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The Important of Vegetation in Urban Area – An Introduction

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Abstract

Flash flood, Urban Heat Island (UHI), air and noise pollution among the problems faced by urban community nowadays. This environment condition affected their health and lifestyle, which make many of them started to concern about living in healthy environment. Due to rapid urbanization; increasing numbers of skyscrapers and hardscape rather than softscape, demands of urban green space in urban area increasing. Studies proves that by increasing vegetation in urban area could help in reducing UHI, provide better environment and improve air quality as well as creating better ecosystem in urban area. This paper summarize the importance of vegetation in urban area and how its work in creating better environment.

Keywords: Urban vegetation, vegetation advantages, urban problem

1. Introduction

Decreasing numbers of green space provision in urban area is a result of rapid urbanization which lead to various problems such as Urban Heat Island (UHI), flashflood, air and noise pollution and extinction of wildlife habitat. Urban environment climate and condition can be improved by increasing the numbers of vegetation in urban area which can also serve for beautification. Plants can soften the view of abundant hardscape and also could create a better environment for urban dwellers.

1.1 Urban Green Infrastructure

With increasing awareness of the importance of quality green space within urban areas, greater attention is now being placed on the provision of effective green space within the urban matrix. Green space can provide a range of ecosystem services including urban cooling (Tyrväinen et al., 2005a), thermal insulation (Dwyer et al., 1992) storm water mitigation (Day and Dickinson, 2008) habitat for biodiversity (Jensen et al., 2005) and enhanced human health and well-being (Chiesura, 2004). Table 1 demonstrates the benefit of urban trees and forest based on 5 categories.

Social benefits	**Recreational opportunities, improvement of home and work environments on physical and mental health. Cultural and historical values of green areas**
Aesthetic and architectural benefits	Landscape variation through different colours, textures, forms and densities of plants. Growth of trees, seasonal dynamics and experiencing nature. Defining open space, framing and screening views, landscaping buildings
Climatic and physical benefits	Cooling, wind control, impacts on urban climate through temperature and humidity control. Air pollution reduction, noise control, reduction of light glare and reflection, flood prevention and erosion control
Ecological benefits	Biotopes for flora and fauna in urban environment
Economic benefits	Products and markets (timber, berries, mushrooms etc.), increase property values, faster property re-sale retail turnover, tourism and employee productivity.

Table 1: Benefits and uses of urban forest and trees (Tyrväinen et al., 2005)

Urban trees and other woody plants are key components of this green space provision, but ironically many are considered to be in a poor state of health themselves, due to the difficult growing conditions encountered in the urban environment (Jim, 1998). Partially, this may due to infrastructure changes over the last 30 years, including

the development of new technologies that have required much alteration and construction within the urban matrix (Jim, 2003). These include the laying down of fibre optic cables for telecommunication purposes, the upgrading of water, sewage and power services, increased urbanisation through greater housing / building density including the construction of skyscrapers, and also the development for transportation services. Major changes in soil structure resulted in poor plant performance caused by poor root development. This may be due to the limited area that roots can spread into, poor aeration within the soil due to compaction, or unsuitable or poorly structured soil types that are not conducive to root development (e.g. stony, drought-prone soils) (Jim, 1998).

Apart from changes in the characteristics of urban soils, pollutants within the soil contribute to poor plant performance. Evaluations of heavy metal contamination in an urban park in Guangzhou, China demonstrated various metals were concentrated in both soil and plants; with the highest concentrations within plants being found in the leaves of trees whilst overall highest levels were correlated with soils in the immediate vicinity of roads (Guan and Peart, 2006). Heavy metals impact on human health by the elements being leached into groundwater and / or absorbed by plant roots, concentrated in the tissues and eventually consumed by humankind (Ajmone-Marsan and Biasioli, 2010). For example in the UK, there have been incidences of vegetables such as radish, lettuce, spinach and cabbage having high concentrations of lead (Thornton, 1991).

1.2 Importance of urban landscape plants

1.2.1 Microclimate modification

Urban areas have been reported to have higher temperatures than nearby rural areas (Streutker, 2002) due to the existence of buildings and other forms of hard surfaced infrastructure. The enlargement of urban centres, and the increased densification (more buildings for a given area) of towns and cities, combined with a warming climate will contribute to this Urban Heat Island (UHI) effect in future. Urban heat island events are dangerous as they have implications for human thermal comfort, with certain sections of society (the elderly, babies and those with respiratory or heat related medical conditions) suffering increased risk of heat stroke and similar physiological problems (Yu and Hien, 2006). UHI phenomena partially exist due to a lack of natural vegetation types and water bodies within many urban areas. These provide a cooling influence and offset the heat built up from buildings, roads, cars, and industrial machinery (Dixon and Mote, 2003). Dense, built up areas cause building structures, concrete and asphalt to absorb heat during the day and release it back to the atmosphere during the night. However, increasing the proportion of urban areas that have trees and other forms of vegetation can help mitigate the urban heat island effect.

