Landscape design for attracting wildlife in southwestern urban environments

Margaret Livingston

Abstract

Urban environments present unique challenges for landscape designers wishing to incorporate wildlife attractants into their designs. Cities such as Tucson, Arizona that are surrounded by relatively large expanses of native vegetation provide many opportunities for effectively enticing native wildlife into urban spaces. Patches of landscape can be designed that mimic vegetation composition found on the peripheral edges and may potentially lure wildlife by providing food and cover. These areas may also provide regenerative patches of native vegetation within the urban matrix, thereby offering connectedness to larger areas of native vegetation. Such corridors encourage wildlife movement and may aid in the retention of wildlife populations. The purpose of this paper is to describe and illustrate design techniques used to create these vegetation patches specifically for attracting songbirds, hummingbirds, and butterflies within urban spaces in Tucson. Design strategies that address plant species, structure, composition and diversity will be presented.

INTRODUCTION

The importance of maintaining biological linkages among urban and natural areas has long been considered an important concept among conservationists, land managers, wildlife biologists, and landscape ecologists involved in human and wildlife interactions (Mann and Plummer 1995). These linkages typically consist of small to large vegetative patches within a developed matrix that are linked by corridors to larger natural areas. Studies have suggested that particular wildlife utilize these corridors, however, the direct benefits with regard to wildlife population dynamics are still questioned (Simberloff and Cox 1987). Furthermore, there has been concern about the possible negative effects of enhancing connectedness of such corridors and patches such as transmission of contagious disease, increased fire potential due to additional fuel from larger massing of plants, and increased transport of invasive plant species (Westbrooks 1998).

Adopting a restorative approach to the design of urban patches that incorporates spatial patterns and species found in existing patches of natural vegetation associated with a wildlife habitat may minimize these negative impacts. This paper discusses such design methodology, in addition to the significance of selection and arrangement of plants for attracting wildlife in urban spaces.

DESIGN METHODOLOGY

Site Analysis

A site analysis serves as an evaluation of the opportunities and constraints of an area in relation to the objectives of a project. It is critical that the initial scope of an analysis for attracting wildlife is at a larger scale than intended for most created wildlife areas. This is because of potential flows and interactions between transient wildlife and regional resources surrounding the proposed wildlife garden site. Using a landscape ecology approach to the initial site analysis is appropriate where the focus starts with the spatial patterns of the land uses in the urban matrix and the expected interactions associated with existing land uses. For example, developed land, created and natural open spaces, wetlands, and watercourses are evaluated and prioritized in relation to significance to the purpose (species attempting to attract), size, and location of the proposed wildlife area. These land uses should then be further categorized and evaluated for quality of wildlife habitats based on assessment of resources such as plant communities and natural water sources.

Initial analysis at this macro-scale allows recommendations to be developed relating to connectivity of the garden site with existing patches of habitat, appropriateness of garden location, and compatibil-

Author's address: Program in Landscape Architecture, 104 Architecture, University of Arizona, Tucson, AZ 85721

ity with the existing plant communities of a large metropolitan area. For example, an analysis of Tucson, Arizona at this larger scale would indicate various plant communities associated with the Sonoran Desertscrub such as Arizona Upland and Lower Colorado River Valley subdivisions. These plant communities provide different opportunities for various wildlife. From a human community standpoint, it is important to seek out these opportunities thereby creating a series of adjacent wildlife-friendly backyards. This type of connectivity can provide a significant respite for migratory songbirds and useful wintering and nesting areas (Kress 1998).

Further site analysis is also done at a meso-scale where evaluation of potential edge effects between the wildlife areas and adjacent land uses is done. Various studies have shown the significance of edge effects on species diversity and population size (Paton 1994). At this scale, the designer evaluates and prioritizes various locations, such as hedgerows and park buffers, in relation to these edge effects. Other site-specific elements such as nearby water, roads, buildings, and existing vegetation are considered for their appeal, hazards, and microclimatic effects. For example, water from a natural source, such as a seep, may provide water for wildlife and nearby plants whereas a swimming pool would ameliorate site temperatures and provide a milder microclimate for frost-tender plants.

