Integrating Nature into the Urban Landscape

A Design Guide

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Ecological Consultants

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Native planting area
in San Jose, CA

Introduction

In our increasingly developed world, wildlife habitat is being lost to development at an alarming rate, putting native plant and wildlife populations at risk and reducing overall ecosystem health. Incorporating wildlife habitat into urban and suburban systems can help counteract these forces, sustaining native plant and wildlife populations while enhancing the human experience. More and more companies, educational institutions, public agencies, and municipalities are recognizing that there is significant value in implementing ecological design in urban and suburban areas. Entities with substantial landscapes to manage are the primary intended users of this document. However, even small landscapes that prioritize habitat creation will provide benefits to wildlife, increasing habitat structure and resources (including shelter, nesting, and foraging). Every landscape project – regardless of size – offers valuable opportunities to incorporate habitat elements and add to the overall urban habitat matrix, maximizing benefits to wildlife.

Increasing urban habitat benefits people by increasing interaction with and connection to nature, including multi-sensory experiences. People experience a more profound sense of place, increased ecological awareness, and improvements in physical and psychological well-being. Urban habitat can also offer a unique opportunity for environmental education in the city, and fosters a greater appreciation of natural spaces.

Monarch butterflies

Who are these Guidelines primarily for?

Any person or organization that manages or makes decisions about landscapes at a substantial scale, including:

- Local Agencies
- Municipalities
- Corporations
- Academic Institutions
- Commercial Developers
- Non-Governmental Organizations

Urban habitat can be implemented in many ways. Projects will need to be assessed on a case-by-case-basis to determine the level of priority given to habitat creation. In some areas, opportunities for valuable habitat areas may lead design teams to give habitat creation a high priority. In other areas, a delicate balance will need to be struck that allows for habitat creation in areas designed to maximize human use. If habitat design can be implemented on projects of all sizes across the urban matrix, substantial habitat will be created.

Although many of the principles in these Guidelines are applicable to Central California and beyond, the plant list features species that are most suitable for the South San Francisco Bay area.

These guidelines are intended to promote and explore opportunities for urban habitat creation in areas throughout the South San Francisco Bay region, where the creation of urban habitat areas would restore some of the ecosystem features that have been lost through development. In order to help users understand how to implement this vision, these guidelines discuss how to leverage plant selection and layout to maximize wildlife habitat value. While the habitat design principles may be applicable to Central California and beyond, the plant list features species that will be most suitable to the San Francisco Peninsula, the South San Francisco Bay, and the East San Francisco Bay areas.

For the purposes of this document, "wildlife" should be considered to mainly refer to birds and insects, who are the primary animals benefiting from urban habitat plantings. The plant palette also provides guidance on plants that are beneficial to pollinators.

These guidelines are intended to give users general direction on native habitat design. However, it is recommended that advisors with local ecological expertise and project implementation experience be involved throughout the design process — from site assessment to final design — to ensure habitat value is maximized. Good habitat design is very site specific, and it is not possible to capture all of the ecological considerations that should be incorporated into the design process in these guidelines. A recommended checklist to assess and guide the design of urban habitat projects can be found in Appendix A.

People & Nature

As humans, we have an "innate tendency to focus on life and life-like processes" (Wilson 1984), and depend on nature in ways that are essential to our physical and psychological health and wellbeing. In addition to material and physical resources, nature can provide us with intellectual, cognitive, emotional, and spiritual meaning and satisfaction. Humans are part of, rather than separate from, nature, and consistent exposure to the natural world benefits us in myriad ways.

Ecological Approach

The following premises are fundamental to a science-based ecological approach (an "ecological philosophy") for urban planning and design. The approach articulated in this document seeks to establish sensitively designed, functional wildlife habitat that allows for human use and enjoyment of these habitats.

What do **ecological enhancements** achieve?

Nature and people are joint beneficiaries of ecological enhancement. The immediate beneficiaries are the native fauna and flora and their constituent ecosystems. As natural ecological systems and processes are established, benefits accrue to the local human community directly and indirectly (experiences with nature, cleaner water and air, moderated temperature, shaded and restful environments, etc.).

Why is it important to invest in **ecological enhancements** such as habitat planting?

The establishment of sustainable habitat areas, intelligently interwoven into the urban setting, is mutually beneficial to ecosystems and humans, and therefore is an enterprise worthy of investment (i.e., of time, money, and limited physical resources such as land and water). The challenge is how to invest limited resources wisely to achieve the maximum benefit. Despite the challenges, we assert that the potential of urban and suburban landscapes to be beneficially transformed can be realized through locally appropriate restoration and management projects.

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How can **science-based design** be successfully implemented?

The goals and priorities for incorporating habitat elements in urban settings should be driven by a sound understanding of biological science and the local and regional ecological and physical context. This understanding should encompass local historical ecology, existing ecosystems, and anticipated changes in the ecosystems over time. A science-based approach is the best way to ensure that habitat development projects, including retrofitting existing landscapes with native plantings in an urban setting, are selected and designed objectively. Ideally, projects would include a monitoring program to assess the effectiveness of urban habitat improvements to contribute to a broader understanding of how urban habitats function over time.

Project longevity should be taken into account when planning habitat development projects. Shorter term projects that may be disturbed within 20-30 years will benefit from the establishment of fast growing shrub and understory plantings, while projects that may remain undisturbed for 30 to 50 years or longer should prioritize creating urban forest/overstory. This is reflective of the time it takes for forested habitats to achieve a level of vegetative maturity that can support significant wildlife and aesthetic values, while shrub and understory plantings can be established quickly and produce a measurable benefit in the near term.

What

resources and investments are to be anticipated, and how can **return on investment** be tracked?

In creating self-sustaining habitats (i.e., habitats that persist and regenerate over time with minimal intervention), initial investments may be large, but long-term costs will be low. Initially, funds would be needed for site assessment, development of healthy soils, management of hydrology appropriate to the habitat type (and vice versa), training of maintenance personnel, and other needs. Also, even with such investment, self-sustaining projects can be successful in the long term only if the design anticipates changing physical conditions (e.g., sea level rise).

Habitat development projects that represent a substantial investment of resources should be subjected to cost/benefit analyses during the design process. Likewise, post-implementation analyses should be conducted when the resources are available. Restoration ecology is a newly emerging science, and it is particularly challenging to accurately anticipate what wildlife benefits new habitats might provide in an urban environment. Therefore, conducting studies on existing and new habitats to quantitatively assess the ecological response is encouraged, as they will inform future design decisions. Such studies present an opportunity for landowners, designers, and ecologists to partner with non-profits and academia to leverage the unique research opportunities presented by urban ecological restoration.

Goals and Priorities

The overarching goal of designing landscapes for habitat value is to contribute to the ecological health of the region.

Supporting Objectives:

- Develop complex and diverse ecosystems at the scale needed to provide key functions and landscape resilience over time.
- Develop habitat areas that persist and regenerate over time.
- Plan habitat enhancements that will synergistically complement other conservation and restoration plans at a regional level.
- Interweave habitat areas in the urban context in a manner that provides a variety of benefits to the community and educates the public about the value and functions of natural ecosystems.
- Prioritize the use of native species (which support high wildlife value) in new landscaping.
- Create and enhance habitat for wildlife.

In the Santa Clara Valley, the priority is to reestablish ecosystem elements historically present that have been virtually eradicated from the region, and which provide important wildlife habitat.

What type of habitats are priorities (both in wildland and in urban settings)?

- Oak dominated landscapes (including other complementary native tree species).
- Native grassland and wildflower meadow patches.
- Willow thickets, as large as possible, where soils and hydrology are suitable; where possible, these should be part of freshwater marsh/wet meadow complexes.
- Riparian (creek) areas, dominated by willow and cottonwood, with substantial width and appropriate hydrology.
- Tidal marsh and transition zones along the bayward edge (e.g., seasonally flooded wetland habitats) and creek interfaces.

Clockwise from top left: Tidal marsh along the edge of the San Francisco Bay; Oak dominated landscape in the East Bay; Riparian woodland.

The San Francisco Estuary Institute offers many resources on the current and historical ecological context of the bay area, including:

Resilient Silicon Valley
http://resilientsv.sfei.org/

Historical Vegetation and Drainage Patterns of Western Santa Clara Valley (SFEI 2010)
http://www.sfei.org/scvheproject

What groups of wildlife species should be targeted for habitat benefits?

- Resident and migratory birds
- Rare wildlife species, although we recommend that a qualified biologist be consulted if these species are targeted
- Pollinators (vertebrate and invertebrate) and other floral visitors
- Insects and other small animals that are food for birds

Where should the habitat be located?

Native habitat is worth creating virtually anywhere in the urban landscape, but some special opportunities are listed below.

- Where possible, on sites connected to existing, established, higher-quality habitat areas—this will reinforce the value of both habitat areas and further buffer them from disturbance. This should synch with a long term vision towards creating connectivity between habitat areas.
- Within 300 feet of watercourses where revegetated habitats will improve water quality and maximize wildlife functions and values.
- Where storm drains can be daylighted and revegetated to achieve habitat and water quality benefits.
- Where ornamental landscaping with low habitat value can be replaced with higher-value native habitat.
- City parks and greenways
- Rooftop gardens
- Urban streetscapes

What types of habitat development projects present multiple benefits to the most recipients (natural communities and the human community)?

- Project design teams (landscape architects, biologists, ecologists, and planners) should assess project opportunities on a case-by-case basis to balance human needs/benefits and wildlife habitat creation opportunities.
- Some projects will trend towards a wildlife habitat focus (core habitat areas) and in more dense urban settings human elements may be emphasized.

Above right: Bees and other pollinators benefit from native planting in San Jose, CA. Below right: The oak titmouse and other oak associate birds would benefit from increased numbers of native oaks in urban areas.

Restoration efforts enhance the user experience and complement natural areas at Crissy Field in San Francisco

Design Parameters

Native Plant Selection

When selecting plants for any particular location, it is vital that site conditions and plant preferences are taken into account in addition to the ecological goals. Placing the "right plant in the right place" is crucial to the long-term success of any landscape.

Several key factors will influence the selection of plants: soil type, drainage and hydrology, available soil volume, sun/shade conditions, and other design constraints including those imposed by adjacent infrastructure and the project's programmatic goals. This section provides a very brief summary of ecological issues relating to plant selection.

Native planting areas complement nearby natural areas on the Bay Trail in Menlo Park, CA

Sun/Shade Tolerance

The plant list in Section 7 provides general guidance on the sun and shade tolerance of individual plant species. It is vital that landscape designers understand how much sun/shade a planting area will receive, both throughout the seasons and over time as the plants grow, particularly where multi-level canopies and dense plantings are established. Designing a plant palette to allow for succession will ensure that plants thrive both at the time of installation and over time as tree canopy develops and the amount of shade increases.

Hydrology

Hydrologic conditions are a key consideration when selecting native plant communities for installation. Depth to groundwater, surface water flows, and soil type all influence how much water will be accessible to plants without perpetual irrigation.

