
Improving the Active Green Space Ratio in Coastal Cities in Turkey

Zerrin Sogut¹, Sibel Mansuroglu², Tanay Birisci³, Ayse K. Onac³
¹*Cukurova University, Faculty of Agriculture, Department of Landscape Architecture,* ²*Akdeniz University, Faculty of Agriculture, Department of Landscape Architecture,* ³*Ege University, Faculty of Agriculture, Department of Landscape Architecture*

Introduction

The active green space ratio in urban areas in Turkey has been determined as 10 m² per capita in accordance with the Construction Law no. 3194. However, this ratio couldn't be reached in most of the cities on the country scale in Turkey. This ratio of green space in urban areas per capita has been determined as 12,68 m² for Izmir, and 11,52 m² for Adana which are the two of the case cities of this study. One of the major factors that effect to reach this standard is the extension of the master plan boundaries. In spite of this, this ratio is very low (3,1 m²) in Antalya, the third case city of this study, although the city is one of the most important tourism centers of Turkey (TUIK, 2016, Izmir Metropolitan Municipality, 2013, Manavoglu and Ortacesme, 2007, Adana Metropolitan Municipality, 2016, Antalya Metropolitan Municipality, 2016). The urban transportation network of which the importance and the intensity is increasing depending on the population growth in urban areas effects the environmental factors and the quality of urban life. In coastal cities of Turkey which have rich ecosystem diversity, housing on green areas causes road construction and the harm given to the natural features of the city increase. Main roads and streets fall short depending on population growth in these ever-growing cities and new roads are needed. Roads that take more space than available green fields in cities are continuously in interaction with people from streets to avenues. In this respect, making use of median strips in urban green fields of coastal cities has gained more importance in terms of contributing to the urban aesthetic and ecology. There are many functional and visual positive effects of the road plant that surround the constructional islands, generate the corridors that link the urban green areas and the natural areas around the city (Table 1).

An important condition of the road trees in urban areas to fulfill the functions expected of them depends on their growth and develop as healthy individuals. Whereas some conditions of urban areas such as the urban climate that can be different from the rural areas around the city, soil and environmental pollution, lack of adequate habitats, pollutions caused by human activities may limit the plant growth. In urban areas while the temperature, rainfall, fog occurrence

and the cloudiness increase, rational humidity, radiation, and sunshine duration decrease compared to the rural areas. In urban areas there can be seen an air pollution of dust and particle 10 times, particles as gas form 5 - 25 times more than the rural areas (Harris et al., 2004; Schwets and Brown, 2000). Roads may have difficult conditions for plant growth for various plant types the trees being in the first place. The soil structure of urban areas change and soil compaction occurs depending on various activities which sometimes causes inadequate soil for a tree and its roots (Kadir and Othman, 2012). Nonetheless for the roads to be green is very important for entire city. Greenways are the only features that can link the natural and divided green areas in urban areas (Poracsky and Scoot, 1999; Schaefer, 2003).

Table 1. Benefits expected from road trees (Aslanboga 1996 and 2002; Birisci et. al, 2012; Birisci, 2002; Carpenter and Walker, 1990; Celem and Sahin, 1996; Harris et. al., 2004)

Benefits of trees		Explanations
Environmental	Ecological benefits	Urban climate regulations; decreasing the high temperature by shading, balancing the rational humidity, blocking the wind corridors, create spaces of biodiversity
	Biodiversity and nature conservation	Linkage of the urban and rural areas; to provide visual relief, seasonal change and link with natural world, supporting the urban fauna
	Pollution control	Control air, soil and water pollution, reducing noise: disposal of the pollutions caused by traffic (Pb, NOx, Cd, Ni, vd.), reducing the particles in the air, reducing the pollution of the soil
Economic and aesthetic	Having visual value	Property value (create pleasing and attractive areas for residents and investors, increase property values and financial returns for land developers)
	Control of the visual pollution	Screening the visual pollution
Social and psychological	Recreation and wellbeing	Provide outdoor leisure opportunities, relaxation areas, emotional warmth, providing natural areas to get in touch for urban citizens, renew the joy of life for urban citizens, giving sense of safety to the pedestrians, the relaxing effect of green color
	Human health	Reduce stress levels, increase the physical and psychological wellbeing of urban citizens, connection between people
Urbanization	Building infrastructure	Establishing the urban infrastructure and simplifying the maintenance
Transportation	Enable the safety on traffic	Clarification of the road, orientation, emphasizing, blocking the lights that reflects or directly disturbs the users, distinguishing the car - pedestrian areas, simplifying the activities of the pedestrians, reducing the speed of the cars

In this study, the planting problems in urban roads of some important coastal cities of Turkey such as Adana, Antalya and Izmir have been determined and some solution offers have been tried to develop. Plantation studies in urban roads include several advantages such as ensuring traffic security, forming visual value, having a positive effect on people psychologically and physically, regulating the city climate, decreasing the environment pollution, contributing to the biological diversity by creating a living space for various creatures. In addition, it will be possible to form an organic structure in cities by establishing relationship between green corridors constructed by urban roads and urban green fields and natural fields around the city.

