landscape architecture and visual art are overlapped with vegetal design, and the thoughts in the human mind come together with vegetal design elements (line, form, texture, color). Understanding and comprehending the visual changes of the seasonal developments experienced by newly planted plants as they grow and develop, and the variations of shadow and light patterns that occur from day to night, requires an accumulation of knowledge. This occurs with vegetal design[3]. In the landscape architecture discipline, plant use is a very important stage in the landscape design process. Here, it is necessary to carefully construct the visual, functional, and ecological complementary interaction between the plant material and its usage area and purpose.

Plants are divided into various groups such as annual herbs, perennial herbs, woodies, bulbs, climbers and shrubs, shrubs, shrubs, and trees. These plants appeal to the senses with their forms, textures, scents, seasonal coloring (flowers, leaves, fruits, branches-shoots, trunks), and temporal changes (growth, leaf fall) and contribute to the enjoyment of open spaces. In addition, plants create physical, sensory, and psychological effects on people by creating functionally dynamic and more livable spaces. In urban landscape designs, design elements that establish a

balanced relationship between humans and nature are plants. [4] state, plants are the most important tools used to create an aesthetically, functionally, and ecologically sustainable landscape.

A successful planting design is possible by combining design elements and principles well and being compatible with the ecological environment and structural character of the application area [3, 5]. In botanical design

In addition to the effects of size, shape, texture, and color, design elements and principles such as movement, light-shadow spacing, emphasis, balance, sequence, line, scale, harmony/contrast, proportion, rhythm/repetition, dominance, and unity should be taken into consideration. The elements and principles that should be taken into consideration in landscape design are given in Table 1.

**Table 1. Landscape Design Elements and Principles**

<b>Landscape Design Elements</b>					
Tissue	Measurement	Colour	Shape-Form	Scale	Line
<b>Landscape Design Principles</b>					
Emphasis/Focus sovereignty	Rhythm/Repetition unity	Rapport/Contrast soap opera	Koram/Hierarchy movement	Ratio/Proportion	balance

Planting design has aesthetic, ecological and functional effects on people and spaces (Table 2) [6, 7]. The first purpose of plant design is to contribute functionally to the space and thus respond to the wishes of the users. Considering the functions of plants, they have many duties in the landscape, such as improving our environment and protecting and supporting nature [8].

**Table 2. Functions of Vegetative Design**

<b>Functions of Vegetative Design</b>		
Completion	Connecting/Integrate	Strengthening Design
softening	Landscape On/Off	Becoming a Decoration Material
Creating Funds	Creating a Space	Wind Curtain
Ensuring Traffic Safety	Light Control	Image Control
highlight	Redirection	Motion Control
Siege/Containment	Temperature Control	Noise Control
Erosion Control	Others	

To create a good planting design, design principles must be combined correctly and the design must be compatible with the ecological environment and structural features of the area where it will be applied. In addition, meeting the functional, ecological, and aesthetic objectives of the plant design are very important criteria to determine how successful the design is. Additionally, the design should revitalize, complement, and combine the features of existing and planned areas through the selection of plant species suitable for growing conditions [9]. When plant designs are made taking into account the qualities of the spaces, it will increase the perception of the space. For this reason, plants should be compatible with the structural elements and the intended use of the space [10].

In landscape design applications, it is necessary to take into account the local and regional landscape as well as the past and future, to protect landscape integrity, encourage landscape sustainability, to strengthen the natural and cultural spirit of the area to be designed, and pay attention to the use of local resources. Additionally, as [11] stated, in landscape design applications, the rational, intellectual, and emotional aspects of the designer must also come into play in the design. This study aims to evaluate Seljuk Park, which has an area of 35 300 m<sup>2</sup> in Sivas city square, in terms of plant design principles and to take the information obtained as a result of the evaluation into account in the new regulations.

## MATERIALS AND METHODS

### *Materials*

The main material of the study is Sivas Selçuklu Park (Fig. 1). Sivas city square; is almost an open-air museum, containing many works from the Seljuk, Ottoman, and early years of the republic. The Şifahiye Madrasa, Buruciye Madrasa, which were the universities of the Seljuk Period, the ruins of the baths, the Kale Mosque from the Ottoman period, the Congress Museum, the province, and the gendarmerie mansion are collected in an area of only 25 000 m<sup>2</sup>. With this feature, it is the original landscape architecture in Turkey.

The project aims to deliver centuries-old works to future generations by revealing them in their original form and integrating them with the needs of the modern world. Sivas Seljuk Park, which is the subject of this study, is a very large park located in the middle of these structures. It contains many plant species to be evaluated in terms of landscape architecture. Other materials of the study include domestic and foreign scientific sources on the subject, impressions obtained from on-site examinations, and photographs taken during this time.

