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A COMPREHENSIVE STUDY ON PLANT CONTAINERS USED IN URBAN OPEN SPACES: A CASE STUDY OF ISPARTA -TURKIYE

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ABSTRACT: The type, size and shape of plants and containers must be carefully overviewed by urban designers. In Isparta city center, seven main types of planters were observed, even some have further subdivisions. These are; concrete-, wood-, plastic-, composite- (wood-plastic), metal- (aluminum), terracotta- and aluminum-wood combined planters. Each type of those has its own aesthetic and functional properties. However, aluminum and composite planters appeared to have resistance to weathering conditions, while many terracotta and concrete planters were found to be stained due to aging, because of lime and mineral salts in their structure. Moreover, terracotta, concrete, plastic and aluminum-wood containers appeared to be sensitive to physical damage, probably due to their weights and transportation difficulties. Besides many variations, only one sized wood-based planter (rectangular) and one type of wood framed trellis were observed throughout the study, which all looked rustic in appearance. In order to carry out sustainability, planters must have certain resistance characteristics; resistance to ageing, temperature variations, ultra violet radiations (natural colour stability), corrosion and wear, both in the case of normal usage and vandalism. In this sense, it is important to note that wood-based containers are not found to be suitable in the present form in the study area, which may be better to utilize as a wooden box. Only one type of trellis has been found to be used in some large planters (e.g., concrete, aluminum, wood, wood-aluminum and composite) and which is very useful for tall plants and vines which can catch the breeze and add movement.

Keywords: Potting plants, planter, plant container, terracotta, concrete, plastic.

KENTSEL AÇIK ALANLARDA KULLANILAN BİTKİ KAPLARI ÜZERİNE KAPSAMLI BİR ÇALIŞMA: ISPARTA-TÜRKİYE ÖRNEĞİ

ÖZET: Bitkilerin ve kapların türü, boyutu ve şekli kentsel tasarımcılar tarafından dikkatle gözden geçirilmelidir. Isparta kent merkezinde yedi ana saksı tipi gözlemlenmiştir, hatta bazılarının daha alt bölümleri de vardır. Bunlar; beton-, ahşap-, plastik-, kompozit- (ahşap-plastik), metal- (alüminyum), pişmiş toprak- ve alüminyum-ahşap kombine saksılardır. Bunların her birinin kendine has estetik ve işlevsel özellikleri vardır. Ancak, alüminyum ve kompozit saksıların hava koşullarına karşı dirençli olduğu görülürken, birçok pişmiş toprak ve beton saksının yapılarındaki kireç ve mineral tuzlar nedeniyle yaşlanmaya bağlı olarak lekelendiği görülmüştür. Ayrıca, pişmiş toprak, beton, plastik ve alüminyum-ahşap kaplar, muhtemelen ağırlıkları ve nakliye zorlukları nedeniyle fiziksel hasara karşı hassas görünmektedir. Birçok varyasyonun yanı sıra, çalışma boyunca sadece tek bir boyutta ahşap bazlı saksı (dikdörtgen) ve tek tip ahşap çerçeveli kafes gözlemlendi ve bunların hepsi rustik bir görünüme sahipti. Sürdürülebilirliğin gerçekleştirilebilmesi için saksıların belirli direnç özelliklerine sahip olması gerekir; yaşlanmaya, sıcaklık değişimlerine, ultraviyole radyasyonlara (doğal renk stabilitesi), korozyona ve hem normal kullanım hem de vandalizm durumunda aşınmaya karşı direnç. Bu anlamda, ahşap bazlı konteynerlerin çalışma alanında mevcut haliyle uygun bulunmadığını ve ahşap bir kutu olarak kullanılmasının daha iyi olabileceğini belirtmek önemlidir. Bazı büyük saksılarda (örn. beton, alüminyum, ahşap, ahşap-alüminyum ve kompozit) sadece bir tür kafesin kullanıldığı görülmüştür ve bu kafes, esintiyi yakalayabilen ve hareket katabilen uzun bitkiler ve sarmaşıklar için çok kullanışlıdır.

Anahtar kelimeler: Saksı bitkileri, saksı, bitki kabı, pişmiş toprak, beton, plastik.

