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Planting Design Project: The Case of Didim Marina

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Bitkisel Tasarım Projesi: Didim Marina Örneği

ABSTRACT:

D-Marin Didim Marina has been serving as one of the largest and most luxurious marinas in the Eastern Mediterranean since 2009. Covering approximately 40 hectares and containing many units and services, this marina is also an area with harsh climatic conditions for plants. The area has extreme conditions for plants such as strong salty winds from sea, high temperatures of summer, winter frost, sea water spray, sloped areas and perpetual winds throughout the year. In the area where these difficult conditions exist, the intention was to make a planting design with the lowest budget as economically as possible. As a result, in such a challenging site, the intended design had been realized, in addition to solving water erosion and aesthetic problems. Moreover, olive oil and lavender oil, which were obtained from the plants of the marina, were labeled, bottled and used as a gift. The planting design project was carried out by Didim Papatya Landscape Ltd. Co. and the author (as the designer and head of the plantation team). This paper explains, the planting design and implementation works carried out under difficult conditions between 2009 and 2012 by comparing it with the pre-design, design sequence and current state. By way of comparison, this paper discusses which plants are affected by environmental conditions, how they changed in time and proposes possible solutions for planting design.

KEYWORDS: Planting Design, Landscape Implementation, Landscape Maintenance, Marina, D-Marin Didim

ÖZ:

D-Marin Didim Marina, 2009 yılından beri Doğu Akdeniz'in en büyük ve lüks marinalarından biri olarak hizmet vermektedir. Yaklaşık 40 hektarlık alanı kaplayan ve birçok birim ve hizmetleri içeren bu marina, aynı zamanda bitkiler için zorlu iklim koşullarına sahip bir alandır. Denizden gelen kuvvetli tuzlu rüzgarlar, yaz sıcaklıkları, kış donu, deniz suyu serpintisi, şevli alanlar ve yıl boyu sürekli esen rüzgarlar gibi bitkiler için ekstrem koşullar bulunmaktadır. Bu zorlu koşulların bulunduğu alanda ekonomik olarak olabildiğince düşük bütçeli bir bitkisel tasarım yapılması istenmiştir. Sonuç olarak, istenen tasarım gerçekleştirilmiştir; su erozyonu ve estetik sorunlarına da çözüm getirilmiştir. Bunun yanı sıra, dikilmiş bitkilerden zeytinyağı ve lavanta yağı elde edilmiş, etiketlenmiş, şişelenmiş ve hediye olarak hazırlanmıştır. Bitkisel tasarım projesi, Papatya Peyzaj Ltd. Şti. ve yazar (tasarımcı ve plantasyon ekibinin başı olarak) tarafından yürütülmüştür. Bu makalede, 2009-2012 yılları arasında zorlu şartlar altında gerçekleştirilmiş bitkisel tasarım ve uygulama işleri, tasarımın öncesi, tasarım sırası ve güncel hali ile karşılaştırmalı olarak ele alınmıştır. Tasarımda hangi bitkilerin çevre koşullarından nasıl etkilendiği, zaman içinde nasıl değişimler olduğu ve bitkisel tasarım çözüm önerileri, karşılaştırılarak tartışılmıştır.

ANAHTAR SÖZCÜKLER: Bitkisel Tasarım, Peyzaj Uygulama, Peyzaj Bakımı, Marina, D-Marin Didim

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INTRODUCTION:

"Following nature's lead in planning and design is the wisdom of achieving sustainability (McHarg, 1969)". Sustainability is stronger by bringing ecologic, economic, social and cultural systems or mechanisms together in a unified framework (Throsby, 1995; Basiago, 1999). Because, these systems interact with each other and become elements/processes within a whole landscape. 'Landscape sustainability' might imply the vitality and quality of landscape processes as a single complex system. By defining landscape as "ecosystem(s) of interrelated elements, such as living/nonliving organisms and their creative, dynamic, and active processes within an environment", whether cultural or natural, landscape can also be commentated as changing modes of nature (Balik, 2021a). Through these definitions, planting design as a branch of landscape design, can be handled as one of the primary objectives of shifting a landscape mode and creating sustainability. Based upon these views, a planting designer should start from the source, which, in the case of landscape, is the surrounding nature and continue examining the systems of landscape.

The act of handling nature in terms of aesthetic often leads to the creation of desired landscapes by forcibly removing their native inhabitants (Saito, 2021). Planting design is dangerous when it destroys the characteristic wildlife with just a claim to 'make it look better'. The source of this problem is aesthetic appreciation. As Berleant remarks, aesthetic appreciation is reciprocal, "requiring the contribution of the appreciator of art or nature in discerning qualities, order, and structure and in adding the resonance of meanings to that experience" (Berleant, 2010). The relation of nature, aesthetic and planting design starts by appreciating nature with its complex dynamics. Planting design is generally a traditional horticulture that is an altered or artificial nature with fewer and much less beneficial ecological mechanisms. Rainer and West (2015) suggest a method of planting design with plant communities by combining traditional horticulture and ecological planting. This method not only links nature to landscapes, but also by observing and embracing the wisdom of natural plant communities, it respects the aesthetic appreciation which Berleant (2021) and Saito (2021) argue.

The relation of nature and economical mechanisms are very fragile. On the macro side of this subject, mankind causes more and more global problems for the benefit of economy. In return, nature decreases inputs for economic growth directly or indirectly by decreasing resources. At lesser scales, we design for sustainability with the balance of conservation and benefit. Adjoining economic and environmental sustainability includes growth, development, productivity, eco-system integrity, carrying capacity and biodiversity (Kahn, 1995).

Social sustainability includes equity, accessibility, public health, participation and sharing (Kahn, 1995). The relation of nature and social mechanisms have become more important especially during the COVID-19 pandemic. Natural and green areas provide social services such as recreational activities, sports and psychological relief (Kalayci Onac et al., 2021a). Besides, with less people using natural areas during lockdowns, ecosystems have been regenerating faster. Apart from the pandemic, the concept of ecology or nature is socially important by means of connecting citizens with nature without travelling far from a city or campus (Kalayci Onac et al., 2021b).