Higher densities of plants help to create a better microclimate by reducing the air temperature in summer (Dimoudi and Nikolopoulou, 2003). Systematic planting design for urban environment especially below the canopy area help create a comfortable ambient pedestrian zone (Ng et al., 2012). In addition, plants function by providing direct shading thus reducing ground surface temperatures (Dimoudi and Nikolopoulou, 2003). In addition plants evapotranspire, thus reducing temperature increments as energy is preferentially consumed in latent heat (converting liquid water to vapour). Research from Hillsboro, Portland indicates that evaporation of water from irrigated vegetation helps to improve hidden heat exchange resulting in decreasing levels of surrounded air temperatures (House-Peters and Chang, 2011).

In contrast to this ability to cool urban areas in summer, the microclimatic effects of plants can also help provide insulation, thus providing a localised warming effect in winter and reducing energy losses through e.g. wind breaks (Bolund and Hunhammar, 1999).

1.2.2 Improve air quality

Air pollution is among the major environmental issues and is a contributor to health problems in urban areas due to factors including transportation and heating of buildings (Bolund and Hunhammar, 1999). Many pieces of research have been done on proving how the existence of vegetation will help to reduce pollution. However, there are contradictory results in studies measuring nitrogen dioxide (NO2) and volatile organic compound (VOCs) in Helsinki where vegetation was found to have little influence on gaseous removal from the environment (Setälä et al., 2013).

Among the studies that support the role of vegetation in improving air quality, Nowak et al., (2006) stated that environmental air quality and human health can be improved by having trees in the cities. Leaf stomata absorb pollutant gases which diffuse into intercellular spaces and are absorbed or deactivated by the plants. In addition leaves can attract larger particles of dust and smuts (particulate pollution) and remove these from the atmosphere. Such particles are thought to contribute to asthma and bronchitis as well as other respiratory and cardio-vascular health problems. Trees with denser leaves are thought to be able to increase infiltration rates of pollutants and surface texture can play a role in attracting the particulate matter (Bolund and Hunhammar, 1999). In addition, infiltration capacity increases with the increasing surface size of the leaf, which can be summarized in diagram 1.

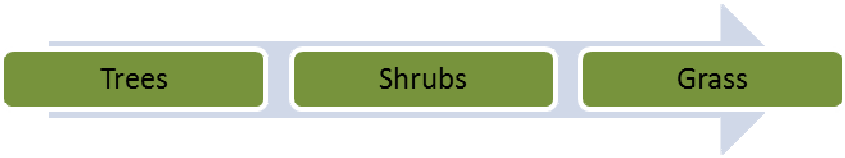

Diagram 1: Order of efficiency for pollutant infiltration. (Givoni, 1991)

On the other hand, bigger particles will be retained on the leaf surfaces rather than the atmosphere and will be washed off by the rain or dropped off to the soil when the leaves fall (Nowak, 2004).

1.2.3 Noise reduction

Noise pollution in urban environment can be reduced by vegetation. By acting as a barrier to the audio source of the noise such as traffic / major roadways etc, vegetation can deflect, absorb and break up sound waves. Noise is also perceived to be less in more green environments, suggesting a psychological benefit as well as physical benefit from the vegetation, and can aid in promoting the ambience of urban places (Bolund and Hunhammar, 1999). Fang and Ling (2003) suggested that noise reduction is greatest when high density shrub planting is employed.

1.2.4 Hydrology effects

Water flows in urban areas are disturbed by increasing built infrastructure and the loss of soil permeability (soil sealing) through extensive use of tarmac roads, concrete pavements etc. (Bolund and Hunhammar, 1999). Infrastructure development results in loss of vegetation, soil removal and natural ground cover being replaced by impermeable surfaces such as parking lots, roads and pathways. This results in poor infiltration of water into the soil, smaller water basins and increased surface runoff (Konrad, 2003). In contrast, higher densities of vegetation in urban areas reduce surface run off, lower the storm water management costs, as well as improve the quality of water (Dwyer et al., 1992). In agreement, Nowak and Dwyer (2007) indicate that rain precipitation can be slowed down through interception and retention by tree leaves and reducing the energy within individual rain drops (e.g. reducing soil erosion).

1.2.5 Habitat for biodiversity

Greater urbanization causes habitat and biodiversity loss and species extinction in urban ecosystems together with urban animal and plant composition being strongly influenced by human activities (Kowarik, 2011, Sukopp, 2004). The awareness of protecting the remaining natural habitat increasing as well as the importance of conserving the biodiversity. Urban vegetation can contain relatively high level of biodiversity, and this can be achieved by the increased number and variety of trees and other plant types found in urban areas (Alvey, 2006). Increasing vegetation creates habitat and attracts wildlife into urban areas, and enables them to complete their life cycle within the boundaries of towns and cities.

2. Conclusion

Healthy lifestyle as well as healthy environment become major concern among urban dwellers nowadays and by

preserving urban green space could help in achieving the desire environment condition. As mention above, cooler climate, reduction of flashflood and noise as well as fresher can be obtain by introducing more vegetation into urban area. This could be implemented without a doubt since plenty of research being done and proved how important plants to the environment.

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