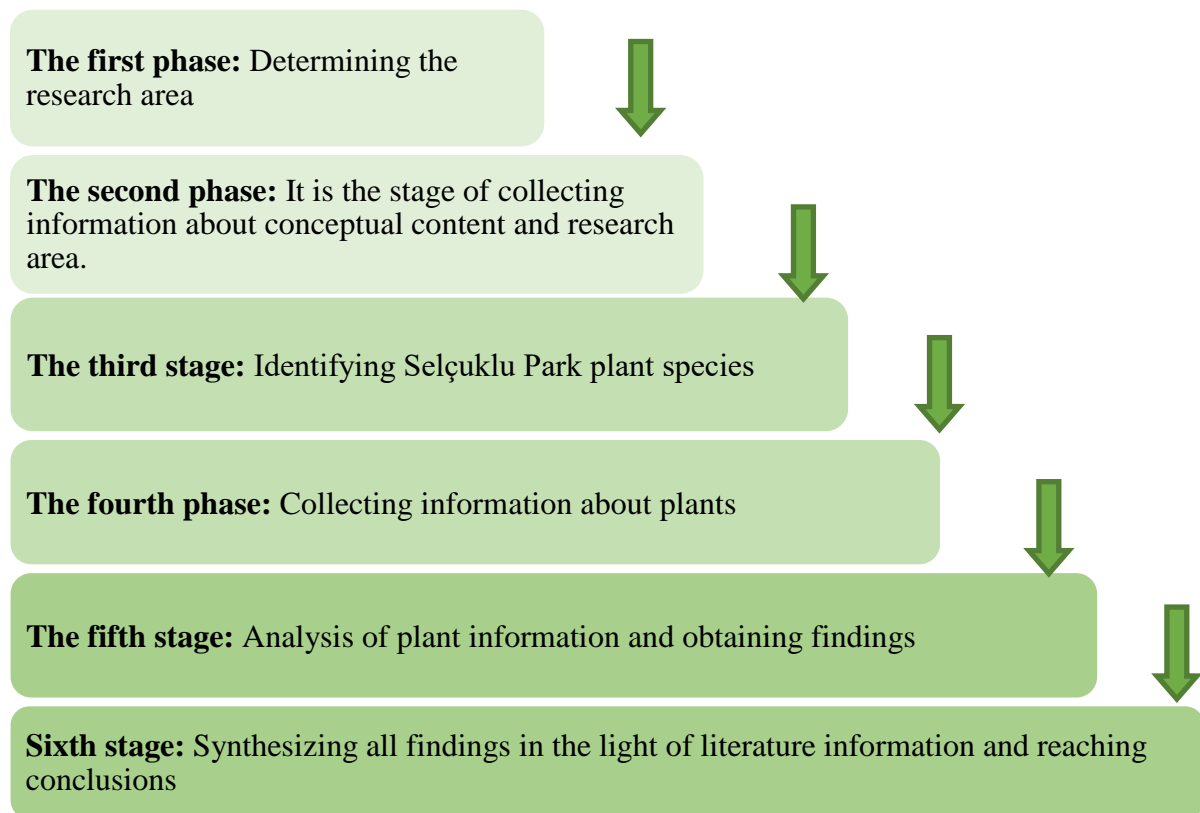


*Fig. 1. Views from the study area (Original 2023)*

### *Methods*

The research method consists of a six-stage process (Fig. 2). The first phase; determining the research area. The reason for choosing Sivas Seljuk Park as the research area is that it contains many historical sites, is located in a central location that is visited by local and foreign tourists, has an important place in the image of the city, has a symbolic value and plays a role of welcoming visitors when entering the city. The second phase; is the stage of collecting information about conceptual content and research area. In this process of research, relevant concepts and literature data containing information about the field were examined, and information about the field was obtained from the expert staff of Sivas Municipality responsible for this field. The third stage; is the stage where field studies are carried out and the plant species

of Selçuklu Park are identified. Samples were taken from plants whose species could not be identified on-site, photographs of the plants were taken, and plant species were determined with the support of experts. In order to evaluate Selçuklu Park in terms of plant design principles, observations, and photo shoots covering four seasons were repeated in the area. The fourth phase; is the stage where information about plants is collected. Here, plant information forms (origin of plants, ecological requirements, ecological tolerances, morphological features, aesthetic features, and functions of use in the park) were created in line with the purpose of the study. These forms were filled in through literature research and field studies. The fifth stage; is the analysis phase. In this process, the information obtained from the plant information forms was analyzed, evaluations were made and findings were obtained. Sixth stage; This is the conclusion and recommendations phase. All findings obtained were synthesized in the light of literature information and conclusions were reached. Applicable suggestions have been developed to eliminate the identified negativities and ensure the continuity of the positive findings.



*Fig. 2. Research Method Flow*

## RESULTS AND DISCUSSION

It was determined that there are 21 species belonging to 14 families in 4 classes (1 magnoliopsida, 10 Eudicots, 2 Pinopsida, and 1 magnolites) in Selçuklu Park. These; *Acer platanoides* crimson king (Red-leaved Maple), *Viburnum* sp. (snowball), *Rhus typhina* (Red Sumac), *Tagetes erecta* (Marigold), *Berberis vulgaris* (Woman's Salt Shaker), *Carpinus betulus* (Horbeam), *Buxus* sp (Boxwood), *Juniperus horizontalis* Blue Chip (Blue Creeping Juniper), *Thuja orientalis aurea nana* (Gold Thuja), *Magnolia grandiflora* (Magnolia), *Morus alba* (White Mulberry), *Picea* spp. (Spruce), *Pinus mugo* (Mountain Glass), *Platanus orientalis* (Eastern Plane), *Chaenomeles japonica* (Japanese Quince), *Mespilus germanica* (Mushmula), *Prunus*

mahaleb (Mahlep), Rosa spp. (Rose), Malus floribunda (Ornamental Apple), Prunus serrulata (Ornamental Cherry), Petunia hybrida (Petunia).