"Great planting design is the result of three harmonious interactions: the relationships of 1) plants to place, 2) plants to people, and 3) plants to other plants" (Rainer and West, 2015). The economic, social, environmental, cultural and ecological mechanisms exist at the heart of these interactions. An ideal planting design should not destroy the existing beneficial mechanisms but should enhance and adjoin them. Therefore, we need planting solutions that are resilient, ecologically functional, aesthetic, economically beneficial and socially equitable.

Bearing with these intentions, this article explains the planting design implementation and maintenance activities that I carried out at D-Marin Didim Marina, by comparing and evaluating it with the current situation. It dwells on the planting design, as well as the plant species and their durability, rather than focusing on superficial design factors, such as form and color. By doing so, the article aims to contribute to the literature on how to choose plant species, how to do maintenance and how to achieve a balance of economic, ecological, aesthetic and social factors in areas with similar challenging conditions in the Mediterranean basin.

MATERIAL AND METHOD:

Between 2009 and 2010, my team and I (as the designer and head of the plantation team of Didim Papatya Landscape Co.) carried out the planting design, implementation and maintenance works of D-Marin Didim Marina. Between

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2011 and 2012, we continued the project, implementation and maintenance works together. The case study area is located at the coordinates of 37°20'26"N, 27°15'34"E, in Didim district of Aydın province (Figure 1). D-Marin Didim, one of the largest and most luxurious marinas in the Eastern Mediterranean, is a facility built for yachts and superyachts entering the Aegean Sea. It covers the surface area of approximately 22 hectares in the terrestrial region and 40 hectares totally, including land and sea regions. It operates as Turkey's only catamaran club with a mooring capacity of 576 (for boats between 8 m and 70 m), a land park of 72,000 square meters and a land park of 600 boats, a mooring capacity of 90 superyachts and a lift (towing) capacity of 400 tons. (D-Marin, 2021a). The marina holds park and promenade areas, yacht club, a 16-room boutique hotel, swimming pool, sauna, sports fields, theatre, markets, restaurants, cafes and bars, banks, travel agencies and social life areas, shopping and entertainment areas, health services and helipad (Figure 2). (EGI, 2021), (D-Marin, 2021b).

Figure 1, 2. The location of D-Marin Didim and the green areas (D-Marin, 2021c)

Planting design project, similar to design process, requires a step by step approach. In the case of real project implementations, a planting design approach depends on a variety of resources, particularly time. For example, if the designer cannot find the plants ordered from a greenhouse, changing the design pattern and species becomes necessary. Likewise, lack of economic resources may lead to choosing cheaper plants, growing plants in a greenhouse or changing the overall plant patterns.

This paper suggests a holistic design approach by handling the architectural and landscape projects simultaneously at the beginning of the project. Yet, we were commissioned the planting design at the end of all implementations. Before our involvement, after the implementation of architectural and landscape projects by another firm, the marina management detected that there were design flaws and malpractices. For this reason, they made a contract with the landscape firm that employed the author to achieve an effective planting design, implementation and maintenance service. We completed the project by using a planting design process synthesized from Ozkan et al. (1993), Kucukerbas and Ozkan (1994), Yilmaz and Yilmaz (2000), Thomas et al. (2001), Korkut (2002), Robinson (2004) and Sisman et al. (2008). This method consists of 5 stages:

1. Determination of Goals and Problems
2. Analysis: The Environment of the Case Study Area
3. Planting Proposals
4. Planting Design Project and Implementation
5. Landscape Maintenance

RESULTS AND DISCUSSION:

This section is discussed within the planting design stages:

1. Determination of Goals and Problems

Goals: Our main goal was the plantation of marina's green areas. In order to achieve this goal, the author combined the secondary goals of the firm, marina management and his own principles as a landscape architect. Such as:

- Following the planting design principles,
- Choosing most economic plants possible,
- Making most economic maintenance,
- Making economic use of plants,
- Creating an aesthetic and functional design,
- Creating wildlife habitats,
- Enhancing ecological and visual characteristics of the marina,
- Covering the soil on the maximum level to shift the visual character of marina's green areas from soil areas to vegetation areas,
- Choosing plants whose water demand are in accordance with the amount of potable water coming from the water treatment facility of the marina,
- Solving water erosion problems on hillsides,
- Choosing plant species that require less maintenance, except remarkable areas. The main staff consists of 5 gardeners, yet the firm hires 25 workers (not gardeners, to be cheap) during the spring time for hoeing and weed cleaning,
- Creating a livable environment for marina users,
- Choosing the right plant species to solve the problems of green areas that are given below.

Problems: Before we started working at the marina, we outlined the problems regarding the green areas:

- The wind frequency is above average at the green areas, which are open to many directions of strong winds,
- Maximum strength of the wind is 40 knots (strong wind),
- Temperature rises above 40^0C in summer and it can drop below 0^0C in winter,
- The soil includes salt because of the misimplementation of saline water irrigation,
- There is seawater spraying on the seashore,
- The marina includes very few species of plants (many of them have died of hard soil and salty water),
- Hillsides include very sloping areas,
- During the construction of the marina, heavy equipment and trucks compressed the soil in some parts of the green areas,
- The soil depth in the berth area which is a sea embankment, is approximately 20-30 cm,
- There is a need to find plants that are resistant to extreme conditions,
- The budget is too low for both project implementation and maintenance,

- The visual quality of the administration building, yacht club and berth areas is very appealing. Either the soil is too visible or the area consists of inappropriate plantation (too many *Nerium oleander* plants or wrong plant species, such as *Gingko biloba* on a rough area). We discussed this matter for every region of the marina during our meetings.

