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Pollination Gardens in Urban Scale

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Abstract **–** The existence of healthy, natural ecosystems and the continuation of the basic services in the ecosystem are essential for the protection of consumable resources. Pollination is one of these basic services. The effective pollination of plants is a key action for the ecosystem, human health and agriculture. Because more than 80 percent of plants grown for consumption and / or medicinal use require pollinators for reproduction and fruiting. Most of the world's food resources are shaped by pollination. However, global climate change, unplanned growth of cities and invasion of natural areas by non-indigenous species adversely affect pollination. Unsustainable landscape design decisions threaten both the plants to be pollinated and the insects that pollinate them. In order to contribute to the sustainability of urban and natural ecosystems within the city, pollination gardens are one of the most applied designs in recent days. Pollination gardens are especially trying to balance the inner and surrounding areas by increasing the pollination potential of the urban areas and contribute to the urban biodiversity by increasing the diversity of plants and animals. In this study, the criteria that pollination gardens designed in the city should have and the plant species that can be used in pollination gardens are mentioned.

Keywords *–Sustainable design, pollinator gardens, useful plants, urban ecology*

I. INTRODUCTION

The globalization effect of modern life has started to show as ordinaryization and identitylessness in living spaces. With the increasing population, the rate of people consuming and destroying natural resources has begun to exceed the rate of self-renewal of nature [1]. The inability of natural resources to raise itself has raised many interrelated problems. Effects of problems; In recent years, it has been felt more violent and threatened the continuity of the existing systems in the world. By eliminating these negativities, holistic concepts deemed necessary for the continuity of all living things on the world have come up [2]. The concept of sustainability comes first. Sustainability is a multi-disciplinary concept that is defined as taking measures to meet the needs of future generations and to ensure the continuity of resource values without deteriorating the carrying capacity.

Urban areas cover 80% of carbon emissions, 60% of water use and 80% of wood use, although they cover a small part of the world surface area [3]. As it can be understood from these ratios, cities that make up some ecological, economic, social, cultural and administrative systems should be handled holistically within the concept of sustainability. For sustainability, the existence of healthy, natural ecosystems and the protection of consumable resources are essential. For this, continuity of basic services in the ecosystem is mandatory. Pollination is one of these basic services. The effective pollination of plants is a key action for the ecosystem, human health and agriculture. Because more than 80 percent of plants grown for consumption and / or medicinal use require pollinators for reproduction and fruiting. Animals are the most important pollinators for plants. Animals help many plants to grow and produce by means of many actions necessary for their life such as pollination, seed distribution, food intake, accommodation, grazing, hunting and reproduction. It is very difficult for a garden to cycle ecologically without animals. The right number of animals is needed in the right place in the garden.

Most of the world's food resources are shaped by pollination. However, global climate change, unplanned growth of cities and invasion of natural areas by non-indigenous species adversely affect pollination. Unsustainable landscape design decisions threaten both the plants to be pollinated and the insects that pollinate them. In order to contribute to the sustainability of urban and natural ecosystems within the city, pollination gardens are one of the most applied designs in recent days. Pollination gardens are gardens designed according to special criteria that attract various insects, birds and other living beings that allow the transfer of pollen from the flowers of the plant to the flowers of the other plant [4].

Pollen gardens can meet many requirements for the city. While I meet the need of recreation of the city user and also know the city's aesthetic value of pollen gardens also contribute to the diversity of plants in the city. The environment created by the plants allows many living things to live. This increases the biodiversity in the city (Figure 1). However, according to the density of plants, microclimates in the city are reduced to some extent.

Figure 1. Pollen garden sample [5]

Pollination gardens are especially trying to balance the inner and surrounding areas by increasing the pollination potential of the urban areas and also contribute to the urban biodiversity by increasing the diversity of plants and animals. In this study, the criteria of pollination gardens designed in the city and the types of plants that can be used in pollination gardens are mentioned.

II. Materials and Method

In this study, bee orchards in the literature were examined. Particularly with regard to residential gardens, it was questioned which kind of plants can be used in pollen garden (Figure 1). Within the scope of the study, many publications were examined and plant lists were created by using these publications [6,7,8].

