

## EVALUATION OF ROOF GARDENS AS A RECREATION AREAS

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### Abstract

In recent years, roof garden practices have become widespread in all of the world. A roof garden is a contained green space on top of a man-made structure. Roof gardens provide a wide variety of public and private benefits such as reducing storm water run-off and energy consumption, reducing the urban heat island effect, and improve the air quality. Roof gardens are classified as extensive, semi-extensive, or intensive, depending on the depth of the growing medium and the amount of maintenance needed. Considering the wide use of roof gardens, it seems that in today's densely populated cities, one of the most important uses of this type of gardens is for recreational and calming use of citizens. Reducing the urban green spaces due to the high construction costs and the increase in the distance between green spaces and parks from residential areas so proper design of roof gardens can partly meet the citizens' need for green spaces. The good planning of roof can be used as a space for relaxation, fun, instruction or horticulture. The recent designed places can give mental peace to the individual and finally improve the comfort of residential circumference. In this paper, by examining the types of the roof gardens, the important design criteria of this kind gardens are mentioned. In addition, this research attempts to justify the creation of accessible and usable spaces for all types of age groups (children / elders / youth) by reviewing various sources and executive samples and the necessity of creating such spaces on the roof gardens and its benefits for the citizens has been investigated too. As results, generally landscape architect in according to age groups design spaces for kind of activities. Choosing the right activity that not only improves the physical and emotional needs of the users but also satisfies their recreational needs is very important. Due to the location of these types of gardens and their limited space, landscape designer needs more knowledges in designing spaces.

**Key words:** Roof garden, recreation areas, landscape design, landscape architect.

## REKREASYON ALANLARI OLARAK ÇATI BAHÇELERİNİN DEĞERLENDİRMESİ

### Özet

Son yıllarda, çatı bahçesi uygulamaları tüm dünyada popüler hale gelmektedir. Çatı bahçesi, yapay bir bina veya yapının çatısında bulunan yeşil bir alandır. Çatı bahçeleri, yağmur suyunun akması ve enerji tüketiminin azaltılması, kentsel ada ısısının etkisinin azaltılması ve hava kalitesinin iyileştirilmesi gibi çok çeşitli kamu ve özel faydalar sağlamaktadır. Çatı bahçeleri, yapıldığı alanın büyüklüğüne ve gereken bakım miktarına bağlı olarak, geniş, yarı geniş veya yoğun olarak sınıflandırılmaktadır. Çatı bahçelerinin geniş kullanım olanağı göz önüne alındığında, bu tür bahçelerin günümüzdeki kalabalık kentlerde, en önemli kullanımlarından biri, toplumun dinlenme ve sakinleştirici alanı olduğu görülmektedir. Yüksek inşaat maliyetleri nedeniyle kentsel açık yeşil alanların azaltılması ve mevcut yeşil park alanlarının yerleşim alanlarına olan mesafelerinin çoğalmasıyla böylece çatı bahçelerinin uygun şekilde tasarlanması, halkın yeşil alan ihtiyacını kısmen karşılayabilmektedir. İyi planlanmış olan çatı bahçesi dinlenme, eğlence, eğitim veya bahçecilik için kullanılabilir. Yeni tasarlanmış olan çatı bahçeleri bireyi zihinsel açıdan rahatlatıp ve sonuç olarak konut çevresinin huzurunu da artırabilmektedir. Bu çalışmada, çatı bahçelerinin tipleri incelenerek, bu tür bahçelerin önemli tasarım kriterleri açıklanmıştır. Ayrıca çalışmada, konuyla ilgili çeşitli kaynaklar ve yapılan örnekleri gözden geçirilerek her yaş grubu için (çocuklar / yaşlılar / gençler) erişilebilir ve kullanılabilir alanların yaratılması önerilmiştir. Topluma sağladığı faydaları açısından, çatı bahçeleri gibi alanların tasarım gerekliliği vurgulanmıştır. Sonuç olarak, yaş gruplarına göre uygun etkinlik alanları peyzaj mimarları tarafından tasarlanmalı. Doğru etkinliği tasarlamak sadece kullanıcıların fiziksel ve duygusal ihtiyaçlarını karşılamakta kalmayıp aynı zamanda eğlence ihtiyaçlarını da sağlayabilmektedir. Bu tür bahçelerin konum açıdan ve genelde sınırlı alanlarda olduklarından dolayı peyzaj mimarları mekân tasarım bigilerine daha çok ihtiyaç duymaktadırlar.