2. Analysis: The Environment of the Case Study Area

The Housing Estate of Parliamentarians which was built and planted 31 years ago, exists at the west of the case study area. It has regularly maintained green spaces. In the analysis section, we examined the plant species of this area, which includes *Pinus pinea, Washingtonia robusta, Elaeagnus angustifolia* trees, fruit trees, citrus trees, *Nerium oleander*, *Cortederia selloana, Pennisetum rubrum* and many other shrub species. The site is sheltered from winds with houses. At the north and northeast, there are frigana and maquis vegetation and soil areas. At the north-west, there is an area of soil and scrub, followed by the beach. The western part is the Aegean Sea (Figure 3,4). 9 km away from the marina at the northeast, Mavisehir district has *Elaeagnus angustifolia* trees at the windy seaside. These species are resistant to cold and they smell good.

Figure 3. The marina environment (D-Marin, 2021a)

Figure 4. Inside the marina (D-Marin, 2021a)

The marina is 28 km away from Latmos Region and Bafa Lake, which host 219 bird species and 20 different orchid varieties (GTS, 2021). The Latmos Region includes many different ecosystems such as sea, lake and forest, with a high diversity of plants. In general, the most widely distributed plant community is the red pine forest (*Pinus brutia*). Apart from this, there are *Pinus pinea, Cistus creticus, Cistus salvifolius, Erica manipuliflora, Lavandula stoechas, Sarcopoterium spinosum, Thymus sp., Tamarix hampeana, Platanus orientalis* and *Quercus sp.* species. (GEKA, 2015)

The ancient Greek cities of Miletus and Priene, and the Temple of Apollo are close to the study area. It is known from Ancient Greek mythology that olive (*Olea europaea*), buckthorn (*Elaeagnus sp.*), laurel (*Laurus nobilis*), rosemary (*Rosmarinus sp.*), thyme (*Thymus sp*.), fig (*Ficus carica*) and mulberry (*Morus sp*.) species are bred and symbolically important (Gezgin, 2007).

3. Planting Proposals

For the D-Marin Didim project, we began making the planting design decisions by proposing our general ideas for all green areas. We discussed our ideas on drafts and sketches which were damaged and lost during the implementation of the project.

4. Planting Design Project and Implementation

Based on the drafts of planting proposals, the author drew the planting design project (Figure 5). In the years that followed, the author and the firm made new additions to the project. This paper discusses the D-Marin Didim Planting Design Project at 6 areas in order to convey the matter in a more comprehensible way:

- Area No.1: The Entrance

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- Area No.2: Olea Area and Commercial Area
- Area No.3: Hillside and Seaside Area
- Area No.4: Yacht Club Area
- Area No.5: Administration Building Area
- Area No.6: Berth Area

