Journal of Architectural Sciences and Applications
JASA 2023, 8 (2), 671-681
Research article
e-ISSN: 2548-0170
https://dergipark.org.tr/en/pub/mbud

Determination of Landscape Use Opportunities of Some Taxa from Şanlıurfa (Türkiye) Wetland Flora

İbrahim Halil HATİPOĞLU [1]*, Hatice TOSYAGÜLÜ ÇELİK [2], Ömer Faruk KAYA [3]

ORCID 1: 0000-0002-7236-4976
ORCID 2: 0000-0003-2739-7047
ORCID 3: 0000-0003-3969-8939

[1] *Harran University, Faculty of Agriculture, Department of Horticulture, 63290, Şanlıurfa, Türkiye.*
[2] *Iğdır University, Faculty of Applied Sciences, Department of Organic Agriculture Management, 76000, Iğdır, Türkiye.*
[3] *Harran University, Faculty of Arts and Sciences, Department of Biology, 63290, Şanlıurfa, Türkiye.*
**** e-mail**: ibrahimhhatipoglu@gmail.com*

Abstract

The aim of this study is to determine the landscape use opportunities of natural plants of wetland habitats (river, stream, rill, moist meadows, etc.) within Şanlıurfa province. In this study, 58 plants were determined from wetland habitats that can be evaluated in terms of landscape use. The characteristics of these plants for their landscape use (life form, structure, flowering period, flower color, landscape value, color, and scent effect) were determined. The obtained data were evaluated using PAST 4.03 data analysis software and Principal Component Analysis (PCA). In addition, cluster analysis was performed to examine the distribution of these plants according to the determined landscape use parameters. With the classification practices, plants were defined in 4 different groups, and it was observed that the parameters were effective in the classification of the species. It was concluded that PC1 and PC2 heavily determined the grouping with parameters such as life form, flowering period, color effect and flower color.

Keywords: *Flora, landscape, wetland, landscape management, environmental sustainability.*

Şanlıurfa (Türkiye) Sulak Alan Florasındaki Bazı Taksonların Peyzaj Kullanım Olanaklarının Belirlenmesi

Öz

Bu çalışmanın amacı, Şanlıurfa il sınırları içerisindeki sulak alan habitatlarındaki (nehir, dere, nemli çayırlar vb.) doğal bitkilerinin peyzaj kullanım olanaklarının belirlenmesidir. Çalışmada sulak alan habitatlarından peyzaj kullanımı açısından değerlendirilebilecek 58 bitki tespit edilmiştir. Bu bitkilerin peyzaj kullanımına yönelik özellikleri (yaşam formu, yapısı, çiçeklenme dönemi, çiçek rengi, peyzaj değeri, rengi ve koku etkisi) belirlenmiştir. Elde edilen veriler, PAST 4.03 veri analiz yazılımı ve Temel Bileşen Analizi (PCA) kullanılarak değerlendirilmiştir. Ayrıca bu bitkilerin belirlenen peyzaj kullanım parametrelerine göre dağılımını incelemek için küme analizi yapılmıştır. Sınıflandırma uygulamaları ile bitkiler 4 farklı grupta tanımlanmış, parametrelerin türlerin sınıflandırılmasında etkili olduğu gözlemlenmiştir. PC1 ve PC2'nin yoğun olarak yaşam formu, çiçeklenme dönemi, renk etkisi ve çiçek rengi gibi parametreler ile gruplandırmayı belirlediği sonucuna ulaşılmıştır.

Anahtar kelimeler: *Flora, peyzaj, sulak alan, peyzaj yönetimi, çevresel sürdürülebilirlik.*

Citation: Hatipoğlu, İ. H., Tosyagülü Çelik, H. & Kaya, Ö. F. (2023). Determination of landscape use opportunities of some taxa from Şanlıurfa (Türkiye) wetland flora. *Journal of Architectural Sciences and Applications*, 8 (2), 671-681.
DOI: https://doi.org/10.30785/mbud.1332420

Received: *25/07/2023 –* ***Accepted:*** *18/09/2023*

1. Introduction

Landscape design involves planning processes that prioritize the relationship between human beings, flora and fauna in line with legal frameworks, taking into account aspects such as natural, socio-cultural, environmental, ecological, economic, technological aspects, compatibility with the land structure, relations with the immediate surroundings as well as vegetative, geographical, innovative aspects and sustainability (Yerli & Kaya, 2018). The landscape areas so designed are regarded as one of the key elements of the cities thanks to the benefits they offer, such as supply of fresh air, wind screening, noise reduction, and creating recreational areas for the urban residents by establishing nature reserves for the cities. Open and green spaces, which are important for the Landscape Architecture discipline, play a major role in the improvement and development of the urban ecosystem, such as reducing the urban heat island effect, carbon capture and storage (Tuğluer & Gül, 2018). Such areas incorporate elements that minimize the negative impact of urbanization on the environment, accessible by people from all segments of the society to benefit therefrom, and improve the living standards. Using natural plant species for landscaping helps to conserve water and maintain the quality of water while preserving the existing natural vegetation (Aksoy & Erken, 2022). It is known that plant material, which is the basic element of urban open and green spaces, provides many benefits to the city. However, in order for plants to provide the expected benefits from them, while being used in landscape architecture studies, along with the design principles, their dendrological characteristics and ecological demands should be taken into consideration (Ekren & Çorbacı, 2022).