**Anahtar kelimeler:** Çatı bahçesi, rekreasyon alanları, peyzaj tasarımı, peyzaj mimarı

## INTRODUCTION

The concept of having green roofs is not a recent opinion to most mankind (Peck and Kuhn, 2003). Roof gardens have earned preliminary steps in Europe, Asia and Transatlantic countries in recent years (Beyhan and Erbas, 2013). Historically, the rooftop gardens have a long history (Ghosh and Giovanangeli, 2016). The roof gardens, which are the leader of modern green roofs, belong to the very generality. First documented roof gardens were the hanging gardens of Semiramis that it is one of the seven wonders of the past World.

Rooftop gardens give several environmental benefits. Their increased use in urban areas has been due their skill to reduce water runoff from the roof area. The first aim of the rooftop garden use is to drain the stormwater and decrease the stormwater runoff from reaching the subterranean stage (Barr, 2016; Castleton, et al., 2010).



Figure 1. Example of roof gardens (URL 1)

Also to the impact of decreasing the urban warmth island event, roof gardening has several positive effects in terms of environment. Because of the urban surfaces paved with the impermeable ingredients such as concrete and asphalt, the amount of rainwater straight flowed into the drainage system has enhanced to create flooding in the urbans. Roof gardening is effective in preventing the urban flooding by reducing the impermeable spaces, storing rainwater for a while and reducing rainwater outflow (URL 2).

The flora further effects groundwater by sucking all of the contaminants from the rainwater previous to runoff. Researches have showed that more than 95 percent of cadmium, copper, lead and a portion of zinc can be taken out of the rainwater, which forestalls their dispersion into groundwater. The flora also subscribes to clean weather by straining and binding powder particles as well as inherently straining fuzzy toxins (D'annunzio, 2010).

The psychological effects of roof gardens are certainly very positive and a huge benefit for the citizens of the city. Added vegetation would be seen by many to be making the roof more beautiful and a more pleasant environment to be in (Mang and Reed, 2013). In addition Rooftop garden has esthetical fascination, and gives the potency for healing and horticultural therapy, especially for hospitals, hotels, and schools. Access to and even views of green roofs can improve property worth, as well as growing employee fertility and ingenuity (Nowak, 2004). The articles on rooftop gardens show the therapeutic effects of rooftop gardens in places such as hospitals, where the garden is noted an opportunity to the healing of patients (Wilkinson,2016). Rooftop gardens supply feel with nature in places such as in mega cities. In addition, because of the decreased pollution equalities and the increase in water and air quality provided by rooftops, needs to health care and stress could be decreased. Less stress levels also means

happier and more productive employees, and therefore easier employee recruitment for companies (URL 3). In the Table 1 there are effects of green roof.



Figure 2. Roof garden as a nature (URL 4).

Table 1. Different Impacts of the Green Roof (Beyhan and Erbas, 2013).

Impacts on environment	<ul style="list-style-type: none"> <li>• Holding, hiding and percolation of the rainfall water</li> <li>• To fulfill as natural filters by holding many harmful materials in the shape of gas.</li> <li>• Plants help to the environmental degradation by creating O<sub>2</sub>.</li> <li>• To improve the relative humidity of the out environment and decrease the heat of the surrounding environment</li> <li>• Vegetation surface and being low of solar radiation reflection of the land have main impacts on heat rise.</li> <li>• Vegetation surface and low rate of sound reflection help to reduce environmental noise</li> <li>• Vegetation surface helps to environment by absorbing dust particles in the air</li> <li>• To creat a new living environment for flora and funa and allow to maintain the natural level.</li> </ul>
Impacts on building	<ul style="list-style-type: none"> <li>• Vegetation surface and soil creat sound insulation.</li> <li>• To decrease thermal expansion and warmth gap in build.</li> <li>• To remain the water isolation on UV radiation and other factors.</li> <li>• To remain water insulation and other sheet against mechanical impacts.</li> <li>• Heat losses depending on the wind can be decreased by 50% by vegetation surface of roof garden.</li> <li>• To improve life of the roof by protecting the ingredients of the roof.</li> <li>• Green ingredients of the roof gardens can be performed with solar panels.</li> <li>• To let the access of roofs.</li> <li>• To have an impact on declin the electromagnetic sparkle.</li> <li>• To supply capacitance to fire.</li> <li>• Vegetation surface and soil preserve the buils shape solar radiation, prohibit increasing of heat, recover the energy spent to hold the building fresh and take the building cooler.</li> </ul>
The Social – Psychological – Aesthetic Satisfaction of the occupant	<ul style="list-style-type: none"> <li>• To supply aesthetic and optical satisfaction by make recreational places that users can take advantages</li> <li>• To let social and cultural actions.</li> </ul>

The purpose of supply roof garden is to limber up the environment at crowded residential complex, especially in mega cities. Without grren places, the environmental healing will progressively break down. As a result, individual in mega cities recently become more informed of the green space.