Vegetation Analysis

A more detailed analysis of vegetation is done following general plant community assessment as described in the previous section. Ideally, species identification, structure (height) and density should be evaluated prior to choosing a site for a wildlife garden. This evaluation of existing vegetation indicates its appropriateness for the wildlife areas being created. For example, large existing nonnative trees in Tucson such as a eucalyptus (*Eucalyptus* spp.) are considered useful perches for raptors such as hawks and owls whereas Gambel's quail (*Callipepla gambelii*) prefer low-branching shrubs (ANPS and TAS 1997). Therefore, it would be more appropriate to remove species such as a eucalyptus and provide a native tree, such as mesquite (*Proposis* spp.), that is a food resource for a native songbird garden. From a design standpoint, existing vegetation at the site level also indicates a potential starting point for selection of additional plant species and placement.

Analysis of Other Resources

Climate, topography, and soils also influence site appropriateness and should be considered at each level of analysis. For example, topography can be associated with significant variation in native vegetation communities (i.e. a watershed basin) at a larger scale, and enhance water catchment or create a warm microsite for an area. In addition, knowledge about variation in rainfall patterns and amounts for a region, erosion potential, and general soil conditions provide additional information relating to the capacity and hence the likely success of a design for a particular site. At this point, the designer is prepared to initiate design development of the wildlife garden.

Development of the Design

Following completion of the site analysis, the design process begins with development of a program and conceptual plan for the selected site. The program includes constraints and opportunities of the site, as indicated by the site analysis, and takes into account the needs of the client if one is involved. For example, questions about whether viewing areas are desired and what type of wildlife the client wishes to attract are addressed in this phase. The conceptual plan involves general arrangement of design elements such as plants, viewing areas, and circulation of users through the wildlife area. The next phase of design development focuses on the specific requirements for the various design elements.

DESIGN GUIDELINES

Designs for wildlife should emphasize the selection of garden elements, primarily plants, which focus on providing shelter, food, nesting spots, and water. However, these requirements can easily accommodate an aesthetic focus of the garden. Below are some simple guidelines for creating an effective and attractive wildlife garden:

1. Arrange plants in large groupings.
   Large groupings of plants will provide the opportunity to create layering of plant species from tall peripheral overstory trees and large shrubs to the smaller shrubs, accents, and ground covers. This arrangement is pleasing to the eye due to the natural sequential appearance, and such layering provides shelter and nesting spots for wildlife.

2. Create variety.
   Using a diverse selection of plants will provide food for a longer period of time throughout the year, attract more species, and will create visual interest in the garden.

3. Use plant massing.
   In contrast to variety, it is important to incorporate some masses that unify the design. Too

many "solo" plants can add disjointedness to the design—adding masses of certain plants creates unity and can also increase pollination and fruit production for those species.

4. Create open spaces.
   Providing open spaces in wildlife gardens is just as important as creating plant masses. These areas serve as an aesthetic contrast to the variety of plant groupings and also create open areas for wildlife interactions (sunning, dust baths) and viewing.

The following discussions cover more specific design guidelines, the elements and plants for gardens designed for songbirds, hummingbirds, and butterflies.

Songbird Gardens

It is important to acknowledge the potential for backyard wildlife gardens to become nodes within a series of associated patches that serve as stopovers and habitat for songbirds (Kress 1998). These areas are particularly critical considering the current status of natural bird habitats. Unfortunately, while we protect wild birds with state and federal laws that apply to parks and refuges, the vast majority of land remains in private ownership with no formal protection (Kress 1998). Organizations such as the National Audubon Society and The Nature Conservancy are actively identifying specific locations that are critical to birds, thereby increasing the opportunities for potential linkages between created and natural bird habitats (Kress 1998).