Water garden designs stand out as one of the most conspicuous elements in landscape planning efforts. In addition acting as the highlight of the landscaping effort, the water garden is also used for generating sounds and for cooling the ambiance. Wetlands are generally known as areas with dominant water saturation, which soil improvement, plant species and animal communities. Considered as areas of great importance due to the biological diversity they feature, the wetlands represent key ecosystems of the earth with natural functions and economic values (Wescoat, 2012; Bhikha, 2013; Haynes, 2015).

The concept of ‘water garden’ is first mentioned in conjunction with the garden art in Ancient Egypt and Far East (Düzenli et al., 2019). The water garden concept can be defined as an architectural space designed to house, exhibit or reproduce certain species or a variety of aquatic plants. When designed and planned with compatible plants, the water gardens compose structures that support sustainable water quality and clarity. Furthermore, aesthetic and functional benefits can also be achieved by planting combined with architectural elements such as fountains, sculptures, waterfalls, rocks, etc.

Giving preference to the plants adapted to local ecological conditions in the design of the water garden shall mitigate the economic risks in landscape design and planning aspects (Cirik, 1993; Gülgün et al., 2010). Such plants shall be used for purposes such as exhibiting the local flora in urban green areas, soil stabilization, as well as their functional features such as shading, guidance, axle and highlighting. Moreover, such natural flora have already adapted to the climatic conditions of their respective region, and once planted, they scarcely require resources for protection and do not require any chemical fertilizers or any chemical pesticides. This also offers an advantage in terms of cost-effectiveness (Aksoy & Erken, 2022). Morphological and aesthetic features of taxa gain importance when evaluating plants (Sarı & Acar, 2015). While choosing plants, even if they belong to a theme, their ecological demands and functional uses are taken into consideration as well as their aesthetic appearance. The color, shape and arrangement of the leaves, flowers, fruits, branches and bark of the plants determine the areas of use in designs and enable effective compositions to be created (Dönmez et al., 2016).

It is important to use local plants adapted to the climatic conditions of the region in order to ensure sustainability of the recreation areas that feature water garden designs in cities such as Şanlıurfa, where semi-arid climatic conditions prevail. Landscape use opportunities of plant taxa from the wetlands that can be used in water garden designs in the natural flora of Şanlıurfa province were identified under this study. In our cities, which are increasingly uniform in terms of using our natural resources and species diversity, studies on the use of natural plant species in plant designs should gain importance. In this context, a classification has been made regarding the qualitative and quantitative

use of wetland plants according to the characteristics that determine their use in the landscape, such as landscape value, color, and odor effect. Suggestions for its use in landscape design studies have been developed.

2. Material and Method

The survey area is the province of Şanlıurfa located in the Southeastern Anatolia Region of Turkey; surrounded by Syria in the south, Gaziantep in the west, Mardin in the east, Diyarbakır and Adıyaman in the northeast and northwest, the topography of Şanlıurfa vary across its northern and southern sections. Despite the mountain ranges in the north, the southern parts are rather flat. The volcanic Karacadağ (1957 m) located in the borders of Siverek is the highest altitude in the province (GPDEF, 2006). Şanlıurfa is located in the region far from the maritime exposure, and predominantly semi-arid climate prevails the survey area. The measurements by the Turkish State Meteorological Service (Turkish State Meteorological Service, 2022) throughout the province Şanlıurfa in the last 50 years indicate that the highest temperature measured is 46.8°C (in July) while the lowest temperature measured is -12.4°C (in February). The highest precipitation, 181 mm, is measured in January, February and December. Annual precipitation is measured to be 379 mm in Şanlıurfa province. The plant taxa from the wetlands of Şanlıurfa constitutes the primary material of the survey. The studies by Davis (1965-1985), Davis et al. (1988), Güner et al. (2000), and Kaya & Bozancı (2022) were used as references for identification of the plants. The list of plant taxa was created in alphabetical order. The author and abbreviation of the taxa is checked using the study by Brumitt & Powell (1992).

The guiding principles for using plant materials in landscape design are based on features such as texture, color and decorativeness as established by Tanrıverdi (1987), Gültekin (1988) and Brickell (1996). Therefore, 7 features (life form, structure, flowering period, flower color, landscape value, color effect, and scent effect) that have an impact on choice of plant taxa by the landscape designer, which will be statistically correlated, were evaluated. The life forms were identified according to Raunkiaer (1934) in order to interpret where the plants can be used in the water garden (as immersed in the water/planted at the edge). Accordingly, the chart that contains the criteria on landscape use of 58 taxa considered to be suitable for landscape use in Şanlıurfa flora was created.

PAST 4.03 data analysis software was utilized at this stage in order to analyze the data. In the first step, the criteria so identified were digitized and tabulated by assigning distinct values thereto in order to interpret the 7 different features that would determine the landscape use of taxa. The Principal Component Analysis (PCA) has been applied contemplating that it may assist in avoiding mutual interactions between single assessment indicators, to render the assessment indicator system simple and effective, to produce strictly linked cases for research objects, and to improve objectivity of the assessment results (Yang & Wang, 2020). The Principal Component Analysis (PCA) was conducted in order to downscale large amount of data designating the characteristics that make taxa preferred in landscape design into meaningful components, to determine the preference size and to comprehend such components are grouped (Hammer et al., 2001). The cluster analysis (dendrogram) was conducted to analyze distribution of 58 taxa on the basis of 7 parameters to analyze the distribution of the groups for the second time. The dominant characteristics of the plant taxa in the groups were reviewed in the cluster analysis (PCA) in order to denominate the parameters as effective factors, and the graphs were generated accordingly.