### **Findings Regarding the Origin of Plants**

The origins and endemic status of the plants found in Sivas Selçuklu Park were examined and the obtained information was compiled in Table 3.

**Table 3. Origins and endemic status of plants using [19, 20, .....81]**

LATIN NAME OF THE PLANT	NA	E	LATIN NAME OF THE PLANT	NA	END
	TU	N		TU	OMI
	RA	D		RA	C
	L	O		L	STA
	EX	M		EX	TUS
	OT	IC		OTI	
	IC	S		C	
		T			
		A			
		T			
		U			
		S			
<i>Platanus orientalis</i>	Doğal	ED	<i>Acer platanoides crimson king</i>	EGZ	ED
<i>Morus alba</i>	EGZ	ED	<i>Berberis vulgaris</i>	EGZ	ED
<i>Rosa spp.</i>	EGZ	ED	<i>Viburnum sp.</i>	EGZ	ED
<i>Carpinus betulus</i>	EGZ	ED	<i>Pinus mugo</i>	EGZ	ED
<i>Rhus typhina</i>	EGZ	ED	<i>Thuja orientalis aurea nana</i>	EGZ	ED
<i>Prunus serrulata</i>	EGZ	ED	<i>Buxus sp.</i>	EGZ	ED
<i>Malus floribunda</i>	EGZ	ED	<i>Juniperus horizontalis Blue Chip</i>	EGZ	ED
<i>Magnolia grandiflora</i>	EGZ	E	<i>Prunus mahaleb</i>	EGZ	ED
<i>Picea spp.</i>	EGZ	ED	<i>Chaenomeles japonica</i>	EGZ	ED
<i>Tagetes erecta</i>	Doğal	ED	<i>Mespilus germanica</i>	EGZ	ED
<i>Petunia hybrida</i>	EGZ	ED			

D: Natural, EGZ: Exotic, E: Endemic ED: Not endemic

According to Table 4, it was determined that only 9.52% of the plants used in the research area were natural plants and 90.48% were exotic species. It has also been determined that 4.76% of the plants have endemic features.

### **Findings Regarding the Ecological Requirements of Plants**

As with all living things, the growth and development of plants are guided by environmental conditions as well as genetic structures. In this case, plant diversity in plant design in landscape architecture studies is largely determined by the climate and soil conditions that make up the environment. Sivas province, where the study area is located, has a unique climate compared to surrounding provinces. It is a microclimatic climate zone relative to its surroundings. The basic elements that provide this feature are that it is higher than the surrounding provinces, is open to the northern winds, has a rugged structure, changes in pressure throughout the year, and the province's territory is located in different geographical regions. Winters are cold and harsh, there is abundant snowfall during the winter months and the province is covered with snow for 3-5 months. Summers are hot and dry, and spring and autumn are rainy [21]. The highest annual temperature in Sivas province is 40.0<sup>0</sup> C and the coldest is -34.4<sup>0</sup> C [22].

Plants that can adapt to the ecological conditions of the study areas have a higher chance of survival and the sustainability of the landscape is possible. For this reason, the plant material of Sivas Selçuklu Park was examined in terms of its ecological requirements and all the

information obtained was compiled and given in Table 4. According to this; 19.05% of the plants are slow growing, 28.57% are medium growing and 52.38% are fast-growing species.

**Table 4.** Ecological requests of plants using [19, 20, ..... 81]

LATIN NAME OF THE PLANT	Requirement for Water	Request for Light	Growth Speed	Air Temperature	Soil
<i>Platanus orientalis</i>	2	3	3	-34,4/+37,9	3,11,15
<i>Morus alba</i>	2	2	3	-31,6/ +40,7	3,14
<i>Rosa spp.</i>	1	3	3	-22/ +16	1,14
<i>Carpinus betulus</i>	1	3	3	-34,4/ +37,9	6,15,13
<i>Rhus typhina</i>	3	2	3	-34,4/ +40,7	6
<i>Prunus serrulata</i>	2	3	1	-28,8/ +40,7	2,9
<i>Malus floribunda</i>	2	3	3	-34,4/ +35,1	5,14
<i>Magnolia grandiflora</i>	2	1	2	-17,7/ +43,5	4,8,15
<i>Picea spp.</i>	3	2	3	-42,7/ +40,7	5,6,7,12
<i>Acer platanoides chrimson king</i>	1	2	2	-42,7/ +37,9	1,4
<i>Berberis vulgaris</i>	3	3	2	-34,4/ +40,7	21
<i>Viburnum sp.</i>	2	2	3	-17,7/ +40,7	3,8,14
<i>Pinus mugo</i>	2	3	1	-9,4/ +51,9	6,1
<i>Thuja orientalis aurea nana</i>	3	2	1	-15/ +30	3,5,15
<i>Buxus sp.</i>	2	3	1	-23,3/ +40,7	5,14,15
<i>Juniperus horizontalis Blue Chip</i>	3	3	3	-40/ +40	4,6,15
<i>Prunus mahaleb</i>	2	3	2	-24/ +20	2,5,10
<i>Chaenomeles japonica</i>	2	3	2	-28,8/ +40,7	5
<i>Mespilus germanica</i>	1	3	2	-12,2/ +43,3	1,2,4
<i>Tagetes erecta</i>	1	2	3	-15/ +21 C	7,14
<i>Petunia hybrida</i>	2	3	3	-18/ , +24	4,14