Figure 2. Pollen garden sample [9]

III. Results

As a result of the examinations made, it was seen that the plants needed to attract the useful animals to the garden were considered as accommodation and providing nutrients. There are design criteria for pollen garden. The location of the pollen garden should be chosen according to certain characteristics in terms of ecological conditions. Gardens should be shaped according to the life demands of pollinators. According to the targeted species, the gardens should be kept away from the wind corridors while the pollen gardens should be in sunny areas. In addition, pollinators must be in the garden to meet their basic life needs such as water, food, shelter and rest. For this, the plants where animals can accommodate and find nutrients must be in the area .

When the applied samples were examined, it was found that the host plants for useful insects were as shown in Table 1 [8].

Table 1. Landscape value of the completely surrounded garden with

Name	**Flowering Period**	**Name**	**Flowering Period**
Alyssum saxatilis	Spring	*Melissa officinalis*	Summer
Ajuga reptans	Spring, Summer	*Tagetes tenuifolia*	Summer-Autumn
Trifolium spp.	Spring, Summer	*Petroselinum crispum*	Summer
Thymus serpyllum	Summer	*Sedum spurium*	Summer-Autumn
Taraxacum officinale	Summer, Autumn	*Achillea millefolium*	Summer-Autumn
Lavandula officinalis	Summer	*Rudbeckia fulgida*	Summer-Autumn
Foeniculum vulgare	Summer	*Carum carvi*	Summer

When the applied samples were examined, it was seen that the plants useful for birds were as shown in Table 2 [7].

Table 2. Plants useful for birds

Name	**Benefit**	**Name**	**Benefit**
Morus spp	Fruit	*Salix spp.*	Shelter
Diospyros spp.	Fruit	*Rhus typhina*	Fruit
Pinus spp.	Shelter	*Prunus avinum*	Fruit
Rosa spp.	Fruit	*Prunus domestica*	Fruit
Eleagnus angustifolia	Fruit, Shelter	*Picea spp.*	Shelter
Platanus	Shelter	*Laurocerasus officinalis*	Fruit, Shelter
Liriodendron tulipfera	Fruit	*Populus*	Shelter

When the applications are examined, the plants that increase the aesthetic value of the city and which can be used in the pollen garden and the flowering period and flowering color of these plants are given in Table 3.

Table 3. Plants with high aesthetic value

Name	Flower Color	Bloom Period
Achillea crithmifolia		Late
Penstemon cobaea		Early
Echinacea angustifolia		Mid.
Liatris spicata		Mid. Late
Salvia officinalis		Late
Helianthus annuus		Late
Prunus angustifolia		Early
Gilia capitata		Early Mid.
Berberis aquifolium		Early
Cercis siliquastrum		Early
Coreopsis lanceolata		Early
Baptisia tinctoria		Early
Pycnanthemum spp.		Mid.
Buddleja davidii		Mid. Late
Viburnum opulus		Early
Tilia tomentosa		Early Mid.
Crataegus monogyna		Early
Rosa virginiana		Mid
Rudbeckia laciniata		Mid. Late

Lavandula officinalis		Early Mid.
Rubus spp.		Early

IV. CONCLUSION

Well-designed planting areas are required to ensure that the pollination required for sustainability can be easily applied in residential gardens. These areas should have a balanced landscape. Plants that attract beneficial animals to the garden, but keep harmful animals away from the garden, must be in the garden. In addition, as a result of examinations, it is seen that the diversity of vegetative diversity increases the number of pollinators and ensures the continuity of pollinators. It is essential for the diversity of plants to meet their needs for the withdrawal of useful animals into the garden.

Birds and insects living in the region should be the criterion for plant selection according to the location of the housing area. The large number of roosting birds in the region indicates that these birds can distribute the seeds. It is necessary to use more seed plants in these areas. Considering that residential areas are low in m2, the use of shrubs is a very appropriate design strategy. Trees provide nutrients to birds and insects as well as protection and shelter. According to the researches, there are certain conditions for the ideal living environment for beneficial animals. These are food, water, shelter and protection. For this purpose, an ideal pollen garden is expected to meet these needs. When we consider these needs as planting design, plant diversity is expected to be in the form of trees, shrubs, shrubs and ground cover.

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