3. Findings and Discussion

The information on 7 distinct features for each taxon that shall improve preference for landscape use is provided in Table 1 hereunder. Of the 58 plants with identified value in terms of landscape use, 50 are herbaceous and 7 are woody in nature. When assessed in terms of life forms (Raunkiaer, 1934), 28 of such plants are hemicryptophytes, 14 are cryptophytes (geophytes, helophytes, hydrophytes), 9 are therophytes and 7 are phanerophytes. When we review the flowering period of such plants, of 58 plant species, 25 are identified to flower in summer, 15 in spring, 10 in autumn and 1 in winter, except for Equisetum arvense L. species. When assessed in terms of flower colors, it is observed the purple(11 taxa), pink (8 taxa), white (7 taxa) and yellow (5 taxa) colors are dominant among the plants. Furthermore, the flowers of 12 taxa are considered to be ineffective in terms of aesthetics. The survey

further revealed that 87% of the plants had no scent effect, while the flowers or leaves of 6 taxa are not scented. 24 plant taxa featured landscaping value with their flowers, while 18 taxa with their forms and 3 taxa with their leaves.

The clusters generated by classification of the taxa based on the landscaping characteristics data acquired from the PCA are illustrated in Figure 1. Accordingly, one can observe that the plant groups classified by the PAST program are vividly distinguishable and present clear pattern of dissociation in the coordination planes. The plant taxa are distributed along the axes PC1 and PC2 in this plane. The eigenvalues for both axes are 0.495 and 0.375, respectively. Statistically, it was concluded that the classification was identified using parameters such as life form, flowering period, color effect and flower color. As illustrated in Figure 1, while the life form and flowering period parameters are more effective in axis PC1, the scent effect and structure parameters contributed less to the distribution in PC1 compared to other features. The most prominent feature in axis PC2 was observed to be the flower color. Accordingly, the plant taxa are subdivided into 4 distinct groups;

Group 1 – *Ceratophyllum demersum*, *Eleocharis palustris* subsp. *palustris*, *Geranium dissectum*, *Groenlandia densa*, *Lemna minor*, *Myriophyllum spicatum*, *Orchis coriophora* subsp. *coriophora*, *Populus euphratica*, *Potamogeton nodosus*, *Rubus sanctus*, *Salix acmophylla*, *Salix alba* subsp. *alba*, *Tamarix smyrnensis*, *Trifolium resupinatum* var. *resupinatum*, *Vitex agnus-castus*

Group 2 – *Bolboschoenus maritimus* var. *maritimus*, *Butomus umbellatus*, *Cionura erecta*, *Cyperus fuscus*, *Euphorbia chamaesyce*, *Iris pseudacorus*, *Ranunculus sphaerospermus*, *Schoenoplectus tabernaemontani*, *Scirpoides holoschoenus*, *Typha domingensis*

Group 3 – *Alisma lanceolatum*, *Althaea cannabina*, *Anagallis arvensis* var. *caerulea, Arundo donax*, *Bellis perennis*, *Centaurium erythraea* subsp. *erythraea*, *Cyperus longus* subsp. *longus*, *Epilobium hirsutum*, *Equisetum arvense*, *Galega officinalis*, *Imperata cylindrica*, *Lythrum salicaria*, *Phragmites australis*, *Potentilla reptans, Saccharum ravennae*, *Sanguisorba minor* subsp. *lasiocarpa*, *Scutellaria galericulata*, *Veronica anagallis-aquatica*

Group 4 – *Anagallis arvensis* var. *arvensis, Catabrosa aquatica, Eclipta prostrata, Blackstonia perfoliata* subsp. *perfoliata, Nasturtium officinale, Lycopus europaeus, Pulicaria dysenterica* subsp. *dysenterica, Inula britannica, Mentha longifolia* subsp. *typhoides, Calystegia sepium* subsp. *sepium, Campanula sclerotricha, Juncus articulatus* subsp. *articulatus, Juncus effusus* subsp. *effusus, Trifolium repens* var. *repens*, *Verbena officinalis* var. *officinalis*

These plant groups formed based on the analysis results indicate the taxa that present equivalent landscape characteristics. The ability of the spaces established in the water garden to maintain their effect during certain periods of the year shall be ascertained by choosing plants from distinct groups so identified. The groups established in this context shall ensure that the landscape characteristics of the taxa serve the desired functions.

The dendrogram graph plotted by evaluating seven parameters identified in terms of landscape design with respect to the plant species is illustrated in Figure 2. 4 groups determined by the PCA and the degree of affinity in the dendrogram are coherent in general.

The taxa included in the same group on the graph (Figure 1) created to identify any similarities and distinctiveness in terms of landscape use characteristics of different plant taxa and located closely in the dendrogram (Figure 2) feature similar characteristics in general. For example, although the taxa in the same group differ from each other in terms of general characteristics, such plants demonstrate similar characteristics when evaluated in terms of landscape characteristic parameters.

Yılmaz & Yılmaz (2009) evaluated the landscaping possibilities of *Campaluna*, *Epilobium*, *Equisetuma*, *Euphorbia*, *Geranium*, *Iris*, *Juncus*, *Mentha*, *Orchis*, *Potentilla*, *Ranunculus*, *Sanguisorba*, *Trifolium*, and *Vitex* genera, some of which some of which were examined in our study. They stated that the species belonging to these genera can be used in landscape restoration and conservation in urban areas, water gardens, rock gardens and roof-terrace gardens.