WATER REQUIREMENT: 1: High, 2: Medium, 3: Low, LIGHT REQUIREMENT: 1: Shade, 2: Sun, 3: Shade, Sun, Semi-shade  
 GROWTH RATE: 1: Slow, 2: Medium, 3: Fast, SOIL: 1: Clayey 2: Chalky 3: Deep 4: Fine Sand Loam 5: Well Drained 6: Dry 7: Loose 8: Humus 9: not selective 10: Rocky 11: Sandy 12: Permeable, 13: Loamy, 14: Rich in organic matter, 15: moist

Water is vital for plants, both in terms of melting the nutrients in the soil and transforming them into a form that can be absorbed by plants, and in transporting these nutrients to plant roots, trunk, branches and leaves. In terms of water requirements, plants can be classified as those with high, medium, and low water requirements. According to Table 4, 23.81% of the plants have high water requirements, 52.38% have medium and 23.81% have low water requirements (Fig. 3). Since the water needs of the plants cannot be met by rainfall in the hot months, water is added from outside.

To produce carbohydrates, plants need to break down carbon dioxide and water molecules, and for this, they get the energy they need from light. Light has effects on the growth and development of plants as well as their morphology and physiology. Plants are divided into three ecological groups according to their light requirements. These include; Sun plants (Heliophyt) are plants that prefer both sun and shade, and shade plants (Sciophyt). In the province of Sivas, which is the study area, the highest monthly average sunshine duration is 11.5 hours, while the lowest sunshine duration is 2.4 hours. The annual average sunshine duration is 6.8 hours/day [22]. According to Table 4, 4.76% of the plants in the study area are suitable for shade environments, 33.33% for sunny environments, and 61.91% for shade, sun, and semi-shade environments (Fig. 3).

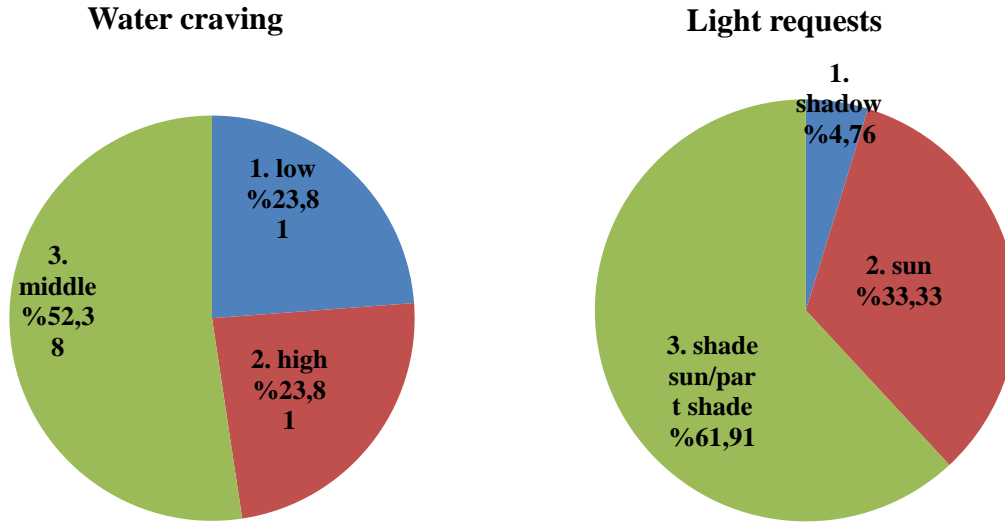


Fig. 3. Water and light requirements of plants

In terms of temperature requirements, the majority of these plants are species resistant to low temperatures and cold. The same plants are species that have a wide tolerance in terms of soil requirements, are not very selective, and are suitable for growing in multi-purpose soil mixtures (Table 6).

**Findings Regarding Ecological Tolerances of Plants**

Ecological tolerance is the degree of severity and effect between the minimum and maximum values that a living being can withstand without being harmed, completely limiting its development. Plants with high ecological tolerance and diversity have more diverse areas of use, lower risk levels in terms of sustainability, and are easier and more economical to care for. It is a preferred feature in plant design that the plants used in urban landscape designs are species that can tolerate conditions such as dust, salinity, drought, air pollution, wind, heat/coldness, infertile soil, diseases, and pests.

The ecological tolerances of the plants in Sivas Selçuklu Park were examined using [19, 20, 81] and the information obtained is given in Table 5.

Table 5. Ecological Tolerances of Plants

LATIN NAME OF THE PLANT	TOLERANCES	LATIN NAME OF THE PLANT	TOLERANCES
<i>Platanus orientalis</i>	1,3,5,9	<i>Acer platanoides crimson king</i>	3,5
<i>Morus alba</i>	14	<i>Berberis vulgaris</i>	3,14
<i>Rosa spp.</i>	14	<i>Viburnum sp.</i>	5,7,14,10,13
<i>Carpinus betulus</i>	11,9,6,12	<i>Pinus mugo</i>	3,4,6,8
<i>Rhus typhina</i>	9,10	<i>Thuja orientalis aurea nana</i>	1,5,6,8
<i>Prunus serrulata</i>	3	<i>Buxus sp.</i>	8,9,14
<i>Malus floribunda</i>	3,9,10	<i>Juniperus horizontalis Blue Chip</i>	3,9,11,13,14
<i>Magnolia grandiflora</i>	2,5	<i>Prunus mahaleb</i>	3,5,8,14
<i>Picea spp.</i>	7,9,14,12	<i>Chaenomeles japonica</i>	3,9,10,14
<i>Mespilus germanica</i>	8,14	<i>Tagetes erecta</i>	8,9
		<i>Petunia hybrida</i>	14