In wetter areas, create high value riparian and wetland components by selecting hydrophytic (water dependent) plant species. Establishing willow and cottonwood thickets is of particular value, even in very urban locations and very small planting areas. This habitat type requires relatively shallow groundwater (no deeper than 6-8 feet in the summer) or a source of near perennial surface flow.

In drier, well drained areas, select upland species. These species often prefer well drained soils and do not tolerate saturated soils or ponding. Oak woodlands would be of particular value, providing habitat for a suite of native birds that were once common in the Valley but that are oak-dependent and thus in decline.

Urban soils are often highly variable, with clay, gravel, imported fill, and contaminants all potentially present. Therefore, soil testing is a vital part of the design process. In some areas where soils have heavy clay content, sub-grade drainage features or surface mounding can be implemented to provide suitable drainage for species less tolerant of soil saturation. (For more information, see subsection Soils and Drainage below).

Water-loving plants thrive in a recently installed bioretention area between a bike path and a pedestrian path in Mountain View, CA

Invasive Species

When selecting plant species, it is important to ensure that any invasive weeds are excluded from the plant list. The California Invasive Plant Council ranks the invasiveness of nonnative plant species. All plants to be installed per a new design, or left in place as part of a redeveloped landscape, should be checked against the Cal-IPC list (which can be found at http://www.cal-ipc.org/plants/inventory/), and any species listed as moderate or high should be removed from the project.

Recycled Water

When selecting plant species, it is vital that the designer take into account the planned irrigation source, and that he or she know whether the planting area will receive potable or recycled water. The use of recycled water is now mandated or strongly encouraged for all new landscapes in the Cities of Mountain View and Sunnyvale. The use of recycled water is also an environmentally responsible goal for all projects. That being said, recycled water is not available in all areas and often has high levels of salinity. If recycled water will be used for irrigation, care should be taken to select plants with moderate to high salt tolerance particularly if soil quality and drainage are poor.

Other reference materials that may be of use to native plant design teams include the following:

At Home, Santa Clara Valley Audubon Society. http://www.scvas.org/page.php?page_id=6694&name=At_Home

California Invasive Plant Council (Cal-IPC) Plant Profiles. http://www.cal-ipc.org/ip/management/plant_profiles/index.php

Calscape. California Native Plant Society. http://calscape.org/

Re-Oaking Silicon Valley, San Francisco Estuary Institute. http://www.sfei.org/documents/re-oaking-silicon-valley

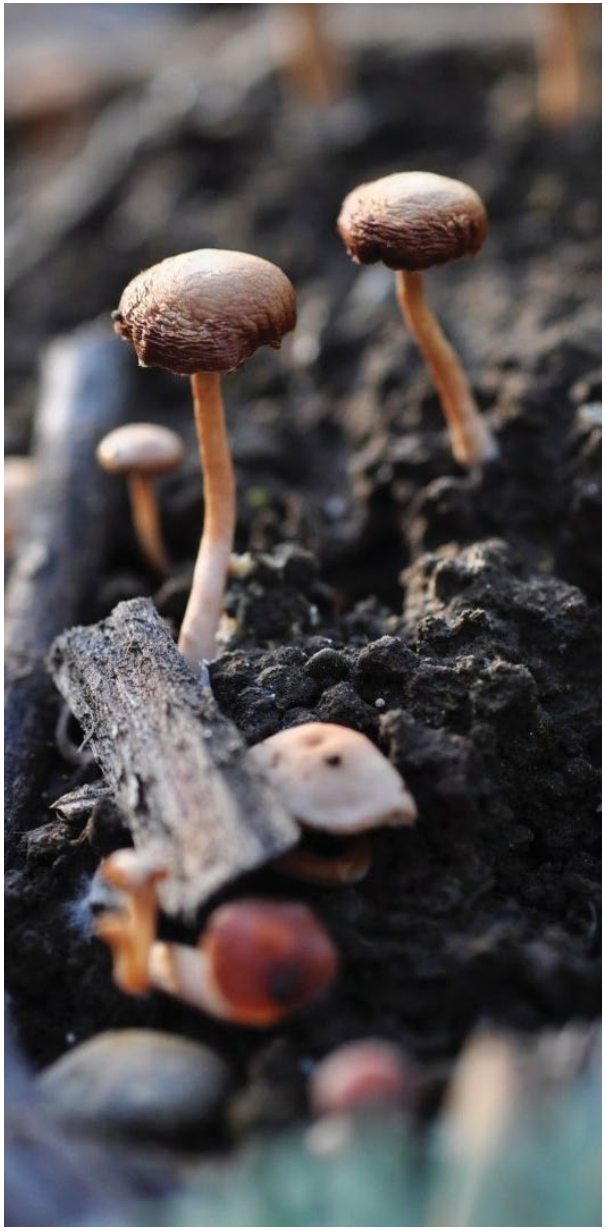
Landscape Standards, Rescape California. http://rescapeca.org/resources/for-community-leaders-landscape-professionals/landscape-standards/

Santa Clara Valley Water District Guidelines and Standards for Land Use Near Streams. https://www.valleywater.org/contractors/doing-businesses-with-the-district/permits-for-working-on-district-land-or-easement/guidelines-and-standards-for-land-use-near-streams

City of Mountain View North Bayshore Precise Plan Plant Palette Recommendations. Available upon request from the City of Mountain View Community Development Department Planning Division.

Cultivars

Many native plant species have been bred over time in nurseries to develop cultivars. Cultivars are often selected because they predictably exhibit specific traits, such as brightly colored flowers, a specific form, or a reduction in seeds or pollen. Although native cultivars are often more readily available in nurseries, their use should be limited or avoided where possible, because they are less likely to provide the same benefits to wildlife than the "straight" native species. Some studies have found that cultivars are visited less frequently by wildlife (White 2016, Williams et al. 2011, and Morandin & Kremen 2013), and the long term impacts of cultivar use have not been studied (Shröder and Prasse 2013, White 2016). Cultivars may hybridize with native species in the landscape (Byrne et al 2011), potentially creating long-term problems.



Soils and Drainage

Generally, standard landscape design techniques should be employed to improve soil texture/ chemistry and drainage to a level suitable for native plants. However, many urban areas are built on large areas of imported fill with heavily compacted and degraded soil. Developing healthy soil and drainage conditions for native plantings in this environment can require considerably more upfront investment than conventional landscaping.

The first step is to conduct a site soil assessment. For very small planting areas, a field assessment of site conditions may be adequate, particularly if the site already supports healthy plants. For larger planting areas with greater investment at risk, the soils should be manually assessed for compaction by digging pits and gathering representative soil samples. The samples should be sent to a qualified soils laboratory for testing of texture, chemistry and drainage characteristics (horticultural suitability analysis). Based on the laboratory results and recommendations, site soils can be amended to improve their suitability for planting. As many urban soils are compacted, measures to decompact soils prior to planting should be considered standard operating procedure. In cases of severely compromised soils it may be necessary to remove poor soils and import suitable topsoil.

Tree planting design should also account for the extent of the open soil surface available as a receiving area for rainfall and surface flow, and to allow healthy aeration of the soil. Ideally, each tree would be planted in an open soil surface equal to 80% of the surface area covered by the species' mature canopy. Especially in urban planting areas, this ideal condition may not always be achievable, in which case permeable hardscape or other methods should be considered to provide a healthy tree planting situation. Avoid selecting species that are particularly sensitive to constrained planting conditions.

Developing healthy soil and drainage conditions to support native plants is an important component of habitat design.

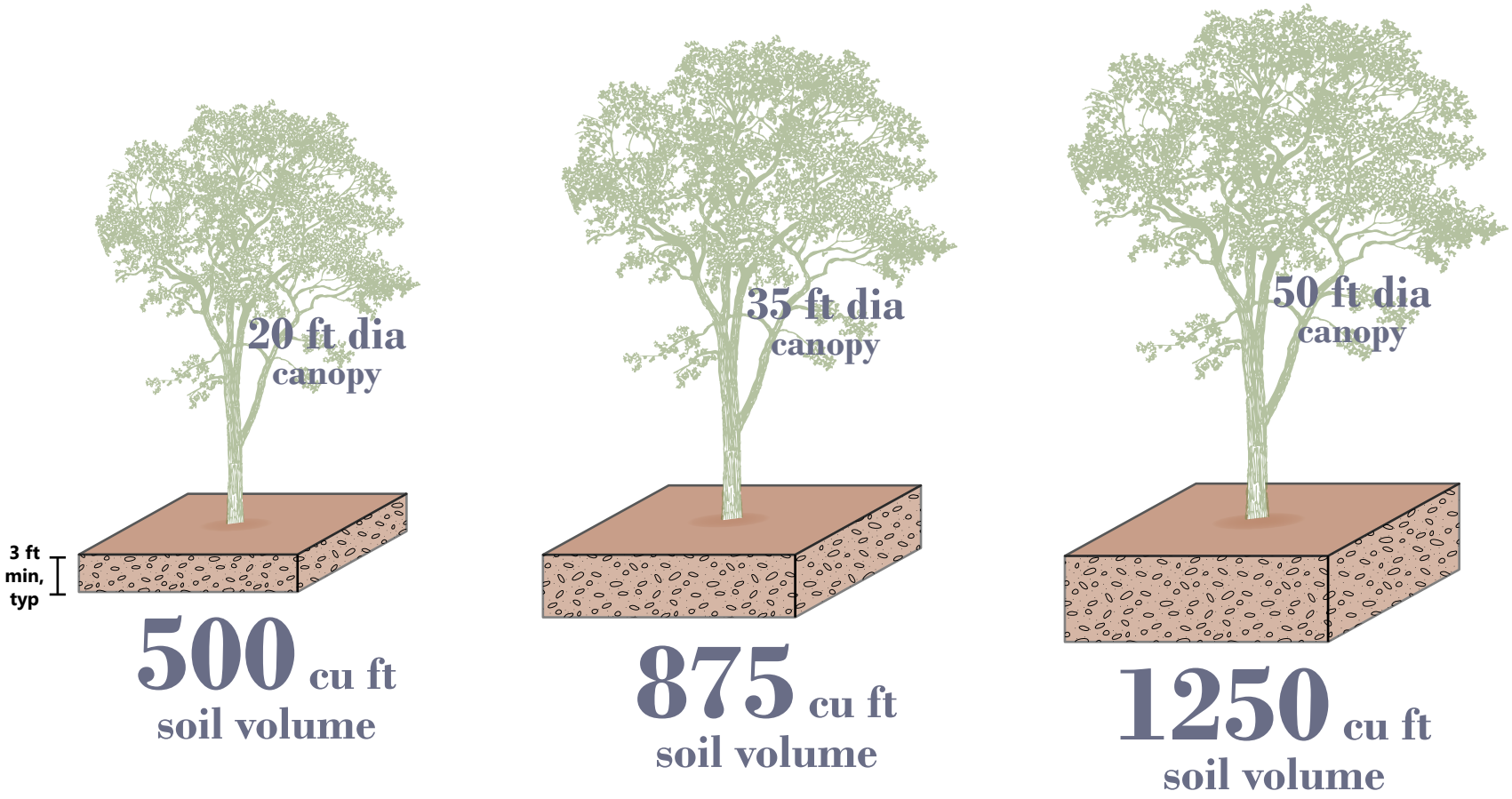


Figure 1. Soil Volume

The volume of soil available for tree rooting must also be considered in any constrained planting situation. Generally, two cubic feet of healthy soil for each square foot of expected mature tree crown area (the area within the tree's dripline) is recommended (Hewitt 2012). Thus, a small tree might require 500 cubic feet of soil to enable healthy canopy growth of at least 20 feet in diameter (see Figure 1). Providing adequate rooting volume for trees will allow for achievement of maximum mature tree size, more resilience to stresses such as drought, and less dependence on prolonged irrigation.