Sarı & Acar (2015) examined different species belonging to the genera *Campaluna*, *Geranium*, *Orchis*, *Potentilla*, *Ranunculus*, *Rubus*, *Trifolium*, and *Veronica*. They examined the functional and aesthetic values of the taxa belonging to these genera.For example, the combination of taxa with contrasting color and form features in rocky areas can be considered as a factor that increases visual appeal. Some genres can be used as focus/emphasis (Sarı & Acar, 2015). In this context, the plants within the scope of the study can be used in the rock garden designed in the park design. Two studies (Yılmaz & Yılmazi 2009; Sarı & Acar, 2015) were conducted at high altitudes. Considering the semi-arid climatic conditions prevailing in Şanlıurfa, non-uniform water garden design that is active in all seasons As mentioned above, when designing the water garden landscape, the best yield of the year can be obtained by choosing plants from different groups.

Çimen & Ulus (2020) stated that *Lythrum salicaria* and *Epilobium hirsutum* species can be used in flower beds and borders in landscape areas and rock gardens. They also stated that different species of *Inula*, *Geranium*, and *Scutellaria* can be used in areas with limited maintenance conditions. In this direction, it was considered to evaluate other plants examined on the basis of the research.

In the past, plants that were not found in our country's flora were used extensively in the open-green areas of cities (Çimen & Ulus, 2020). Even if the upper vegetation starts to disappear due to the drought that may occur due to global climate change, together with the studies carried out with the plants used in the country flora, natural species that can protect the green cover after these plants should be used in the designs. For this reason, it is recommended that the species determined in the study be used in landscape areas by providing these effects. In this context, in addition to flowers, leaves and life forms, species that are effective in terms of some characteristics of the plant were also determined. Thus, plants that stand out with their fruit and form characteristics after flowering will be directed to more use in urban open-green areas.

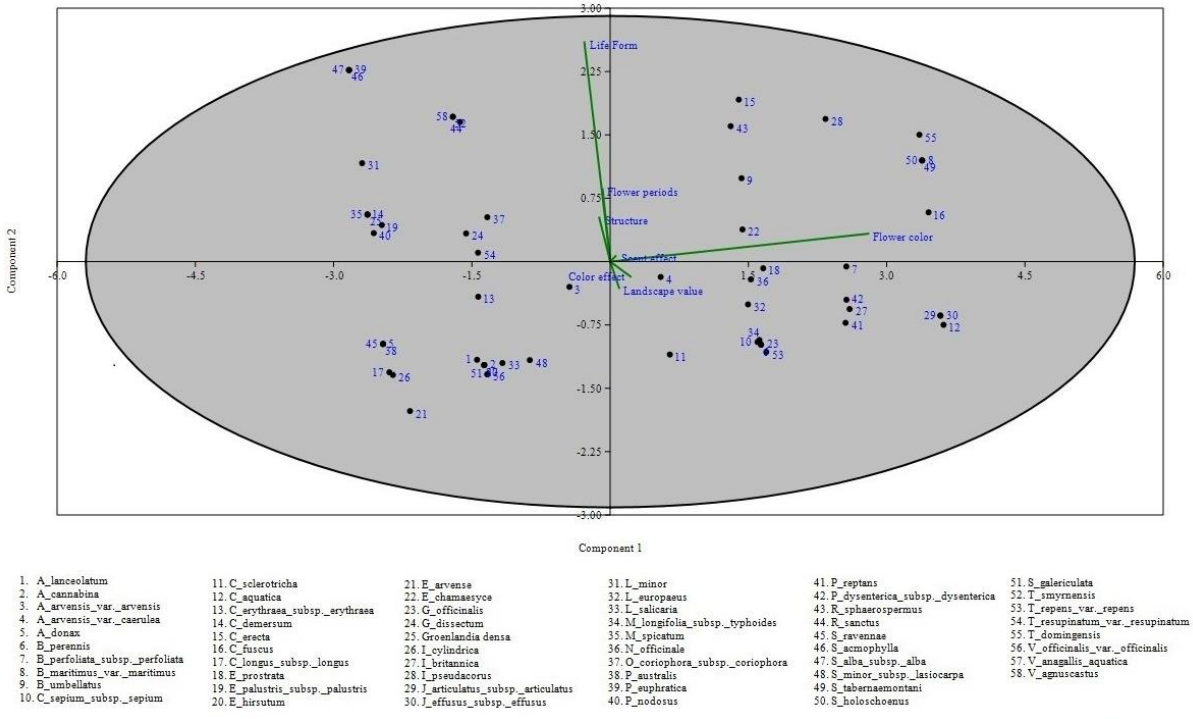

Figure 1. PCA ordination showing the grouping of taxa with Landscape features obtained from the PAST program (58 taxa x 7 landscape features)