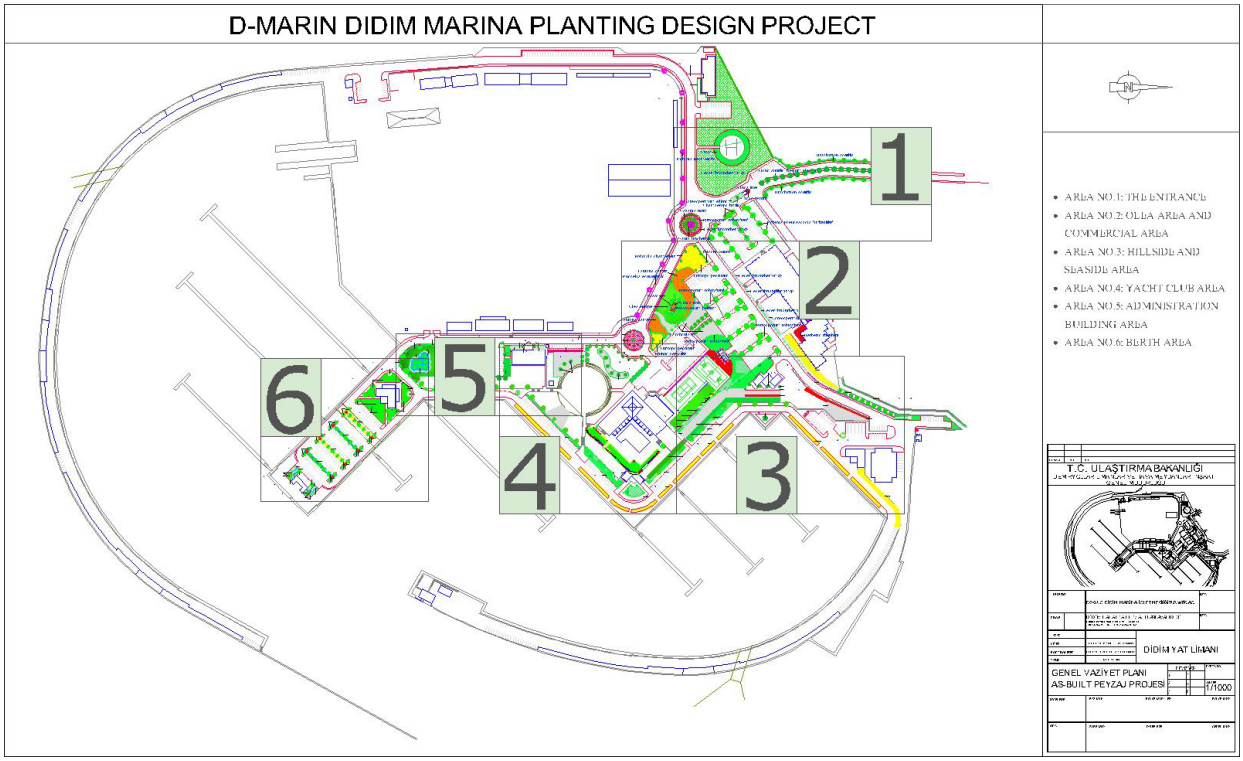

Figure 5. D-Marin Didim Planting Design Project

4.1. Area No.1: The Entrance

Before we began working on the project, the previous firm planted *Nerium oleander* at the entrance of the marina. We planted *Brachytion populneus* trees on the road sides and *Washingtonia robusta* trees on the central refuge. We pruned *Nerium oleander* plants every year to keep their hight optimum for the traffic control principle of the planting design. Because of the yearlong strong winds, after sometime, *Brachytion populneus* trees have been in a weak condition (Figure 6). In 2009, we planted *Dimorphotheca ecklonis* and *Washingtonia robusta* species at the security office area. But later, we changed them with *Rosmarinus officinalis 'Prostratus'* (at the front side of the security), *Cynodon dactylon* (Bermuda grass), *Olea europaea, Cycas revoluta, Pyracantha coccinea 'Nana'* and seasonal flowers. There are a few reasons for this change. The root-crown rot of *Dimorphotheca ecklonis* shrubs were deformed aesthetically. Besides, they were having problem with water and their life span was short. *Cycas revoluta* plants were at the berth area at first. Because of the harsh weather and soil conditions, some parts of their leaves turned to yellow. We potted them up and made them recover. After their recovery, they were planted in this area. By doing so, they attracted more attention and suited visually with the surrounding. We covered the olive tree and Cycas plants with wooden curbs because the Bermuda grass was creeping and we planted seasonal flowers under them. By changing the design, the maintenance became easier (Figure 7, 8). The helipad area was covered with *Delosperma floribunda* species. The area was fully in purple color during March for only 1.5 months. Since the condition was not so green or purple during other months, the administration requested a change. We planted *Cynodon dactylon*

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(Bermuda grass) and *Festuca arundinacea* grass on the main ground and *Pyracantha coccinea 'Nana'* shrubs on the perimeter (Figure 9).

At the roundabout, we planted *Delosperma floribunda*, *Pittosporum tobira 'Nana', Gazania rigens, Gaura lindheimeri* and *Washingtonia robusta* species at first. Later, we changed the *Gazania rigens* and *Gaura lindheimeri* species with *Tulbaghia violacea, Callistemon laevis* and *Cupressus macrocarpa 'Goldcrest'* (spiral) (Figure 10, 11). The lifespan of Gazanias is now expired. Besides, we produced *Tulbaghia violacea* species inside our greenhouse at the marina. Production made plants much more economic. At the parking lot green area, we planted *Cotoneaster horizontalis* at first (Figure 12). The plants did not cover the area thoroughly. Therefore, they were later changed with *Nerium oleander*. In addition, the previous landscape firm planted *Robinia pseudoacacia 'Umbraculifera'* in the area. Some of the *Robinia pseudoacacia 'Umbraculifera'* trees were well grown, yet some of them became weaker (Figure 13, 14). The parking lot area had a very dense soil, because it was one of the main areas of heavy machinery during construction. When we began working there, we potted up the weak plants. We ploughed the area, transferred 2 trucks of soil, applied organic fertilizer, harrowed the area and lastly, planted trees and shrubs.

At the roadside, near the roundabout, the previous firm planted *Russelia equisetiformis* species. They showed a good formation as they are pruned yearly. Behind the concrete wall near the *Russelia equisetiformis* species, there are *Fraxinus excelsior* and *Ficus australis* trees and *Viburnum lucidum* and *Ligustrum vulgare* shrubs (Figure 15). 7 out of 10 *Ficus australis* trees were dead a few years ago due to the frost (the temperature was below 0^0C). In exchange with the dead Ficus trees, *Fraxinus excelsior* trees were planted. The remaining *Ficus australis* trees were pruned hard at the shelter of concrete wall in order to make them continue living as a short size tree.

Figure 6. Outside the Marina, 2010 (Balik, 2021b)

Figure 7. The Entrance and Security, 2010 (Balik, 2021b)

Figure 8. Plant Composition at The Entrance, 2021 (Balik, 2021b)

Figure 9. Helipad, 2021 (Balik, 2021b)

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Figure 10. Roundabout, 2021 (Balik, 2021b)

Figure 11. Roundabout, 2010 (Balik, 2021b)

Figure 12. Parking Lot Area, 2009 (Balik, 2021b)

Figure 13. Parking Lot Area, 2011 (Balik, 2021b)

Figure 14. Parking Lot area, 2021 (Balik, 2021b)

Figure 15. Roadside, 2021 (Balik, 2021b)

4.2. Area No.2: Olea Area and Commercial Area

The large green area no.2 takes a lot of attention after entering the marina. During the marina construction, the trucks compressed the soil in this site unintentionally, making the soil very hard and dense. We had to bring extra soil with fertilizer and plough the area much like the parking lot section of area no.1. There was also a salination problem. Before the sea-water desalination plant was placed, saline well water was used for irrigation. The soil was also

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salinated and the plants developed problems of growth until recent years in this area. When we altered the water, soil, plant and wildlife conditions completely, salinity has disappeared form the soil.

Before we began the implementation of the project, there were tree species such as *Acer campestre*, *Aesculus hippocastanum* and *Gingko biloba* that were planted by the previous landscape firm. These trees were not suitable for this case study area (Figure 16 - 28). We planted *Olea europaea* trees in 2009 with *Polygala chamaebuxus* plants covering the whole area, pruned *Olea europaea* trees in the shape of bonsais, and planted *Melia azedarach* where the soil was softer and more productive. As for the rest of the area, we planted *Lantana camara* and *Lavandula angustifolia* plants, which, unfortunately, did not grow well and finally withered. Later, we changed them with *Callistemon laevis, Festuca glauca, Pennisetum rubrum, Rosa 'Madame A. Meilland', Ruellia brittoniana, Pittosporum tobira 'Nana'* shrubs and *Grevillea robusta* trees. *Grevillea robusta* trees are evergreen, resistant to wind and slightly resistant to cold. We first noticed and observed them on the streets of Bodrum (a city 115 km far from Didim with similar but milder conditions). Therefore, we tried them on our site and they worked well in the Marina. We produced *Festuca glauca, Pennisetum rubrum, Rosa 'Madame A. Meilland'* and *Ruellia brittoniana* plants in our greenhouse therefore, we only needed to buy *Callistemon laevis* plants. Callistemon shrubs attracted many bee and bird populations. Overall, because the area is large and rich of plants, the plants attracted wildlife and changed the ecosystem.