Depending on the location, design guidelines will vary according to site resources and bird species attempted to be attracted. However, there are some general guidelines that are important for the design of any songbird garden:

1. Mimic nature in species selection and arrangement.
   Native plants play an important role in bird gardens due to interactions between indigenous birds and associated plants over evolutionary time. Native plants that have co-evolved with native wild birds are more likely to provide nutrition for the birds when it is needed (ANPS and TAS 1997, Kress 1998). It is also important to recognize the wide range of plants necessary for creating a garden that can provide food and shelter. For example, selecting plants that have dense foliage and thorns provide nesting opportunities and cover for songbirds.
   Arrangement of plants should mimic patterns of existing native plant communities. These layers of plant growth are used for a multitude of purposes. Birds may build their nests in the layer of tall shrubs, and below find food by scratching through leaf litter. Again, it is typical to arrange tall species along the periphery of the garden, followed by large understory shrubs or small trees closer to the view point (in many cases, the home), and layers of small shrubs, groundcover and annuals such as wildflowers and grasses in the forefront.

2. Create both variety and same-species clumps in the garden.
   Different birds require different food in different seasons. Therefore, it is important to have enough variety in the garden to sustain birds year-round, if possible. On the other hand, it is also important to maintain some masses of high fruit-producing species to provide very visible, massed displays for recognition.

3. Leave nature alone.
   This is probably the most difficult goal to achieve in a wildlife garden. With any type of planned landscape, it can be quite difficult for garden managers to leave litter and old branches or tree snags in the design. However, these provide perches, nesting cavities, and insects for food. Unraked areas contribute litter that harbors food for ground-feeding birds such as thrashers (*Toxostoma* spp.). On the other hand, maintaining some open areas is important for dust baths.

4. Avoid use of exotic plants.
   Exotic trees and shrubs should be avoided when possible due to their potential to spread into native habitats. Minimize turf areas because they provide little habitat or food for birds and may be associated with factors that have a negative affect on birds such as fertilizer and pesticide use (Kress 1998).

5. Provide water.
   A circulating water source is preferred because traditional bird baths can cause spread of disease. If a bird bath is used, it should be cleaned with a stiff brush every day and should be no deeper than three inches (Terres 1968). A simple system can be installed using a separate zone on a drip irrigation system that provides flow each day.

Plants that attract songbirds

Birds consume fruits, buds, flowers, and nectar of plants. For example, quail (*Callipepla* spp.), doves (*Zenaida* spp.) and finches (*Carpodacus* spp.) consume large quantities of seeds whereas mockingbirds (*Mimus polygottos*) and thrashers prefer fruits and berries when they are available (ANPS and TAS 1997). Birds also depend on insects for food, and these are typically associated with a healthy, functioning garden. On the other hand, many plants rely on birds for pollination and dispersion of seeds over the landscape. This relationship is indicated by the numerous plant characteristics that have evolved to ensure appeal of their fruits to specific birds. For example, many fruits ripen when bird migration reaches its peak, have fruit sizes appropriate for bird consumption, and are brightly colored (Kress 1998). Table 1 provides a list of plants that provide the variety in growth type and attractants for a southwestern bird garden.

Hummingbird Gardens

Many of the design guidelines for landscapes that attract songbirds also apply to hummingbirds. In addition, it is important to remember that hummingbird food requirements are relatively higher than for other birds because of their small size and high metabolic rate (Holmgren 1986, Stiles 1973). Because of this, hummingbirds tend to spend more of their activities tied to their food sources than other birds. For example, Anna's hummingbirds (*Calypte anna*) will attempt to stay year-round in a location where food persists (Stiles 1973). It has also been indicated that migrating hummingbirds look for resting stops or nesting sites where they initially find adequate food (Holmgren 1986).

