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Chapter 10

Integrating Ecosytem Landscapes in Cityscape: Birds and Butterflies

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Additional information is available at the end of the chapter

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1. Introduction

Today, with the rapid growth of cities, sustainable landscape planning and design are a serious concern, because within the urban context, green areas such as parks, gardens, green belts, and road reserves enable positive human interaction with nature, help maintain natural resources, and form environments that bring in wildlife, including, in particular, birds and butterflies [1]. Such eco-friendly urban gardens increase people's appreciation of nature, which can be a source of pleasure, and also make it possible for the behavior and ecology of these species of wildlife to be studied [2].

In urban environments which are not ecologically designed, the practices of mowing lawns, clipping shrubs and raking up organic material from borders, as well as the widespread use of deadheaded flowers, eliminate food sources, nesting grounds and places of shelter for wildlife. Typically, gardens designed with open populations of birds and butterflies in mind are found in urban and suburban areas, and those with closed populations are found in parks and in public or private lots [3]. These gardens help to create and maintain communities which are essentially urban ecosystems where human beings interact with nature.

Gardens in urban ecosystems may have co-existing bird and butterfly species, although the kinds of vegetation and habitats that various species require, as well as their life cycles, may differ [4]. Australian researchers have noted relationships between endemic vegetation and the presence of endemic bird species (French et al., 2005; Daniels and Kirkpatrick, 2006), and Burghardt et.al. (2009) found larger populations of endemic birds and butterflies in areas designed with endemic landscaping [5].

Birds and butterflies have simple needs: consistent food and water sources, safety, and shelter. It is therefore critical that urban gardens designed to attract them should have

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appropriate vegetation, water features, feeding areas, and also areas where they can take cover from predators and thrive in safety and security.

1.1. Benefits of bird and butterfly gardening

The primary benefits of designing bird and butterfly gardens as part of urban ecosystems are, for the wildlife, flower pollination, food sharing, and environmental conservation, as well as public education. Additional benefits for people include pest and weed control, the stress relief provided by the natural environment, and financial gain as a result of the increasing value of eco-friendly property.

2. Issues in urban ecosytem landscape design

2.1. Bird gardens

Site Selection

Bird gardens are easy to create, since birds' requirements are flexible; however, they should be open to sunlight as well as have ample areas of shade; and vegetation that affords shelter should be available.

2.1.1. Criterias for structural design in bird gardens

Paths

Rigid, linear paths are less attractive to wildlife than natural, organic paths, and animals are attracted to unexpected twists and turns, where they can explore new areas. Organically curved and narrow pathways in a garden make it easy for birds to visit a wide range of shrubs and flowers.

Slopes

Certain kinds of birds forage for food on the ground, and they are attracted to uneven slopes, such as one finds in low, rocky hills where there are fallen trees and underbrush. This environment can be provided for them in the form of rock walls or rock gardens with vegetation covering them.

Water

Liquid water is an essential requirement for birds in the winter months, when natural sources are frozen, and also during the summer, when they use it to cool down [6]. Sources may include bird baths, misters, ponds, waterfalls or streams; but flowing water is safer than the static pool of a traditional bird bath, from where diseases may be spread [7]. Interestingly, birds such as robins, flickers, and hummingbirds are highly attuned to the sound of flowing water, and may hear it even if the source is very small. Robins are particularly attracted to the steady spray from lawn sprinklers [8]. Some plants, such as *Hosta spp. and Cornus spp.*, have concave leaf surfaces where water accumulates, and these are used as baths by small birds, including warblers and hummingbirds.

Bird baths

Bird baths are made of various substances, including concrete, metal, ceramic and plastic, and come in various sizes and shapes. A bird bath should be set up at least 4.5m away from the feeding station, and near plants or shrubs that afford shelter, since birds do not fly efficiently immediately after bathing. It should also be surrounded by a clearing about three meters in diameter, so that while they are drinking, the birds will have time to escape from approaching predators. Several birds can use a bird bath at the same time if it is at least 60cm in diameter; however, the depth of the water in it should not exceed 5cm. The ideal depth of bath is sloping from 1.25cm – 2.5cm at the edges, down to between 6cm and 7.5cm in the middle [9].