INTRODUCTION

Urban open space quality is a growing concern, as populations become more urbanized and people spend a greater proportion of their quality of the outdoors. However, potted plants are great value for the outdoors. They are one of the useful approaches to boosting the appeal of open spaces [Cooper-Marcus and Wischemann 1987; Francis, 1987, 2001 and 2003]. In this sense, boulevards and streets could be designed with urban furniture, adding colorful plant containers [Johnston, and Newton. 1996; Turgut et al., 2012]. It has already been reported by a number of researchers that landscaping plants, suitable open space designs and appropriately established greenery areas in crowded city centers could help people to reduce stress and healing mental fatigue [Carr et al., 1992; Clemente et al., 2005; Dijkstra et al., 2008; Johnston and Newton 1996; Kavanagh, 1998; Knox, 2008; Langergraber et al., 2021; Schweitzer et al., 2004]. Another study suggests there being some placement of potted plants may reduce physical discomfort, while the calming effect of plants is an internal response, evolved in closely connected nature [Lee, et al., 2015].

Many terms have been used to describe pots for planting both indoors and outdoors. Sometimes they are used interchangeably. In general, individual containers are usually called pots, cans or planters, but they are simply called planters or plant containers. There are numerous types of plant containers that come in a wide variety of sizes, colors, shapes and materials, and could be useful for potted plants. However, each specific container has advantages and disadvantages of its own [Knox, 2008; Luna et al., 2009; Turgut et al., 2012]. But climate, aesthetic value, maintenance, durability and cost are some of the important factors for considering making a

decision [Luna et al., 2009]. Aside from adding beauty to urban open spaces, those can also make the environment richer and healthier. The selected planter may be made potted plant more aesthetic, may further support a positive effect on the environment. In contrast, planters may also be rejected by the city inhabitants, and can be damaged or discarded [Scarfone, 1996; Dascălu, 2011; Woolley, 2003; Marcus and Francis 1998]. Therefore, when the urban furniture is placed in open spaces, it should have good outdoor conditions which allow for good drainage and is of the right weight, color and size.

Pressed paper, natural fiber, ceramic, metal, concrete, wood, plastic, terracotta and composites are some of the common materials for potting. However, the selected planter can feature a single or a combination of effects, depending on the kind of user wants to achieve [Knox, 2008; Turgut et al., 2012]. Thanks to potting plants, professionals in landscaping can switch out plants seasonally to guarantee non-stop colour throughout the year. But these elements could also function differently. For example, when those place at the end of a street, to lead eyes through the street or to signal a change in direction on a walkway [Cooper-Marcus and Wischemann (1987; Clemente et al., 2005; Francis 1987 and 2003; Johnston and Newton 1996]. Hence, these landscape objects are not only for planting and aesthetic appearance, but also correct placement can play a significant role in the look of streets. A lot of research has been reported to improve the effect of potting plants, on concentration, productivity, and memory of people [Cooper-Marcus and Wischemann 1987; Clemente et al., 2005; Knox, 2008; Francis 1987 and 2003; Johnston and Newton 1996]. But for achieving positive power of plants in cities, the weather and location conditions could be carefully checked while sunlight, temperature and humidity levels are very important factors to planting. It is important to note that plant containers are elevated and plants may dry out more quickly than those in the ground [Knox, 2008; Luna et al., 2009]. Therefore, the water and nutrients they need could be provided. It is also a well-known practice that planters should be placed where they will thrive easily. It is also valuable to suggest that moisture-loving plants could be placed in shadier spots while drought-tolerant species in hot, sunny places [Knox, 2008; Luna et al., 2009].

However, growing cities and populations have led to greater accumulation of pollutants from motorized vehicles, highly populated commercial and residential units. Numerous researchers have already well proposed benefits of plants in urban spaces. Thanks to photosynthesis, plants increase oxygen levels because they release oxygen and absorb CO2 [Burchett et al., 2010; Orwell et al., 2006]. A number of scientists have suggested that potting plants are one of the useful approaches to reducing air pollution and noise, reducing a range of costly physicochemical methods have been developed. Some toxic vapors (VOCs) such as formaldehyde and carbon monoxide are reported to be absorbed by plants [Burchett et al., 2010; Orwell et al., 2006; Tarran et al., 2007; Wolverton et al., 1989; Wood et al., 2006]. In order to obtain beneficial effects from potting plants, it should focus not only on material and plant adequation but also of planters involved in design and spatial localization, like urban furniture. Therefore, during arrangements, the functionality, volume, and nature of materials must be considered.

The main objective of this study was to plant containers examine in Isparta city center, Turkiye. The type of planters and placement practices could be an approach for assessment of urban furniture elements, are considered in the study. In this regard, it is examination of planters with the goals of what it would like to see in the Isparta city center. We aimed to find some universality within the use of those objects, for urban public space design practices, which could be considered a proper use in the city center of Isparta.