Considering the wide use of roof gardens, it seems that in today's densely populated cities, one of the most important uses of this type of gardens is for recreational and calming use of citizens. Reducing the

urban green spaces due to the high construction costs and the increase in the distance between green spaces and parks from residential areas so proper design of roof gardens can partly meet the citizens' need for green spaces. The good planning of roof can be used as a space for relaxation, fun, instruction or horticulture. The recent designed places can give mental peace to the individual and finally improve the comfort of residential circumference.

## METHODOLOGY

In this paper, by examining the types of the roof gardens, the important design criteria of this kind gardens are mentioned. In addition, this research attempts to justify the creation of accessible and usable spaces for all types of age groups (children / elders / youth) by reviewing various sources and executive samples and the necessity of creating such spaces on the roof gardens and its benefits for the citizens has been investigated too.

### Green Roof Types

There are three main types of green roofs:

#### Extensive roof gardens

Extensive roofs, that are comparatively inexpensive to establish and are used largely for environmental advantages, and intensive roofs that let a large variety and dimensions of vegetations such as shrubs and small trees but which are usually more costly to establish and protect, partially due to the demand for irrigation. Trading and public structures incline to use extensive roofs unless the roofs are intended mainly as busy garden sweetness space. Extensive roofs have a slim soil sheet and character succulent plants such as sedums which can keep alive in hard positions. Extensive roofs need minor care once they are founded, and are usually cost-effective, especially in structures with long lasting (GSA, 2011). So the vegetable chosen, extensive greening can be exceptionally low care, with no extra irrigation needed, and the vegetation population can be self-propagating. Maintenance is decreased to twice a year, to lift any grass trees which may have seeded in. Ordinarily these kind of roofs are not reachable other than by maintenance staff. Generally, this kind is the least expensive to establish and maintain. Due to weight it can be the least demanding on the roof infrastructure. Extensive greening is the well way for roofs where availability may be closed, and in most instance are intended to be connived (Van Lennep and Finn, 2008).



Figure 3. ICU Rooftop Garden. Example of extensive roof garden (URL 5).

### Intensive roof gardens

Intensive roofs have a thicker soil sheet and should be designed as a landscape with kind of plants considered in parks and gardens normally. These plants may need to irrigation indry times. Due to their thicker soil, intensive roofs want greater constructional backing than extensive ones. Though, intensive roofs also have larger capacity for ecological impact and amenity use than extensive roofs (GSA, 2011). Elements like seat, pergolas and pagodas can be designed and hard surface in the shape of ways, can be considered. The heaviness involved with an intensive green roof are remarkable and the load bearing valency of individual roofs will bid whether or not they can protect such an assembling. In most instance, a intention to combine an intensive green roof is built at the planning and design phaze. This type of roof needs ordered care and so good availability must be considered evrey times. This would be the expensive roof garden choice both in terms of built and care (Van Lennep & Finn, 2008).



Figure 4. intensive roof garden– Linz, Austria (URL 6).

### Semi-intensive roof gardens

Semi-intensive green roofs – factors of both extensive and intensive systems, Semi-intensive roofs, compositions of both extensive and intensive green roofs, are ordinary accepted to harness both the environmental advantages of a roof garden, as well as a diverse garden within a manageable maintenance budget (URL 7). The sowing on this kind of green roof is limited to smaller bushes, perennials and grasses. The substratum sheet would not be thick enough to keeps trees, but this does make it a lighter weight greening method and so feasible to more conditions. There are no construction enforced on this kind of green roof, and so reducing the extra load (Van Lennep and Finn, 2008).

### The growing need for recreational roof garden

Fast urbanization made different environmental issues ranging from the regional to the universal scale including increased atmospheric and aquatic dirt and decreased water provision, climate change and increased energy needs, inadequate housing and sanitation amenities and traffic blockage, and a main reduction in natural plant output and carbon preservation /sequestration (Cui and Shi, 2012).