Safety and shelter

Appropriate plants need to be planted in urban gardens, because birds use them as a means of escape or to seek cover from predators, to perch and rest on, to nest in during the summer, and to shelter in during the winter months. In the winter, when the leaves have fallen from other trees, evergreens such as *Magnolia spp., Ilex spp.,* and *Rhododenron spp.,* and conifers such as the *juniper* tree provide essential shelter. Landscaping features frequented by birds seeking shelter include shade arbors, pergolas, arches, and trellises.

Food

Sources of nutrition must be made available throughout the year; birds are more likely to visit gardens where supplementary food sources are available, especially during the winter [11]. The saps, buds, and seeds of some plants are also used as food sources [10]. Food sources and the times they are sought vary depending on the species: chickadees and nuthatches, for example, tend to eat during daylight hours; some birds eat berries and other fruits from trees and shrubs; others, such as woodpeckers and many songbirds, hunt for insect eggs and larvae in tree trunks and branches [12]. In the case of hummingbirds, there ought to be several feeders available, each at least 180cm away from the others; this is because these territorial birds do not share food unless there is competition between large numbers of them, and having several feeders will prevent one hummingbird from dominating the entire garden [13].

Bird garden equipments

Bird houses

Bird houses are shelters, usually made of wood or more durable composite materials, that can be set up for birds to nest and roost in. They are quite simple, consisting of four sides, a base or bottom, and an overhanging sloping roof (this should be watertight to prevent rainwater entering); the birds go in and out either through a hole or the front side (if this is left open) under the roof [14]. Bird houses should be fixed to trees, walls or fences, at a height of about 2-5m, and well insulated to provide shelter; if they are wooden, the walls should be at least 1.5cm thick. Holes may be drilled in the bottom to drain out any water that may get in, and these same holes will also provide ventilation. Bird houses should not

be set up in direct sunlight [15]; they should face northeast-southeast, affording protection from the sun and wet winds [16].

Bird feeders

Providing food to garden birds at feeding stations with bird feeders can increase urban bird populations in the landscape as a whole [17]. The water in the feeders needs to be changed at least once a week in hot weather, and the feeders need to be washed regularly with soap and hot water [18].

Dead trees (snags)

Birds tend to defend their territories by finding perches, such as dead trees, and using them as singing posts. For this reason, dead trees are particularly useful as supports for bird houses [6].

2.1.2. Criterias for planting design in bird gardens

The most useful way to plan a bird garden is to start by finding out which bird species already exist in the area, and which are to be attracted to the birdscape. Each species adapts to different parts of the habitat, depending on its needs, so native vegetation will provide the best types and ranges of food and shelter that the birds need at different times of the year.

For the same reasons, diversity in the vegetation will attract a broader range of bird species: some will be ground foragers, and others bush and shrub feeders; some may prefer nesting at lower levels, and others higher up. The habits of a single species may include using different types and layers of vegetation for feeding, roosting and nesting, and these habits also need to be taken into account.

The landscaping should include trees which afford protection from winds, especially during the winter months – for example, rows of evergreens or a mixture of evergreens and deciduous trees (a 50:50 mix would be ideal); and if the typical winds are northwesterly, the trees should line the north and west sides of the garden. These tall trees will also have the added advantage of attracting birds and providing a high perch for them from which they can look out for any possible danger before descending into the garden [19].

In addition, the landscaping should provide a variety of levels of vegetation to be used as food sources and nesting sites, This can be done by layering in smaller trees and shrubs, such as *Malus* trees, *Rosa, Amelanchier spp.,* and deciduous *İlex spp*., planted in front of the windbreaks created by the taller trees. Perennials and annuals, whose seeds and nectar are an excellent food source, can form yet another layer in front [12]; birds are drawn to the bright colors of wild flowers and fruit, in particular when they are migrating, and *Salvia coccinea,* Penstemon spp., and *Campsis radicans* will attract a wide range of species [20].

Another essential part of a good birdscape is grasses, which are resilient, tolerate extremes of heat and dryness as well as the winter cold, and are easily sustainable. Song and game birds that feed at low levels use the grass seeds as a food source, and the blades of grass to

build nests; dried grasses during the winter also enable them to hide from predators. For successful urban ecosystems to flourish, then, this type of landscape should be increased at the expense of mowed lawn and turf areas, which are unproductive habitats and tend to attract less desirable species, such as *Columba livia,* the Sturnidae family, the *Molothrus* genus and Quiscalus quiscula [20]. These turf areas provide little in the way of nutrition or habitable environment, and may also be maintained by fertilizers and pesticides which have a detrimental effect on birds, as well as on other wildlife [7].