MATERIAL AND METHOD

The plant container types and their features for landscaping in Isparta City Center (Turkiye) were examined. A comprehensive observation was made on the scope of containers used for potting in various types. It was aimed at selecting planters along with the material type and plants, in Isparta city center. Isparta falls within a broad cultural range due to the inhabitants' characteristics, which are home of the two big universities. It is a small to middle sized city and the population is approximately 266.982 (in 2021) [URL-1]. Administratively, it is subdivided into 45 district neighborhoods [URL-1]. It was believed that the most crowded districts of the city center could be represented and given clues for selecting potting plant principles for the city.

Spatial and functional roles of selected containers were studied based on universal function of material and placement principles. Main streets, avenues and boulevards from four neighborhoods (Primehmet, Yayla, Kutlubey and Istiklal) were selected for sampling approaches. Current attitudes to the creation of urban public spaces using plant containers were explored by our own research into public spaces. Figure 1 shows location maps of Isparta city and the selected study area. A number of stages have followed to examine and evaluate planters and utilization properties.

- A detailed site observation was carried out,
- The photographs were taken and comparative evaluations were made,
- Interviews were conducted with municipal park and garden directorate staff of Isparta city to evaluate from past to current time the establishment practices of planters,
- The topic of planter selection, in terms of outdoor potting planting practices, some literature and visual resources have been utilized.
- Some recommendations were made regarding landscape architecture discipline.

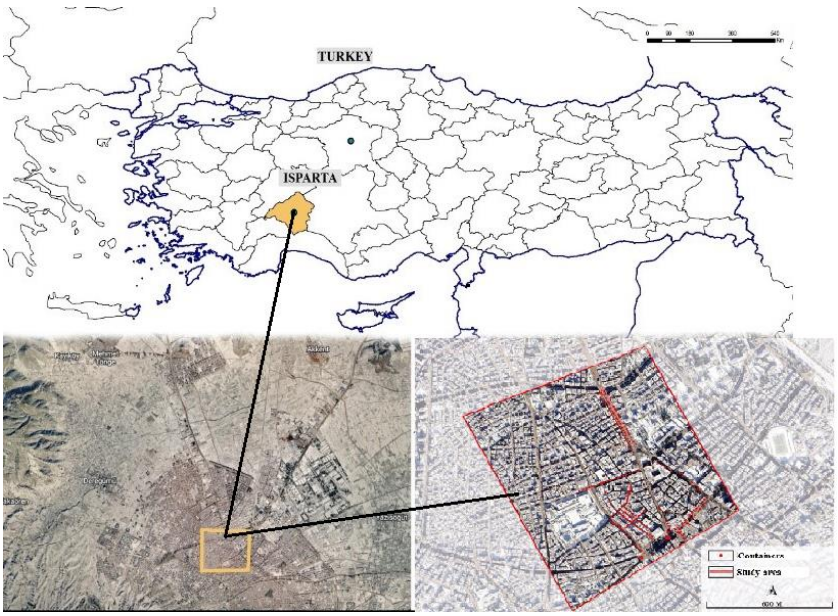

Figure 1. Location Maps of Isparta City And The Selected Study Area.

RESULTS

The evaluation of planters may be important. These have been utilized in cities as urban furniture elements, and may confer city identity feelings. However, it is very important to use proper materials for successful planting outdoors. In this regard, the selected planter should promote healthy root growth and improve aeration, as well as insulate the roots from temperature changes. Moreover, these urban furniture objects are important elements for not only urban open space decorations but also correct placement and planting.

In terms of potting plants found in the study, 17 different species were identified. However, the majority of the plants were found to be shrubs besides seasonal plants. These were encountered in which plants were planted in a random fashion. The most commonly observed potting plants in the study area are briefly given in Table 1.