Because of this heavy reliance on constant and plentiful food sources, gardens should emphasize a wide variety of flowering species to maintain an extended flowering season. The resourceful Anna's hummingbirds will seek out remnants of pollen or nectar on half-frozen blossoms if fresh blooms are not available at the end of the warm season (Holmgren 1986). In some cases, non-invasive exotics that flower during late winter, such as *Aloe vera* and *Tecomaria capensis*, are used to extend the flowering season of these gardens. Species choices should be guided by hummingbird preference of pink, red or orange color, and single flowers of a trumpet or tubular shape (Holmgren 1986).

Nectar in plants that attract hummingbirds has a sugar content that matches a ratio of about 3 or 4 parts water to 1 part white cane sugar (Holmgren 1986). If sufficient food is not provided by plant nectar, garden managers can resort to syrup feeders. If this is the case, feeders should be properly cleaned to prevent spread of disease, as mentioned with the use of bird baths. Table 2 provides a list of plants that should provide the variety in growth type and attractants for a southwestern hummingbird garden.

Butterfly Gardens

In the last few decades, there have been dramatic reductions in the ranges of rare butterflies due to the modification and devastation of their habitats (Pollard and Yates 1993). Increases in agriculture and other land uses have led certain butterfly species to be restricted to isolated areas. Due to the highly varied plant communities in this area, southeastern Arizona is considered a critical region in terms of butterfly habitat, providing an environment for 240 species of butterflies in 6 counties (Bailowitz and Brock 1991). Butterfly gardens in urban communities can supplement adjacent natural environments and provide extended habitats during the colder months. For example, it has been noted that particular populations are able to expand their population and thrive in a human-dominated landscape (Pollard and Yates 1993).

Gardens should accommodate various cycles and activities of the butterflies, typically associated with seasonal changes (Bailowitz and Brock 1991). Butterfly activity increases in the spring due to greater availability of nectar and larval foodplants. During this time, males use hilltops for mate location and frequently perch on the tallest shrubs or trees in natural communities (Bailowitz and Brock 1991). In the hottest months, butterflies cluster in lower elevation locations, and "puddle parties" (gatherings of butterflies in moist pockets on the ground) occur during the rainy season in July and August, when the adults take in moisture and salt (Bailowitz and Brock 1991). The fall season is a productive time for egg production, until freezing nights cease adult activity. Created gardens may include some nonnative species that extend the period of availability of nectar-rich plants (ANPS and SASI 1996; Xerces Society 1990). For example, exotic species such as lantana (*Lantana* spp.) and rosemary (*Rosemarius* spp.) are often attractive during the late fall and early spring when limited nectar is available from native plants. However, use of these species should be minimized to prevent potential contamination of natural areas.

Design of a butterfly garden follows the general design guidelines relating to the arrangement of plants and variety. However, there are slight variations and additional guidelines that should be used that take into account some of the seasonal needs of butterflies:

1. <u>Provide a variety of plants that feed larval and adult butterflies.</u>
   Food plants need to provide for 2 different

stages of the butterfly's life: larval and adult. Therefore, it is important to have an adequate mix of plants that will support larvae and other plants that will be available for the adults.

2. Emphasize massing of plants.
Massing should be relatively greater in butterfly gardens compared to bird gardens. This is due to the greater recognition factor of plant masses rather than a singular plant by adult butterflies. Use of accent plants with unique shapes such as agaves (*Agave* spp.) or yucca (*Yucca* spp.), can create effective contrast and interest for the garden visitor.

3. Provide sunny, wind-protected locations.
Butterflies do not self-regulate their body temperature and need sunlight to warm the muscles they use to fly, and protection from wind when feeding.

4. Provide a puddle.
Butterflies require a shallow puddle or moist soil for water. A slow dripping emitter near a water-loving plant can fulfill this need.

Table 3 provides a selection of plants that should provide the variety in growth type and attractants for a southwestern butterfly garden.

SUMMARY

Successful wildlife gardens can be created through emphasis on thorough site analysis, careful arrangement of plantings and other design elements, and attention to plant species selection. Site analysis should provide the designer with the knowledge of existing natural communities that support wildlife and indicate the possibilities and limitations that exist at community and site-specific levels.

