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Research Article

THE ROLE OF PLANT DESIGN IN THE LANDSCAPE ERGONOMICS OF THERMAL TOURISM AREAS: THE CASE OF EYNAL THERMAL SPRINGS, SIMAV-KÜTAHYA

Necmettin Gür[1] - Özgür Kahraman[1*]

[1] *Department of Landscape Architecture, Graduate School of Education, Çanakkale Onsekiz Mart University, 17100, Çanakkale, Turkey.*

[1*] *Department of Landscape Architecture, Faculty of Architecture and Design, Çanakkale Onsekiz Mart University, 17100, Çanakkale, Turkey.*

*Corresponding Author:
E-mail: ozgurkahraman@comu.edu.tr

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ABSTRACT. Tourism assets have an important place in the promotion and economy of the country. Thermal tourism, which is a type of health tourism, can be carried out in any period without any seasonal restrictions. Landscape design and landscape ergonomics of thermal tourism areas are important in terms of visitor satisfaction and comfort. The optimum properties of the plants that make up the plant design in thermal tourism areas directly affect the ergonomics of these areas together with all the landscape elements. This study was carried out in order to reveal the importance of plant design in the landscape ergonomics of the thermal tourism areas of Eynal Thermal Springs in the Simav district of Kütahya. 53 plant taxa were identified in the study area. Of these taxa, 64.1% tree, 18.8% shrub, 11.3% tree and 5.6% flower group. Bending, drying and maintenance deficiencies of the plants in the area were determined.
Keywords: *Plant design, thermal tourism, landscape ergonomics, Simav, Eynal Thermal Springs*

INTRODUCTION

A busy and stressful life causes imbalances in human health. People travel various reasons such as to improve their health and increase their well-being. This forms the basis of health tourism [1]. Thermal tourism, known as spa tourism, is a part of health tourism [2]. Thermal tourism is a type of alternative tourism that includes visits to hydrotherapy and thalassotherapy centers to regain physical and mental health, as well as the use of mineral waters in various ways, such as drinking, bathing, and mud baths at certain temperatures [3]. Unlike other tourism types, thermal tourism can be done in all seasons and appeal to all ages and physical and economic conditions [4]. The absence of seasonal restrictions and its appeal to large masses cause a continuous circulation in thermal tourism areas [5]. Considering that the circulation is in all seasons and the definition of the user is wide, it would not be wrong to say that especially the thermal tourism areas and the landscape are closely related [6]. Landscape planning and design provide an environmental advantage by interacting between natural and artificial elements and the tourist and tourism area. Therefore, landscape design and planning of thermal tourism areas are essential [7]. Giving the necessary importance to ergonomics in landscape design and planning will meet user demands and increase the necessary comfort at the same rate [8, 9]. To provide landscape ergonomics in thermal tourism areas, designers should pay attention to optimally exhibiting the functional and ecological characteristics of the plant species that make up the majority of the materials used in landscape studies,

as well as their morphological characteristics [10]. It is essential in terms of aesthetics and functionality to structure the plants according to their formal characteristics, such as leaves, stems, shoots, height, diameter, and whatever form they are used for in landscape architecture. Disease, desiccation, death, and similar conditions in plants can cause deformities. Even if these inconveniences are not experienced, using specific plants may reduce the desired aesthetic effect and create difficulties in providing landscape ergonomics [11]. However, the correct use of ornamental plants in landscape designs reveals different functions. People; in the physical, emotional, and psychological fields; show dynamic and static effects [12]. Psychologically, it shows effects such as aesthetic, relaxing, exciting, uplifting, intriguing, soothing, social commentary (criticism), emotional attachment, deep thinking, bonding, and consensus. Physically, it shows effects such as appealing to the visual, auditory, tactile, and olfactory senses, interacting with each other like walking, resting, and playing games. Static and dynamic effects can be separated spatially. Accordingly, as stationary, it shows effects such as defining space, creating outdoor spaces, preventing unauthorized access, providing privacy, separating private and public spaces, and creating spatial illusions. Dynamically, circulation control, orientation, combining, inviting to travel, and helping to guide [13, 14]. With all these effects, plant design and the right use of plants are significant in providing ergonomics and user comfort in thermal tourism areas [15].

This study was carried out to evaluate the role of the plant design in the landscape ergonomics in the areas of thermal tourism in Eynal Thermal Springs.