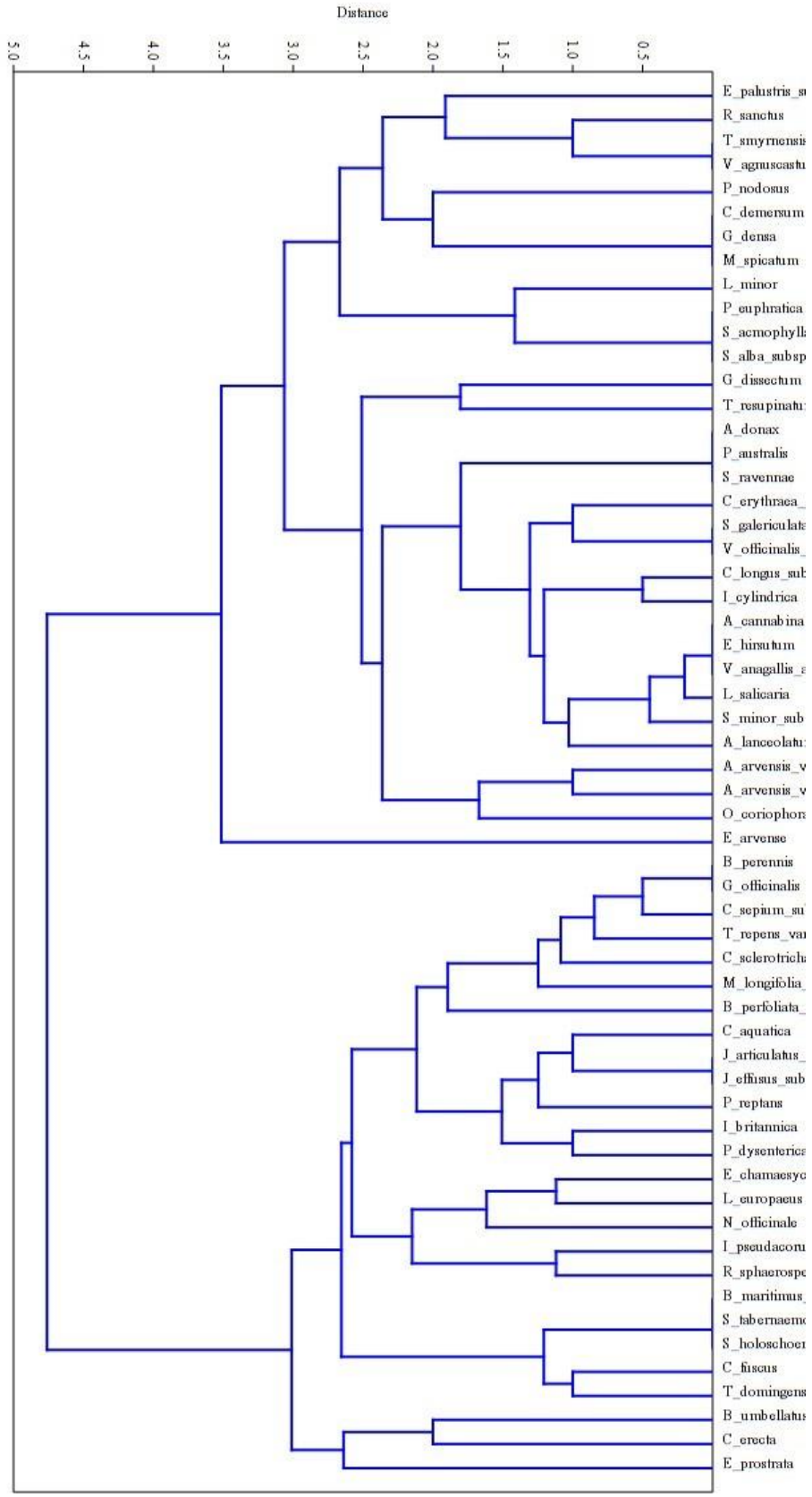

Figure 2. Clusters resulting from the classification of Landscape features and taxa (58 taxa x 7 landscape features) obtained from the PAST program

Table 1. Attributes of 58 taxa identified based on 7 parameters

Taxon	Life form (Raunkiaer, 1934)	Structure	Flower periods	Flower color	Landscape value	Color effect	Scent effect
***Alisma lanceolatum* With.**	Hemicryptophyte	Herbaceous	4-9	Pink/Lilac/ White	Form	Leaf	-
***Althaea cannabina* L.**	Hemicryptophyte	Herbaceous	6-8	Pink	Form	Flower	-
Anagallis arvensis* L. var. *arvensis	Therophyte	Herbaceous	4-9	Orange/Red	Flower	Flower	-
***Anagallis arvensis* L. var. *caerulea* (L.) Gouan**	Therophyte	Herbaceous	3-8	Blue	Flower	Flower	-
***Arundo donax* L.**	Hemicryptophyte	Herbaceous	10	Noneffective	Form	Leaf	-
***Bellis perennis* L.**	Hemicryptophyte	Herbaceous	3-8	White	Flower	Flower	-
Blackstonia perfoliata* (L.) Huds. subsp. *perfoliata	Therophyte	Herbaceous	4-8	Yellow	Leaf	Flower	-
Bolboschoenus maritimus* (L.) Palla var.*maritimus	Cryptophyte (Helophyte)	Herbaceous	5-9	Brown	Form	Flower	-
***Butomus umbellatus* L.**	Cryptophyte (Geophyte)	Herbaceous	5-9	White (with purplish veins)	Form	Flower	Flower
Calystegia sepium* (L.) R.Br. subsp. *sepium	Hemicryptophyte	Herbaceous (rhizomatous)	5-9	White	Flower	Flower/ Leaf	-
***Campanula sclerotricha* Boiss.**	Hemicryptophyte	Herbaceous	7-8	Violet/Blue	Flower	Flower	-
***Catabrosa aquatica* (L) P. Beauv.**	Hemicryptophyte	Herbaceous	5-8	Greenish/Yellowish-brown/Brownish-violet	Flower	Flower	-
Centaurium erythraea* Rafn. subsp. *erythraea	Therophyte	Herbaceous	5-7	Pink/Purple	Flower	Flower	-
***Ceratophyllum demersum* L.**	Cryptophyte (Hydrophyte)	Herbaceous	7-9	Noneffective	Form	Leaf	-
***Cionura erecta* (L.) Griseb.**	Phanerophyte	Woody	4-9	White	Flower	Flower/ Fruit	Flower
***Cyperus fuscus* L.**	Therophyte	Herbaceous	7-10	Brown	Form	Flower	-
Cyperus longus* L. subsp. *longus	Hemicryptophyte	Herbaceous	5-9	Noneffective	Form	Flower/ Leaf	-
***Eclipta prostrata* (L.) L.**	Therophyte	Herbaceous	7-8	White	Form	Flower/ Stem	-
Eleocharis palustris*(L.) Roem.&Schult. subsp. *palustris	Cryptophyte (Helophyte)	Herbaceous	3-9	Noneffective	Form	Fruit	-
***Epilobium hirsutum* L.**	Hemicryptophyte	Herbaceous	7-9	Pinkish-Purple	Form	Flower	-
***Equisetum arvense* L.**	Hemicryptophyte	Herbaceous (rhizomatous)	-	Noneffective	Form	Stem	-
***Euphorbia chamaesyce* L.**	Therophyte	Herbaceous	5-10	White/Pinkish	Form	Flower/ Leaf	-
***Galega officinalis* L.**	Hemicryptophyte	Herbaceous	6-9	White/Lilac/ Purple	Flower	Flower	-
***Geranium dissectum* L.**	Therophyte	Herbaceous	4-5	Carmine/Purple	Form	Flower/ Leaf	-
***Groenlandia densa* (L.) Fourr.**	Cryptophyte (Hydrophyte)	Herbaceous	5-9	Noneffective	Form	Leaf	-
***Imperata cylindrica* (L.) Raeusch.**	Hemicryptophyte	Herbaceous	4-7	Noneffective	Form	Flower	-
***Inula britannica* L.**	Hemicryptophyte	Herbaceous	6-10	Yellow	Flower	Flower	-
***Iris pseudacorus* L.**	Cryptophyte (Geophyte)	Herbaceous	4-5	Yellow	Form	Flower	-
Juncus articulatus* L. subsp. *articulatus	Hemicryptophyte	Herbaceous	4-8	Brown	Form	Flower	-