Method

This study includes the determination of plantation problems of main roads and boulevards of three cities of Turkey located at the coasts of Mediterranean (Adana and Antalya) and Aegean (Izmir) seas. In this study, which has been completed in three steps, first of all the typology of the sidewalks and refuges that are under the control of local managers were determined. At the second part the problems of trees and plantation locations have been determined. At the last part, these problems have been classified and depending on their intensity suggestions have been made at the urban scale.

Results

There are not any transportation plans of the case cities and the transportation is generally busy and unorganized. Main roads, the refuges and sidewalks of the three case cities have been examined and the general qualifications of them have been classified as roads with no refuges, roads with narrow refuges and sidewalks and roads with wider refuges and sidewalks. While examining the roads of case cities, generally the problems about space narrowness (refuge size, the size of the space left around plant root on sidewalks) and soil (compactness of soil, general quality) have been considered mostly. According to the data gathered during the research it has been seen that the refuges are not wide enough. The width of the sidewalks is not constant along the roads. Circular areas are left on the roundabout central islands along the main roads. Diameter of these circles also differ and on some of them plastic and water features can be seen.

Sidewalks are very narrow in city centers and there are no plant usage on these sidewalks. Existing planted areas are unstable. In some areas on the narrow refuges palm trees that belong the *Washingtonia filifera* type have been used. On the refuges which have a width of 0,8 m or more some shrubs and annual plants can be seen with palm trees. On the refuges that are wider than

1m trees other than palms (*Phoenix canariensis*, *Jacaranda mimosifolia*, *Schinus molle*, *Tilia* sp., *Robinia pseudoacacia*, *Magnolia grandiflora*, *Morus alba*) and big shrubs (*Nerium oleander*, *Pyracantha coccinea*, *Berberis thunbergii* 'Atropurpurea') have been planted. On the refuges wider than 2m, smaller shrubs (*Juniperus horizontalis*, *Pittosporum tobira nana*, *Rosmarinus officinalis*), perennials, annuals and grass types have also been used with the other plants. Visual quality has been put ahead on intersections and trees have been used as single or in small groups with annual plants in different patterns.

Platanus orientalis, *Ficus microcarpa*, *Robinia pseudoacacia*, *Melia azedarach* and *Morus alba* have been used on sidewalks commonly. No standard has been determined on the distances of the plants on the sidewalks to roads and to the buildings. The problems based upon soil have been seen relatively less on refuges. Soil compaction is more common on narrow (0,5-1m) refuges and sidewalks. The plant soil on sidewalks has low quality compared to the refuges. Issues such as adequate tree crown height to enable pedestrian mobility haven't been paid enough attention and it is necessary for the pedestrians to avoid the lower branches of the trees. Especially *Schinus molle*'s that are used as sidewalk trees in Izmir lower branches that hang down need to be pruned every year because of this reason.

The spoilt form of trees and shrubs are very common in urban green areas. Within the reasons of this there are the planting place qualifications and pruning failure as much as the genetical structure of the plant type. Not having qualified staff to get the maintenance work done is one of the major problems about maintenance. Pruning in the shape of pad, cube and sphere of *Ficus microcarpa* in Adana and failure of pruning of *Morus alba* which caused the plants to lose the original form of the plant and opened scars on the plant can be samples of this. Also, diseases and harmful organisms can live within never pruned very dense and irregular tree crowns because of the rise of temperature and humidity. As an example to this there is the situation of *Citrus aurantium* trees in Adana which have dense leave texture and because of not being pruned cochineals have reproduced on the leaves. A mulching application that will support the protection of the plant's water balance in the irregular irrigation conditions is not also available. Mulching is done in very small areas with the visual purposes.

Discussion

The factors that generally limit plant development in case cities observed and have been grouped under four items such as; problems about growing field, problems about plant species, maintenance problems and problems about public awareness. The problems of the roads of examined cities have been

given in Table 2. The most important problem of the roads have been determined as the lack of an organized continuous plant texture. The examined roads don't have the qualification of linking the green areas and natural areas as greenways.

