

## O 30. THE LINK BETWEEN URBAN ECOSYSTEM AND TREES IN ROADSIDE PLANTING

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**ABSTRACT:** Playgrounds, parks in neighbourhoods, urban parks, cemeteries, school gardens are considered to be the most common forms of urban green areas. However, these local green areas are seen all over the city. Besides local greenery; trees along the highways and roads play an essential role in creating urban green areas. Thus, trees along highways and the ones in open public spaces contribute to the sustainability of urban green areas as they are the linear forms of greenery. Trees along roads are the most affected by their environment. Therefore, roadside planting requires attention and precision and the effort put into the work must be extreme. In this study the importance of using suitable trees in roadside planting according to trees' purpose and ecological needs were explained.

*Keywords:* Landscape ecology, Landscape planning, Planting

### 1. INTRODUCTION

In everyday urban life, open green areas that working people can benefit from are limited. However; streets, avenues, boulevards and traffic islands can be used for recreational purposes both by pedestrians and drivers on a daily basis. Therefore; roadside planting configurations are more efficient, permanent, dominant, aesthetical and functional compared to the other forms of landscaping arrangements (semi-evergreen shrubs, woody-shrubs and spreading ground covers). Thus; the trees in streets, avenues, boulevards and traffic islands are the most essential elements of urban green areas (Kucuk and Gul, 2005).

#### 1.1. Definitions

**City:** Socially developing, a high populated site that provides habitation, traffic, working environment, housing, recreational and entertainment areas for its residents. In cities, a little amount of people conduct agricultural operations and neighbouring is not significant.

**Road:** Significant element built for people to travel along as it affects the growth of the sites nearby.

**Urban Road:** According to Aslanboga (2001), open space elements that regulate transportation for people and vehicles. If combined with planting arrangements, these elements are qualified as green areas. Urban roads are designed for different purposes, they can be solitary or combined with other elements if needed (Kucuk, 2002).

**Traffic Island:** Separative arrangements or gears in between roads as they prevent or restrain vehicles to cross to the other side of the road.

**Planting arrangement (afforestation, reforestation):** The action of creating forests in areas that currently do not have forests.

### 2. FUNCTIONS AND CONTRIBUTIONS OF ROADSIDE PLANTING

**Visual Contributions:** According to Yilmaz (1998), green areas and trees as their dominant elements with various shapes, textures, colours, structures and sizes create eye-catching, diverse spaces. Plant's growth rate and maturity level are the main criteria that contribute to the visual impact. It takes 50-100 years for trees to enter into their maturity stage which means every roadside planting aims to serve the next generations. Whereas, visual impact emerges as a result of the healthy growth of plants. Healthy leaves and density of the branches are the main criteria (Figure 1).

**Scale Impact:** Humans are likely to feel misplaced and under pressure in large areas due to the size difference between humans and the place. When the size difference between humans and the place decreases, they feel safer. To achieve this, plants are frequently used as they scale down the size

difference. Planting a tree or a shrub in a space surrounded by tall buildings ensures the gradual change in size. Therefore, humans form clearer perceptions regarding the area (Korkut et al., 2010)

**Space Impact:** According to Aslanboga and Gunduz (1986), the densely planted trees along roads and in public open areas create the ceiling effect. Celem and Uslu (2006) state that tree crowns define the lines that form the space. The crowns can either sharpen or smoothen the lines. Densely planted trees with thick trunks create the corridor effect whereas the effect fades away with sparsely planted trees.



**Figure 1.** Reference image from Bornova - Izmir

**Contrast or Harmony (Cohesiveness):** According to Celem and Sahin (1996), trees' visual features can enrich the qualities of a place and create a cohesive environment with contrast and harmony. The rough corners of geometric structural elements along the road can be muted with round-shaped trees. The importance of roadside planting derives from densely arranged vegetation rather than the silhouette of plant growth in an open area. A cohesive space with contrast or harmony is determined by the design process. Ekmekci (2007) states that planting in large gaps generates round-shaped crown form and creates contrast with the environment. Ekmekci (2007), also expresses that densely planted trees ensure harmony due to their conical and column-like growth form.

**Variety:** According to Celem and Sahin (1996), seasonal colour change of the leaves, flowers and stems creates variety stimulating a sense of movement in the monotonous environment. Using various shapes and colours in roadside planting has a significant impact on people who live in cities estranged from their natural form. If evergreen plants are used, the canopy effect is created (Ekmekci, 2007).

**Blocking view of the unwanted:** According to Celem and Sahin (1996), signboards along with the other hardscape elements can cause visual pollution in the streets or along the roads. Trees planted along the road are the most effective elements regarding blocking the view of the unwanted created by buildings in a different size or some window displays (Ekmekci, 2007). Visible chaos can also distract drivers. Korkut et al. (2010) state that trees along the roads blocks unwanted views and prevent drivers from distraction.

### **Contributions Regarding Urban Health:**

**Noise Reduction:** The outdoor noise or environmental noise endangers the health and well-being of humans. Loud noises can harm humans physically and mentally. Noise reduction depends on the condition of the atmosphere, the area of sound propagation, the distance between the sound source and the soil, the absorbing capacity of the soil and vegetation condition (Ekmekci, 2007). Yildirim (2000) reported that plants can reduce the noise by the rate of 0,7-10,0 dB depending on the size and position of leaves, density of leaves and branches, also the size and shape of the project area (Celem and Uslu, 2006).