There are two main categories of vegetation that are appropriate for bird gardens: nectar plants and fruit plants.

Nectar plants

As for this category of plants, it is essential to have diversity, as each species of bird feeds on different food at different times of the year; at the same time, there should be a sufficient quantity of plant species that produce visible masses of fruit, so these can be recognized by the birds (Table 1). However, this diversity should not extend to exotic trees and shrubs, which can invade and take over endemic habitats.

Fruit plants

In their natural habitats, birds have a wide variety of fruits to choose from during the year, as different fruits ripen in each season; among the most appealing are: *Prunus, Sorbus, Ilex, Amalanchier, Cornus* and *Juniper*. Vines are also a good food source; and they provide nesting sites and shelter for birds (Table 1).

Many bird species are attracted to the fruit of *Cornus* and *Juniper*; for example, *Cornus florida* draws bluebirds, robins, thrushes, and 30 other species. The dogwood tree is colorful in spring, has beautiful leaves in the autumn, and then produces bright red fruit. Junipers, many of which have attractive red bark, can be incorporated practically anywhere in an eco-friendly garden; *Juniperus virginiana* attracts some 54 bird species, and can tolerate a wide range of environmental conditions (only the female plant bears fruit, but both male and female plants are required for fruit to be produced) [8].

Botanical Name	**Birds Attracted**	**Plant Appeal**
Trees		
Acer spp.	Cardinalidae family, Carduelis pinus, Passerina caerulea, Parulidae family, Pheucticus melanocephalus, Pheucticus ludovicianus, Poecile carolinensis, Sitta europaea, Troglodytes troglodytes and many others	Seeds, nesting
Amelanchier spp.	40+ species, including genus Ailuroedus, Cardinalidae family, genus Carduelis, Erithacus rubecula	Fruits
Betula nigra	35 + species, including songbirds, genus Bombycilla, Fringilla coelebs, Garrulus glandarius, genus Junco, Poecile carolinensis	Seeds; flower buds; insects on foliage

Botanical Name	Birds Attracted	Plant Appeal
Carpinus spp.	Songbirds, especially Cardinalidae family, Carduelis carduelis, Passerina caerulea, Pheucticus melanocephalus, Pheucticus ludovicianus	Nutlets; shelter
Celtis occidentalis	48 + species, including Erithacus rubecula, Picidae family and Toxostoma rufum	Fruits ripen in late summer, nesting; shelter
Malus spp.	29+ species, including songbirds, Erithacus rubecula and Picidae family	Fruit; nesting site
Morus spp.	40+ species.	Fruit ripens July-August; nesting site
Picea spp.	25+ species, including genus Loxia, Sitta europaea, Poecile carolinensis	Cones; shelter; nesting site
Pinus spp.	Carduelis spinus, Fringilla coelebs, Garrulus glandarius, Loxia curvirostra, Picidae family and Sitta europaea	Cones on trees 10+ years old; shelter; nesting site
Prunus spp.	84+ species, including genus Bombycilla, Passerina caerulea, Pheucticus melanocephalus, Pheucticus ludovicianus, Pheucticus ludovicianus, Picidae family	Fruit
Quercus spp.	60+ species, including Cyanocitta cristata, Picidae family, Sitta europaea, Toxostoma rufum	Acorns; insects; shelter; nesting site
Sorbus spp.	20 + species, including genus Bombycilla, Erithacus rubecula, Icteridae family, Picidae family and genus Sialia, Turdus migratorius	Fruit ripens in late August- September
Taxodium distichum	Anatidae family	Seeds; shelter
Taxus cuspidata	Genus Bombycilla, Cardinalidae family, Turdidae family and many others	Cones; shelter; nesting site
Thuja plicata	Cardinalidae family, Erithacus rubecula, Passeridae family, Passerina caerulea, Pheucticus melanocephalus, Pheucticus ludovicianus and Poecile carolinensis	Cones; shelter; nesting site
Shrubs		
Berberis ssp.	Many species	Berries ripen in fall; shelter
Cornus spp.	93+ species, including Empidonax minimus, Picidae family	Fruits ripen in late summer.
Cotoneaster spp.	Genus Ailuroedus, Cardinalidae family, Erithacus rubecula, Fringillidae family, Garrulus glandarius, Turdus migratorius and many others	Fruit; shelter
Crataegus spp.	Bombycilla cedrorum, Cardinalidae family	Fruits; insects on foliage; nesting site
Ilex decidua	49+ species including genus Ailuroedus, genus Bombycilla and Erithacus rubecula	Fruit matures in autumn and persists through winter; nesting site