Juncus effusus* L. subsp. *Effuses	Hemicryptophyte	Herbaceous	4-7	Brown	Form	Flower	-
***Lemna minor* L.**	Cryptophyte (Hydrophyte)	Herbaceous	7	Noneffective	Form	Leaf	-
***Lycopus europaeus* L.**	Hemicryptophyte	Herbaceous	6-10	White (with small dark purple spots)	Form	Leaf	-
***Lythrum salicaria* L.**	Hemicryptophyte	Herbaceous	6-8	Purple	Form	Flower	-
***Mentha longifolia* subsp. *Typhoides* (Briq.) Harley**	Hemicryptophyte	Herbaceous	7-9	Lilac/White	Flower	Flower/ Leaf	Leaf
***Myriophyllum spicatum* L.**	Cryptophyte (Hydrophyte)	Herbaceous	5-7	Noneffective	Form	Leaf	-
***Nasturtium officinale* (L.) R.Br.**	Hemicryptophyte	Herbaceous (rhizomatous)	3-7	White	Form	Flower/ Leaf	Flower
Orchis coriophora* L. subsp. *coriophora	Cryptophyte (Geophyte)	Herbaceous	4-6	Dark purple/Brownish-red/Greenish-red	Flower	Flower	-
***Phragmites australis*(Cav.) Steud.**	Hemicryptophyte	Herbaceous	8-10	Noneffective	Form	Leaf	-
***Populus euphratica* Olivier**	Phanerophyte	Woody	4	Noneffective	Form	Leaf	-
***Potamogeton nodosus* Poir.**	Cryptophyte (Hydrophyte)	Herbaceous	4-8	Noneffective	Leaf	Leaf	-
***Potentilla reptans* L.**	Hemicryptophyte	Herbaceous	5-8	Yellow	Form	Flower/ Leaf	-
Pulicaria dysenterica* (L.) Bernh. subsp. *Dysenterica	Hemicryptophyte	Herbaceous	6-10	Yellow	Form	Flower	-
***Ranunculus sphaerospermus* Boiss.& C.I.Blanche**	Cryptophyte (Helophyte)	Herbaceous	1-9	White	Form	Flower/ Leaf	-
***Rubus sanctus* Schreb.**	Phanerophyte	Woody	6-8	Pink	Form	Flower/ Fruit	-
***Saccharum ravennae* (L.) L.**	Hemicryptophyte		9-10	Noneffective	Form	Leaf	-
***Salix acmophylla* Boiss.**	Phanerophyte	Woody	2-3	Noneffective	Form	Leaf	-
Salix alba* L. subsp. *alba	Phanerophyte	Woody	4-5	Noneffective	Form	Leaf	-
***Sanguisorba minor* Scop. subsp. *lasiocarpa* (Boiss. & Hausskn.) Nordb.**	Hemicryptophyte	Herbaceous	7-9	Green (with whitish or pinkish margins)	Form	Flower	-
***Schoenoplectus tabernaemontani* (C.C.Gmel.) Palla**	Cryptophyte (Helophyte)	Herbaceous	4-8	Brown	Form	Flower	-
***Scirpoides holoschoenus* (L.) Sojak**	Cryptophyte (Helophyte)	Herbaceous	4-8	Brown	Form	Flower	-
***Scutellaria galericulata* L.**	Hemicryptophyte	Herbaceous	6-8	Lavender/ Lilac-blue	Flower	Flower	-
***Tamarix smyrnensis* Bunge**	Phanerophyte	Woody	4-8	Pink	Form	Flower	-
Trifolium repens* L. var. *repens	Hemicryptophyte	Herbaceous	3-9	White	Flower/ Leaf	Flower/ Leaf	-
Trifolium resupinatum* L. var. *resupinatum	Therophyte	Herbaceous	5	Pink	Flower/ Leaf	Flower/ Leaf	-
***Typha domingensis* (Pers.) Steud.**	Cryptophyte (Helophyte)	Herbaceous	6-11	Brown	Form	Flower	-
Verbena officinalis* L. var. *officinalis	Hemicryptophyte	Herbaceous	6-8	Pale lilac	Flower	Flower	-
***Veronica anagallis-aquatica* L.**	Hemicryptophyte	Herbaceous	3-9	Lavender/Pale blue/Pale lilac	Form	Flower	-
***Vitex agnus-castus* L.**	Phanerophyte	Woody	6-9	Pale lilac/Blue	Form	Flower	-