URBAN CONDITIONS TO WHICH THEY ARE RESISTANT: 1: Dust, 2: Salinity, 3: Drought, 4: Excessive Rainfall, 5: Air Pollution, 6: Wind, 7: Alkaline and Acid Soil, 8: Extreme Coldness, 9: Frost, 10: Infertile Soil, 11: Dark Shade, 12: Extreme Humidity, 13: Prone to Pests, 14: Full Sun

According to Table 5, it is seen that the majority of plants are resistant to drought, air pollution, extreme cold, frost, infertile soils and environments exposed to direct sunlight. Resistance to dust, salinity, excessive rainfall, wind, alkaline and acidic soils, dark shade, extreme humidity, and pests has also been determined within the same plants.

### ***Findings Regarding the Morphological Characteristics of Plants***

Morphological characteristics of plants mean; they are the features that express the physical form and external structure of plants and enable the visual identification of plants. These features are very important in plant design; It is the shape, texture, size, color, and smell characteristics of plant organs such as stems, leaves, flowers, fruits, and seeds. In addition, the general form of the plant is also an important feature in this sense. All these features determine the aesthetic value of plants and affect their use in vegetal design. The morphological characteristics of the plants used in Sivas Selçuklu Park were examined using [19, 20, .....81]and the information obtained is given in Table 6.

**Table 6. Morphological Characteristics of**

LATIN NAME OF THE PLANT	l i f e s p a n	R o o t St ru ct ur e	Trunk	Leaf	Lea f Col or	Flower	Flow er Color	Fruit	Fruit Color
<i>Platanus orientalis</i>	3	1	1,7,11, 17	2,7,9,12	3	7	1,5	2	3,5
<i>Morus alba</i>	3	1	1,7,14,18	2,9,10	3	11	3,4	5,6	7
<i>Rosa spp.</i>	3	2	1,13,22	2,5,12	3	7,8, 9	1,2,3,4,9	2	5
<i>Carpinus betulus</i>	3	1	1,15, 19 2,	2,5,12	3,9	7	3,8	1	3,5
<i>Rhus typhina</i>	3	2	15,20,23	2,7,11	2	10,11	3,4	1,2,5,12	1,2
<i>Prunus serrulata</i>	3	2	1,4,15, 23,26	2,4,10,12	1,3,10	6,8,9	2	2,5	3,4
<i>Malus floribunda</i>	3	2	1,15,16,20,24 ,26	2,4,10,12	3	6,1	7	2,5	1,2
<i>Magnolia grandiflora</i>	3	2	1,7,9,10,20, 26	1,4,6,12	3,9	8,9,12	2,3,9,11	10,11	9
<i>Picea spp.</i>	3	2	1	1,3,11	3	4	1,12	2,3	3
<i>Acer platanoides</i>	3	2	1,15, 19	2	1,7	6,10,11	3	8	1,3
<i>Berberis vulgaris</i>	3	1	2,5,24	2,8,10	3	10,11	3,4	1,3,5	1
<i>Viburnum sp.</i>	3	2	2,9,18	2,5,7,12	3,4	11,12	2,9	9	6
<i>Pinus mugo</i>	3	1	2,20,27,25	1,8	3	5	3,4	9	3,4
<i>Thuja orientalis aurea nana</i>	3	2	2,4,20,22	1,3,	5,9	2	6	9	3
<i>Buxus sp.</i>	3	2	2,7,20	1,4,5	3,8	1,7	10	3	11
<i>Juniperus horizontalis</i>	3	1	2,4	1,4,5,13,11	2,3	6,11	11	2,4	5,10
<i>Prunus mahaleb</i>	3	2	1,7,13,21	2,5,7,8	4	11,12	9	1,2,5	1,4,5
<i>Chaenomeles japonica</i>	3	2	2,8,13, 25,26	2,4,8	3	13	1,14	5,7,9	12
<i>Mespilus germanica</i>	3	2	2,7 20	2,4,7,12	6	6	2	2,5	3

<i>Tagetes erecta</i>	1	2	3, 22	2,4,12	4	1,7,8,9,12	3	2	4,8
<i>Petunia hybrida</i>	1	2	3,6,22	2,7	3	3,8	1,2,9,11,1	2	4