Botanical Name	Birds Attracted	Plant Appeal
Juniperus species	Bombycilla cedrorum, Coccothraustes vespertinus, Erithacus rubecula, genus Junco, Melospiza melodia, Toxostoma rufum, Turdus migratorius, Spizella passerina	Fruit; shelter; nesting site
Rhus typhina	98+ species, including genus Colaptes, Erithacus rubecula, Passeridae family, Picidae family, genus Pipilo and Thraupidae family	Fruit ripens in August – September and persists into spring; shelter
Ribes spp.	98+ species, including Erithacus rubecula, Passeridae family, genus Pipilo and Thraupidae family	Fruits ripen in June-July on female plants
Rosa spp.	42+ species, including genus Bombycilla, Passerina caerulea, Pheucticus melanocephalus, Pheucticus ludovicianus and Poecile carolinensis	Fruit ripens in August, often persisting into winter, nesting site
Rubus allegheniensis	149+, including genus Ailuroedus, Picidae families, genus Tyrannus, Thraupidae family, Zonotrichia leucophrys and Zonotrichia albicollis	Berries ripen from late August into fall
Sambucus spp.	120+ species including genus Ailuroedus, genus Bombycilla, Fringillidae family, Parulidae family, Picidae family and genus Regulus	Fruit ripens July-September; nesting site
Syringa spp.	Cardinalidae family, Fringilla coelebs and Poecile carolinensis.	Nesting site
Symphoricarpos orbiculatus	Erithacus rubecula, Poecile carolinensis and Cardinalidae	Berries ripen in October, persisting late into winter
Viburnum spp.	Cardinalidae family, Genus Sialia, Mimidae family	Berries ripen in fall; nesting site

Other attracting plants for birds:
Vines: Hedera helix, Lonicera spp., Vitis spp.,
Annuals: Cosmos spp., Helianthus spp., Zinnia spp.,
Perennials: Aster spp., Centaurea cyanus, Echinacea spp.
Grasses: Carex spp., Digitaria spp., Panicum spp.
Water plants: Hosta spp., Polygonum spp., Typha spp.,

Table 1. Bird Garden Plant List [8, 12, 28, 30]

2.2. Butterfly gardens

"Butterfly gardening" is the term used to describe the development and maintenance of a tract of land as a butterfly habitat. It involves attracting and retaining populations of butterflies, which, apart from their being beautiful, enable plant reproduction through pollination [14] . Butterfly gardening is believed to have begun in England in the 1970s, as an expression of the British love of gardening and nature; the Butterfly World habitat was inaugurated at Coconut Creek in Florida, in the USA, in 1988.

Site selection

One factor that affects butterflies' activities is wind; strong winds tend to work against them, so a windbreak will be crucial if the chosen site is an open area. Of course, a site surrounded by trees or houses will not need wind protection [21]; however, the site should not be shaded: butterflies need warmth to fly and most plants preferred by butterflies also thrive in sunlight. The ideal site would have a southern exposure and get no less than six hours of sunlight daily [22].

Climate

Sunlight is a critical factor, both for flowers and for butterflies. Butterflies can only fly efficiently when their body temperature is about 85-100F. This is why they tend to rest in the early morning on rocks, bricks or gravel paths that have been heated by the sun. When the temperatures rise during the day, they seek out flowers for their nectar, but only in areas where there is warm sunlight.

2.2.1. Criterias for structural design in butterfly gardens

The area allocated for a butterfly garden can be as small as a 1.5 x 3m strip of land by a path, or as large as a naturally landscaped garden, but drainage and walkways around the beds of plants must be taken into consideration; materials ranging from boards to railroad ties, rocks, bricks, etc., can be used to create a raised-bed butterfly garden.