Planting Configuration

Vegetation structure, placement, and density are three physical elements of a native landscape that translate into varying degrees of habitat function.

Vegetation Structure

Vegetation structure refers to the vertical and horizontal architecture of plants. Generally, high wildlife function is associated with habitats with the vertical structure of a multi-layered canopy – a diversity of overlapping vertical layers (understory, midstory, and overstory). In areas where approximating a woodland plant community is possible, creating multi-story canopy by using plants with a variety of different heights should be prioritized (see Figure 2). As is common practice in most projects, existing large trees on a project site should be preserved and protected to the extent feasible.

Plant placement can increase wildlife value by creating varying plant density (refuge and buffering from disturbance) and diversity of foraging opportunities. This can be achieved by using plants with a variety of widths, and varying the planting density to provide horizontal structural diversity – both very dense areas as well as some small open areas.

Figure 2. Vertical Vegetation Structure

Providing planting structure that maximizes habitat value is specific to the ecological context of each planting area, and depends on proximity to other habitats, sources of disturbance, and other factors. Planting layout and density will have to balance the establishment of wildlife values (through dense planting configurations) with public safety (the ability to see into plantings near public use areas). See Figure 3 for an example of vertical and horizontal structure. See Section 7 for the plant list, which cites the growth forms of individual species to help designers create appropriate habitat structure with plantings. It is recommended that a person with local biological expertise assist design teams with plant species selection and layout to maximize wildlife values.

Generally, wildlife responds best to considerably higher planting densities than those found in conventional commercial landscaping. Higher density translates to higher initial planting cost, different management requirements (see Section 5), and a different visual aesthetic than conventional landscaping as well.

Visual Aesthetic

The visual aesthetic of native habitat planting areas is generally different than that of conventional manicured landscapes. Native habitat areas should not be maintained in the same fashion as conventional landscapes. For example, it is recommended to allow leaf litter and fallen branches to accumulate (see also below under Soil Development). Designers can soften the more rugged appearance of native planting areas by planting the edges with aesthetically pleasing species, clustering them densely to mask interior habitat areas that have a rougher appearance. It can also help to provide visual and educational cues that the habitat area is special (Nassauer 1995). This could include subtle signage, bird/bat houses, or other easily perceived indicators. Over time, as people are exposed to native habitat plantings in the urban context, it is expected that their appreciation of these areas will grow, and the expectation of a manicured landscape will diminish. It will of course take time to establish the native habitat plantings, and for people to experience the new benefits (wildlife, new sights, sounds and smells, etc.) these areas can provide.

Top Right: Simple fences and other features can be used to delineate planting areas, communicating that they are spaces that are cared for.
Middle Right: Brightly colored flowers are massed in high use areas for visual interest.
Bottom right: careful placement of stones, logs, or other elements can add interest to planting areas.

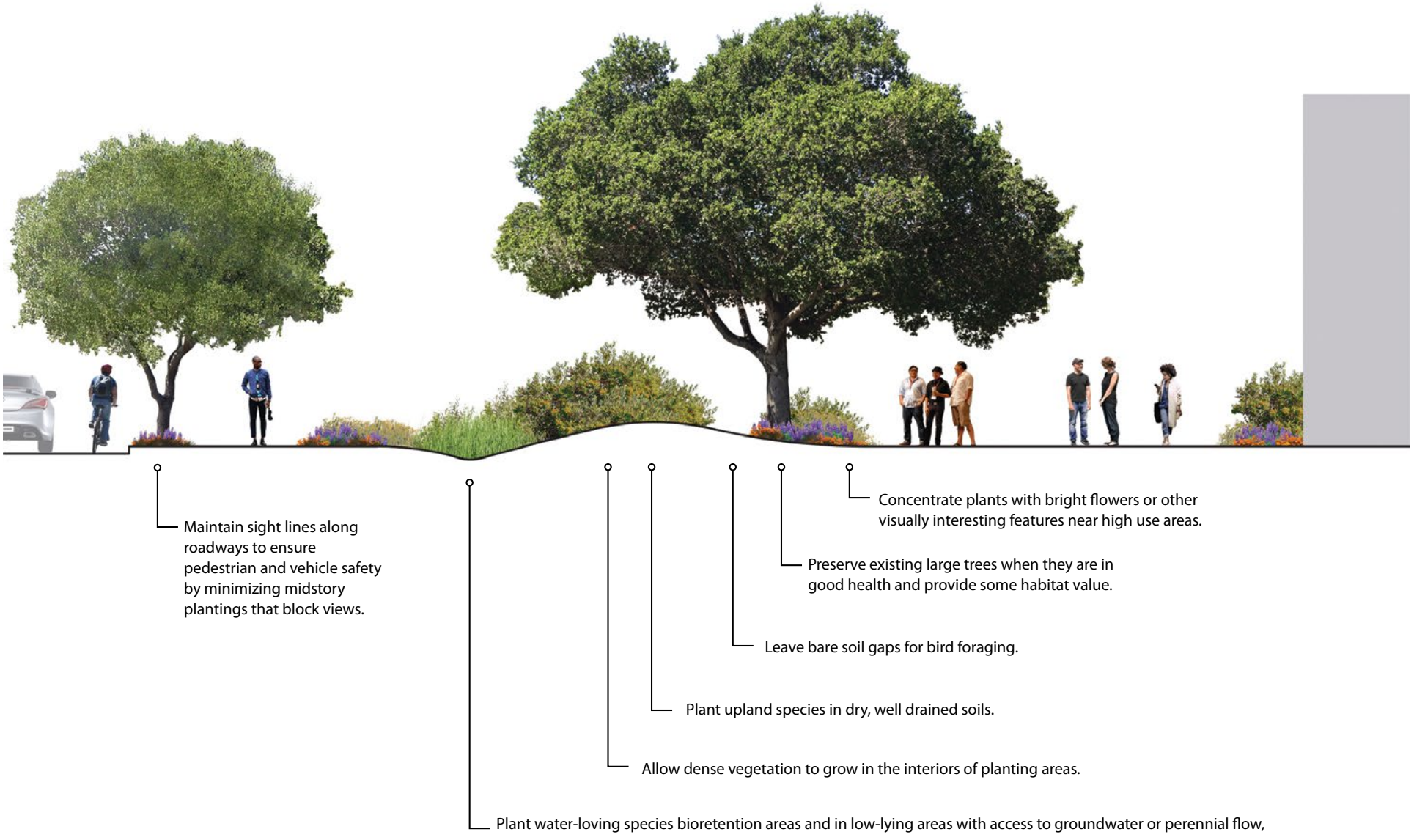


Figure 3. Planting Configuration Considerations

Re-oaking

In addition to the structure and density of individual planting areas, habitat value can be improved by viewing the regional landscape as a systemic whole. Historically, the Santa Clara Valley landscape was dominated by scattered oaks – both as individuals and in clusters. Re-oaking is a concept built on research by the San Francisco Estuary Institute that entails re-introducing oaks across the landscape.

A simple rule of thumb is to create a network of native oaks by planting native oaks close to other native oaks (a good goal is 75-100 feet between oaks or at least one oak per acre) and striving to plant an oak as part of every project that has conditions appropriate for oaks. This network can support a variety of oak-associate bird species currently absent from the landscape, and also bring back a historical landscape typology that has all but disappeared from the valley. The use of native oak species or other species associated with oak-dominated landscapes should be prioritized in all projects where conditions are met for oaks to survive (see plant list for appropriate species).

Valley Oak (*Quercus lobata*)

Supporting re-oaking through the maintenance of existing oaks is also important. Wherever possible, development should be configured in a way that avoids removing existing native oaks, especially large specimen trees, which are uniquely valuable ecologically.

For more information on native oaks and re-oaking, read San Francisco Estuary Institute's

Re-Oaking Silicon Valley: Building Vibrant Cities with Nature

http://www.sfei.org/documents/re-oaking-silicon-valley

Soil Development

Planting designs should plan for allowing the accumulation of leaf litter and fallen branches. This organic mulch will provide wildlife value, assist in the evolution of healthy living soils, moderate soil temperature, improve moisture absorption and retention, and reduce irrigation needs. However, organic mulch does create a "wilder" visual aesthetic to which users may need to become accustomed.

Use of bark, mulch, gravel, or landscape fabrics should be avoided except immediately around the base of new plantings, and then only during the first few years while the plant is becoming established. Such materials significantly reduce bird foraging habitat in planting areas by impeding direct access to the soil (and the insects living there).

When using natural mulch is not feasible, carefully consider what type of mulch to use. Try to reduce or eliminate the use of mulch as plants become more established.

Leaf litter accumulates in a native planting area in Mountain View, CA

Types of Mulch

Organic compost: Fully composted organic mulch. Provides excellent nutrients for plants but requires frequent replacement and may encourage weeds.

Arborist mulch: Chipped leaves and branches from various sources. Inexpensive, but of inconsistent quality.

Bark or wood chips: If using bark or wood chips is unavoidable, use naturally colored chips and avoid buoyant chips that can wash away during rainstorms. Maintain occasional bare soil gaps in the mulch (approximately 3' x 4') for bird foraging.

Cardboard sheet mulch: Uses layers of organic compost, cardboard, and bark or woodchip mulch or variations thereof. Great for areas that were lawn in the past because it can stop the lawn from growing back.

Landscape Management

A recently installed native landscape in Menlo Park, CA

Management of native landscapes is different from that for traditional landscapes. Generally, conventional landscapes can be maintained by standard landscaping crews, whereas native landscapes can require more specialized knowledge of adaptive management and native plants. Over time, native landscapes can reduce maintenance efforts, such as through reduced irrigation where drought tolerant species are used, less trimming and clearing of leaves, reduced weeding due to natural mulch accumulation, etc.

Maintenance Crews and Education

Most landscape maintenance crews are not adequately trained in the management of native landscapes. It is recommended that all maintenance crews receive training in native plant identification and management procedures from a restoration ecologist or other appropriately trained person.

Nonnative (weed) plant control

Control of invasive nonnative plants (weeds) is important to support wildlife functions, maintain a natural aesthetic, and decrease competition with native plant species. The California Invasive Plant Council (Cal-IPC) ranks the invasiveness of nonnative plant species. Typically, invasive weeds are targeted if they are rated as Limited, Moderate, or High, with the highest priority control targeting Moderate and High rated species.