**LIFETIME:** 1: Annual 2: Biennial 3: Perennial **ROOT STRUCTURE:** 1: Pile 2: Fringe **BODY Shape:** 1:Single-Stemmed 2:Multi-Stemmed, **Texture:**3:Herbaceous body 4:Thin Shell 5:lenticular 6:Eye glands 7:Fissured 8 Dense Body 9:Shiny 10:Thick shell 11:Shells shell 12:Thin plate sheds 13: Spiny 14: Striped 15: Smooth 16: Fibrous inner shell, **Colour:** 17: Whitish-gray 18: Light-gray 19: Dark-gray 20: Gray 21: Purplish-gray 22: Green 23: Reddish-Brown 24 Red 25: Black, 26: brown **LEAF** 1:Evergreen 2:Deciduous **Form:** 3: Needle 4: Ellipse 5: Egg-like, **Texture:** 6: Fleshy 7: Hairy-Slightly hairy 8: Spiny 9: multi-lobed 10: toothed edge, 11: Lance-like, 12: Pointed, **Colour:** 1: red, 2: silverblue, 3:green, 4:dark green, 5:golden yellow, 6:mattegreen, 7:dark purplish, 8:yellow, 9:brown 10:blue-green **FLOWER** Shape: 1:Single flower 2:clustered 3:Cone 4: Egg Shaped 5: Cylinder Shaped 6: Star Shaped 7: Circular 8: Attractive 9: double 10: Cluster 11: Many Flowered, 12: Cone, 13: Umbrella Shaped, **Colour:** 1: red, 2: pink, 3: yellow, 4: orange, 5: brown, 6: yellowish green, 7: pink\red, 8: green, 9: white 10: cream, 11 purple 12 yellow-white 13 lavender-blue 14 orange**Fruit Shape:** 1: cluster shape . 2: Oval, 3: Circular, 4: Plain, 5: Edible, 6: compound shaped, 7: fragrant, 8: winged., 9: Egg-shaped, 10: Poisonous, 11: Poisonous **TEXTURE:** 12: Hairy **FRUIT Colour:** 1: red, 2: pink, 3: brown, 4: black, 5: green, 6: dark blue, 7: white, 8: orange 9: darkbrown 10: blue-black 11 tawny 12 greenishyellowish

According to Table 6, all plants in Selçuklu Park, except *Tagetes erecta* and *Petunia hybrida*, are perennial species. In terms of root structure, 71.43% of the plants are fringe-rooted and 28.57% are tap-rooted. pile-rooted. Plants are resistant to wind or erosion because they form a strong and solid foundation. Plants with fringe roots undertake important functions in preserving moisture and preventing surface erosion.

In terms of trunk characteristics, 47.62% of the plants have a single trunk and are trees and small trees. The others are 42.86% multi-stemmed shrubs and 9.52% herbaceous plants. The plants here vary in terms of stem tissue, *Rosa* spp, *Prunus mahaleb*, and *Chaenomeles japonica* species are spiny. Among the species, *Carpinus betulus*, *Rhus typhina*, *Prunus serrulata*, *Malus floribunda*, and *Acer platanoides* crimson king trunk texture are smooth. Body colors vary greatly, including whitish-gray, dark-gray grey, purplish-gray, green, reddish-brown, red, black, and brown (Table 6).

In terms of leaf characteristics, 28.57% of the plants are evergreen species and 71.43% are deciduous species. Among the species, *Berberis vulgaris*, *Pinus mugo*, *Prunus mahaleb*, and *Chaenomeles japonica* have spiny leaves. Leaf colors in many species are cold colors such as silver-blue, green, dark green, dull green, dark purple, and blue-green (Table 6).

Plants with remarkable features in this area with their flowers; *Rosa* spp., *Prunus serrulata*, and *Magnolia grandiflora*. Some of the other species also bloom, although they are not very showy. The flower colors of these plants vary depending on the species; The colors are red, pink, yellow, orange, brown, yellowish green, pink\red, green, white-cream, purple yellow-white, lavender-blue, orange (Table 6).

When the plants of Selçuklu Park are examined in terms of fruit characteristics, it is seen that *Morus alba*, *Rhus typhina*, *Prunus serrulata*, *Malus floribunda*, *Berberis vulgaris*, *Prunus mahaleb*, *Chaenomeles japonica*, and *Mespilus germanica* have edible fruits. All plants in the park vary in terms of fruit color, and these colors are red, pink, brown, black, green, dark blue, white, orange dark brown, blue-black, yellowish brown, and greenish yellowish (Table 6).

### Findings Regarding the Aesthetic Properties of Plants

In landscaping, aesthetics is seen as design, style, or shaping. Evaluation of visual appreciation in outdoor spaces is related to the value and aesthetics it adds to the landscape [12]. The most important design element that adds aesthetic value to the landscape is plants. The features that add aesthetic value to plants are the color, shape, size, texture, and smell of the plant, in addition to its morphological features. The aesthetic properties of the plants in Sivas Selçuklu Park were examined using [19, 20, .....81] and the information obtained is given in Table 7.

The volume a plant gains in horizontal and vertical directions constitutes its size, which is one of the important aesthetic features of the plant. When the plants of Selçuklu Park are examined in terms of size characteristics, 47.63% of the plants are trees, 9.52% are shrubs, 33.33% are shrubs and 9.52% are herbaceous (Table 7).