At the commercial area section, we planted *Grevillea robusta, Erythrina crista-galli, Robinia pseudoacacia 'Umbraculifera', Platanus orientalis, Ruellia simplex, Thuja orientalis, Cupressus macrocarpa 'Goldcrest', Cynodon dactylon* (bermuda grass), *Festuca arundinacea, Dichondra repens, Pittosporum tobira 'Nana'* and *Bougainvillea spectabilis* species. After the plantation, the marina administration constructed a children playground. The grass ground held the children that play and served as a smooth surface for people who bring their own chairs to sit on and enjoy the weather. We planted *Erythrina crista-galli* trees for aesthetic purposes and attraction as they bloom in summer. These trees are not resistant to wind, so we planted them at a section which is sheltered from the north wind by a building. As for the ground, we planted *Festuca arundinacea* with *Cynodon dactylon* species, because the area is covered with penumbra, which forms greener surface together year-round (Figure 30-34).

The parking lot section had *Pittosporum tobira 'Nana'* and *Robinia pseudoacacia 'Umbraculifera'* plants that generally grew well. At the roundabout, we planted *Washingtonia robusta, Callistemon laevis, Pittosporum tobira 'Nana'* and *Pyracantha coccinea 'Nana'* (Figure 35).

Figure 16. Trees at the Olea Area, 2021 (Balik, 2021b)

Figure 17. Shrubs at the Olea Area, 2021 (Balik, 2021b)

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Figure 18. Areas No.2,3,4, 2009 (Balik, 2021b)

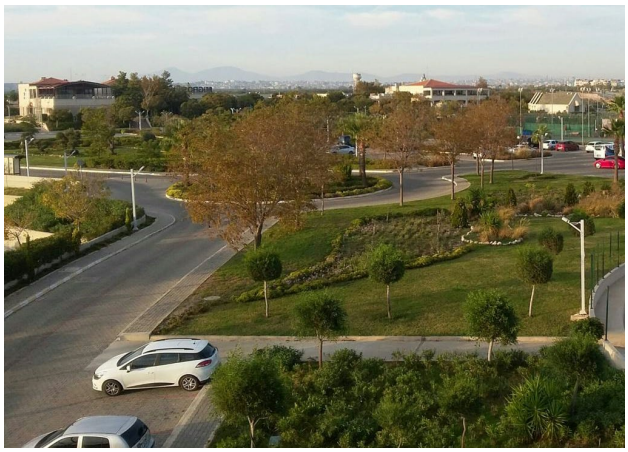

Figure 19. Areas no.2,3,4, 2021 (Balik, 2021b)

Figure 20. Olea Area photo No.1, 2009 (Balik, 2021b)

Figure 21. Olea Area photo No.2, 2009 (Balik, 2021b)

Figure 22. Olea Area photo No.1, 2010 (Balik, 2021b)

Figure 23. Olea Area photo No.2, 2010 (Balik, 2021b)

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Figure 24. Olea Area, 2010 (Balik, 2021b)

Figure 25. Olea Area, 2021 (Balik, 2021b)

Figure 26. Plant Communities at the Olea Area, 2021 (Balik, 2021b)

Figure 27. Olea Area, 2021 (Balik, 2021b)

Figure 28. Olea Area, 2021 (Balik, 2021b)

Figure 29. Roundabout, 2021 (Balik, 2021b)

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Figure 30. Commercial Area, 2021 (Balik, 2021b)

Figure 31. Commercial Area, 2021 (Balik, 2021b)

Figure 32. Playground, 2021 (Balik, 2021b)

Figure 33. The Roadside, 2021 (Balik, 2021b)

Figure 34. Commercial Area, 2021 (Balik, 2021b)

Figure 35. Parking Lot Area, 2021 (Balik, 2021b)

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4.3. Area No.3: Hillside and Seaside Area

The most problematic area was the hillside. There was too much water erosion and plants could hardly grow. Under heavy rainfall, soil comes down. Besides, it was hard for workers to hoe the slopes at summer heat. But this area is one of the most sheltered areas from dominant mistral and afer winds. There were *Robinia pseudoacacia 'Umbraculifera'* trees before we began working. We planted *Elaeagnus angustifolia, Acacia farnesiana, Berberis thunbergii, Jasminum fruticans, Rosmarinus officinalis, Cotoneaster horizontalis* and *Ruellia simplex* plants. Under the hillside, there are very enduring *Nerium oleander* plants that bloom at the beginning of the summer. Besides, *Robinia pseudoacacia 'Umbraculifera'* plants exist along the road (Figure 37-42).

The seaside section is an earth embankment with arid soil which takes salination from the sea. At this section, we planted *Ficus australis* trees at first. When they died from frost, as mentioned at the area no.1, we changed them with *Acacia farnesiana* and *Washingtonia robusta* trees. Due to very shallow soil (20-30 cm), we planted the trees in concrete pots with extra soil depth. The shallow root system of *Acacia farnesiana* tree held the soil successfully. We also planted *Rosmarinus officinalis 'Prostratus', Pennisetum rubrum, Delosperma floribunda, Lavandula angustifolia*, and *Cupressus sempervirens' Stricta'* plants. Near the parking lot, we used *Nerium oleander* as a single-stem plant (Figure 43-47).

The marina and the landscape firm produced and labeled the olive oil obtained from the olives of the site's *Olea europaea* plantation. These bottled and labeled olive oils were given as gifts to yacht owners. In addition, a bottle of lavender oil was produced from the Lavandula shrubs of area no.1 and 2. This proves that the plants are not only beneficial by their ecological and visual gains, but also beneficial for the economy (Figure 36).