For information on how to maintain trees for optimal habitat value, visit the

Tree Care for Birds and other Wildlife

website at http://treecareforbirds.com/

The use of chemical herbicides, pesticides, or other chemicals in native landscapes is strongly discouraged. The primary approach to weed control is through manual treatment (hand pulling, mowing, excavation, flaming, solarization, mulch, sheet mulch, etc.). Dense plantings and natural leaf mulch can help reduce weed infestations while also supporting good habitat values. Chemicals should be applied as a last resort. Weeds in native planting areas should not be controlled by the pervasive placement of bark mulch, gravel, or landscape fabrics. These materials deprive the planting areas of most of their foraging value for birds. During the initial plant establishment period, the use of such groundcover materials is acceptable in limited areas around the base of new plantings. However, over time leaf and branch litter should be allowed to accumulate and decompose, thereby protecting and enriching the soil and supporting wildlife values.

With the right management native plants can thrive in a variety of urban landscapes, including parking lots.

Irrigation

Many native species are fairly hardy and drought tolerant once established. Irrigation will generally be necessary during a three-year plant establishment period. In the second and third year, irrigation should be tapered off to acclimate the plants to local conditions. It will be necessary, however, for qualified maintenance crews to carefully monitor the adaptation of the plants to determine an appropriate irrigation regime. Grouping plants by their water needs (see "WUCOLS" column in the plant list at the end of this document) will help ensure plants are receiving an appropriate amount of water. Some plantings may require longer term irrigation, while others may more quickly become self-reliant, such as willow or cottonwood trees that tap into groundwater. As mentioned above, allowing the accumulation of large amounts of natural leaf litter on the ground surface will reduce irrigation demands.

Top Left: Recycled water is being used more and more for irrigating urban landscapes.
Middle Left: Native species will often spread within a planting area. This should be encouraged.
Bottom left: A maintenance crew maintaining a native planting area in Mountain View, CA.

Recycled Water

Although the use of recycled water is often highly desirable from a water conservation and environmental perspective, its constituent parts can build up in the soil over time and negatively affect plant growth. In particular, higher levels of salts, boron, heavy metals, and chlorine can affect plant growth and soil quality over time. Periodically flushing soils with a large quantity of water may help mediate this issue.

Replanting

In more natural environments, native plantings can be very resilient and not require ongoing maintenance or replacement. However, unlike many cultivated varieties of conventional landscape plants, native plants have not been bred to tolerate harsh urban conditions (extensive hardscape, altered drainage patterns, compacted soils, trampling, etc.). Therefore, anticipate replanting until native planting areas are fully established. Even after establishment, occasional replanting will be necessary to "refresh" the visual appeal of native planting areas in the urban environment.

Strategies for Native Landscape Management

- Let leaf litter accumulate
- Minimize use of wood chips
- Do not use plastic or recycled tire mulch
- Minimize use of herbicides and pesticides
- Leave dead trees as snags for woodpeckers and other birds where safe
- Do not deadhead plants
- Let plants spread naturally

Lesser goldfinch
on a bird feeder

Bird-Safe Design

Making urban areas safer for birds is of the utmost importance in places where new habitat is being created that will encourage them to spend more time in developed areas. A common issue that birds face in developed areas is fatality or injury due to collision with glass, but additional risks include habitat loss and degradation (through development, light pollution, water pollution, and other factors), fatality or injury due to construction activities, and risk of predation by feral cats or other common urban wildlife. These risks can be mitigated by ensuring bird-safe design guidelines are implemented throughout the design and construction of buildings, and the design construction, and management of landscapes.

Bird-Safe Design for Buildings

Avian collisions with glass fall into two primary categories: birds making daily movements (for foraging, etc.), and birds migrating at night. During the day, birds may see vegetation reflected in glass windows, or see interior vegetation through windows. Attracted to the vegetation and unable to perceive glass, they fly toward the building and collide with the window.

Birds migrating at night can be attracted to lights in buildings, causing them to collide with lit windows during the night and the next morning. Inclement weather, foggy conditions, and relatively tall structures increase nighttime bird strikes (Gauthreaux and Belser, 2006). This can involve large numbers of birds, even at a single building on a single night under certain conditions.

In response to concern over bird collisions with buildings, many cities, including San Francisco and Oakland, California, have adopted building guidelines for reducing risks to birds. These guidelines advocate minimizing the use of glass in architecture, and also often address two aspects of architectural design: designing glass surfaces that have reduced reflectivity and are visible to birds, and reducing visible light at night.

Nuttal's Woodpecker (*Picoides nuttallii*)

Links to more detailed bird-safe building design guidelines, including examples and references to scientific studies can be found at:

Bird Friendly Building Design.
http://www.abcbirds.org/abcprograms/policy/collisions/pdf/Bird-friendly_Building_Guide_WEB.pdf

City & County of San Francisco Standards for Bird-Safe Buildings.
http://www.sf-planning.org/index.aspx?page=2506

Audubon Society Bird-Safe Building Guidelines.
http://www.nycaudubon.org/pdf/BirdSafeBuildingGuidelines.pdf

B3 Guidelines: Bird-Safe Building.
http://www.b3mn.org/guidelines/s_14.html

Note that there is an LEED Pilot Credit (#55) for Bird Collision Deterrence.

Bird-Safe Architectural Lighting

Turn lights off at night.

Reduce artificial light at night to only that required for safety or human functioning. For example, all interior building lighting can be turned off except in areas with active human activity (automatic lights out function) or areas requiring lighting for safety purposes. Many cities in the United States and Canada have now adopted bird-safety "lights out" programs. Such programs are particularly effective at reducing nocturnal bird collisions when implemented during the main migratory periods (which vary by location; consult an ornithologist with detailed knowledge of local migratory patterns to help establish these periods). Of course, such programs conserve energy as well.

Pull shades after dark.

Block interior light from being emitted through windows at night by drawing blinds, curtains, etc., over windows in lit spaces.

Direct lighting downwards.

Design lighting so that it is directed downward, rather than up or outwards.

Use blue or green light.

Blue or green light has been experimentally demonstrated in limited lab and field experiments to be safer for birds than white or red light (Poot, et al, 2008). Similarly, strobe or non-static lighting is safer than static light, especially white light.

Anna's Hummingbird (*Calypte anna*)

Bird-Safe Architectural Surfaces

Avoid highly reflective glass coatings throughout all glazing systems. Birds can perceive reflected landscape images as actual landscape features and attempt to fly to them, colliding with the glass. Although it is not possible to eliminate all reflections on glass assemblies, high performance coatings and glass treatments can be carefully selected to avoid vivid reflections of the sky and foliage. While highly reflective coatings are often used to help mitigate heat gains across the building envelope, the latest developments in ultra-high performance coatings allow for improved thermal performance with very low reflectivity.

Create fine-grained visual obstacles.

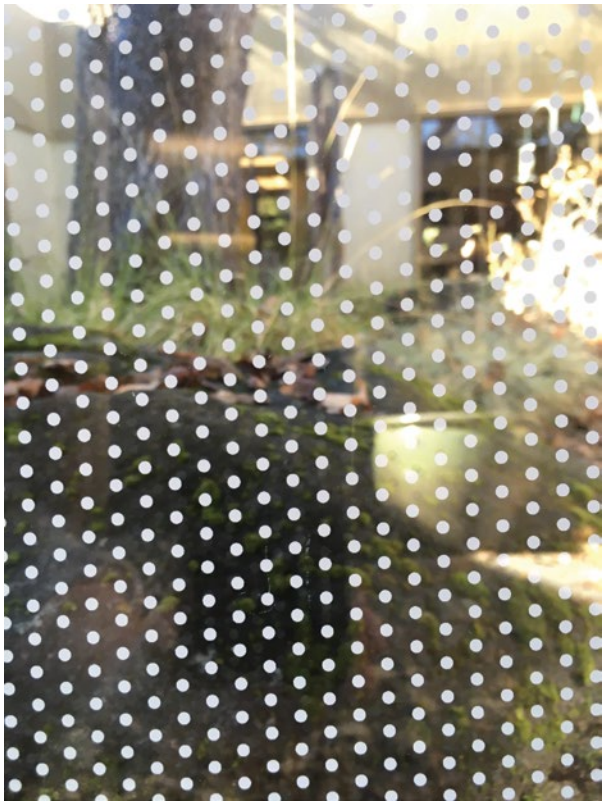
Visual obstacles may include: permanent patterns on the glass in the form of ceramic frit or printed interlayers, external shading louvers or fins, exterior fabric or metal mesh shades, blinds or shades located exteriorly, or shading integrated within the insulating glass units. Such visual obstacles help birds understand that the glazed assemblies are physical barriers.

Experimental approaches to determining safety thresholds in pattern density of visual clues in glass are relatively limited. Currently, based on research conducted on deterring avian collisions, glass fritted in patterns spaced at about 2x4-inches (5 to 10 cm) has been effective at deterring collisions (Klem, 1990). In areas where hummingbirds are common, 2x2-inch patterns have been used to mitigate hummingbird – glass interactions. Opaque or translucent glass features represent excellent options for reducing avian collisions (ibid).

While exterior visual obstacles and patterns that cover the entire external glass surface are highly effective, interior visual obstacles are not necessarily effective in deterring bird collisions as they do not decrease the reflectivity of the exterior glass. Visual cues on the second or other interior layers of the glass have been determined to be effective at deterring bird strikes, but placing the pattern on the outer surface is preferable if possible (there are constraints to which layer can support frit depending on the glass features).

Eliminate atria and courtyards.

There should be no atria or courtyards that can trap birds, especially if they are heavily planted and bordered by glass walls, windows or skywalks.



Fritted or patterned glass can be effective at deterring avian colisions with buildings.

Bird-Safe Design for Landscapes

More developed urban landscapes have lower bird diversity and the species composition is less reflective of the native bird population. As more and more greenery is incorporated into the landscape, species diversity increases and native species increasingly utilize these habitats. The vegetation species composition and configuration within the landscape represent important variables in determining avian species composition, richness and abundance.

Bird-safe lighting installed in Mountain View, CA

Taking care to incorporate strategies for bird-safe landscape design at an early stage in the design process will ensure a healthy bird population can be sustained in urban and suburban areas.

Bird-Safe Landscape Design

Strategically place vegetation to minimize collision risk. The goal should be to avoid placing vegetation in areas where it will be reflected in a building's glass façade in such a way that a bird might fly into the glass trying to reach the reflected vegetation. San Francisco's bird-safe design guidelines state that trees and shrubs should be located directly adjacent to the building (within three feet) to slow down a bird's approach, or placed far enough from the building to avoid reflecting the vegetation in the glazing. The risk potential associated with each building should be analyzed independently by a qualified ornithologist because overall risk to birds is a function of many variables.

Bird-Safe Landscape Lighting Design

In addition to collisions and habitat loss, habitat degradation because of light pollution is a major concern in urban and suburban areas. Light pollution, in which artificial light is directed at, or spills over into, sensitive habitats, can impact birds and other wildlife. It interferes with activity patterns and increasing predation pressure, among other factors. Careful design can diminish these issues.

Reduce the use of artificial light.

Artificial light in landscaping should be minimized to that necessary for safety and function (i.e., unnecessary lighting should be turned off at night). Sensitive habitats such as restored native habitats should be subject to low-lumen lighting and no lighting where possible.