4. Conclusion and Suggestions

This study investigates the landscape use criteria of the plant taxa from the wetland flora of the region that can be used in water gardens, an important aspect of urban green space systems, in regions far from sea where semi-arid conditions prevail, as is the case in Şanlıurfa. The life forms, structures, flowering times, flower colors, scent and color effects and landscape values of the plant taxa addressed in the study were identified. The plants with intense similar characteristics were grouped together in line with the statistical evaluations.

Majority of the woody plant materials used in outdoor-green areas in Şanlıurfa and other cities with similar ecological conditions is of exotic origin. In general, such species are used for aesthetic intentions. Out of the taxa evaluated under this study, the taxa *Populus euphratica*, *Salix acmophylla*, *Salix alba* subsp. *alba* and *Tamarix smyrnensis* can also be considered in this context.

Majority of the plants used in urban landscape areas also represent sources of various raw materials. However, such plants are not utilized based on the functional properties thereof, since such plants are rather used for their aesthetic properties in the urban areas. An example for such plant species is *Rubus sanctus* as evaluated under this study.

Only 3 plants out of all plants identified under the study (*Butomus umbellatus, Mentha longifolia* subsp. *typhoides* and *Nasturtium officinale*) were observed to have an intense and pleasant scent effect. Therefore, one can see that use of at least one of such species in landscape design can contribute to the aromatic plant diversity at outdoor and green areas by introducing scent effect in the water garden. It is of great importance to encourage use of fragrant plants at levels that shall not disturb the users in landscape design efforts.

Another key aspect in the landscape design efforts is the color effects by the plant materials to be planted. It is determined that the majority of the plant taxa evaluated under the study created color effect with their organs such as flowers and leaves, etc. The fact that such plant taxa feature flowers in various colors such as pink, purple, orange, blue, white, yellow and brown, etc., stands out as an important factor in terms of color effect.

Based on the outcomes from the study, it would be possible to create an enduring landscape composition by securing perpetuity of the flower effect by taking into account other characteristics of the plants that bloom in different periods. Designs wherein taxa such as *Althaea cannabina, Campanula sclerotricha, Potentilla reptans*, and *Scutellaria galleryculata,* which bloom in different periods and feature various flower colors, are used in combination shall ensure sustainability of the aesthetic appearance at the water garden during different periods.

In conclusion, this study evaluated the parameters of natural wetland plant taxa that are suitable for creating striking visual compositions in outdoor garden landscapes of the buildings such as residences, restaurants, hotels, complexes, campuses, etc., in particular at the parks and gardens. Accordingly, the wetland plants from the natural flora of Şanlıurfa were classified based on their landscape values.

The fact that the examined natural plant taxa are in a semi-arid climate, such as the Southeastern Anatolia Region, will provide support in terms of their use as ornamental plants, and in terms of bringing in the drought-resistant species that are likely to be experienced in the zone where Turkiye is located due to global climate change. In cities such as Şanlıurfa, where semi-arid climatic conditions prevail, preferring use of local natural plants adapted to ecological conditions rather than exotic plants shall not only eliminate adaptation problems, but also be sustainable in the long run.

Acknowledgements and Information Note

The paper complies with national and international research and publication ethics. Ethics committee approval was not required for this manuscript.

Author Contribution and Conflict of Interest Declaration Information

All authors contributed equally to this manuscript. There is no conflict of interest.

References

Aksoy, O. & Erken, K. (2022). Marmara florasında doğal olarak yetişen bitki türlerinin peyzaj mimarlığında kullanımı "Dört mevsim çiçekli bir bahçe için bitkisel tasarım projesi örneği'' (The use of plant species that grow naturally in the Marmara flora in landscape architecture "An example of a plant design project for a garden with flowers in all seasons"). *Ağaç ve Orman*, 3(1), 8-19.

Bhikha, P. (2013). The productive landscape 'wetland rehabilitation at the lower reaches of the liesbeek river'. Design Dissertation Report, Master of Architecture (Professional) in the School of Architecture, Planning and Geomatics. University of Cape Town, South Africa. Brickell, C. (1996). The Royal Horticultural Society, A–Z encyclopedia of garden plants. Dorling Kindersley, London.

Brickell, C. (1996). The Royal Horticultural Society, A–Z encyclopedia of garden plants. Dorling Kindersley, London.

Brumitt, R.K. & Powell, C.E. (1992). Authors of plant names. Kew: Royal Botanic Gardens.