Open areas

Because of their need for warmth in order to fly, butterflies need sunny open areas, and these can be supplied by designing open lawns with groundcover and clover, as well as flat surfaces such as rocks or paving stones for the butterflies to rest on; in addition, the clover will provide nectar for adult butterflies, and help the lawns to grow by fixing soil nitrogen.

Water

Butterflies are unable to drink directly from open water; instead, they "mud-puddle," which means they take in water from the moist areas near open water. This situation can be catered for by leaving a bowl of wet sand or creating a mud puddle in the garden where the butterflies can drink. [23]. If sand is used, ideally it should be salt-saturated beach sand, because the salt helps the male butterflies produce sperm; an added advantage is that the salt keeps away slugs and snails which attack the butterflies' host plants and kill caterpillars [24]. Adding a few rocks or sticks to the bowl or puddle will allow the butterflies to perch on them while they are drinking, and as the male butterfies need extra sodium in the mating season, a little salt can be added to the puddle [25].

Shelter

Like most fauna, butterflies need shelter from wind and rain, and will tend to take cover in protected areas [26]. They also tend to feed and lay their eggs in warm areas sheltered from the wind. For these reasons, the design of the butterfly garden might well include a row of

taller trees or shrubs serving as a windbreak, with another inner layer of tall plants for further protection [23].

Food

Butterflies begin their life cycle as eggs, which are laid on plants and adult hatch into larvae or caterpillars, which first eat their egg shells and then feed on the leaves of their host plant. This is different from the case of the adult butterflies, which feed on primarily on liquid nectar from flowers [27].

Some butterfly larvae, such as tent caterpillars, cutworms, and the tobacco hornworm, are seen as pests; most, however, are not, and emerge as beautiful adult butterflies. It is therefore essential that a butterfly garden have plants which will serve as food for different kinds of butterfly larvae, such as flowering plants with long blooming periods and life cycles covering different months. This diversity will create a source of nutrients for a range of species, and also conceal damaged leaves. In any case, the larvae usually do little harm to plants; they also feed on tree sap, organic detritus and animal waste, and adults are often attracted by fruit which has fallen off plants and lies rotting on the ground.

Rocks

Butterflies tend to sit and warm themselves on rocks that have been heated by the sun.

Fences

Fences or corner nooks and crannies may be used by butterflies as shelters in strong winds and rainstorms.

Butterfly garden equipments

Butterfly houses

In adverse weather conditions, migrating butterflies usually take shelter in cracks in buildings or trees. A butterfly house is a shelter created specifically to assist migrating and hibernating butterflies by providing them a place to stay.

Wood piles

Wood piles also offer butterflies shelter and a place where they can hibernate [31].

2.2.2. Criterias for planting design in butterfly gardens

As noted earlier, in a butterfly garden there should be an appropriate range of plants that will support both the larvae and the adult butterflies [7]. The location of the flowering plants is not simply a matter of aesthetics; they should be planted in clusters, with taller plants in the background and shorter ones in the front, so that the butterflies can have access to the widest possible range of flowers. If the garden is in the middle of an open area, taller plants should be placed in the center and shorter ones at the outer edge, with the shortest flowering plants closer to the center.

The types of flowering plant selected are also significant, because the sizes and shapes of flowers may determine the kinds of butterflies that visit them: large butterflies like *Papilio machaon,* for instance, have a tendency to alight on flowers with large compact heads, on which they can rest their bodies while feeding.

The two basic types of plants that butterflies look for are: first, those that provide nectar for food; and second, host plants, on which the females lay their eggs, and which also serve, when the eggs hatch, as food for the caterpillars.

Nectar plants

The butterfly garden can include a wide range of nectar plants, comprising a mixture of annuals, perennials, herbs, shrubs and endemic wildflowers (Table 2). Such colorful flowering plants are key to attracting and maintaining butterfly populations [32], for when the female finds these food sources, she will deposit her eggs [24].