**Psychological Effects:** Ulrich et al. (1993) and Celem and Uslu (2006)'s research regarding the comparison of two images and their effect on the human brain reported that images with trees and other natural elements create a great number of alpha waves in the human brain which was a sign of relaxation.



**Figure 2.** Reference image from Champs-Élysées



**Figure 3.** Reference image from Sydney

### 3. IMPACTS OF TREES ON ECOSYSTEM

According to Baris (2005), the impacts of trees and green areas on the urban ecosystem should be assessed as given below:

**Cooling the planet:** Plants are not capable of reserving heat in their body structures. Therefore, radiation balance occurs in planted areas. On average, 60-75 % of solar energy is used in physical activities. In urban areas without planting, solar energy is used in warming up the air and the buildings. A research done in Berlin suggests that the temperature in a park of 212 ha is 7 centigrade degrees lower than in an area of buildings. Trees' cooling effect is greater at nights due to transpiration. Evaporation of the water that is inside plants requires high temperatures. With evaporation, an average tree loses 1460 kg of water. 860 microjoules of energy are used in this process. The cooling effect that is caused by this amount of energy equals almost five air conditioners. Trees play an important role in saving energy and their benefits are proven. To give an example; the trees and shrubs near buildings decrease the overwhelming effect of high temperatures and cause a reduction of air conditioner costs by the rate of 15-35 %. Therefore, shading plants and facade planting arrangements reduce the air conditioner cost.

**Providing Fresh Air:** The air from urban depression areas is filtered and cooled if it travels through trees and green areas. Thus, trees help the city's ventilation. Every tree works as a refrigerator because the total surface area of their leaves is 10 times bigger than its crown area. The cooling effect of trees is greater than the grass-covered areas. Also, the cooling and filter effects depend on the number of leaves rather than the total area of the green space (Baris, 2005).



**Figure 4.** Urban buffer zone

**Infiltration of Air:** Baris (1998), tests and researches done regarding wind screening state that trees and green areas play an active role in air infiltration. Other than pollens, there is no dust particle produced in vegetated areas. Trees primarily reduce air's carrying capacity. Trees form a windscreen or a living wall. The ones in parks filter 85% of particles and the ones in streets filter 70%. Even in winter when the plants are without leaves, trees filter 60%. Trees can hold dust particles 5-10 times more than the total weight of their leaves. 5-year research done in France shows that 1 m<sup>3</sup> of air in an area without trees contains 3910 bacterias, however, a park nearby has 455 bacterias (Baris, 2005). Trees even when they are without leaves can filter 60 % of dust particles. Trees along the roads are known to hold 7000 particles of dust in 1 lt of air. Aslanboga (1998) reported that sparsely planted areas cause wind speed decrease and large dust particles (i.e. road dust) are filtered. Especially the trees with woolly leaves hold a great amount of dust. Planting with multiple layers (spreading ground cover, shrub, tree) helps dust particles get washed up in rain and hold by soil afterward. However, in sparsely planted areas (i.e. roadside planting), the washed-up dust particles land on the ground, start flying around when dried off. Dust particles held by plants have positive outcomes for humans, but it has negative effects on plant's health; (i.e. difficulties in receiving sunlight, stoma blockage, forced transpiration due to heated solid particles) (Girit et al., 2010).

#### 4. IMPACTS OF URBAN ECOSYSTEM ON TREES

The urban conditions that affect the plant growth in regard to the works of Aslanboga (1988), Celem and Percin (1988), Gultekin (1988) Atay (1990), Saebo et al. (2003) (Doygun and Ok, 2006):

**Climate:** Reflective surfaces such as buildings and roads cause an increase in night radiation. The industry, vehicles and heating systems create extra heat produce. Urbanization leads to a reduction in airflow speed. These factors cause the microclimate change and the city becomes a heat island.

**Soil:** Buildings and roads covering entire land, urbanization, traffic, deformation of fertile soil, litterfalls not being in the biogeochemical cycling are oppressions on urban soils. Therefore; soil's link to surface water vanishes, the oxygen level decreases, drainage becomes a problem, organic material cannot be regained and the land cannot grow plants efficiently.

**Pollution:** The dust particles from the industry, vehicles and heating systems congregate on the surface of the leaves which causes absorption of sunlight on high levels and tissue burn. The particles also can contain heavy metals that dissolve in rain and enter the plant's body structure through stomas or roots which leads to tissue burn.

**Mechanical Oppressions:** The disintegration of roots during construction and excavation works, sewer lines preventing root growth, parking lot incidents, improperly attached banners, posters and signboards, paving stones blocking roots, and damage caused by pruning are main mechanical oppressions on plant growth.

#### 5. CONCLUSIONS AND SUGGESTIONS

It is a well-known fact that roadside planting has positive impacts on the ecosystem, both nationally and internationally. Planting arrangements which are made according to principles of urban green areas changes the environment in all aspects. Plants are not only aesthetical entities with their textures, colors, shapes, sizes; but also they are functional elements that prevent air, noise, visual pollution. Air pollution and other environmental issues have various impacts on trees as they are living organisms. City planners, naturalists, landscape architects and environmental engineers should collaborate to prevent urban environmental issues and create a city master plan. In addition, the importance of green areas regarding human health and their environmental value should be introduced to both students and everyone in public.

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