MATERIAL AND METHOD

Material:

The study area, Eynal Thermal Springs, is located in the Simav district of Kütahya province in the west of Turkey and is 5 km away from the district centre (Fig. 1). The hot spring area is located at the intersection of 39º07'32.96" north and 28º59'40.68" east coordinates, and its height from sea level is 804 m. Eynal Thermal Springs, together with Çitgöl and Naşa thermal springs, is one of the important hot water resources in the Simav geothermal basin. In addition, Eynal is the hot spring area with more hot water wells and the largest area among them compared to the other two thermal springs. The temperature of the water wells in Eynal Thermal Springs varies between 58 Cº and 162 Cº [16].

Fig. 1. *Eynal thermal springs, which is the study area.*

Method:

The study was carried out as in the following steps;

1. Step: The structure, area and plant species of the spa area were determined by conducting on-site investigations between March and May 2022.

2. Step: The shape, texture, shape, color criteria and visual situation of the plant species in the area were evaluated ergonomically.

3. Step: Ergonomically unsuitable plant species were photographed and presented in tabular form.

4. Step: Suggestions were made regarding the precautions to be taken in plants to ensure ergonomics in the field.

RESULTS

As a result of the investigations, in the spa area, one restaurant, two Turkish baths, three family tea gardens, one boutique hotel, one open water park, two cafes, one volleyball, one basketball, one grass football field, one tennis court, three markets, four children's playgrounds, one reception building, three picnic areas, one hotel building, and one mosque has been identified as construction and recreation areas. In addition, it was determined that coniferous and broad-leaved tree species were dense among the plant species in the area. All plant species identified in the area are shown in Table 1.

Table 1. *Plant species in the Eynal thermal springs area.*

No	Plant species	Family
1	*Acer negundo* var. aureovariegatum Wesm.	*Aceraceae*
2	*Acer negundo* L.	*Aceraceae*
3	*Acer pseudoplatanus* L.	*Aceraceae*
4	*Aesculus hippocastanum* L.	*Hippocastanaceae*
5	*Ailanthus altissima* Mill.	*Simaroubaceae*
6	*Aronia prunifolia* Rehder.	*Rosaceae*

7	*Berberis julianae* C. K. Schneid	*Berberidaceae*
8	*Betula pendula* Roth.	*Betulaceae*
9	*Canna indica* L.	*Cannaceae*
10	*Catalpa bignonioides* Walt.	*Bignoniaceae*
11	*Cedrus atlantica* (Endl.) Manetti ex. Carrière	*Pinaceae*
12	*Cedrus deodora* (Roxb.) Loud.	*Pinaceae*
13	*Cercis siliquastrum* L.	*Fabaceae*
14	*Chamaecyparis lawsoniana* (A. Murray) Parl.	*Cupressaceae*
15	*Cotinus coggygria* Scop.	*Anacardiaceae*
16	*Cotoneaster frigidus* Wall. ex. Lindl.	*Rosaceae*
17	*Cupressus arizonica Greene*	*Cupressaceae*
18	*Cupressus arizonica var. glabra (Sudw.) Little*	*Cupressaceae*
19	*Cupressus macrocarpa Hartw. ex. Gordon*	*Cupressaceae*
20	*Cupressus sempervirens* L.	*Cupressaceae*
21	*Elaeagnus angustifolia* L.	*Elaeagnaceae*
22	*Euonymus japonica* var. aurea Thunb.	*Celastraceae*
23	*Festuca glauca* Vill.	*Poaceae*
24	*Fraxinus excelsior* L.	*Oleaceae*
25	*Juglans regia* L.	*Juglandaceace*
26	*Juniperus sabina* L.	*Cupressaceae*
27	*Koelreuteria paniculata* Laxm.	*Sapindaceae*
28	*Lavandula officinalis* Chaix.	*Lamiaceae*
29	*Levisticum officinale* WJD Koch.	*Apiaceae*
30	*Mahonia aquifolium* (Pursh) Nutt.	*Berberidaceae*
31	*Morus alba* L.	*Moraceae*
32	*Morus nigra var. pendula* L.	*Moraceae*
33	*Nandina domestica* Thunb.	*Berberidaceae*
34	*Photinia fraseri* Dress.	*Rosaceae*
35	*Phyllanthus acidus* L.	*Phyllanthaceae*
36	*Picea pungens* Engelm.	*Pinaceae*
37	*Pinus brutia* Ten.	*Pinaceae*
38	*Platanus orientalis* L.	*Platanaceae*
39	*Platycladus orientalis* (L.) Franco	*Cupressaceae*
40	*Populus alba* L.	*Salicaceae*
41	*Prunus cerasifera* Ehrh.	*Rosaceae*
42	*Prunus cerasus* L.	*Rosaceae*
43	*Prunus persica* (L.) Batsch	*Rosaceae*
44	*Robinia pseudoacacia* L.	*Fabaceae*
45	*Rosa damascena* Mill.	*Rosaceae*
46	*Rosmarinus officinalis* L.	*Lamiaceae*
47	*Salix babylonica* L.	*Salicaceae*
48	*Sophora japonica* L.	*Fabaceae*
49	*Tagetes erecta* L.	*Asteraceae*
50	*Tilia tomentosa* Moench.	*Malvaceae*
51	*Viburnum lucidum* L.	*Adoxaceae*