**Table 7. Aesthetic Properties of Plants**

LATIN NAME	Aesthetic Features					LATIN NAME	Aesthetic Features				
	Size	Form	Tissue	Color	odor		Size	Form	Tissue	Color	odor
<i>Platanus orientalis</i>	1	3	2	2	0	<i>Acer platanoides crimson king</i>	1	2	2	2	0
<i>Morus alba</i>	2	6	2	2	0	<i>Berberis vulgaris</i>	3	3	2	1	0
<i>Rosa spp.</i>	3	3	2	2	1	<i>Viburnum sp.</i>	3	3	1	1	0
<i>Carpinus betulus</i>	1	1	1	1	0	<i>Pinus mugo</i>	1	1	1	1	0
<i>Rhus typhina</i>	3	3	2	1	1	<i>Thuja orientalis aurea nana</i>	1	2	2	4	0
<i>Prunus serrulata</i>	2	3	2	2	0	<i>Buxus sp.</i>	3	2	1	1	0
<i>Malus floribunda</i>	1	1	1	1	0	<i>Juniperus horizontalis Blue Chip</i>	1	5	2	1	0
<i>Magnolia grandiflora</i>	1	3	2	2	1	<i>Prunus mahaleb</i>	1	1	2	4	1
<i>Picea spp.</i>	1	1	1	1	1	<i>Chaenomele s japonica</i>	3	3	2	3	1
						<i>Mespilus germanica</i>	3	3	1	1	0
						<i>Tagetes erecta</i>	4	1	2	1	1
						<i>Petunia hybrida</i>	4	4	2	1	1

**SIZE:** 1:Tree, 2:Shrub, 3:Shrub, 4:Herbaceous **FORM:** 1:Column and Pyramid, 2:Round, 3:Scattered, 4:Oval, 5:Spreading-Climbing, ground cover and vine 6:Close **TISSUE:** 1:Coarse, 2:Fine **COLOR:** 1:Dark Green , 2:Light Green, 3:Red, 4: Gray **ODOR:** 0: Ineffective, 1:Good

The form of plants is defined as their external appearance. Plant form has an impact on user behavior in plant design. The form is seen in various forms in plants. Forms detected in the plants in the Selçuklu Park; Column and Pyramid, Round, Scattered, Oval, Spreading-Climbing, ground cover hugging, and cluster forms. There are mostly scattered form plants (42.86%) (Table 7).

The texture of a plant refers to all the characteristics of the shape, size, and color of its leaves, the structure of the leaf surfaces, and their branching. The texture of the plant affects the size of the space where it is used, the effect of the plant in four seasons, and the psychology of the user. It depends on the perception of plant texture and the distance from the user. Users can only detect plant texture when they are close to the plant. In terms of texture, plants are divided into coarse, medium, and fine-textured plants. 33.33% of the plants in the Selçuklu Park consist of coarse-textured plants and 66.67% consist of fine-textured plants (Table 7).

Plants get their colors from the interaction of pigments in their cells with sunlight. Colors have different psychological effects on people [13-15] stated that warm colors such as red, yellow, and orange have the effect of creating stimulating and warm atmospheres that are invigorating, joyful, and exciting, while cold colors such as blue and green are more calming. They stated that it has relaxing, soothing, and soothing effects [16] and that while warm colors give the perception of getting closer to the perceiver, cold colors give the feeling of retreating in the design [13]. They stated that bright and warm colors cause excitement and movement of

the perceiver towards the landscape area. [17] stated that dark green tones in design give a feeling of strength, weight, silence, and peace and that these tones cause the distance between the object and the perceiver to appear shorter[18]. Considering the leaf, flower, fruit, and stem colors of the plants, and the color changes according to the age of the plant and the seasons, plant color is the feature that offers the most design options in vegetal design. The plants of Selçuklu Park are in dark green, light green, red, and gray color tones, and color combinations occur with seasonal changes (Table 7).

Fragrant substances in plants are chemical compounds that can easily evaporate. Plants secrete these substances mostly to attract pollen-bearing creatures. Just as there are fragrant plants, there are also plants that have a bad smell or are ineffective in terms of smell. Fragrant plants have an important power in improving the physical, emotional, and spiritual health of users. Therefore, it is important to use beautiful, fragrant plants in vegetal design. On the other hand, the majority (61.90%) of the plant species in Selçuklu Park are species that are ineffective in terms of odor (Table 7).

## CONCLUSION

Landscape design covers all open areas other than buildings, and plants form a very important part of landscape design. The correct selection, placement, care, and management of plant species adds aesthetic, functional, and ecological values to landscape design and ensures the creation of sustainable landscapes.

This study aims to evaluate the Selçuklu Park, which has an area of 35 300 m<sup>2</sup> in Sivas city square, in terms of plant design principles and to take the information obtained as a result of the evaluation into account in the new regulations. The results obtained from the study are listed below. 21 different types of plants were used in this park area. Only 9.52% of the plants used are natural species, while 90.48% are exotic species. Natural species should be prioritized in new regulations. Thus, the ecological sustainability of the landscape, ease of maintenance, and the city's unique identity will be contributed to. 23.81% of the plants used in the park have high water requirements, 52.38% have medium and 23.81% have low water requirements. During the phytodesign process, a balanced relationship must be established between the soil water in the area and the water demand of the plant.

In terms of light requirements, species suitable for sun/shade/semi-shade conditions have been mainly used, and this sensitivity should be shown in new regulations, and the relationship between the light requirements of the plants to be used in plant design and the sun/shade conditions of the usage area should be established. In terms of temperature requirements, the majority of these plants are suitable for the ecology of Sivas and have been selected from species that are resistant to low temperatures and cold. The highest annual temperature in Sivas is +40<sup>0</sup> C, while the coldest is -34.4<sup>0</sup> C. Therefore, among the plants in the park, *Prunus serrulata*, *Magnolia grandiflora*, *Viburnum* sp., *Pinus mugo*, *Thuja orientalis aurea nana*, *Prunus mahaleb*, *Mespilus germanica*, *Tagetes erecta*, *Petunia hybrida* plants are damaged because they cannot meet the temperature requirements. In new regulations, care should be taken to select plants suitable for the Sivas climate. In terms of soil requirements, all plants in the park have wide tolerance and have been selected as the right species.