Host plants

Having sufficient host plants in the garden will maintain the butterfly population: when the female is ready to lay, she searches for and locates host plants with leaves that the caterpillars will eat when the eggs hatch. Many species of larvae eat only the flowering parts and ignore the leaves; some feed on the leaves [33]; others feed on the reproductive parts of flowers or seeds. Caterpillars typically spend most of their time feeding on their host plant (Table 2); many starve to death if they cannot find the right plant [25]; and in the end, only about 5% of the 60-150 eggs the female lays will survive to the adult phase.

Botanical Name	**Butterfly Caterpillar/Larval Host**	**Nectar Source/Butterflies Attracted**
Trees		
Amelanchier spp.	Satyrium liparops	
Betula spp.	Nymphalis antiopa, N. Vaualbum; Papilio glaucas,	Enodia anthedon
Gleditsia triacanthos	Hesperia comma	
Carpinus spp.	Limenitis arthemis	
Carya spp.	Satyrium calanus	
Celtis occidentalis	Asterocampa celtis, A.clyton; Libytheana carinenta, Nymphalis antiopa, Polygonia interrogationis	
Juglans nigra	Satyrium calanus	
Liriodendron tulipifera	Papilio glaucas	
Malus spp.	Limenitis, Papilio glaucas	
Populus spp.	Limenitis arthemis, Nymphalis antiopa, Rubidus Hybrid, Satyrium liparops	Enodia anthedon

Botanical Name	**Butterfly Caterpillar/Larval Host**	**Nectar Source/Butterflies Attracted**
Prunus spp.	Celastrina ladon, genus of Limenitis, Papilio glaucas, Satyrium liparops	
Quercus spp.	Satyrium liparops	
Salix spp.	Satyrium liparops, Limenitis arthemis, L. archippus, Papilio glaucas, Nymphalis antiopa, N. vaualbum	Enodia anthedon, Nymphalis antiopa
Tilia spp.	Polygonia interrogationis	
Ulmus hybrids	Nymphalis antiopa, Polygonia interrogationis, Polygonia c-album	
Shrubs		
Buddleja davidii		Battus philenor, Danaus plexippus, Junonia coenia, Libytheana carinenta, Nymphalidae families, Papilio polyxenes, Papilio glaucas, Phyciodes tharos, Pyrgus communis, Speyeria cybele, Vanessa atalanta
Cornus sericea spp.	Celastrina ladon	Libytheana carinenta
Crataegus spp.	Limenitis arthemis, Satyrium liparops	
Hamamelis virginiana	Celastrina ladon	
Hydrangea paniculata 'Tardiva'		Danaus plexippus
Lantana spp.		Papilio glaucas, Papilio troilus Papilio zelicaon
Lavandula angustifolia		Cupido comyntas, Danaus plexippus, Papilio machaon
Lonicera spp.		Hesperia comma, Papilio cresphontes, Papilio glaucas, Papilio cresphontes
Rhododendron spp.		Battus philenor, Papilio cresphontes, Papilio cresphontes
Syringa vulgaris		Battus philenor, Danaus plexippus, Nymphalidae family, Papilio machaon,

Botanical Name	Butterfly Caterpillar/Larval Host	Nectar Source/Butterflies Attracted
Viburnum dentatum	Macroglossum stellatarum	Polygonia interrogationis, Vanessa atalanta
Viburnum lentago	Celastrina ladon	

Other attracting plants for butterfly:

Annuals: Antirrhinum spp., Cleome spp., Echium vulgare, Helianthus spp., Tropaeolum majus.
Perennials: Asclepias spp., Aster spp., Carex spp., Centaurea spp., Coreopsis spp., Echinops ritro, Rudbeckia hirta, Solidago spp., Viola odorata, Verbena spp.
Herbs: Anethum graveolens, Artemisia dracunculus, Humulus lupulus, Levisticum officinale, Mentha spp., Origanum vulgare, Salvia officinalis.
Weeds: Boehmeria spp., Plantago spp., Trifolium spp., Urtica spp.

Table 2. Butterfly Garden Plant List [24, 34, 35, 36]

Color

The flowers selected for a butterfly garden should have a variety of colors [32]. Each butterfly species has its own preferences as regards color, but they usually tend to prefer warm colors such as reds, yellows, and oranges, and especially purple, white, yellow, and pink [27].