Table 1. Potting plants found in the study area

Plant species	**Aluminum**	**Terracotta**	**Plastic**	**Wood**	**Aluminum-wood**	**Concrete**	**Composite**
Buxus sempervirens	✓			✓	✓		
Chamomillae Romanae			✓				
Euonymus japonica aurea	✓	✓	✓	✓		✓	
Gaura	✓						
Juniperus horizantalis			✓				
Laurus nobilis	✓						
Ocimum basilicum		✓					
Osteospermum ecklonis			✓				
Parthenocissus quinquefolia	✓				✓		
Petunia hybrida	✓	✓					
Rosa sp.	✓			✓	✓		✓
Salvia splendes	✓		✓				
Tagetes erecta	✓	✓	✓			✓	
Taxus baccata		✓					

Thuja orientalis	✓	✓			✓	✓	
Viola tricolor	✓		✓				
Wisteria sinensis				✓			

Many types, shapes and sizes of planters were observed, in seven main material types in four main shapes and 33 different sizes. These variations make it very complicated to evaluate all planters in a simple way. Table 2 summarizes the general properties of planters comparatively. However, the highest variations were observed with aluminum- and aluminum-wood planters (seven different sizes), followed by concrete (six different sizes), plastic and terracotta (four different sizes), wood (three different sizes), composite (two different sizes) planters, respectively.

Table 2. General properties of planters found in the study area

Type (Sizes)	**Color**	**Rectangle**	**Square**	**Round/ oval**	**Count**
Aluminium **(7)**	Gray	2	3	2	69
Wood **(3)**	Dark brown	3			23
Plastic **(4)**	Pink, Brown, yellow, Black	2		2	135
Concrete **(6)**	Gray, red, pink	1		5	19
Aluminum-wood **(7)**	Gray-brown	5	2		24
Composite **(2)**	Dark brown	1	1		11
Terracotta **(4)**	Orange-red			4	21
Total	**-**	**14**	**6**	**13**	**302**

Figure 2 shows some examples of concrete-based containers found in the study area. Many sizes and shapes of those were found to be randomly placed in streets. Some oval (Fig. 2a, c, d-f) or rectangular (Fig. 2b, g-h) shapes can be made to look like stoneware elements. In some of them, some are found to be combined with sitting units, which have a more aesthetic and functional appearance with plating (Fig. 2b-d). Concrete planters might be a good choice for large plants, foliage or small trees that may need ballast support against the wind. It is commonly accepted that these planters are somewhat porous and could allow moisture to get through. However, during selection of concrete-based elements (e.g., planters) the chemical compositions should be carefully overviewed. Because these are typically made up of cement and limestone (calcium carbonate), they may be leached into the soil, impacting on increasing pH level to an alkaline level. It has already well been proposed that high level alkalinity reduces the solubility of the minerals in the soil, making it less available for plants to absorb [Knox, 2008; Luna et al., 2009].

Some deformed (cracked, broken and aged) textures of concrete planters are also shown in Figure 2 (Fig.2f-g). These damaged structures could be expected considering the structural properties of these elements, which are very heavy objects to be moved or placed in. Although concrete is a reliable insulator and will protect the roots even during times of large temperature changes, these planters have typically become stained or aged (weathered), depending on duration and climate conditions (Fig. 2h).

Figure 2. Some examples of concrete-based planters found in study area

Figure 3 shows some wood-based containers found in streets and boulevards in Isparta city center. It is notable, only one sized and shaped (rectangle) wooden container was observed in this study (there is only one exception as explained below). It was realized that all these were lined inside with a water-resistant fabric product (Fig. 3f) to prevent direct contact with soil and moisture to wood. This is a good and suggested approach to extending the lifecycle of wooden containers. As it is well known, wood is not durable for outdoor conditions if it is not properly treated. Hence, wood-based materials are very sensitive to both abiotic (fungi, insects, creatures) and biotic (sun, UV, moisture, heat) factors. But impregnations or surface coatings

that form moisture, UV and sun-repellent surfaces are effective in preventing decay. Even paint on the wood seals shed water, thus protecting wood by keeping it dry. But there were not any treatments observed throughout the wooden containers evaluated in this study. The samples shown in Figure 3 (Fig.3a-d, f-h) clearly show ages of wood and deepen in natural color.

But in one exception, a set of concrete-wood combined containers was also found, as benches and planted together in a concrete reserved area, very suitable and softened structures, calming sound to a nearby seating area and masks street noise by creating a balance (Fig. 3e). This makes very useful and special urban furniture elements from wood-concrete planters.

Figure 3. Some examples of wood-based planters found in study area

Figure 4 shows some metal-based planters observed in the study area. In contrast to wooden-containers, numerous types, sizes and shapes of metallic containers were randomly placed on streets, boulevards and squares. It is well known that metals are durable and weather resistance if properly prepared. However, all metal-based containers were found to be only the aluminum-type which could be offered the durability with a lighter weight, making the planting and moving of pots much more practical. Typically, aluminum is very durable against rust, while it does not need protective painting.