Direct light downward.

Landscape lighting should be low, directed downwards, and shielded above.

Use colored light.

Blue and green monochromatic light sources have been experimentally demonstrated to be less disruptive for migrant birds in lab and field experiments (ibid). However, light in the red/yellow range has been shown to be better for insects (Longcore and Rich, 2016). Use red and yellow light at low levels (bollard lights and lower) and blue and green light on taller light fixtures.

Bird-Safe Construction Practices

Birds can be impacted by construction activities, including both direct impacts (for example, destruction of a nest) and indirect impacts (reduction or loss of foraging habitat). Habitat degradation and loss represent the most serious threats to the conservation of wild birds. Therefore, habitat loss due to project construction should be minimized to the extent possible and mitigated for when impacts are unavoidable. Ideally, provide higher quality habitat or habitat areas with greater extents than the minimum required for mitigation.

During construction, actions leading to bird or egg fatalities of most bird species are prohibited by the Migratory Bird Treaty Act (FWD, n.d.). Although the Act covers "migratory" birds, enforcement branches of the U.S Fish and Wildlife Service and various state wildlife agencies, including the California Department of Fish and Wildlife, interpret this as covering essentially all native species, whether migratory or not.

To the extent feasible, construction activities should be scheduled to avoid the nesting season.

Guidelines for protection of nesting native birds from project construction activities are listed below. These guidelines are an example of an approach that protects nesting birds during the breeding season (February 1 through August 31 for most species) to avoid the incidental loss of eggs or nestlings, either directly through the destruction or disturbance of active nests or indirectly by causing the abandonment of nests.

This particular approach is the recommended approach for avoiding code violations as well as violations of the Migratory Bird Treaty Act (MBTA). It was developed for projects in northern California, but the approach can be modified (for example, with respect to the timing of nesting) and applied broadly.

Measure 1: Avoidance.

To the extent feasible, construction activities should be scheduled to avoid the nesting season. If construction activities are scheduled to take place outside the nesting season, all impacts to nesting birds protected under the MBTA and California Fish and Game Code should be avoided.

Measure 2: Pre-construction / Pre-disturbance Surveys.

If it is not possible to schedule construction activities outside the nesting bird season, then pre-construction surveys for nesting birds should be conducted by a qualified ornithologist to ensure that no nests will be disturbed during project implementation. These surveys should be conducted no more than seven days prior to the initiation of construction activities. During this survey, a qualified ornithologist will inspect all trees and other potential nesting habitats (e.g., trees, shrubs, ruderal grasslands, buildings) in, and immediately adjacent to, construction impact areas for nests. If an active nest is found sufficiently close to work areas to be disturbed by these activities, the ornithologist will determine the extent of a construction-free buffer zone to be established around the nest (typically 300 ft. for many raptors and 100 ft. for other species), to ensure that no nests of species protected by the MBTA and California Fish and Game Code will be disturbed during Project implementation. Consultation with a qualified ornithologist is recommended to determine if buffer modification is appropriate (and when implemented, reduced buffers are often monitored by an ornithologist to ensure that construction activities do not impact nesting).

White-breasted Nuthatch (*Sitta carolinensis*)

Measure 3. Inhibition of Nesting.

If construction activities will not be initiated until after the start of the nesting season, we recommend that all potential nesting substrates (e.g., bushes, trees, grasses, and other vegetation) that are scheduled to be removed by the Project be removed prior to the start of the nesting season. This will preclude the initiation of nests in this vegetation, and prevent the potential delay of the Project due to the presence of active nests in these substrates.

Bird-Safe Landscape Management

Avoid the use of chemicals.

Avoid or minimize use of pesticides, fungicides, herbicides, or other chemical treatments.

Take care to avoid impacting nesting birds while managing the landscape.

Landscape management such as vegetation removal and trimming should take care to avoid harming nesting birds. Strategies for protecting nesting birds can be found above in Bird-Safe Construction Practices.

Reduce wildlife access to human food (garbage etc.).

Many "pest species" of birds are attracted to, and benefit from human food sources, including garbage and purposeful feeding (bread crumbs, etc.). Some of these species, including corvids (ravens and crows) and gulls, have increased greatly due to access to garbage, and these species prey upon other species of birds – including special- status birds and birds listed as threatened and endangered. Thus, wildlife-proof garbage receptacles should be used, and people should be discouraged from feeding human food to birds (educational approach). This should not be confused with using bird feeders to feed avian food to birds, which benefits many native species.

Install bird feeders.

Native birds benefit from bird feeders. Non-native birds can benefit as well, however typically the more extensive and native the vegetation, the fewer the nonnative birds. The Cornell Lab of Ornithology manages a citizen-science program called "Project FeederWatch". Over 15,000 people count birds at their feeders for this effort and FeederWatchers have contributed valuable data for monitoring changes in the distribution and abundance of birds (The Cornell Lab of Ornithology, 2015).

Feeders also allow for close observation of often otherwise difficult to see birds, which creates an educational opportunity for people to see and appreciate birds at a much closer than normal scale. However, care must be taken to avoid unintended problems from feeders; they must be cleaned regularly to avoid disease transmission; they should be placed where they will not be a focal point for cats to prey on birds, and spilled seed should be minimized to avoid boosting rat and squirrel populations.

Rufous and Anna's hummingbirds congregate at a feeder.

Install bird baths and water features.

Adding water sources for birds and other wildlife can be very beneficial (DeCecco and Brittingham, 2015), especially in semi-arid and arid regions. Although they can extract some water from food, most birds drink water daily. They also use water to clean feathers and remove parasites. Guidelines on providing appropriate bird baths and water features are provided by the Cornell Lab of Ornithology.

Install nest boxes.

The installation of nest boxes is a widely used conservation measure for cavity-nesting birds of all sizes and nest boxes can significantly benefit these species in areas where appropriate sized cavities are limited (Rodriguez, 2011). However, nest boxes should be placed in the correct location (height, compass direction, light exposure, etc.), and a qualified ornithologist should be consulted with respect to nest box placement. In addition, an ornithologist should be consulted to provide next boxes that do not provide suitable nesting sites for introduced species such as European starlings and house sparrows. Nest boxes for predatory birds, such as owls, can be an effective natural management approach for controlling local rodent populations (for example, barn owl nest boxes are widely used to control rodents in agricultural settings). An example of a corporately sponsored nest-box project is IBM Corporation's IBM Research center in California's Santa Clara Valley where almost 300 western bluebirds were successfully fledged from over 100 bluebird nest boxes in 2013. This program has been highly successful in helping to restore the local bluebird population (The Conservation Registry, 2015).

Minimize pet encroachment into habitats.

Domestic and feral cats can have highly significant negative effects on bird populations. Domestic pets should be kept indoors and on leash when outdoors near sensitive habitats. Educational signage about the impacts of domestic and feral animals on sensitive habitats could be included as part of an educational program on local ecology. Information derived from refereed scientific publications on the impacts of domestic and feral cats on bird populations should be included in this program.

Top right: Tree swallows use a nest box.

The Cornell Lab of Ornithology's NestWatch Program
provides excellent information on nest box design and installation

https://nestwatch.org/learn/all-about-birdhouses/

Plant List and Photos

The attached plant palette includes native species that provide high-value habitat for native wildlife. For the purposes of these guidelines, a "native" plant is defined as a plant species that is native to the San Francisco Bay Region, with a special emphasis on those "natives" suited to the South Bay and its environmental conditions. The plant palette also includes a selection of nonnative plants that provide wildlife value. It is recommended that designers prioritize native species unless they have a compelling reason to include nonnative species.

With assistance from an expert in local ecology, the designers should strive to select suites of plant species that closely mimic plant communities seen in nature and thus attract and support the most native wildlife species. To assist in this the plant list has been organized to identify major plant communities that are appropriate to the Santa Clara Valley: mixed oak woodland, mixed riparian forest, oak savanna, and wet and dry meadows.

The majority of plants selected fall into Sunset Climate Zone 17 (marine effects in California), which encompasses most of the Valley floor nearest the San Francisco Bay. This area also falls into USDA Hardiness Zone 10a, and plants have been selected with this in mind (see Section 8 for references). Consideration can also be given to expected climate change, by taking into account that future conditions may be warmer and drier at times. Given the complexity of climate change projections, however, it is very difficult to provide simple guidance on this issue.

An indication of each species' water needs is included on the plant lists (WUCOLS value). Designers should strive to use plants that can sustain themselves with as little irrigation as possible on their project site. High water use plants should be used in riparian areas or wetlands where they have easy access to groundwater. Plants with low water use should be prioritized in upland, well drained areas.

Some native plants may be less predictable than conventional landscape plants. For example, some species of grasses (such as *Elymus triticoides*) spread rhizomatously, and can take over planting areas in specific conditions. Other plants like deergrass need plenty of space to grow, so should not be planted too densely to avoid future shearing by maintenance crews. Consultation with local plant experts can help address these considerations.