With the increase in the urbanization ratio, balance between environmental quality and human health is changing continually. Because of that, finding more natural places in urban areas can be difficult and is the common trouble for the entire world's urban regions nowadays (Pouya et al., 2016). Moreover, the solutions of these problems, made by the urban life conditions, are in the urban setting. These conditions might be improved by reasonable planning and administration. Due to the lack of enough unoccupied lands by buildings and also increase of building construction, roof green technology has recently become the most effective way for implementing greening in the cities (Pouya, 2017). In addition it is main not to overlook the optical effect of a roof garden. Very individual like to view some greenery in their casual life, and it's usually lacking in urbans. Green roofs are a strong appliance for beautification, and they can help set the sound for a circumference (URL 8).



Figure 5. Example of roof garden in the private home (URL 9).

Desired roof garden may be a solution to the problems mentioned above. Roof gardens can offer open space functions and values to high-rise buildings. Gardens with a proper design can be an environment for many user activities that are discouraged due to lack of suitable and close green spaces.

A landscape designer in the design process specially the analysis the site step must obtain information about the type of the building and their users and their needs by conducting observations/questionnaires and interviews. For example, if a the building is an office building, it is often used by its officials in an age group with similar demands. But if the building is a hospital, user groups include hospital staff/patients or patients' companions.

After analysis of site, in creat a fuctional diyagram, Landscape Architect in according to age groups design spaces for kind of activities. Choosing the right activity that not only improves the physical and emotional needs of the users but also satisfies their recreational needs is very important. Due to the location of these types of gardens and their limited space, landscape designer needs more knowledges in designing spaces. Below are some important activities that are needed by most people, as well as important design points that a designer should pay attention to.

Accessibility is one of the most important issues in design of roof gardens. Landscape designer in the garden design must pay attention to the fact that all users can equally get the roof garden. If there are people with disabilities or the elderly who use wheelchair among the living, the landscape architecture should pay attention to designing access roads.

### **Activities In Roof Garden**

#### **Horticulture and gardening**

One of the activities that can be done on the roof garden is a place for horticulture. The horticulture activities can be adapted for preschool children, elderly adults, and intergenerational groups. The goals for these activities included participation, self-motivation, and fun.

The children's activities were designed for freedom to explore and learn and to ensure completion of the activity. The elderly adult activities were designed for flexibility to adapt to the different ability levels of the participants. The intergenerational activities were designed for group interaction. While these activities produced variable results for the children's group, the elderly adult group, or the intergenerational group, they were all successful (Wright and Wadsworth, 2014).

Rooftop gardens, as a specific urban agriculture niche set within a broader system of city gardens, enjoy their own set of distinctive benefits. There are essentially three options for rooftop gardens. The first is container gardening, a less formal, cheaper form of roof gardening. In container gardening, few to no modifications are made to the existing roof structure; containers – anything from plastic swimming pools to recycled-wood planters – are placed on a rooftop and filled with soil and plants. The second type of roof garden, in which the rooftop actually becomes the planting medium, involves more intensive

investments, but comes with its own set of advantages, 8 including greater storm-water retention, building insulation, and the formation of patchwork urban “stepping stone” ecosystems, which work to reverse the fragmentation of ecosystems that follows urbanization by offering temporary habitats to fauna such as birds and butterflies during their long migrations. The third rooftop garden possibility is rooftop hydroponics, in which plants are grown in a soilless medium and fed a special nutrient solution. Rooftop hydroponics can be the lightest of the three options and may offer the possibility for faster plant growth and increased productivity (Nowak, 2004).



Figure 6. Horticulture and gardening in roof garden (URL 10 & 11)

### Social activity

Green roofs are usually created as a meeting point to foster a sense of community among the people and the surrounding environment. This sense will bring relaxation and joy to them. As stated by Korpela, engagement with the natural environment includes pleasurable feelings, joy, relaxation, comfort, and calmness (Bintishukri and Misni, 2017).

Roof gardens, if properly designed, can be an environment for increasing social relationships. Residents of the apartment meet in the roof garden or work together to carry out activities such as gardening or sport. The landscape designer has an impressive influence on the social relationships of the residents by creating spaces suitable for group sitting or drinking tea and coffee.