Thanks to its easy processability, numerous sized and shaped aluminum-based containers could be useful together to create an aesthetic appearance. Figure 4 (Fig. 4f-g) clearly represents a group of similar types of containers, creating a focal point at a place that is carefully established. In this multi-container arrangement, taller and shorter containers at the same point may attract interest, while a wide range of colorful plants in similar shapes but in different sizes, could be able to create harmony. It is better to place tall plants in the back, and short ones in front. In this practice, it keeps the arrangement cohesive by using one shade of the pots and a narrow line for the plants. With these placement practices, foliage and tall plants can create a feeling of being surrounded by greenery and are important for open space potting plants. However, these usually come in a wide variety of green tones, add height and sheer presence

to places, but others also flourish in bright hues like yellow adding and red. Moreover, small metal-based potting plants in front could act as accessories, while large plants can enliven a space and even make a statement (Fig.4e-f).

But some issues should be considered before aluminum containers are selected to be used for both indoor and outdoor potting purposes. Aluminum (Al) was reported as toxic to most plants [Sade et al., 2016]. It has been proposed that a number of symptoms caused by aluminum toxicity are generally associated with damage to the root system [Kopittke and Blamey 2016]. Because aluminum could be leached into the soil, it causes toxicity that will impact on the roots and stunt the growth of the plant. It has been suggested that when soil pH changes acid level, aluminum becomes soluble and the chemical composition of the planter's soil changes. It has been hypothesized that soil aluminum concentration of 2-5 ppm is toxic to the roots of sensitive plant species and above 5 ppm is toxic to many tolerant species [Sade et al., 2016; Kopittke and Blamey 2016].

Another issue for selecting metal-based planters is insulation properties. It is well established that metal containers could be conducted heat and don't provide much insulation to plant roots [Knox, 2008; Luna et al., 2009]. This typically causes soil and roots to dry out more quickly. As a result, they are prone to overheating, and excessive heat in potting soil can stress plants and damage their roots.

Figure 4. Some examples of Metal-based (Aluminum) planters found in study area

The terracotta is a clay-based material, while it is already modeled and baked. Figure 5 shows some terracotta containers found in the study area. These types of planters are generally considered as cheap and available in various sizes and shapes, but commonly oval. Depending on plant type and availability of space, they could be utilized in small, medium or large sizes. Due to its natural reddish-brown color, it may offer a natural appearance to designers. In the study area, a special design practice was also used. It was a large-sized terracotta placed as plant dispenser (Fig. 5d). This is clearly a creative design approach and adding value to

landscaping. Because of terracotta's porous nature, it is also great for plants as it allows more air to move through the pot's walls, well drainage, helping to prevent root rot and soil disease.

However, two aspects that are very important to be aware of are that terracotta is more fragile than some of the other containers, and retained moisture may be prone to cracking because the moisture in it will freeze and expand several times during the cold (freezing). Figure 5 also shows some aged (Fig. 5e-f) and cracked/damaged (Fig. 5g-h) terracotta found throughout the study area. Although terracotta is very useful for plants and can be useful in both indoors and outdoors as a cheap solution, it needs to be brought inside in cold weather against damage. It could also be recommended to coat with protective paint if terracotta is used outdoors.