Fragrance

Yet another factor that affects butterflies' choice of habitat is fragrance, which may surpass color in significance [2]. Butterflies' antennae are speckled with thousands of minute holes that absorb scents so intensely that they can pick up the fragrance of flowers up to two miles away. Flowers such as *Lavandula, Syringa* and *Lonicera* emit strong scents to attract butterflies for pollination [25], as do the wild flowers that grow in fields, meadows, and beside roads [29].

2.3. Maintenance of butterfly and bird gardens

These gardens should be maintained in much the same way as any other flower garden. Applying 5-7.5cm of a coarse wood chip mulch enhances the soil, prevents weed growth, helps the soil to retain moisture, and also provides cover for butterfly pupae and beneficial insects.

The greatest problem for butterfly gardens is the growth of undesirable plants such as weeds and grasses that might crowd out the adult butterflies' nectar plants and the larvae's host plants [3]. During weeding and pruning, care should be taken not to damage or destroy butterfly eggs, which are frequently laid on the undersides of leaves and other parts of host plants [2]. Pesticides should be avoided [25]; organic pest control in the form of insect-repelling plants should be used instead.

3. Conclusion

Butterflies and birds, in contrast to most fauna, are not restricted in their habitat to distant natural environments; they live in both rural and urban environments, and their

populations can easily be increased and maintained with some basic knowledge and organization. Urban ecological environments for them do not need much land; indeed, existing gardens can be modified for this purpose [32].

Urban ecological gardens can be created by carrying out an analysis of the proposed site, and selecting and arranging the planting of appropriate vegetation and other design elements. Birds and butterflies have the same fundamental needs – food, water, safety, and shelter – and these needs can be met through the creation of simple constructions such as water features and feeding stations, as well as through basic procedures that afford protection from predators, and privacy.

There are some design differences in the construction of gardens for birds and those for butterflies: while butterflies need what is provided by particular plants, birds tend to need particular kinds of habitat structures which facilitate sheltering, roosting, nesting, and food-finding. These structures may range from open plains, to deep woods, to a combination of both [37]. Butterflies prefer, and indeed need, the warmth of the sun, whereas birds make use of both sun and shade. Water features (e.g. the bird bath) are more important for bird gardens than for butterfly gardens, because birds need to drink more to cool themselves.

Food is, of course, important for both birds and butterflies; increasing its availability. will result in larger populations of both in the cityscape [11]. For butterflies, the food source of the host plant is needed for the larval phase, and nectar for the adult. Food sources like berries will attract the birds; fragrant flowers will draw in the butterflies. Certain types of equipment can also enhance the appeal and sustenance provided by both types of urban ecological garden: these include bird houses, feeders and dead trees for bird gardens; and butterfly houses and wood piles for butterfly gardens.

The design and organization of vegetation plays a critical role in both types of garden; in each case the garden should be seen as comprised of three basic areas: the background, middleground and foreground. The background area, comprising purpose-planted trees and shrubs, functions as a windbreak, and also as a backdrop for the flowers. The middleground, comprising clusters of colorful, medium to tall flowers, is the central focus of the garden; and the foreground, with low-growing plants, marks its front boundary. Unmowed areas of gardens where nature is left to itself may have more diverse plant species than are found in mowed areas, and so form better habitats with more food sources. Because adult butterflies are more likely to recognize plant masses than individual plants, there should be relatively more massed vegetation in butterfly gardens than in bird gardens.

In the planning of ecological urban gardens, it should be reiterated that plants that produce seeds, berries, fruit, or nuts tend to attract birds, while fragrant and nectar-producing flowers attract butterflies; and that host plants are also critical for butterflies, especially in the larval period. Nectar plants which also serve as food sources are the main desirable plants for both birds and butterflies. Ecological urban gardens usually contain a mixture of such plants, both endemic and non-endemic [38], and the landscape should be designed to reflect the natural environment. Research indicates that the range of bird species seen in these gardens increases the more endemic plants they contain, and the greater the total plant biomass [39].

Today in the cityscape context, landscaping based on ecological principles is increasing in importance, and the successful creation, development and maintenance of sustainable environments requires both the construction of natural habitats, and the attraction to these habitats of compatible and balanced populations of wildlife species. Bird and butterfly gardens are paradigms for the new eco-friendly city.

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