Cirik, S. (1993). Sulak alanlar (Wetlands). *Ekoloji Dergisi*, 7, 50-51.

Çimen, Ş. & Ulus, A. (2020). Türkiye Milli Botanik Bahçesi'nde bulunan bazı doğal bitki taksonlarının süs bitkisi kullanım potansiyelinin belirlenmesi. *Bursa Uludağ Üniversitesi Ziraat Fakültesi Dergisi*, 34 (Özel Sayı), 269-290.

Davis, P. H. (ed.) (1965-1985). Flora of Turkey and the East Aegean Islands, vols. 1-9. Edinburgh University Press, Edinburgh.

Davis, P.H, Mill, R.R, & Tan, K. (eds) (1988). Flora of Turkey and the East Aegean Islands, vol. 10 (supplement). Edinburgh University Press, Edinburgh.

Dönmez, Ş., Çakır, M. & Kef, Ş. (2016). Bartın'da yetişen bazı tıbbi ve aromatik bitkilerin peyzaj mimarlığında kullanımı. *Journal of Architectural Sciences and Applications*, 1 (2), 1-8. DOI: 10.30785/mbud.295486

Düzenli, T., Alpak, E. M. & Akyol, D. (2019). Peyzaj mimarlığında su öğesinin tarihsel süreçteki kullanım amaçları. *Sanat ve Tasarım Dergisi*, 9(1), 20-35.

Ekren, E. & Çorbacı, Ö. L. (2022). Kahramanmaraş kentsel açık yeşil alanlarında kullanılan bitki materyalinin değerlendirilmesi. *Düzce Üniversitesi Orman Fakültesi Ormancılık Dergisi*, 18 (1), 25-50.

GPDEF. (2006). Governorship Provincial Directorate of Environment and Forestry, Environmental Status Report of Şanlıurfa Province.

Güner, A., Özhatay, N., Ekim, T., Hüsnü, K., Başer, C. & Hedge, I. (2000). Flora of Turkey and the East Aegean Islands vol 11 (Supplement 2). Edinburgh University Press, Edinburgh.

Gülgün, B., Keskin, H. & Aktaş, E. (2010). Doğal ve yapay sulak alanlar ve kullanılan bazı bitki türleri (Natural and artificial wetlands and some plant species used in). *Ziraat Mühendisliği Dergisi*, 355, 8-13.

Gültekin, E. (1988). Plant composition. Cukurova University, Faculty of Agriculture, Textbook. Adana.

Hammer, O., Harper, D. A. T. & Ryan, P.D. (2001). PAST: Paleontological statistics software package for education and data analysis. *Palaeontologia Electronica*, 4, 1-9. Access Address (01.10.2021): http://palaeo-electronica.org/2001_1/past/issue1_01.htm

Haynes, R. (2015). Use of industrial wastes as media in constructed wetlands and filter beds–prospects for removal of phosphate and metals from wastewater streams. *Critical Reviews in Environmental Science and Technology*, 45, 1041–1103.

Kaya Ö. F. & Bozancı, S. (2022). Wetland flora of Şanlıurfa, Turkey. *Phytologia Balcanica*, 28(2), 239-248.

Raunkiaer, C. (1934). The life forms of plants and statistical plant geography. Oxford University Press, London.

Sarı, D. & Acar, C. (2015). Alpin kayalık habitatlardaki doğal bitki taksonlarının bitkisel tasarımlardaki fonksiyonları bakımından değerlendirilmesi. *Artvin Çoruh Üniversitesi Orman Fakültesi Dergisi*, 16 (2). DOI: 10.17474/acuofd.54669

Tanrıverdi, F. (1987). Peyzaj mimarlığı bahçe sanatının temel ilkeleri ve uygulama metotları (Basic principles of landscape architecture garden art and application methods). Atatürk Üniversitesi Yayını No:643, Erzurum.

Tuğluer, M. & Gül, A. (2018). Kent ağaçlarının çevresel etkileri ve değerinin belirlenmesinde UFORE modelinin kullanımı ve Isparta örneğinde irdelenmesi. *Turkish Journal of Forestry*, 19 (3), 293-307. DOI: 10.18182/tjf.341054

Turkish State Meteorological Service. (2022). Sanliurfa province climate data. Access Address (10.10.2022):https://www.mgm.gov.tr/veridegerlendirme/il-ve-ilceler-istatistik.aspx?m=SANLIURFA

Wescoat, J. (2012). On water, landscape, and architecture. *Architectural Research Quarterly,* 16(1), 6-8.

Yang, T. & Wang, X. R. (2020). Evaluation of the plant landscape suitability in mountain parks based on principal component analysis: A case study of Guiyang City. *Agronomy Journal*, 113, 760–773.

Yerli, O. & Kaya, S. (2018). Bir kuru bahçe tasarım sürecinin peyzaj tasarım öğe ve ilkeleri açısından değerlendirilmesi ve uygulaması (Evaluation and application of a dry garden design process in terms of landscape design elements and principles). In: Mimarlık, Planlama ve Tasarım Alanında Yenilikçi Yaklaşımlar (Innovative Approaches in Architecture, Planning and Design) (ed. Latif Gürkan Kaya) pp 7-20. Gece Publishing, Ankara.

Yılmaz, H. & Yılmaz, H. (2009). Use of native plants in landscape planning of roadside banks under extreme climatic conditions in eastern Anatolia, Turkey. *International Journal of Biodiversity Science & Management*, 5 (2), 102-113. DOI: 10.1080/17451590903097523