While this presentation focuses on gardens for a particular type of wildlife, many plants such as velvet mesquite (*Prosopis velutina*), catclaw acacia (*Acacia greggii*), or fairy duster (*Calliandra eriophylla*), will support more than one type of wildlife. Therefore, it is possible to create a single garden for a variety of wildlife such as birds and butterflies. In this case, attention should be given to needs of the diverse wildlife and the overall design of the project. For example, an area with concentrated massing and full sun locations for butterflies can transition into an area with more overstory species and variety in structure for birds. A few species of plants can be repeated throughout the garden to provide unity and hence effectiveness of the overall design composition. With these few requirements and a large number of plant species to choose from, a landscape design for wildlife can be created to meet the spatial confines of any urban enthusiast.

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Table 1. Plants for a songbird garden in Southwest desert gardens.

Species	Common Name	Plant type	Use
Acacia greggii	catclaw acacia	tree/shrub	food, cover
Acacia constricta	whitethorn acacia	tree/shrub	food, cover
Atriplex lentiformis	quailbush	shrub	food, cover
Baileya multiradiata	desert marigold	forb	food
Carnegiea gigantea	saguaro	cactus	food, shelter
Celtis pallida	desert hackberry	shrub	food, cover
Celtis reticulata	western hackberry	tree	food, shelter
Cercidium floridum	blue paloverde	tree	food, shelter
Chilopsis linearis	desert willow	tree	food
Encelia farinosa	brittlebush	shrub	food
Fraxinus velutina	Arizona ash	tree	food, shelter
Larrea tridentata	creosote	shrub	cover
Lycium species	wolfberry	shrub	food, cover
Muhlenbergia rigens	deer grass	grass	food
Opuntia spinosior	cane cholla	cactus	shelter
Prosopis velutina	velvet mesquite	tree	food, shelter
Vitis arizonica	Arizona grape	vine	food

Table 2. Plants for a hummingbird garden in Southwest desert gardens.

Species	Common Name	Type	Notes
Acacia willardiana	palo blanco	tree	shelter *
Anisacanthus thurberi	desert honeysuckle	shrub	food
Calliandra californica	Baja fairy duster	shrub	food
Campsis radicans	trumpet creeper	exotic vine	food
Fouqueria splendens	ocotillo	accent	food
Hesperaloe parviflora	red yucca	accent	food
Justicia spicigera	Mexican honeysuckle	shrub	food
Lobelia cardinalis	cardinal flower	small shrub	food
Nicotiana glauca	tobacco tree	tree/shrub	food
Penstemon spp.	any native penstemon	small perennial	food
Ribes spp.	gooseberry species	shrub	food, shelter
Salvia greggii	autumn sage	small shrub	food
Zauschneria californica	hummingbird trumpet	small shrub	food

** Native trees listed in Table 1. can also be used for peripheral plantings and shelter for hummingbirds.*

Table 3. Plants for Butterfly Gardens in Southwest desert gardens.

Species	Common Name	Type	Notes
Acacia angustissima	Fern acacia	shrub	larval food
Acacia greggii	catclaw acacia	tree	adult food*
Ageratum corymbosum	butterfly mist	shrub	adult food
Aloysia gratissima	bee bush	shrub	adult food
Asclepia linaria	pineleaf milkweed	shrub	larval, adult food
Caesalpinia pulcherrima	red bird of paradise	large shrub	adult food
Calliandra californica	baja fairy duster	shrub	larval food
Celtis pallida	desert hackberry	large shrub	larval food
Chrysothamnus nauseosus	rabbitbrush	shrub	adult food
Dyssodia pentachaeta	golden dyssodia	small perennial	adult food
Eupatorium greggii	eupatorium	small shrub	adult food
Lantana montevidensis	trailing lantana	groundcover	adult food
Lysiloma thornberi	feather bush	tree	adult food

* Native trees listed in Table 1. can also be used for peripheral plantings and shade for butterflies.