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Ecologıcal Impact Of Urban Forests (Example Of Kastamonu Urban Forest)

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Abstract

Despite the attractive advantages of life, because of agricultural and industrial developments, and also the growing population, in the cities which took place of rapid urbanization and which have irregular structure, have negative effects on people's mental and physical health. Urban forests and green areas have ecological, bioclimatic, city formatting and aesthetic gain, increase the value of life, the human-nature relationship building and the ability to improve the climate of the city. In addition, they play an important role in every aspect in term of a positive impact on people with like features which are the city's dirty air filter, noise reduction of the city.
In this study, firstly the concept of urban forest that form the basis was examined in detail. Then, the features and criteria for urban forests and contributions in the urban living field, its the various usage possibilities and environmental impacts were examined. As a result of all these considerations, in the Kastamonu city, in the sample field of urban forest that is provided the integration of human and natural, maintaining the ecological balance of the city, focused on the properties how to adapts the environment and its other ecological features.

Keywords: Urban Forest, Kastamonu, Ecology

Introduction

As a result of rapidly increasing population, existence of green field in cities has been constantly under threat and this situation leads up to various environmental issues including noise, air pollution, and unplanned urbanization. Developing and growing locations haven't been able to satisfy individuals' longing for nature. On the contrary, people need green field more and more while cities are going on developing and growing. Such requirements have caused green fields near towns to be planted and so urban forests have been brought to the agenda in order to take advantages of benefits which forests present to people. Urban forests draw the public attention in terms of benefits to society, recreation, wildlife, and landscape as well as energy conservation, pollution reduction, and positive effects on public health.

In recent years, increasing attention to green composition of urban areas has resulted in a lot of professions directly related to this composition and thus new concepts and terms have emerged [1]. The statement "urban forestry" was - for the first time in 1965 - used by Professor John W. Anderson, Toronto University [2]. In a study relating to urban forestry conducted in 1999-2000, Urban Forestry was determined as follows: It is to project, architect, plant, and manage trees and woods in or near the city considering their relaxing values. For Konijnendijk [3], Urban Forestry contains not only woods in and near the city but also other tree resources and whole vegetation. For example, trees in the park and along the roads, or gardens, and trees in other private lands are involved in management of Urban Forestry. For Geray [4], Urban Forestry is to take advantages of forest ecosystem, woods, trees, shrubs, and bushes and also to preserve, improve and manage these resources on the purpose of assuring sustainable urban life with history, configuration, organization, and culture and of contributing to urban societies' physiological, psychological, economic, social, and moral levels.

There are lots of similar definitions influenced by traditional forestry and forest existence of every country interested in the concept "Urban Forest". On the other hand, discrepancies are quite a lot, too. The concept "Urban Forest" commonly mentioned in the country points out places which are architected beside or around residential areas such as metropolises, cities, and large districts so as to present social functions of forests such as health,

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sport, aesthetic, cultural, and so on, to the public rather than sense of having barbecue and also introduce local flora and fauna by means of technical forestry operations [5].

When examining the current practices relating to urban forestry; we can realize that Turkey Ministry of Environment and Forestry has launched the project "urban forests" in order to improve social functions of the forests and aimed at planting an urban forest in each city. Within this framework, 63 of the urban forests have been planted in the country in 2003-2008 [6, 7]. However, forest recreation ground accounts for 0,045% of total forest land in Turkey while nearly 50% in England, 2% in Germany, and 1% in Sweden. Namely, in Sweden, total 430.000 hectares of urban forests, 71.000 hectares of which are recreation forest for city-dwellers, have been managed even though 55% of the land is forested. Hong Kong where the required wood-raw materials are all imported has established - for this purpose - 21 public gardens covering 40.000 hectares in spite of having the land on a limited scale [8].

The studies conducted in order to determine the importance of the green lands for people suggest that people who go to green land and commune with nature rest and relax more when compared to those who don't and they can have high concentration. In other words, these areas have positive effects on human health. In developed countries, the quantity of green area per person is 25-30 m^2 while 1-9 m^2 in the country. WHO (world health organization) suggests that this quantity be minimum 9 m^2 per person. As a result of insufficient green area, life gets less satisfying for those living in cities. Because interaction with nature is one of people's basic needs and urban green spaces play an important role in this interaction [9, 10, 11].
Within the scope of this study, Kastamonu Urban Forest has been based on in order to specify characteristics and features of urban forests, their contributions to urban living spaces, their environmental and ecological effects, and their benefits and uses.