California sycamore
Platanus racemosa

Valley oak
Quercus lobata

Coast live oak
Quercus agrifolia

California buckeye
Aesculus californica

Fremont cottonwood
Populus fremontii

Red willow
Salix laevigata

Scientific Name	Common Name	Native	Sun/Shade Tolerance	Color/Seasonality	Canopy Width	Salt Tolerance	WUCOLS	Mixed Riparian Woodland	Mixed Oak Woodland	Oak Savanna	Bayside Scrub	Wet Meadow	Dry Meadow	Birds	Hummingbirds	Butterflies (Larvae and/or Adult)	Beneficial Insects	Observations
NATIVE OVERSTORY																		
Acer negundo	boxelder	Y	Sun / Part shade	Golden fall foliage	50 ft	L	M	X	X	-	-	-	-	X	-	-	-	provides moderate food resources for seed-eating birds and small mammals, and good seasonal cover and nesting sites for a variety of bird species
Acer macrophyllum	big leaf maple	Y	Sun / Part shade	yellow to pink flowers April to May	65 ft		M	X	X	-	-	-	-			X		Io moth host, wind pollinated
Aesculus californica	California buckeye	Y	Sun / Part shade	white to pale rose flowers; May-Jun	20-30 ft	S	VL	X	X	X	-	-	-	X	-	X	X	provides food resources for seed-eating birds and small mammals, nectar for butterflies, food for butterfly larvae, and moderate seasonal cover for birds; seeds may be safety hazard near bike path;pollen toxic to non-native honey bees
Alnus rhombifolia	white alder	Y	Sun / Part shade	catkins Jan-Apr	40-70 ft	R	H	X	-	-	-	-	-	X	-	-	-	food for birds; seasonal cover and nesting sites for birds; mature tree provides tall perching sites for birds
Arbutus menziesii	Pacific madrone	Y	Sun / Part shade	Showy pink or white flowers in spring	50 ft		L	-	X	-	-	-	-	X	-	X	X	Food for insect and seed-eating birds, nectar plant for adult butterflies; year-round cover and limited nesting sites for birds
Platanus racemosa	California sycamore	Y	Sun / Part shade	Bronze fall foliage	20-50 ft	R	M	X	-	-	-	-	-	X	-	X	-	Although this species often hybridizes with London plane tree, and thus nursery stock is often a hybrid of the two species, it can be appropriate in urban settings and has good wildlife value. Strongly recommend that an expert assess nursery stock prior to purchase, because a well-trained eye can often detect (and reject) hybrids based on leaf shape, bark and branch morphology. Food for butterfly larvae; seeds for birds and small mammals; moderate seasonal cover and nesting sites for birds; mature trees provide tall perching sites for birds
Populus fremontii	Fremont cottonwood	Y	Sun	Golden fall foliage	30-50 ft	S	M	X	-	-	-	X	-	X	-	X	X	high wildlife habitat value - provides food resources that would be used by birds and butterfly larvae, tall perching and nesting sites for birds, including cavity-nesters, and moderate seasonal cover for birds
Quercus agrifolia	coast live oak	Y	Sun / Part shade	Evergreen glossy dark green leaves.	50 ft	S	VL	X	X	X	-	-	-	X	-	X	X	food for butterfly larvae, acorns for birds and small mammals; mature trees provide tall perching sites for birds; high-quality year-round cover and nesting sites for birds
Quercus berberidifolia	scrub oak	Y	Sun / Part shade	Evergreen inconspicuous yellow flowers Feb-Apr	15 ft		VL	-	X	X	X	-	-	X		X	X	
Quercus douglasii	blue oak	Y	Sun / Part shade	March to May	30 ft		VL	-	X	X	-	-	-			X		Host for CA sister and mournful duskywing, wind pollinated
Quercus lobata	valley oak	Y	Sun / Part shade	Bronze or gold fall foliage	50 ft	S	L	X	X	X	-	-	-	X	-	X	X	high wildlife habitat value - provides food resources that would be used by butterfly larvae, birds, and small mammals, tall perching sites for birds, and moderate seasonal cover and nesting sites for a variety of bird species
Salix laevigata	red willow	Y	Sun	Catkins Dec-Jun	5-10 ft	L	H	X	-	-	-	X	-	X	-	X	X	high wildlife habitat value - provides food resources that would be used by insect and catkin-eating birds, butterfly larvae, and adult butterflies, and seasonal dense cover and nesting sites for a variety of bird species
Salix lasiolepis	arroyo willow	Y	Sun / Part shade	Gold foliage in fall	15 ft	S	H	X	-	-	-	X	-	X	-	X	X	high wildlife habitat value - provides food resources that would be used by insect and catkin-eating birds, butterfly larvae, and adult butterflies, and seasonal dense cover and nesting sites for a variety of bird species

LEGEND

Salt Tolerance
S: plant has moderate or high salt tolerance
R: plant is tolerant of recycled water
L: plant has low salt tolerance

WUCOLS (Water Use Classification of Landscape Species)
H: high water use; M: moderate water use
L: low water use; VL: very low water use

An 'X' in any category indicates that the plant is either associated with that habitat type or provides a benefit to the indicated wildlife.

Manzanita
Arctostaphylos spp.

Buckbrush
Ceanothus cuneatus

Common snowberry
Symphoricarpos albus

Chaparral current
Ribes malvaceum

Black sage
Salvia mellifera

California coffeeberry
Frangula californica

Blue elderberry
Sambucus nigra ssp. caerulea

Scientific Name	Common Name	Native	Sun/Shade Tolerance	Color/Seasonality	Canopy Width	Salt Tolerance	WUCOLS	Mixed Riparian Woodland	Mixed Oak Woodland	Oak Savanna	Bayside Scrub	Wet Meadow	Dry Meadow	Birds	Hummingbirds	Butterflies (Larvae and/or Adult)	Beneficial Insects	Observations
NATIVE MIDSTORY																		
Arctostaphylos sp.	manzanita	Y	Sun (some species tolerate part shade)	White to pink flowers	-	S	VL or L	X	X	-	X	-	-	X	X	X	X	food resource for butterflies and birds, provides cover for birds and other wildlife
Artemisia californica	coastal sagebrush	Y	Sun	Silvery light green to gray foliage	-	-	L	-	X	-	X	-	-	X	-	-	-	foraging and nesting for birds, insects, and mammals
Baccharis pilularis	coyote brush	Y	Shade tolerant	White to cream flower	-	S	L	X	X	X	X	X	-	X	-	X	X	food for insect eating birds; dense year-round cover and nesting sites for birds and small mammals
Baccharis salicifolia	mulefat	Y	Shade tolerant	White flowers year round	-	S	L	X	-	-	-	X	-	X	-	X	X	food and shelter for birds, butterflies, insects, and other wildlife
Calycanthus occidentalis	spicebush	Y	Sun / Part shade	Burgandy flowers Apr-Aug	-	-	M	X	-	-	-	X	-	X		X	X	
Ceanothus cuneatus	buckbrush	Y	Sun	White, pale blue, blue, or lavender flower	-	-	L	-	X	-	-	-	-	-	-	-	X	attracts bees
Ceanothus oliganthus	hairy ceanothus	Y	Sun	lavender flowers March to May	-	-	na	-	X	-	X	-	-			X	X	Host for several moths and possibly Erynnis skippers, favored by bees and early flowering.
Ceanothus thyrsiflorus	blue blossom ceanothus	Y	Sun / Part shade	Evergreen; blue flowers in spring.	-	S	L	X	X	-	X	-	-	X	-	X	X	provides food resources that would be used by butterfly larvae and nectar-eating birds and butterflies, and year-round dense cover for birds
Cercis occidentalis	western redbud	Y	Sun / Part shade	showy purple flowers in spring; red, gold, or multicolored fall foliage	-	S	VL	X	X	-	X	-	-	-	X	-	X	attracts bees
Cercocarpus betuloides	mountain mahogany	Y	Sun / Part shade	Evergreen; green, red, or white flowers in spring	-	-	VL	-	X	-	-	-	-	-	-	X	X	attracts bees
Cornus glabrata	brown dogwood	Y	Part Shade	white to cream flowers May to June	-	-	M	X	X	-	-	-	-			X	X	Can be host for echo blue butterfly, will attract bees as well
Cornus sericea	red osier dogwood	Y	Part shade	Red-brown bark, white flowers in summer/fall	-	L	H	X	-	-	-	X	-	X	-	-	-	birds feed on fruits
Corylus cornuta	hazelnut	Y	Shade tolerant	Inconspicuous yellow flowers; Jan- Mar	-	-	L	-	X	-	X	-	-	X	-	-	-	shade-tolerant; provides food resources that would be used by nut-eating birds and small mammals, and seasonal cover and possible nesting sites for birds

LEGEND

Salt Tolerance
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An 'X' in any category indicates that the plant is either associated with that habitat type or provides a benefit to the indicated wildlife.

Scientific Name	Common Name	Native	Sun/Shade Tolerance	Color/Seasonality	Canopy Width	Salt Tolerance	WUCOLS	Mixed Riparian Woodland	Mixed Oak Woodland	Oak Savanna	Bayside Scrub	Wet Meadow	Dry Meadow	Birds	Hummingbirds	Butterflies (Larvae and/or Adult)	Beneficial Insects	Observations
Frangula californica	California coffeeberry	Y	Sun / Part shade	Evergreen	-	R	L	X	X	X	X	-	-	X	-	X	X	attracts insects, food plant for butterfly larvae, nectar plant for adult butterflies, fruit for birds and small mammals; year-round cover and limited nesting sites for birds
Fremontodendron californicum	flannelbush	Y	Full sun	Yellow flowers; April - Jun	-	-	VL		X	-	X			-	-	-	X	
Garrya elliptica	coast silktassel	Y	Sun / Part shade	Evergreen; Showy green or yellow flowers in winter.	-		L	X	X	-	-	-	-	X	-	-	X	provides food resources that would be used by fruit-eating birds, and year-round cover and nesting sites for birds
Heteromeles arbutifolia	toyon	Y	Sun / Part shade	Evergeen, showy white flowers, prolific red berries	-	S	L	X	X	-	X	-	-	X	X	X	X	provides food resources that would be used by adult butterflies and fruit-eating birds and small mammals, and moderate year-round cover and nesting sites for a variety of bird species; attracts bees
Holodiscus discolor	cream bush	Y	Shade tolerant	Small creamy white to pinkish flowers	-	-	L	X	X	-	X	-	-	-	-	-	X	attracts bees
Lonicera interrupta	chaparral honeysuckle	Y	Sun / Part shade	yellow flowers April to Aug	-		L	-	X	-	X	-	-				X	Host plant for checkerspots but mainly for those not expected to occur in Mtn View area
Lonicera subspicata	southern honeysuckle	Y	Sun / Part shade	yellow to pink flowers May to Aug	-		L	-	X	-	-	-	-				X	Only moth hosts, but bees like it.
Morella californica	California wax myrtle	Y	Shade tolerant	Flowers Mar-Apr Evergreen	-		M	X	-	-	-	X	-	X	-	-	-	provides food resources that would be used by fruit-eating birds, and year-round dense cover and nesting sites for a variety of bird species
Oemleria cerasiformis	oso berry	Y	Part Shade	white flowers March to May	-		M	X	X	-	X	-	-					host for a few moth species. I suspect mostly attracts night flying pollinators
Prunus ilicifolia	holly leaf cherry	Y	Sun / Part shade	Showy cream or white flowers, prolific red or purple drupe.	-	R	L	X	X	-	-	-	-	X	-	X	X	food for butterfly larvae, fruit for birds and small mammals; moderate year-round cover and nesting sites for birds
Rhamnus crocea	redberry buckthorn	Y	Sun / Part shade	small yellow flowers, Feb to March	-		L	-	X	-	X	-	-	X		X	X	Provides food resources for fruit-eating birds, and dense year-round cover for a variety of bird species. Host plant for pale swallowtail - a butterfly not common in south bay. Also host for ceanothus silkmoth, a rare but impressive sphinx moth.
Rhus aromatica	fragrant sumac	Y	Sun	Flower petals generally yellow; Mar-May	-	-	L	-	X	-	X	-	-	-	-	X	X	food for insects, nectar plant for adult butterflies; seasonal dense cover and nesting sites for birds
Rhus integrifolia	lemonade berry	Y	Sun / Part shade	White to pink flowers; Feb-May	-	S	L	X	X	-	X	-	-	X	-	X	X	provides berries for birds and small mammals, food source for butterfly adults and larvae, year-round dense cover and nesting sites for various birds
Ribes aureum var. gracillimum	golden currant	Y	Sun / Part shade	yellow flowers Feb to April	-		na	-	X	-	X	-	-	X				Provides food resources for fruit-eating birds, and some cover for ground-foraging birds. Host for some moths, if dense flowers can draw bees but often too sparse to attract many.