52	*Vitis vinifera* L.	*Vitaceae*
53	*Zinnia elegans* Jacq.	*Asteraceae*

When the plants determined in the area are analyzed, the plant species used in the landscape design of the spa; are 64.1% is tree, 18.8% is shrub, 11.3% is short tree, and 5.6% is in flower group (Fig 2).

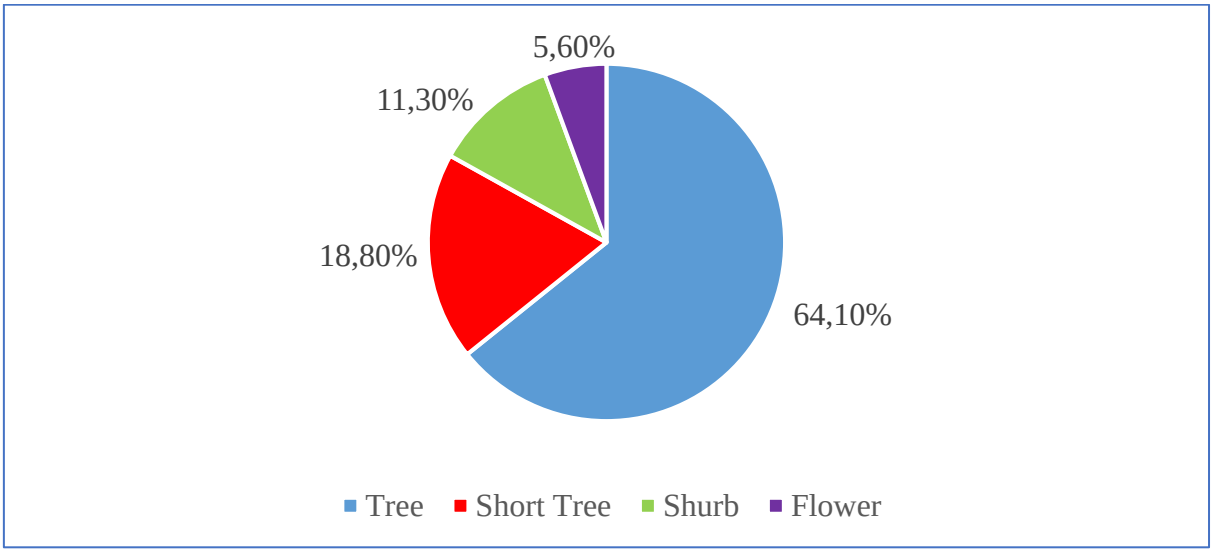


Fig. 2. *Plant groups in the study area.*

According to the evaluations, most of the plants were found to be bent in terms of shape and drying in terms of texture. The examples of deterioration in the plants, which were determined from an ergonomic point of view, are given in Table 2 with a photograph.

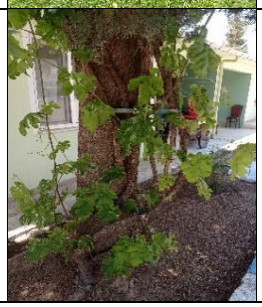
Table 2. *Ergonomic evaluation of plants used in the area of Eynal thermal spring.*

No		Plant species	Property	Situation
1		*Acer pseudoplatanus* L.	Shape	Bending
2		*Aronia prunifolia* Rehder.	Form	Thinning

3		*Betula pendula* Roth.	Form, Shape	Thinning, Bending
4		*Canna indica* L.	Texture	Drying
5		*Cedrus atlantica* (Endl.) Manetti ex Carrière	Shape	Bending
6		*Cupressus arizonica* Greene	Shape	Bending
7		*Cupressus arizonica* var. glabra (Sudw.) Little	Shape	Bending
8		*Elaeagnus angustifolia* L.	Form, Shape	Branching from the bottom, Bending