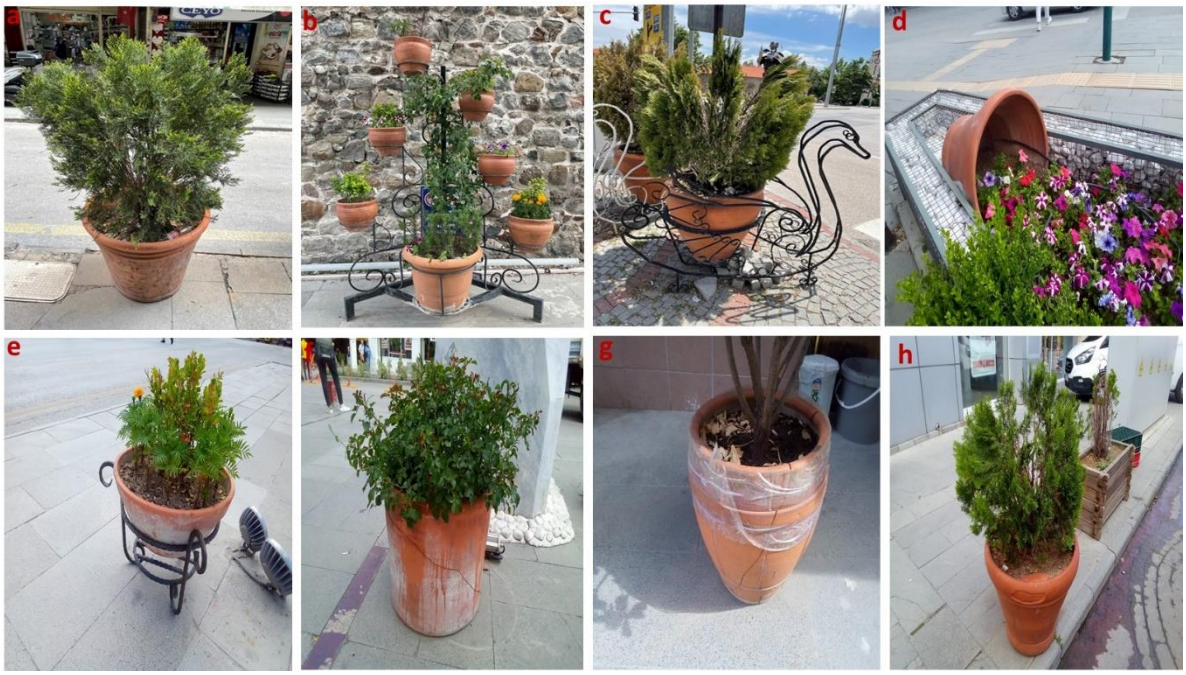

Figure 5. Some examples of Terracotta planters found in study area

Various colored and shaped plastic containers were observed in the study (Figure 6a-h). Plastics are considered safe for potting plants. However, they are lightweight, durable, and look very much like the materials they are molded to imitate. The plastic pots are typically non-porous, not letting in or out moisture or oxygen. Therefore, they may retain moisture more than other porous pots, which may probably be a better option than moisture-loving plants or for supplying water infrequently. However, the color of pots is also important because it can play a role in how much heat the pots will retain. In this sense, dark-colored pots could absorb more sunlight and retain heat longer than light-colored ones [Luna et al., 2009]. Like aluminum or terracotta containers, groups of plastic containers appeared to be created a point at place with miniature cart (Fig. 6e). In this multi-container arrangement in one place (cart), it can be useful for decorating and creating an interest in squares, while, a wide range of colorful plants with similar appearances.

There are numerous studies that have already been conducted on plastic materials which are consistently reported to be ecologically not friendly. However, plastic could also be weathered, aged or worn out in outdoor conditions. Some damaged and brooked plastic containers are shown in Figure 6 (Fig. 6f-h). It may be valuable to suggest limited utilization of plastic materials at outdoor conditions, especially for sustainable design approaches.

Figure 6. Some examples of plastic-based planters found in study area

Figure 7 shows composite-based (wood-plastic) containers. These elements are typically made from wood and plastic together to extrude a shape. They are a resilient material that looks like painted wood but is impervious to rot, moisture and corrosion. Therefore, these are made to resist against harsh outdoor conditions.

It that foliage and small trees could be planted in these planters with (Fig. 7b-d) or without trellis (Fig. 7a). Although composite-based containers are made in a wide variety of shapes and sizes, they are considered to be expensive, they may be an option because they are durable and weather resistant in cold and hot climates. Hence, those planters could look great all year round even in severe weather conditions.

Figure 7. Some examples of wood-plastic based planters found in study area

Figure 8 shows two different materials (aluminum-wood) used together for potting and planting. However, by processing these to bring them (polishing, grinding, chiseling, scrapping etc.), various types of textures on a container may be created. In the case of combinations of materials used in aesthetic situations, like planters, it appears to aluminum confer stability and wood allows decoration (Fig. 8a-e). In this design practice, an aluminum tub is combined with wooden corners and strips in the middle to be made to have vivid-orange, pink and green

colored flower figures which have an image-catching texture. It looks like a wide range of colors here, but there's a colored flower figure, and special planters in similar shapes clearly create harmony. However, it is also visible that large plants are planted, while simple wooden trellises appear to be utilized which are capable of supporting the lateral branches. Although large heavy planters could make the street alongside, a road obscure could also be created for vehicles by blocking them (Fig. 8e), it pauses before a turn in the street, catching an interest. It appears to combine sitting elements with this type of planter to make a multipurpose urban furniture object (Fig. 8f). Colorful greener with greenery plants create an intricate texture may even leave it unplanted as a piece of sculpture.