Table 2. The problems of road trees in Adana, Antalya and Izmir cities

Group	Problems	Adana	Antalya	Izmir
Problems about growing field	Size of planting habitat	+	+	+
	Soil of habitat	+	+	+
	Drainage	+	-	+
	Soil compaction	+	-	+
Problems about plant species:	Prioritizing the aesthetic benefits	+	+	+
	Usage of foreing origin plants	+	+	+
	Copy planting	+	+	+
	Not keeping up with the plant desing criterias	+	+	+
Maintenance problems	Irrigation	-	+	-
	Fertilization	-	-	-
	Pruning-forming	+	+	+
	Combating the diseases and pests	-	-	-
	Staking	+	+	-
	Cutting- disassembly	+	+	-
Public awareness	Physical harms caused by people	+	-	-
	Littering	+	+	+
	Vandalism	+	+	+

Conclusion

It is important to take multiple and sustainable precautions for avoiding the problems of road plantation in three coastal cities of Turkey. The actions to take and the benefits they can enable to the cities have been summarized below.

Improvement of the growing field: The most important improvement that should be achieved on growing fields on roads is to enable the enough soil mass for plant roots to be able to grow and to increase the quality of soil. It is not easy to widen the growing field. In urban scale it can be possible to widen the root growth area by raising the refuges from the edges. On the refuges where the adult trees and shrubs are planted cleaning, aeration, addition of high quality soil, fertilizing can be applied without harming the roots of the plants.

The selection of appropriate plant species: The most important issue on plant type selection is to select the exotic plants. There are plant species appropriate for different sizes of urban areas. On the refuges narrow but wide enough to plantation (0,6m<-) xerotolerant shrub species can be used. *Cistus* sp., *Juniperus sabina*, local *Rosa* species, *Erica verticillata* can be samples of these species. Species such as *Celtis australis*, *Ceratonia siliqua*, *Nerium oleander* are plants with high performance of achieving both the aesthetical and functional expectations such as xerotolerance (Mansuroglu ve Kinikli, 2010). Kirkpatrick et. al. (2012) have mentioned that one of the reasons of planting a plant in urban areas can be the plant being local, and one of the reasons of removing a plant can be that the plant is exotic. Invasiveness of a local plant should also be considered on urban areas. Invasive species can change the plant existence on an area and they can decrease the qualification of plants. Natural vegetation must be protected and developed in urban areas. In some Europe cities the natural vegetation plans have been started to be based on protecting and improving existing natural and local gardens.

Sogut (2005) determined that on a road of 18,5km length in Adana, within 45 trees and 32 shrub species, only 8 trees and 5 shrub species were local and the others were exotic, the usage rate of natural and local species on the area was 16,9%. It is important to select the plants that are in less need of renewal and to establish a permanent plant tissue as much as selecting the plants with less need of maintenance and appropriate for the environmental conditions. With this purpose it is possible to lessen the grass fields and use woody or semi-woody ground cover plants. And also it is important to limit the usage of some annuals and some bulbous plants with temporary effect like tulips. There are a lot of shrubs and similar plants that could be used to enable permanent colour effect. In urban places suitable areas for covering with trees should be established and trees should be planted on the fields wide enough for plant growth not on the refuges. Projects for increasing the number of trees in urban areas are being carried on in developed countries. With a similar project in New York, the tree number in the city has reached up to one million (NYC, 2016). There are legal regulations about the protection of trees in 25 European cities. Within these regulations cutting, minimizing by pruning, knocking over, harming and changing the trees have been forbidden (Schmied and Pillmann, 2003).

Carrying the maintenance works regularly and correctly: If the maintenance is not regular and correct problems can occur even if the right plant species are selected and planted in areas with appropriate width and conditions. It is vital that regular irrigation should be established. Low quality waters such as urban sewage water should be used after refining and particular irrigation systems for

this should be established. Establishing the appropriate irrigation system, usage of sewage water, and the education actions are some of the precautions to reduce the need of irrigation (Figure 1).

Applications of educational activities to upgrade the awareness of local people: The awareness level of local people is very effective on the continuity of the quality of urban green areas. Since the awareness starts at very young ages the prior education is formal training. Local managers can contribute to formal training about this subject by organizing plantation activities, involving the students into maintenance activities, labeling the trees to give information about them, preparing catalogues about the green areas and plants, giving away free seedlings and organizing competitions about the subject.

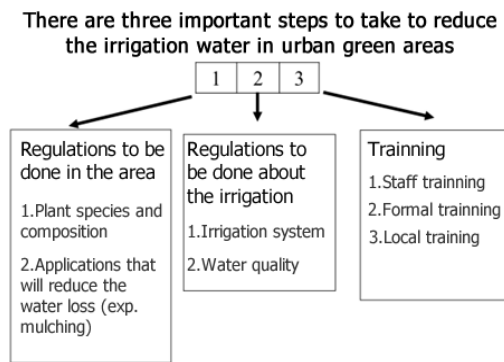


Figure 1. Activities to be done to reduce the irrigation on urban green areas.