Figure 36. Olive Trees, 2021 (Balik, 2021b)

Figure 37. Hillside No.1, 2021 (Balik, 2021b)

Figure 38. Hillside No.2, 2021 (Balik, 2021b)

Figure 39. Hillside No.3, 2021 (Balik, 2021b)

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Figure 40. Hillside No.4, 2021 (Balik, 2021b)

Figure 41. Under the Hillside, 2021 (Balik, 2021b)

Figure 42. Hillside No.5, 2021 (Balik, 2021b)

Figure 43. The Seaside No.1, 2021 (Balik, 2021b)

Figure 44. The Seaside No.2, 2021 (Balik, 2021b)

Figure 45. The Seaside No.3, 2021 (Balik, 2021b)

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Figure 46. Under Hillside No.1, 2021 (Balik, 2021b)

Figure 47. Under Hillside No.2, 2021 (Balik, 2021b)

4.4. Area No.4: Yacht Club Area

At the Yacht Club, we planted roll-on lawn with *Cocos nucifera*, *Washingtonia robusta*, *Cycas revoluta* and several shrub species such as *Cortederia selloana, Pittosporum tobira 'Nana', Nerium oleander* and *Bougainvillea spectabilis. Cocos nucifera* tree could not grow well with the dominant mistral and afer winds, so we changed it with *Washingtonia robusta* (Figure 48-51). At the rear side of the Yacht Club, there is a narrow green area, which is more sheltered from wind than the front. We planted *Cocos nucifera, Acacia saligna, Cupressus macrocarpa 'Goldcrest', Pittosporum tobira 'Nana', Ruellia simplex, Gaura lindheimeri, Bougainvillea spectabilis* and Bermuda grass (Figure 52, 53). The soil of amphitheater's green area was of poor quality and the area was too sloping. We constructed an irrigation system, fertilized the soil and sow Bermuda grass. The same seeds still carry on for 11 years (Figure 54, 55). The seaside section and the parking lot have the same plant species with the Area No.3 (Figure 56, 57).

Figure 48. Yacht Club No.1, 2021 (Balik, 2021b)

Figure 49. Yacht Club No.2, 2021 (Balik, 2021b)

Figure 50. Yacht Club No.3, 2021 (Balik, 2021b)

Figure 51. Yacht Club No.4, 2021 (Balik, 2021b)

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Figure 52. Rear Side of the Yacht Club No.1, 2021 (Balik, 2021b)

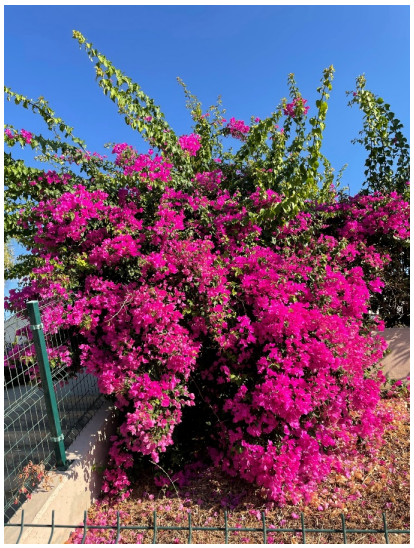

Figure 53. Rear Side of the Yacht Club No.2, 2021 (Balik, 2021b)

Figure 54. Amphitheater Slope Area, 2009 (Balik, 2021b)

Figure 55. Amphitheater Slope Area, 2021 (Balik, 2021b)

Figure 56. Parking Lot and Seaside Section, 2021 (Balik, 2021b)

Figure 57. The Seaside Section, 2021 (Balik, 2021b)

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4.5. Area No.5: Administration Building Area

The entrance of the administration building is the main face of the marina. It is sheltered from much wind by the buildings. Therefore, we designed the fron and the side sections with *Cocos nucifera, Cycas revoluta, Aloe vera, Festuca arundinacea, Bougainvillea spectabilis, Frezya iridaceae* and *Cynodon dactylon* (Bermuda grass) (Figure 58-60). *Frezya iridaceae* plants bloom at the beginning of spring and smell very nice. We designed the rear section of the building with a different version of the arrangement at the front section (Figure 61-63). We used *Cycas revoluta, Ruellia brittoniana, Echinocactus grusonii, Albizzia julibrissin, Ficus nitida, Ficus australis* and *Olea europea*. Because of the frost, as mentioned earlier, four *Ficus nitida* trees and one *Ficus australis* tree have died. *Ficus australis* trees were replaced with *Albizzia julibrissin* trees and *Ficus nitida* was changed with *Olea europaea*.

At the southwest of the building, there is a large green area (fig tree area) which we designed using rocks (Figure 64-66). The area gets salination from the sea. We first planted *Lantana camara* here, giving it a wavy figure. As they did not grow well enough to cover the area, we changed them with *Cynodon dactylon* (Bermuda grass), *Callistemon laevis, Pennisetum rubrum, Rosmarinus officinalis 'Prostratus'* and *Cortederia selloana* species. We also planted *Washingtonia robusta, Acacia saligna, Robinia hispida 'Rosea', Platanus orientalis* and *Ficus carica* species. Marina users could easily collect figs from the *Ficus carica* trees every summer. Along the roadside, *Russelia equisetiformis* plants grew quite well as they are pruned every year (Figure 67). The seaside section has the same character with the previously mentioned areas (Figure 68, 69).