However, the wrong design or planters could generate the wear of some components. In this sense, the upper part of aluminum-wood-based containers appear to be demolished during placement or transportation due to inappropriate design (Fig. 8g-h). Although metal and wooden containers are at some level durable, it appears the combination of those two materials is not shown a durable property for potting plants.

Figure 8. Some examples of metal (Aluminum) wood combined planters found in study area

CONCLUSION

The plant container is one of the important topics for planting in both indoors and outdoors. However, potting plants require special effort to succeed in the outdoors. It could be that they can keep in bloom even when in proper lighting and soil conditions with proper pots. Therefore, some design matters must be considered before selecting plants and planters, especially aesthetic and functional considerations must be made in urban space design practices. In this study, there has been an effort revealed to urban space design practices in Isparta city center by using various types of planters.

The seven main types of non-formally placed planters have been found in the study area. They are further subdivided into homogenous, non-homogenous, colorful, natural, polished or

opaque. These elements should attract, should be mostly used, and should offer value to Isparta city. In this sense, some recommendations have been made in terms of landscape architecture discipline.

- Soil in porous pots is able to absorb moisture well and may not dry out as fast. In this sense it is reasonable to suggest using porous pots rather than plastic or metal pots. However, wood, concrete and terracotta are three porous containers compared to others.
- One of the main issues associated with aluminum planters is that it attracts and absorbs heat. As a result, plant soil and roots become hotter than they should be, in many cases causing the roots to completely overheat.
- Concrete-based containers are usually considered to be more expensive than terracotta. While the use of cement as a planter is not environmentally friendly.
- Although wood is one of the materials for potting, retains water well, is relatively lightweight, and has aesthetic natural value, if left untreated outdoors, it can be damaged quickly. Therefore, wood must be carefully prepared for potting, moisture and decay resistance fabric could be used inside to protect it from water and keep it from rotting,
- For preventing wood-based planters outdoors, chemical treatments may be valuable.

But not suggested in certain places because of environmental concerns. However, wooden containers used in Isparta city center appear to not be very suitable for potting plants, which may be better to use as a plant box rather than potting.

- The correct selection of the potting plants and the appearance influence the comfort. However, texture can intensify or diminish the warmth and coolness sensation. The same material can be seen colder in a sitting place made of unfinished planter than if it would be made of surface finished planter.
- The color of the selected pot is important for planting. In particular, lighter colored pots are very important for any heat-sensitive plants, especially in hot weather or sunny conditions. Therefore, certain planters can help protect plants' roots from overheating.
- The containers should be allowed to be transported easily without damage. The terracotta, plastic and concrete planters appear to be more sensitive against damage than composite and aluminum-based containers. Hence, they should not plan to move it to prevent damage during transportation.
- Although trellis is very helpful for planting, easily spread taller or vine plants, throughout the study, only one type, wood framed trellis has been observed. In some cases, it may be considered to use a folding trellis which works like an accordion, so its height and width can be adjusted in various situations.
- Broad-leaved plants should be recommended to use as a screen blocking sight line. Size of the selected pot is an important matter. In particular, if the pot is too small, plants will quickly become rootbound and the soil will not be able to hold enough moisture between watering while plants are allowed to dry out quickly. Therefore, drought resistance plants, if watering is limited, should be planted in large planters.

AUTHOR CONTRIBUTIONS

Candan KUŞ ŞAHİN: Selecting the study topic, conducting the study, drafting the article, interpreting the data, discussing the results. **Esra BAYAZIT and Beyza SAVA**: Conducting

fieldwork, collecting data, taking photographs, interpreting data. **Büşra ONAY**: Writing the article, reviewing the article.

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The authors declare no conflict of interest.

ETHICS COMMITTEE APPROVAL

This study does not require any ethics committee approval.

REFERENCES

Francis, M. (1987). Urban Open Spaces. Advances in Environment, Behavior, and Design, E. H. Zube and G. T. Moore (Editors), Plenum press, NY.pp. 71–106

Francis, M. (2001). A case study method for landscape architecture. *Landscape journal*, 20(1), 15-29

Francis, M. (2003). Urban Open Space: Designing for User Needs. Land and Community Design Case Study Series. Island Press, Washington, D.C.

Cooper-Marcus, C. & Wischemann, T. (1987). Outdoor spaces for living and learning. *Landscape Architecture*, 78: 54–61.