The area where the park is located is a city center and at the same time, it is in a location with air pollution due to heavy traffic, very dense soil, and dust. In addition, considering the climate of Sivas Province, it is a place where harsh cold and frost occur. The majority of the plants used in the park are species that can tolerate these extremely adverse urban conditions.

Except for two herbaceous plant species in the park, the plants are perennial species. The extensive use of perennial species eliminates the need to renew plants every year. However, annual herbaceous plants are also very inadequate in terms of diversity.

The stem and leaf colors of the plants are generally cold and are ineffective in softening the cold and harsh climate of Sivas City. In terms of color characteristics, new arrangements should include plant species that can create a color effect in all four seasons.

When evaluated in terms of its aesthetic properties, in terms of size there are the most tree species, there is diversity in terms of form, and in terms of texture, it is seen that fine-textured plants predominate. However, since the relationship between the plants and their usage area has not been established, unprincipledness manifests itself. The use of fragrant plants is very insufficient.

Each type of plant used in botanical design should aim to solve a problem along with its aesthetic function. That is, in design, plants do not only serve to beautify the environment in an aesthetic sense but also serve functions such as fencing, road afforestation, erosion control, noise screening, wind screening, traffic control, creating shadows, orientation, creating beautiful views, covering unwanted images, creating space effects should also be used to fulfill it. In this case, the right type of plant should be used in the right place.

The results of the on-site investigations regarding the usage relationship of the plants in Sivas Selçuklu Park are given in Table 8.

**Table 8. Seljuk Park functions of plants**

Plants	Usage areas
<i>Platanus orientalis</i>	As a shading plant on roadsides, medians, and slope areas
<i>Morus alba</i>	As a shading plant on roadsides, medians, and slope areas
<i>Rosa spp.</i>	Roadside, medians and hillside areas, flower beds
<i>Carpinus betulus</i>	As a wind curtain on roadsides, medians, and hillside areas
<i>Rhus typhina</i>	Create landscape
<i>Prunus serrulata</i>	Roadside, medians, and hillside areas
<i>Malus floribunda</i>	Roadside, medians and hillside areas
<i>Magnolia grandiflora</i>	As a shading plant and as a sound curtain on roadsides, medians and slopes.
<i>Picea spp.</i>	As a siege element,
<i>Acer platanoides chrimson king</i>	Roadside, medians, and hillside areas
<i>Berberis vulgaris</i>	As a siege element, in flower beds
<i>Viburnum sp.</i>	In flower beds, roadsides, medians, and hillside areas
<i>Pinus mugo</i>	in flower beds
<i>Thuja orientalis aurea nana</i>	Hedge plant in flower beds
<i>Buxus sp.</i>	Hedge plant
<i>Juniperus horizontalis Blue Chip</i>	Use as ground cover
<i>Prunus mahaleb</i>	Flower beds, shade, wind screening
<i>Chaenomeles japonica</i>	Sound screening in flower beds, roadsides, medians and hillside areas
<i>Mespilus germanica</i>	Flower beds, roadsides, medians and hillside areas
<i>Tagetes erecta</i>	Flower parterres
<i>Petunia hybrida</i>	Flower parterres

According to Table 8, it can be seen that the relationship between the uses of plants in many areas in the Selçuklu park is not correct. Although plant species are correct in terms of their ecological, morphological, and aesthetic characteristics, the usage relationship has not been established in a principled manner. The determinations on this subject are listed below.

There are planting areas that have been constructed without design value or whose principals have been disrupted by subsequent intensive planting (Fig. 4).



*Fig. 4. Unprincipled and densely planted area*

The use of single types of herbaceous plants in flower beds reduces attractiveness. In addition, the random use of shrub-shaped plants on the roadside blocks the flower beds and it weakens the effect of the landscape (Fig. 5). This mistake has been made repeatedly throughout the park.



*Fig. 5. Flower parterre*

Shading plants were not used on the seating elements in the park. This situation was a faulty practice because it did not create a space effect and it was necessary to sit under the sun on summer days when the park was used extensively (Fig. 6). In the application shown in Figure 6, it can be seen that thorny plants were used alongside the seating elements. These incorrect practices have been repeated repeatedly throughout the park.



*Fig. 6. Planting around seating elements*

In Sivas, a province with a cold climate, it is important to benefit from the color effects of plants during the winter months. However, there are deficiencies in this regard in this park. As seen in Figure 7, plants are ineffective in softening the harsh effects of snow and concrete.



*Fig. 7. Ineffective in climate and concrete hardness vegetation areas*

Although maintenance is very important in herbal practices, there are planting areas that are neglected (Fig. 8).



*Fig. 8. Unmaintained, vegetation areas*

In this park area, plant lighting is provided at night. However, the lighting technique and colors applied are far from attractive (Fig. 9).



*Fig 9. Plant illumination*

As a result, vegetal design requires knowledge of issues such as selection, placement, maintenance, and updating of the right plant species. Therefore, plant designers should know about plant care, plant types and characteristics, light requirements, irrigation needs, etc.

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