Scientific Name	Common Name	Native	Sun/Shade Tolerance	Color/Seasonality	Canopy Width	Salt Tolerance	WUCOLS	Mixed Riparian Woodland	Mixed Oak Woodland	Oak Savanna	Bayside Scrub	Wet Meadow	Dry Meadow	Birds	Hummingbirds	Butterflies (Larvae and/or Adult)	Beneficial Insects	Observations
Ribes californicum	California gooseberry	Y	Part Shade	whilte to pink flowers Jan to March	-		VL	X	X	-	-	-	-	X				Provides food resources for fruit-eating birds, and some cover for ground-foraging birds. Host for some moths, if dense flowers can draw bees but often too sparse to attract many.
Ribes malvaceum	chaparral currant	Y	Shade tolerant	Pink to purple/ white flowers	-	-	VL	-	X	-	X	-	-	-	-	-	X	attracts bees
Ribes sanguineum	flowering currant	Y	Shade tolerant	White, pink, or red flowers	-	-	L	X	-	-	X	-	-	X	X	X	-	provides food resources for nectar-eating birds and butterlies; berries provide food for birds
Salix exigua	sandbar willow	Y	Shade tolerant	Inconspicuous yellow flowers	-	-	H	X	-	-	-	X	-	X	-	X	X	
Salvia mellifera	black sage	Y	Sun	White to pale blue or lavender (pale rose; Mar- Jun	-	S	L	-	X	-	X	-	-	X	X	X	X	attracts bees
Sambucus nigra ssp. caerulea	blue elderberry	Y	Sun / Part shade	showy cream or yellow flowers, prolific black or purple berry	-	-	L	X	X	-	-	X	-	X	-	X	X	food for insects, nectar plant for butterflies and birds, fruit for birds and small mammals; seasonal dense cover and nesting sites for birds
Solanum umbelliferum	blue witch nightshade	Y	Sun / Part shade	violet to purple flowers Jan to June	-		L	-	X	-	X	-	X			X	X	Provides some nectar for bees and butterflies. Host plant for a few small moths. Bees sometimes drawn to this if flowers prolifically, and they make a cool noise to make the pollen spray out of pores in the anthers like a tuning fork.
Symphoricarpos albus	common snowberry	Y	Shade tolerant	Bell shaped pink flowers; May-Jul	-	-	L	-	X	-	-	-	-	-	X	-	-	
Viburnum ellipticum	common viburnum	Y	Part shade / Shade	white flowers May to June	-		na	-	X	-	-	-	-					Host to several moth species. Have not observed to attract many bees, also not native to this area

LEGEND

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L: plant has low salt tolerance

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California poppy
Eschscholzia californica

Douglas iris
Iris douglasiana

Columbine
Aquilegia formosa

California buckwheat
Eriogonum fasciculatum

California fuschia
Epilobium canum

Sticky monkey flower
Mimulus aurantiacus

Blue eyed grass
Sisyrinchium bellum

Yarrow
Achillea millefolium

Scientific Name	Common Name	Native	Sun/Shade Tolerance	Color/Seasonality	Canopy Width	Salt Tolerance	WUCOLS	Mixed Riparian Woodland	Mixed Oak Woodland	Oak Savanna	Bayside Scrub	Wet Meadow	Dry Meadow	Birds	Hummingbirds	Butterflies (Larvae and/or Adult)	Beneficial Insects	Observations
NATIVE UNDERSTORY																		
Achillea millefolium	yarrow	Y	Intermediate Shade Tolerance	White to pink flowers; Apr-Sep	-	S	L	X	X	X	X	X	X	-	-	X	X	flowers attract many insects and bees
Agrostis exarata	spike bentgrass	Y	Sun / Part shade	Texture late spring	-	-	na	-	-	X	-	X	X	X	-	-	-	
Allium unifolium	one leaf onion	Y	Part shade / Shade	May to June	-		VL	-	-	-	-	-	X				X	bees love it if dense, but will smell of onions
Aquilegia formosa	columbine	Y	Shade tolerant	Red to yellow flowers; Apr-Sep	-	-	L	-	X	-	X	X	-	-	X	-	X	requires higher soil moisture, use in low spots that receive regular water. attracts bees
Artemisia douglasiana	mugwort	Y	Sun to shade	May-Nov	-	-	L	X	-	-	-	X	X	-	-	-	X	can look weedy, best for backdrop groundcover
Asclepias californica	California milkweed	Y	Sun	Purple April-July	-	-	L	-	X	X	-	-	X	-	-	X	X	
Asclepias fascicularis	narrow leaf milkweed	Y	Sun	white/pink	-	L	L	x	X	-	x	x	X	-	-	X	X	attracts butterflies and insects, food source for butterfly larvae, spreads easily via underground stems; attracts bees
Asclepias speciosa	showy milkweed	Y	Sun	rose purple - yellow	-	-	L	X	X	-	-	X	X	-	-	X	X	attracts butterflies and insects, food source for butterfly larvae, spreads easily via underground stems
Baccharis glutinosa	marsh baccharis	Y	Part shade	white July-Oct	-	-	na	X	-	-	-	X	-	-	-	X	X	
Barbarea orthoceras	American rocket	Y	Part Shade	yellow flowers Feb to April	-		na	X	-	-	-	X	-			X	X	host for cabbage white butterfly, bees like it
Berberis pinnata	California barberry	Y	Sun to shade	yellow Feb-May	-	-	M	-	X	-	X	-	-	X	-	-	-	
Bromus carinatus	California brome	Y	Shade tolerant	Textural	-	S/R	na	X	X	X	-	-	X	X	-	-	-	
Calamagrostis nutkaensis	reed grass	Y	Part shade	Textural	-	-	M	X	-	-	X	X	-	X	-	-	-	
Cardamine californica	bitter cress	Y	Sun / Part shade	white flowers Feb to April	-		na	-	-	X	-	X	X					will be visited by bees, but I have not witnessed in great numbers
Carex barbarae	Santa Barbara sedge	Y	Sun / Part shade	Brown inflorescence and fruit; May-Aug	-	L	na	X	-	-	-	X	-	X	-	-	-	
Carex nudata	torrent sedge	Y	Part shade / Shade	Textural April-July	-	-	na	X	-	-	-	X	-	X	-	-	-	
Carex praegracilis	clustered field sedge	Y	Sun	Textural May-Jun	-	S	M	X	-	-	-	X	X	X	-	-	-	
Carex tumulicola	foothill sedge	Y	Sun / Part shade	Textural	-	-	L	X	X	X	X	-	X	X	-	-	-	
Ceanothus thyrsiflorus var. griseus	Carmel ceanothus	Y	Sun / Part shade	blue flowers March to May	-	-	L	-	X	-	X	-	-	X	-	X	X	Actinorhizal plant may benefit from innoculation with Frankia sp. Consider incorporating native soil known to contain Frankia sp., because such inoculum is not commercially available.
Chlorogalum pomeridianum	soap plant	Y	Sun / Part shade	May to Aug	-		VL	-	-	X	X	X	X			X	X	Good for bumblebees. Major host for brown elfin

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Clarkia rubicunda	farewell to spring	Y	Sun	pink flowers May to Aug	-		na	-	-	X	-	X	X			X	X	great for bees, host for white-lined sphinx moth, one of the more common large sphinx moth you will see in urban areas around here.
Clarkia unguiculata	elegant clarkia	Y	Sun / Part shade	pink to purple flowers June to Sept	-		na	-	X	X	X	-	X			X	X	great for bees, host for white-lined sphinx moth, one of the more common large sphinx moth you will see in urban areas around here.
Claytonia perfoliata	miner's lettuce	Y	Part Shade	small white flowers Feb to May	-		na	X	X	X	-	X	-			X		host for white-lined sphinx moth, one of the more common large sphinx moth you will see in urban areas around here. Not much attractiveness for bees.
Collinsia heterophylla	Chinese houses	Y	Sun / Part shade	blue to purple flowers Feb-April	-	-	na	-	-	-	X	-	X	-	-	X	-	annual wildflower, adds color to meadows in spring, requires mowing after seed set to avoid weedy appearance
Cyperus eragrostis	tall flatsedge	Y	Sun	Textural May-Nov	-	-	H	-	-	-	-	X	-	X	-	-	-	seed provides food for birds and small mammals
Deschampsia caespitosa	hairgrass	Y	Sun / Part shade	Textural	-	S	L	X	X	-	-	X	-	X	-	-	-	
Deschampsia danthonioides	annual hairgrass	Y	Sun / Part shade	Textural Mar-Aug	-	S	na	X	-	-	-	X	-	-	-	-	-	
Dichelostemma capitatum	wild hyacinth	Y	Sun	lavender/purple to blue flowers Feb to April	-		VL	-	-	-	-	X	X					Bees will visit, but is not corucopian species in most settings
Elymus condensatus	giant bluerye	Y	Sun	Textural Jun-Aug	-	-	L	X	X	-	X	X	X	X	-	-	-	seed provides food for birds and small mammals
Elymus glaucus	blue wildrye	Y	Shade tolerant	Textural	-	S	na	X	X	X	X	X	X	X	-	-	-	seed provides food for birds and small mammals
Elymus triticoides	creeping wildrye	Y	Part Shade	Textural Jun-Jul	-	S	L	X	X	-	-	X	X	X	-	-	-	seed provides food for birds and small mammals
Epilobium canum	California fuchsia	Y	Shade tolerant	Red-orange Aug-Oct	-	-	L	X	X	X	X	X	X	-	X	X	X	hummingbird and butterfly food source, attracts bees
Erigeron glaucus	seaside daisy	Y	Sun	White, pink, purple May-Jul	-	-	L	-	X	-	X	X	-	-	-	X	X	flowers attract many insects
Eriogonum fasciculatum	California buckwheat	Y	Sun / Part shade	white, pink Apr-Sep	-	R	VL	X	X	-	X	-	X	-	-	X	X	flowers attract many insects and bees
Eriogonum latifolium	Coast buckwheat	Y	Sun / Part shade	white, pink, rose year round	-	-	L	-	X	-	X	-	-					
Eriogonum nudum	naked buckwheat	Y	Sun	May to Aug	-		L	-	X	X	X	-	X			X	X	Favored by bees and butterflies for nectaring.
Eriogonum umbellatum	sulfur buckwheat	Y	Sun / Part shade	white, yellow, red Aug-Oct	-	S	L	-	X	-	X	-	X	-	-	X	X	flowers attract many insects
Eriophyllum confertiflorum	golden yarrow	Y	Sun	yellow Feb-Aug	-	L	L	-	X	-	X	-	-	-	-	X	X	
Eschscholzia californica	California poppy	Y	Sun	orange, yellow Apr-Jul	-	L	VL	-	X	X	-	-	X	-	-	-	X	annual wildflower, adds color to meadows in spring, requires mowing after seed set to avoid weedy appearance
Euthamia occidentalis	western goldenrod	Y	Sun	Yellow Aug-Oct	-	S	na	X	-	-	X	X	-	-	-	-	X	