Turgut, H., Atabeyoğlu, Ö., Yılmaz, H. & Irmak, M.A. (2012). Evaluating different planting design compositions for visual landscape quality in street planting. Artvin Çoruh Üniversitesi Orman Fakültesi Dergisi, 13(1), 49-66.

Johnston, J. & J. Newton. (1996). Building green. A guide for plants on roofs, walls and pavements. The London Ecol. Unit, London

Clemente, O., Ewing, R., Handy, S. & Brownson, R. (2005). Measuring urban design qualities—an illustrated field manual, Robert Wood Johnson Foundation, Princeton, N.J.

Carr, S., Francis, M., Rivlin, N. & Stone, A. (1992). Public Space. Cambridge University Pres, NY, 420p.

Knox, G. W. (2008). Container gardens for outdoor spaces. EDIS, 2008(2), University of Florida, IFAS extension.

Kavanagh, J. (1998). Outdoor space and adaptive gardening: Design, techniques, and tools. In S. P. Simson & M. C. Straus (Eds.), Horticulture as therapy: Principles and practice. NY: The Food Products Press/The Haworth Press, Inc.

Lee, M. S., Lee, J., Park, B. J., & Miyazaki, Y. (2015). Interaction with indoor plants may reduce psychological and physiological stress by suppressing autonomic nervous system activity in young adults: a randomized crossover study. *Journal of physiological anthropology*, 34(1), 1-6.

Luna, T., Landis, T. & Dumroese, R. K. (2009). 6: Containers, In: Nursery manual for native plants a guide for tribal nurseries. Dumroese, R. Kasten; Luna, Tara; Landis, Thomas D (Editors), Agriculture Handbook 730, USDA Forest Service, Washington. D.C. pp. 99-111.

Scarfone, S. C. (1996). Design of outdoor environments for wellness and the role of landscape architecture. *Journal of Therapeutic Horticulture*, 8, 68-71.

Dascălu, D. M. (2011). Landscape effects of urban furniture textures. *Bulletin UASVM Horticulture*, 68(1): 324-331.

Woolley, H. (2003). Urban Open Spaces. Spon Press, London Taylor & Francis.

Marcus, C.C. & Francis. C. (1998). People places: design guidelines for urban open space (2nd ed.), Van Nostrand Reinhold, New York.

Langergraber, G., Castellar, J. A., Pucher, B., Baganz, G. F., Milosevic, D., Andreucci, M. B. & Atanasova, N. (2021). A framework for addressing circularity challenges in cities with nature-based solutions. *Water*, 13(17), 2355.

Dijkstra, K., Pieterse, M. E., & Pruyn, A. (2008). Stress-reducing effects of indoor plants in the built healthcare environment: The mediating role of perceived attractiveness. *Preventive medicine*, 47(3), 279-283.

Tarran, J., Torpy, F. & Burchett, M. (2007). Use of living pot-plants to cleanse indoor air–research review. In Proceedings Of 6 th Internat. Conf. On Indoor Air Quality, Ventilation & Energy Conservation, -*Sustainable Built Environment*, 249-256.

Wood, R. A., Burchett, M. D., Alquezar, R., Orwell, R. L., Tarran, J. & Torpy, F. (2006). The potted-plant microcosm substantially reduces indoor air VOC pollution: I. Office field-study. *Water, Air, and Soil Pollution*, 175(1), 163-180.

Orwell, R. L., Wood, R. A., Burchett, M. D., Tarran, J. & Torpy, F. (2006). The potted-plant microcosm substantially reduces indoor air VOC pollution: II. Laboratory study. *Water, air, and soil pollution*, 177(1), 59-80.

Burchett, M., Torpy, F., Brennan, J. & Craig, A. (2010). Greening the great indoors for human health and wellbeing. Sydney: Plants and Indoor Environmental Quality Group, Centre for Environmental Sustainability (CEnS).

Wolverton, B.C., Johonson, A. & Bounds, K. (1989). A study of interior landscape plants for indoor air pollution abatement, Technical Memorandum, Nasa Stennis Space Center, MS. 27p.

Schweitzer, M., Gilpin, L. & Frampton, S. (2004). Healing spaces: elements of environmental design that make an impact on health. *Journal of Alternative & Complementary Medicine*, 10(Supplement 1), S-71.

Sade, H., Meriga, B., Surapu, V., Gadi, J., Sunita, M. S. L., Suravajhala, P., & Kavi Kishor, P. B. (2016). Toxicity and tolerance of aluminum in plants: tailoring plants to suit to acid soils. *Biometals*, 29(2), 187-210.