9		*Festuca glauca* Vill.	Texture	Drying
10		*Fraxinus excelsior* L.	Shape	Bending
11		*Juglans regia* L.	Texture	Drying
12		*Lavandula officinalis* Chaix.	Texture	Drying
13		*Morus alba* L.	Form	Decay
14		*Photinia fraseri* Dress.	Texture	Same species and frequent planting

15		*Picea pungens* Engelm.	Texture	Drying
16		*Pinus brutia* Ten.	Shape	Bending
17		*Platanus orientalis* L.	Shape	Bending
18		*Prunus cerasifera* Ehrh.	Shape	Bending
19		*Prunus persica* (L.) Batsch	Form	Different species and frequent planting
20		*Robinia pseudoacacia* L.	Shape	Bending

21		*Rosa damascena* Mill.	Texture	Same species and frequent planting
22		*Salix babylonica* L.	Form	Scrawny body
23		*Tilia tomentosa* Moench.	Form	Branching from the bottom
24		*Viburnum lucidum* L.	Texture	Drying
25		*Vitis vinifera* L.	Form	Different species and frequent planting

In the study area, drying and bending were observed in most of the existing plants. It was observed that the bending of the plants could be fixed by guiding them at the growth times together with the support systems to be used appropriately. With the right pruning methods, the dried limbs of the plants can be pruned, and regular irrigation and necessary plant protection measures can be taken to prevent drying out. Two other ergonomic problems are the intensive planting of the same species and different species. Ergonomic deterioration caused by this problem can be solved with the right transplantation practices without harming the plants. In addition, branching disorders detected in plants can be

healed by pruning methods. In another similar study, Sağlık et al. [17] investigated the importance of plant design in urban ergonomics. They visually examined the plant materials used in the city park called Halk Bahçesi in Çanakkale, Turkey, observed ergonomically, and listed the problematic plants. They found that the ergonomics of 14 out of 83 plant species in Halk Bahçesi were unsuitable. As a result, they focused on the importance of plant design for urban ergonomics in their studies. This study observed deterioration in the ergonomy of 25 out of 53 plant species.

CONCLUSION

The share of tourism in the economies of countries is increasing day by day. The fact that tourism has a quality structure makes this share a steady income. In parallel, accommodation, transportation, food, shopping opportunities, good landscape planning, landscape design infrastructure, and ergonomic tourism areas are very important factors for quality tourism. The ergonomics of tourism areas directly affect user comfort. Thermal tourism is a valuable type of tourism for the country's economy, just like other types of tourism in Turkey. Because the relationship between tourism and landscape is inseparable, attention should be paid to the characteristics of the plant material used during the landscape design for the ergonomics of thermal tourism areas. Landscape design and planning, in which the visual, functional, and sustainable characteristics of plants are brought to the fore, and the increase in the visual quality of the tourists coming to visit the tourist areas can provide tourist satisfaction to a large extent.

It is observed that some of the plant species used in landscape design of Eynal Thermal Springs, one of the important thermal tourism centres of Turkey, cannot exhibit the optimum properties. This may be due to the inadequacy of landscape maintenance and intensive planting. It was determined that the area's plants used for shading and resting purposes were misused. For example, it was seen that coniferous species were preferred instead of broad-leaved trees, which could create a shading effect. As a result, it was observed that these plants were located very close to the structures, and they were likely to damage these structures and did not create the desired effect. To correct these adverse effects that disrupt ergonomics, the mentioned plants should be removed from the structures to a certain extent, and the use of the wrong plant species should be replaced with the correct ones. It was determined that as a result of the planting of some plants used in the spa area more extensive than they should be, the shape, texture, and form characteristics of the plants began to deteriorate. Due to the shadow created by the tall and wide trees, the plants in the shrub group used under these plants could not reach their optimum height and could not benefit from the sun properly. In some plants, bending and twisting were detected in these plants due to the lack of or insufficient support systems. According to the size of the Eynal Thermal Springs area, the diversity of plant species used was another issue determined to be insufficient. It was observed that the aesthetic perceptions of the area were negatively affected because the intensive use of the same type of plants created uniformity in visual quality. A uniform image would be obtained in traffic and routing only with plants to be used sequentially in the intra-area circulation network and the medians. Using long and broad-leaved trees, necessary pruning should be done, and the sunlight should be delivered to the low shrub group. The branching problem in trees can be solved by timely pruning. In plants with a risk of bending and overturning, support systems with sufficient strength should be used to avoid and correct such situations. The aesthetic quality should be increased by using plants with different

colors of leaves or flowers in areas where green color dominates and where the emphasis should be made.

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