Figure 7. The Crossrail Place Roof Garden (URL 12)

### **Physical activity and movement**

Physical inactivity is identified as the fourth leading risk factor for global mortality. Physical inactivity is becoming increasingly common in many countries with major implications for the prevalence of noncommunicable diseases and the general health of the population worldwide (WHO, 2016). Several environmental factors are recognized as contributing to physical inactivity in 6 cities, such as high traffic volumes and lack of parks and footpaths. Hartig et al. (2014) found some evidence for an association between green space and levels of physical activity, suggesting that the relationship may vary considerably between population subgroups; they underline how walking for recreation may be supported by green environments in a different way than walking as a means of transport (WHO, 2016).

Physical activity has been shown to improve cardiovascular health, mental health, neurocognitive development, and general well-being and to prevent obesity, cancer, and osteoporosis. Providing attractive roof garden may encourage people to spend more time outdoors and facilitate physical activity. In particular, many older people find it very difficult to maintain moderate levels of physical activity; therefore, providing green spaces that encourage older people to be active, even if it is only at a light level, is important for public health (WHO, 2016).

Landscape designer can design suitable sports grounds with respect to the age groups of residents. Environments in which they have been fitted with fitness equipment or places for walking and running and swimming.

### **Playground for children**

Play is essential to development because it contributes to the cognitive, physical, social, and emotional well-being of children and youth. Play also offers an ideal opportunity for parents to engage fully with their children. Despite the benefits derived from play for both children and parents, time for free play has been markedly reduced for some children (Ginsburg, 2007). With the increase in population and the density of building, playgrounds have become less accessible. On the other hand, with the advent of technology and the construction of new home entertainment, most children have spent their free time at home behind the TV or computer games.

Well-designed roof gardens, if large enough, may provide unique spaces for playing. Successful play spaces offer movement and physical activity with space and features that allow a range of energetic and strength building play experiences, maybe providing access to music and sound, and different smells made by plants and leaves, allowing children to choose whether and when to play alone or with others, to negotiate, cooperate, compete and resolve conflicts and use tools, have access to bits and pieces of all kinds and activities that test the limits of their capabilities, including rough and tumble, sports and games, and opportunities to climb (Shackell et al., 2008).

### **Views and sightseeing**

Landscape designer should consider view of the surrounding buildings in the roof garden design. If view of the roof garden be a beautiful and spectacular or the scenic beauty of the city, he/she can create a sense of comfort and healing with a suitable design for user and conversely, if the side view of the garden be ugly and unpleasant or a part of the garden is facing the window of the surrounding buildings that it cause a sense of insecurity and loss of privacy in users, so the landscape designer can solve this problem using a special planting design.

## **RESULT AND DISCUSSION**

Considering the wide use of roof gardens, it seems that in today's densely populated cities, one of the most important uses of this type of gardens is for recreational and calmig use of citizens. Reducing the urban green spaces due to the high construction costs and the increase in the distance between green spaces and parks from residential areas so proper design of gardens can partly meet the citizens' need for green spaces. The well designed roof can be used as a place for rest, recreation, education or



gardening. The newly created spaces can give spiritual comfort to the people and ultimately enhance the comfort of residential environment.

Desired roof garden may be a solution to the problems mentioned above. Roof gardens can offer open space functions and values to high-rise buildings. Gardens with a proper design can be an environment for many user activities that are discouraged due to lack of suitable and close green spaces. A landscape designer in the design process specially the analysis the site step must obtain information about the type of the building and their users and their needs by conducting observations/questionnaires and interviews. For example, if a the building is an office building, it is often used by its officials in an age group with similar demands. But if the building is a hospital, user groups include hospital staff/ patients or patients' companions.

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Accessibility is one of the most important issues in design of roof gardens. Landscape designer in the garden design must pay attention to the fact that all users can equally get the roof garden. One of the activities that can be done on the roof garden is a place for horticulture. The horticulture activities can be adapted for preschool children, elderly adults, and intergenerational groups. The goals for these activities included participation, self-motivation, and fun. Roof gardens, if properly designed, can be an environment for increasing social relationships. Residents of the apartment meet in the roof garden or work together to carry out activities such as gardening or sport. The landscape designer has an impressive influence on the social relationships of the residents by creating spaces suitable for group sitting or drinking tea and coffee. Landscape designer can design suitable sports grounds with respect to the age groups of residents. Environments in which they have been fitted with fitness equipment or places for walking and running and swimming. Well-designed roof gardens, if large enough, may provide unique spaces for playing.

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