Figure 58. Front Section of the Administration Building, 2021 (Balik, 2021b)

Figure 59. Front Section of the Administration Building, from Left and Right, 2021 (Balik, 2021b)

Figure 60. Side Section of the Administration Building, 2021 (Balik, 2021b)

Figure 61. Administration Building: Rear Section No.1, 2021 (Balik, 2021b)

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Figure 62. Administration Building: Rear Section No.2, 2021 (Balik, 2021b)

Figure 63. Administration Building: Rear Section No.3, 2021 (Balik, 2021b)

Figure 64. Fig Tree Area No.1, 2021 (Balik, 2021b)

Figure 65. Fig Tree Area No.2, 2021 (Balik, 2021b)

Figure 66. Fig Tree Area No.3, 2021 (Balik, 2021b)

Figure 67. Roadside, 2021 (Balik, 2021b)

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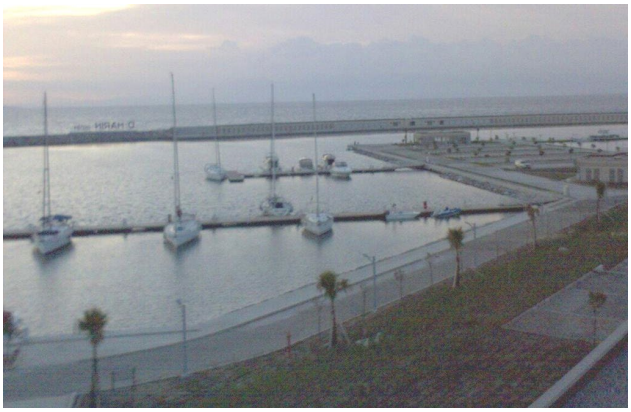

Figure 68. Yacht Club Hillside, 2009 (Balik, 2021b)

Figure 69. Yacht Club Hillside, 2021 (Balik, 2021b)

4.6. Area No.6: Berth Area

The berth area is an earth embankment with arid soil (Figure 70-72). The depth of the soil is approximately 20-30 cm. Sea spray affects the seaside section of this area. It is open to all directions of wind. Under these conditions, the *Acacia farnesiana* trees were put in concrete pots with extra soil depth. Before planting these trees, there were 35 *Ficus australis* trees in their places. They were all dead because of the frost mentioned before. At the parking lot section, we planted *Lantana camara* plants first. But they could not grow well enough to cover the soil. Therefore, we designed this section with *Pennisetum rubrum, Cortederia selloana* and *Acacia farnesiana* species. These plants can tolerate these conditions and grow well with well care (Figure 73, 74).

At the southwest end, we placed pumice stones and planted *Washingtonia robusta, Cortederia selloana* and *Rosmarinus officinalis 'Prostratus'* species (Figure 75). At the northeast side, around the building, there were *Gingko biloba* trees that could not grow well because of the wind. Instead, we planted *Elaeagnus angustifolia* trees and added *Cynodon dactylon* around them (Figure 76, 77).

Figure 70. Berth Area: Seaside, 2021 (Balik, 2021b)

Figure 71. Berth Area, 2021 (Balik, 2021b)

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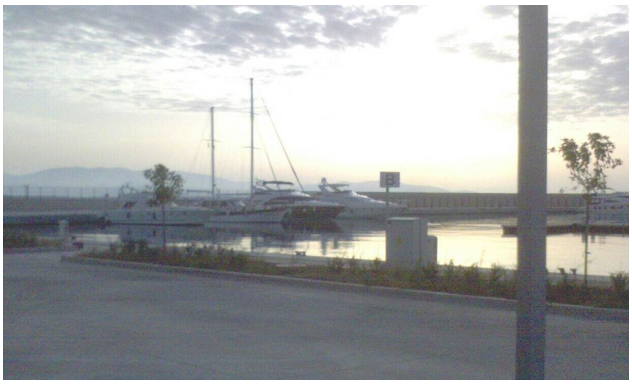

Figure 72. The Berth Area: Seaside Section, 2009 (Balik, 2021b)

Figure 73. The Berth Area: Seaside Section, 2021 (Balik, 2021b)

Figure 74. Berth Area: Parking Lot, 2021 (Balik, 2021b)

Figure 75. Berth Area: Southwest End, 2021 (Balik, 2021b)

Figure 76. Berth Area: Northeast No.1, 2021 (Balik, 2021b)

Figure 77. Berth Area: Northeast No.2, 2021 (Balik, 2021b)

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5. Landscape Maintenance

The most important aspect of plant care is pruning. It must be timely and correct. Especially at windy locations, it saves the lives of plants. Plants with very fringe roots can topple, but their roots hold more soil and grow faster. Gardeners prune many fast-growing plants that are exposed to constant wind in winter. On the other hand, they give special care to some plants. In particular, they peel the trunks of *Washingtonia robusta* trees every two years with a knife to ensure that they are significantly protected from red spider mites.

For the marina project, we did not use chemical fertilizers unless absolutely necessary, since they are not economic and ecological. While choosing plants, we have chosen content plants that do not require very fertile soil. Thus, plants can develop healthily with natural fertilizers. When chemical spraying with herbicides or pesticides is not used, plants create their own habitat. We observed that the number of bird and insect species has increased in the case study area. Bird sounds that have never before in the area can now be heard. It should not be forgotten that before we started working on the soil embankment, under current situations, there could hardly any plants grow (Figure 78, 79). In time, the ecosystem has been getting richer with more wildlife species of animals and plants.

In the area, we did weed control mechanically by hoeing and aerating the soil, instead of using herbicides. Planting design and care have continued by preserving and improving living species as much as possible. Our ecological aim was to create a green space environment close to a natural habitat and to increase the number of wildlife species, even if many plant species were exotic. The plants we used increased bird and insect populations. Insects and bees prevent plant lice and pests that require pesticides. We did not use pesticides in green areas to protect and develop an ecosystem. Instead, we prefered to use resistant Mediterranean plants. As the plants spread over the soil over time, the amount and visibility of weeds decreased. Over the years, as the plant ecosystems have developed, the mechanical struggle has become lesser. Besides, losing any plants would do less effect for the aesthetic feature of marina landscapes.