But the training shouldn't be for only local people, authorized organizations and people should also be involved in training by in service training activities. Concerning the solutions of the problems, some offers have been given from the point of landscape architecture; such as reserving planting areas suitable for the species, using natural plants, increasing the roads' planning process standards, planning the roads in view of construction

plan, showing a multidisciplinary approach in planning and designing the roads on which professions such as transportation planner, traffic engineer, environmental engineer, city planner, architect, and landscape architects get involved to planning process.

References

- Adana Metropolitan Municipality, 2016. *Rekreasyon Calismalari*. <http://eskisite.adana.bel.tr/proje-12.html> Access: 09.02.2016.
- Antalya Metropolitan Municipality, 2016. *1/25000 Olcekli Nazim Imar Planı Degisikligi Plan Aciklama Raporu*. <http://www.antalya.bel.tr/Content/UserFiles/Files/PLANRAPORU.pdf> (Access: 09.02.2016).
- Aslanboga, I. 1996. *Kentlerdeki yol ve meydan agaagacilarinin islevleri, agaagacilanin planlanmasi, uygulanmasi ve bakimlariyla ilgili sorunlar*. Kent Agaagacilandirmalari ve İstanbul '96 Sempozyumu. Bildiri Kitabı: 7-12.

- Aslanboga, I. 2002. *Odunsu Bitkilerle Bitkilendirmenin İlkeleri*. Ege Ormançılık Arastirma. Mudurlugu, Izmir
- Birisci (Yildirim) T, 2002. Planting Design in Street in Respect of Pedestrians and Vehicles. International Traffic and Road Safety Congress & Fair (8-12 May 2002), 122-126, Ankara.
- Birisci, T., Guney, M.A., Turel, S.H. ve Kilicaslan, C., 2012. *Bitkisel Tasarim*. Genclik Offset ISBN 9944-5419-0-7, 73 p, Bornova.
- Carpenter, P. L., Walker, T. D., 1990. *Plants in the Landscape*. Published by W. H. Freeman & Company, New York, ISBN 10: 0716707780
- Celem, H., Sahin, S. (1996) *Kentici Yol Agaclarinin Gorsel ve Islevsel Etkileri*. Kent Agaclandirmalari ve Istanbul '96 Sempozyumu, 41-54.
- Harris, R. W., Clark, J.R., Matheny, N.P., 2004. *Arboriculture*. Integrated Management of Landscape Trees, Shrubs, and Vines. Pearson Education Inc., Upper Saddle River; New Jersey 07458 USA 578 p.
- Izmir Metropolitan Municipality, 2013. *Izmir'de yesil seferberligi*. Haber arsivi. <https://www.Izmir.bel.tr/HaberDetay/9943/tr> Access: 09.02.2016
- Kadir, M.A.A., Othman, N., 2012. Towards A Better Tomorrow: Street Trees and Their Values in Urban Areas. *Procedia Soc.Behav. Sci.* 35: 267-274.
- Kirkpatrick, J.B.; Daniels, G.D.; Davison, A., 2011. Temporal and Spatial Variation in Garden and Street Trees in Six Eastern Australian Cities. *Landscape and Urban Planning* 101: 244-252.
- Manavoglu, E., Ortacesme, V. (2007). Konyaaltı kentsel alanında bir yesil alan system onerisi gelistirilmesi. *Akdeniz Univ. Zir. Fak. Derg.*,20(2):261-271.
- Mansuroglu, S., Kinikli, P., 2010. *Antalya Kent Merkezindeki Yerel Bitki Turleri ve Bunların Peyzaj Mimarligi Calismalarında Kullanım Alanları*. IV. Sus Bitkileri Kongresi, Kongre Kitabı: 272-281. Selim Ofset, Mersin.
- NYC, 2016. *A Planyc Initiative with NYC Parks and New York Restoration Project*. www.milliontreesnyc.org Access: 12.02.2016.
- Poracsky, J., Scott, M., 1999. Industrial Area Street Trees in Portland-Oregon. *Journal of Arboriculture* 25(1): 9-15.
- Schaefer, V., 2003. *Green Links and Urban Biodiversity - An Experiment in Connectivity*. Georgia Basin/Puget Sound Research Conf. Proceed. 9 p.
- Schmied A.; Pillmann, W., 2003. Tree Protection Legislation in European Cities. *Urban Forestry and Urban Greening* 2: 115-124.
- Schwets, T., Brown, R.D., 2000. Form and Structure of Maple Trees in Urban Environments. *Landscape and Urban Planning* 46: 191-201.
- Sogut, Z., 2005. *Kentici Yesil Yollar ve Adana Ornegi*. Akd.Uni., Ziraat Fakultesi Dergisi 18(1): 113-124.
- TUIK, 2016. *Yillara gore illerin yillik nufus artis hizi ve nufus yogunlugu, 2007-2015*. www.tuik.gov.tr/PreIstatistikTablo.do?istab_id=1591. Access: 09.02.2016.