Materials and methods

Throughout Kastamonu Urban Forest covering 37.24 hectares along the motorway from Kastamonu to Ankara, observational and analysis studies have been conducted. The area is surrounded on the south by Şerife Bacı Forest Recreation Park, on the north by the local traffic hospital, and on the east by a free field with inactive buildings – 11 km far from the city center – which was once planned to make into a university campus. During the study process, relevant domestic and non-domestic thesis studies, reports, books, internet tools, and scientific publications have been benefited from. In parallel with the examinations and observations conducted in the area, some photos have been taken while primary and secondary plant species found in the urban forest have been identified.

Results and discussion

Throughout the urban forest quite rich in vegetation, tree species including *Abies nordmanniana* subsp. *bornmullariana, Pinus nigra* subsp. *pallasiana, P. sylvestris, Quercus sp., Sorbus sp., Populus tremula, Salix alba* grow throughout the forest. With a gate house, toilet, observing tower, 100-car parking lot, children's playground, 3974-meter hiking trail, volleyball court, view terrace, and 521-meter running track, the urban forest helps people commune with nature by introducing the nature into the urban environment and presenting the opportunity to observe the alterations in the nature depending on time and seasons.
For the urban forestry, the main purpose is to help people in cities to benefit at maximum level from all aesthetic and functional features of trees and forests. In other words, the aim is to contribute positively to urban environment and improve city-dwellers in socio-economy, psychology as aesthetic recreation spaces. These contributions can be specified as beautifying the environment, influencing psychologically and relaxing, shading, improving the urban climate, reducing the wind speed, preventing the noise, preserving the land and water, and developing the wildlife. Therefore suitability of trees for their intended purpose have importance [12, 13].
Urban Forests can change ecological factors of cities in accordance with community life. It is well known that plants as a part of its physiological functions consume carbon dioxide and generate oxygen through photosynthesis under suitable conditions. For instance, a well-developed beech tree can meet daily oxygen needs for 64 people and also improve the humidity through evaporation and transpiration [14, 15]. Urban Forests play an important role in reducing atmospheric carbon dioxide in cities [16].

Conclusion

Urban Forests carry out significant functions in purifying city weather. It prevents city weather from pollution by keeping and absorbing particulates and aerosols coming from pollutant sources on the leaf surface, and by slowing down their air movement

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while falling down on the ground. Green belt planting ensures that toxic gases dissolve into the ground through raining as leaves partly absorb and store them. Industrial establishments working out mine impair air quality because such establishments generate dirt due to their raw materials. Trees and forests play so significant a role in preventing particles which are transported by wind. In a study, it was reported that a green belt surrounding the city had decreased the amount of lead in the city air by 85% [17, 15]. According to a study conducted in the USA; a decrease by 20% in a tree community caused max ozone concentrations to increase 123 ppb to 140 ppb as a result of 2^0C temperature rise [18].

Urban Forests protect the ground against erosion and landslide which may occur arround the cities which have been established on sensitive areas. In urban forests which are planted - in accordance with biological engineering techniques – especially on sloped areas where vegetation is thin and gradient of slope is high, the soil conservation function comes into the forefront compared to other functions [15].

Covered with concrete and asphaltic surfaces widely, Urban areas lack humidity resources through which city air is able to meet the humidity deficit. Therefore, the city air is drier compared to that in natural and rural areas. Together with other green areas, urban forests rise relative humidity - which is low in cities - through transpiration and thus provide freshness. The studies conducted in Frankfurt, Germany suggested that the forest belt with 50 to 100-meter width surrounding the city reduced the temperature by 3,5 ^{0}C and rose the humidity by 5% compared to the city centre through evapotranspiration. Moreover, urban forests prevent local damages of powerful winds and storms by slowing them down, regulates the local air movements, and tones the local climate down by reducing the temperature extremes [15]. When considering the field surveys conducted in 10 cities of the USA and the national values of the urban forests, it is declared that the value of the urban forests in the USA is equal to 14.300 million USD and they store 700 million tons of carbon (22.8 million ton carbon equal to 460 million USD per year. In this study, the national average of carbon storage for the Urban Forests (25.1 tC/ha) was compared to that of Forest Areas (53.5 tC/ha) in the USA. Consequently it is emhasized that the urban forests play a significant role in reducing CO_2, strictly dominated greenhouse gas [19].