Figure 78. The Author (in the Middle) and Workers, 2010 (Balik, 2021b)

Figure 79. The Author (on the Right) and Workers, 2010 (Balik, 2021b)

In addition to general maintenance, different practices should be processed in the marina specifically for some plant species. For example, *Cocos nucifera* trees have poor tolerance to cold and wind. For this reason, we wrapped these trees with a rime cover made of white fiber material in winter. After the winter was over, the covers were opened. Secondly, reed group plants are resistant to heat, wind and salt. In order to keep them alive in coastal areas for a long time, we potted them every three years in December, fertilize and hoe their soils, and take them into a greenhouse care. With the beginning of the spring season, they are planted again in their places on the coast. Moreover, we prune Fraxinus trees hard periodically until they grow strong roots and thick trunks, since they take too much wind resistance.

It is very important to know the lifespans of the plants before starting the project and maintenance. Especially shrubs and fruit trees have a short lifespan. However, the advantage of shrubs is that their production is easy and fast. We carry out the plant production continuously with the cuttings taken from the plants in the field, so we grow many

plants in the greenhouse. If some plants deteriorate or expire, we replace them with the ones that we produce in the greenhouse. These actions reduce the plant maintenance and project costs. It is clear that with the right landscape maintenance, economic costs decrease at noticeable amounts, while ecological, aesthetic and social features develop. From the beginning of the project, landscape maintenance is essential and should be planned carefully by a landscape architect.

CONCLUSION:

The marina landscape is a soil embankment and is artificially created, so we did not destroy any native plants at the beginning of our work. On the contrary, we created an artificial marina ecosystem and then benefitted aesthetically, economically and socially. The ecosystem still develops by the enhancing wildlife, growing plants, enriching soil and salt cleansing.

In the survey phase of a similar project, soil, water and wind analysis should be done with detailed measurements. Plant preferences, soil supplements and irrigation system preparations should be made in line with the results of the analysis. In Didim Marina, wind is the most challenging effect, rather than soil, water and temperature. Most of this region is open to harsh winds from all directions. The continuity and maximum intensity of the winds throughout the year is very challenging for many plants.

There are approximately 150.000 shrubs in our study area. Losing 10% of these plants equates to losing 15.000 plants per year, which is a significant economic damage. In order to overcome this issue, greenhouses should be established in places with large green areas. Apart from the greenhouse, there should be an open area for caring potted plants. The advantage of the greenhouse is that, in rainy weather, gardeners can engage in plant production in the indoor greenhouse. During the harsh weather in winter, greenhouses can produce approximately 20.000 plants per year. Thus, plants are produced at low costs, reducing external dependency. In the marina, we constructed three greenhouses and an open plant production and care area. Every year, we produced 15.000 plants indoors and 5.000 plants outdoors. Reducing the amount of air pollution and increasing oxygen levels with the large number of plants is a significant outcome of landscape designs. A further analysis regarding the carbon footprint and oxygen calculations can be conveyed in marina, similar to Kalayci Onac (2020).

Surface rooted trees, such as Acacia species are preferred for areas with low soil depth (20-30 cm). In such difficult and continuously-used areas, evergreen plants should be preferred. Likewise, we did not use any Pinus species. Their leaves spill into the soil, making it acidic, and restrain other plant species. Collecting Pinus leaves also requires a lot of labor. Instead, we used Grevillea species. When we began working in the field, the soil cover was in the foreground instead of plant material image. Over time, the soil have become covered with vegetation. In large green areas, we preferred long-lived plants that remain green throughout the year, instead of shrubs that give an appealing appearance but are short-lived. Instead of a visually aesthetic plant, a long-lasting, durable and evergreen plant, which has ecological and economic values, should be chosen for a permanent ecosystem and economic return. Many plants should be taken into periodic maintenance, while plant production should be done in greenhouses and open areas.

For a similar future project, my suggestion is to separate the plant irrigation water from the utility water. Warehouses must be separate. If it is done accordingly, liquid fertilizer can be given as there is a drip system that surrounds all green areas. Through drip irrigation system, liquid fertilizer is only plant-oriented and not given to non-vegetation areas. This motive reduces the rate of weeds.

My economic suggestion is to grow and use plants that produce economically important products, such as fruit and oil. Citrus species should be used at sheltered sections from winds. Olive trees, fruit trees, aromatic plants, evergreen trees and shrubs should be used where appropriate. Over the years, these plants have economic returns. For example, in the marina, we obtained 50 lt. of oil from the Olive trees. Besides, when the lavenders were in good form, 1 lt. of lavender oil was obtained from their flowers. We also expect to obtain rosemary oil in the near future. Plants have adapted to the area over time and have been able to create their habitats. If we had dealt with the economic production dimension while planting the sloped area and if the budget had been sufficient, these areas would have been very good vineyards. The sloped areas could be terraced and used as vineyards, from where we can obtain grapes and wine. Vines are long-lived and contented plants with high economic return. I suggest combining natural plant communities with traditional horticulture, as Rainer and West (2015) note. In the marina, we tried to produce natural plants, but could not get a successful and economic result. This situation may depend on the harsh environmental conditions.

Besides, we created the ecosystem from zero, did not plant a new layer within an existing ecosystem and did not destroy the existing vegetation.

Recently, in many implementations of the private sector, plant design work is the last stage of architectural work. It is the place where the budget is the most difficult to raise and is allocated the least. Therefore, it is necessary to plan the economy well from the beginning. The major issue is to make the best use of available resources. While evaluating resources, economical, ecological and visual factors, which support and interconnect with each other, should be planned together. If the economic process is handled well, the number and quality of plants, namely ecological conditions, will improve. As ecological conditions improve, so do the visual and perceptual states of users. Therefore, efficient use of economic factors is related to the well ecological planning.

There is no easy and suitable ground for plant growth in challenging areas similar to the marina. It is necessary to be prepared to work in difficult landscapes. The work of a landscape architect in planting design does not only include visual, ecological or economical quality; in order for the design, implementation and maintenance work to be sustainable, economical, ecological, aesthetic and social features or mechanisms should be carefully planned and balanced as we tried to establish in Didim Marina.

Compliance with Ethical Standard

Conflict of Interests: The author declare that for this article they have no actual, potential or perceived conflict of interests.

Ethics Committee Approval: Ethics committee approval is not required for this study.

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