Occurrence mechanism of city climate improvement was performed in the years when the consept “urban forest” wasn’t yet known in the country,Turkey, by Miraboğlu [20]: the flora which is cooler compared to the city creats thermal circulation (turbulence) and the resultant air movements allow a decrease in heat island. The hot air in the city creates a vacuum effect while climbing up and thus a specifial wind corridor - 3,3 m/s- occurs. This corridor can refresh the city air in an hour. This effect is in parallel with the size of green area. Beside this, green areas make the cities more attractive, improve life standarts, increase property value, and become the component of city architecture [21].

Global carbon cycle is described as a primary one of biogeochemical cycles due to its role in regulating an important greenhouse gas - CO_2 - concentration in the atmosphere. Forests play a significant role in global carbon cycle. They store carbon in soil and vegetation, perform carbon exchange in the atmosphere through respiration and photosynthesis, become atmospheric resources when it is exposed to human or natural interference. If it is released or rejuvenated after interference, it transforms into carbon reserve again [22].

According to the South Carolina Forestry Commission report, trees reduce greenhouse effect by 30% by decreasing fossil fuel quantity used for energy generation. This carbon dioxide combination from atmosphere is stored by trees. Trees, which are so effective in fight against greenhouse effect, perform a refrigerating effect. Trees planted on 1-decare area generate enough oxygen for 18 people in a day [23]. A study conducted by McPherson [24] suggested that 6.000.000 trees keep approximately 304.000 tons of atmospheric carbon dioxide, 12.000 tons of ozone, and 9.000 tons of particulate matters. Rosenfeld, Martin, and Rainer determined that urban trees could be ten times as effective in reducing carbon dioxide as forest trees [25].

Trees and tall bushes reduce the wind speed and its effect by acting like a windbreak. They balance the solar radiation by shading [26]. Due to the positive effects on microclimate, urban forests can increase or decrease the energy use in the buildings. It is determined that the vegetation around the dwellings generally creates a positive effect by 5-15% for heating and 5-50% for cooling [27].

Urban forests play a significant role in assuring water supply for cities. Urban forests which enable water from rain to infiltrate into the ground reduce the loss caused by surface runoff. Thus they are considered as a factor regulating the hydrologic cycle in the city. Wastewater is a serious matter for urban ecosystems. Urban forests are suitable places where this wastewater can be recycled after satisfying water

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purification. Therefore, it is possible to improve the growth conditions of urban forests in regions where water resources are insufficient and also make a great contribution to the hydrological cycle of water resources around the cities [15].

Urban forests soften the hard-edge structures of the city in terms of aesthetic. They present interesting and attractive views creating contrast shapes and textures. Industrial establishments take on significant tasks in bordering and camouflaging raw material resources, garbage dumps, and undesired areas around the city [28, 29].

Urban forests and urban green texture underlie urban biological diversity. Urban or rural green areas, in which birds creating nice reflection of sounds, a lot of pretty animals, helpful insects nestle, build up an environment suitable for fauna diversity that makes a contribution in general manner to ecological balance. The studies conducted by IUCN suggested that generating an appropriate green area network serves for preserving and developing biological diversity and that green tracks such as green belts and linear parks make into biological tracks [30, 15].

Trees and green areas balance the air temperature by controlling the solar rays in the city environment. Tree leaves keep, reflect, and absorb the solar rays, and allow a little part of rays to pass through. These effects vary depending on tree species, leaf density, leaf form, branching form. In the urban forests found in temperate regions, trees with leaves are effective in controlling the temperature. In summer, they keep the temperature at low levels by preventing the solar rays. In winter, they take on an opposite task by loosing their leaves [31]. Streiling ve Matzarakis [32] determined that the annual avarege temperature difference was approximately 10^0C between woodland and glade in Freiburg, Germany and the difference increased in parallel with the quantity of the trees [33].
Urban forests created with proper species or trees planted on suitable areas decrease kinetic energy form rain drops and prevent the surface runoff by means of leaves, branches, and trunks. Their roots hold the soil and set against erosive effect of surface water runoff. Thus, soil erosion is prevented and also water resources are prevented from being polluted by soil particles [34].

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