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Festuca californica	California fescue	Y	Sun / Part shade	Textural Feb-Apr	-	S	L	X	X	X	-	-	X	X	-	-	-	shade tolerant, great choice for under oaks
Festuca idahoensis	Idaho fescue	Y	Sun / Part shade	Textural Jun-Jul	-	L	VL	-	X	X	-	-	X	X	-	-	-	
Festuca rubra	red fescue	Y	Shade tolerant	Textural Apr-May	-	S	L	X	X	X	X	X	X	-	-	-	-	
Fragaria chiloensis	beach strawberry	Y	Sun / Part shade	White Feb-Nov	-	L	M	X	-	-	X	X	X	X	-	-	X	
Fragaria vesca	woodland strawberry	Y	Shade tolerant	White Jan-Jul	-	-	M	X	X	X	-	-	-	X	-	-	X	
Gilia capitata	globe gilia	Y	Sun	white Feb-Apr	-	L	na	-	-	-	X	X	-	-	-	-	X	annual wildflower, adds color to meadows in spring, requires mowing after seed set to avoid weedy appearance
Glycyrrhiza lepidota	American licorice	Y	Sun	June to Aug	-		na	-	-	-	-	-	X				X	If dense enough, will draw bees
Grindelia camporum	common gumplant	Y	Sun	Yellow May-Nov	-	S	?	X	-	-	-	X	X	-	-	-	X	attracts bees
Grindelia stricta	gumplant	Y	Sun / Part shade	Yellow May-Oct	-	S	L	X	-	-	X	X	-	-	-	X	X	
Helianthus annuus	sunflower	Y	Sun	Yellow Jun-Oct	-	S	na	-	-	-	-	-	X	-	-	-	X	attracts bees
Heracleum maximum	common cowparsnip	Y	Part Shade	white flowers June to July	-		na	X	-	-	-	X	-					
Heuchera micrantha	alum root	Y	Shade tolerant	white, pink Apr-Jul	-	-	M	-	X	-	-	-	-	-	X	-	X	shade tolerant, great choice for under oaks or in shady rock outcrops
Hordeum brachyantherum	meadow barley	Y	Sun	Texture Jun-Jul	-	S	na	X	X	X	-	X	X	X	-	-	-	
Iris douglasiana	Douglas iris	Y	Sun to shade	lavender, red-purple, pale cream, veined purple May-Jul	-	L	L	X	X	X	X	X	X	-	-	-	X	shade-tolerant
Juncus effusus	common rush	Y	Sun	brown, texture Jun-Aug	-	L	M	-	-	-	-	X	-	X	-	-	-	
Juncus patens	spreading rush	Y	Sun / Part shade	Texture	-	L	L	-	X	X	X	X	X	X	-	-	-	
Juncus xiphioides	iris leaved rush	Y	Part Shade	Texture May-Jul	-	L	na	-	-	-	-	-	-	X	-	-	-	
Lasthenia californica	California goldfields	Y	Sun / Part shade	Yellow Feb-Jun	-	S	na	-	-	X	-	X	X	-	-	-	X	annual wildflower, adds color to meadows in spring, requires mowing after seed set to avoid weedy appearance
Layia platyglossa	tidy tips	Y	Sun	yellow, white Feb-Jul	-	L	na	-	X	-	-	X	X	-	-	-	X	annual wildflower, adds color to meadows in spring, requires mowing after seed set to avoid weedy appearance
Limnanthes douglasii	meadowfoam	Y	Sun / Part shade	white, yellow Mar-Jul	-	-	na	-	-	-	-	X	-	-	-	-	X	annual wildflower, adds color to meadows in spring, requires mowing after seed set to avoid weedy appearance

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Lomatium californicum	California lomatium	Y	Part shade / Shade	yellow flowers March to April	-		L	-	-	-	X	X	X			X		Host for Anise Swallowtail
Lupinus albifrons	silver bush lupine	Y	Sun	violet Apr-July	-	L	VL	-	X	-	X	-	X	X	-	X	X	attracts bees
Lupinus nanus	sky lupine	Y	Sun	Blue, lavender, pink, white Mar-Jun	-	L	na	-	-	X	-	X	X	X	-	X	-	annual wildflower, adds color to meadows in spring, requires mowing after seed set to avoid weedy appearance
Malva assurgentiflora	island mallow	Y	Sun	pink to purple flowers Feb to July	-		L	-	X	-	X	-	-		X	X		formerly Lavatera assurgentiflora. Host for the West Coast Lady and Painted Lady, outstanding for hummingbirds. Grows fast and flowers profusely.
Melica californica	California melicgrass	Y	Sun / Part shade	textural June-Aug	-	-	na	-	X	X	-	X	X	X				
Melica imperfecta	coast melic grass	Y	Sun / Part shade	Texture Feb-Mar	-	S/R	na	-	-	X	-	-	X	X	-	X	-	seeds and cover for birds, butterfly larvae food source
Mimulus aurantiacus	sticky monkeyflower	Y	Sun / Part shade	yellow, orange, red Mar-Aug	-	L	VL	-	X	-	X	-	-	-	X	X	X	
Mimulus cardinalis	scarlet monkeyflower	Y	Sun / Part shade	corolla orange, red May-Sep	-	L	H	X	-	-	-	X	-	-	X	-	X	
Mimulus guttatus	seep monkeyflower	Y	Shade tolerant	Yellow Apr-Jun	-	L	H	-	-	-	-	X	-	-	-	-	X	
Monardella villosa	coyote mint	Y	Sun / Part shade	white, pink, purple Jun-Aug	-	L	VL	-	X	X	X	-	-	-	-	X	X	attracts bees
Nemophila menziesii	baby blue eyes	Y	Sun / Part shade	white, blue Mar-Jun	-	L	na	-	X	-	-	X	X	-	-	-	X	annual wildflower, adds color to meadows in spring, requires mowing after seed set to avoid weedy appearance
Oenothera elata ssp. hookeri	common evening primrose	Y	Sun / Part shade	yellow flowers Aug to Sept	-		L	X	-	-	X	X	X					Mostly night-visiting pollinators
Penstemon heterophyllus	beard tongue	Y	Sun	purple, blue May-Jul	-	L	L	-	X	-	X	-	-	-	X	X	X	attracts bees
Perideridia kelloggii	Kellogg's yampah	Y	Sun	cream flowers June to Aug	-		M	-	-	-	-	X	X			X		Host for Anise Swallowtail
Phacelia tanacetifolia	tansy leafed phacelia	Y	Sun	lavender/purple flowers March to May	-		na	-	X	-	X	-	X				X	
Polystichum munitum	sword fern	Y	Shade	textural	-	-	M	X	X	-	-	X	-					
Ranunculus californicus	California buttercup	Y	Sun / Part shade	yellow flowers Feb to May	-		VL	-	-	X	-	X	X				X	Favorite of bees, also provides early season resources and color.
Rhus aromatica 'gro-low'	fragrant sumac	Y	Sun	pale yellow flowers	-	-	L	-	X	-	-	-	-	-	-	X	X	food for insects, nectar plant for adult butterflies; seasonal dense cover and nesting sites for birds
Rosa californica	California rose	Y	Sun / Part shade	pink Feb-Nov	-	L/R	L	X	-	-	X	-	-	X	-	-	X	attracts bees
Rubus ursinus	California blackberry	Y	Shade tolerant	White Mar-Jul	-	L	L	X	X	-	X	-	-	X	-	-	X	attracts bees

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Salvia clevelandii	Cleveland sage	Y	Sun	purple, dark violet Apr-Jul	-	S	L	-	X	-	-	-	-	X	X	X	X	flowers attract hummingbirds, butterflies, and many insects
Salvia leucophylla	purple sage	Y	Sun	rose, lavender	-	S	L	-	X	-	-	-	-	X	X	X	X	flowers attract hummingbirds, butterflies, and many insects
Salvia sonomensis	Sonoma sage	Y	Sun / Part shade	Blue to lilac or purple flowers; Mar-July	-	-	L	-	X	-	X	-	X	-	-	X	X	
Salvia spathacea	hummingbird sage	Y	Sun / Part shade	Green to purple inflorescence; Mar-May	-	S	L	-	X	X	X	-	-	X	X	-	X	shade-tolerant; provides food source for nectar-eating birds; attracts bees
Sanicula bipinnatifida	snakeroot	Y	Part Shade	maroon flowers March to May	-		na	-	X	X	X	-	X					
Scrophularia californica	California bee plant	Y	Shade tolerant	red to maroon flowers; Mar-Jul	-	-	L	-	X	-	X	-	X	-	-	X	X	attracts bees; can spread aggressively by underground stems
Sisyrinchium bellum	blue eyed grass	Y	Sun / Part shade	Blue-purple or pale blue/ white flowers; Mar-May	-	-	VL	-	X	X	X	X	X	-	-	-	X	
Solidago velutina ssp. californica	California goldenrod	Y	Sun / Part shade	yellow flower July to Oct	-	-	M	X	X	-	X	X	X	-	-	X	X	attracts bees; spreads by rhizomes, can be aggressive if over irrigated
Stipa cernua	nodding needle grass	Y	Sun / Part shade	textural Feb to July	-	-	VL	-	X	X	-	X	X					
Stipa pulchra	purple needlegrass	Y	Intermediate Shade Tolerance	Textural	-	S	VL	-	X	X	-	X	X	X	-	X	-	seeds and cover for birds, butterfly larvae food source
Symphyotrichum chilense	pacific aster	Y	Sun / Part shade	Violet flower; Jun-Oct	-	-	M	X	X	-	X	-	X	-	-	X	X	provides flowers in late summer and early autumn; attracts bees; can spread aggressively if over-irrigated
Trichostema lanatum	woolly bluecurls	Y	Sun	Blue to pink or white flowers; Apr-Jun	-	-	VL	-	X	-	-	-	-	-	X	X	X	
Trifolium willdenovii	tomcat clover	Y	Sun	purple to pink flowers April to May	-		na	-	-	X	-	X	X				X	liked by larger bees
Triteleia laxa	Ithuriel's spear	Y	Sun to Shade	lavender/purple to blue flowers April to July	-		VL	-	X	X	-	X	X					Bees will visit, but is not corucopian species in most settings
Wyethia angustifolia	mules ears	Y	Sun / Part shade	Yellow flower; Apr-Aug	-	-	L	-	-	X	-	-	X	-	-	X	X	
NATIVE VINES																		
Aristolochia californica	California pipe vine	Y	Part Shade	Jan to April	-		L	X	X	-	X	-	-			X		Host plant for Pipevine Swallowtail
Clematis lasiantha	chaparral clematis	Y	Sun to Shade	white to cream flowers March to July	-		L	-	X	-	X	-	-				X	Will draw lots of bees when the flowers are dense

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NONNATIVE OVERSTORY																		
Acer buergerianum	trident maple	N	Sun to shade	Yellow flowers in spring, gold or red foliage in fall	20-25 ft	L	M							X	-	-	-	provides food resources that would be used by seed-eating birds and small mammals, moderate seasonal cover and nesting sites for birds, and tall perching sites for birds
Acer rubrum	red maple	N	Sun / Part shade	Red, orange, or multi-colored fall foliage	40 ft	L	M							X	-	-	-	provides food resources that would be used by seed-eating birds and small mammals, moderate seasonal cover and nesting sites for birds, and tall perching sites for birds
Aesculus x carnea	red-horse chestnut	N	Sun / Part shade	Showy red flower	25-35 ft		M							X	-	X	-	provides food resources that would be used by butterflies (including larvae and adults) and birds and seasonal cover for birds
Arbutus x 'Marina'	Marina madrone	N	Full sun	Showy pink or rose flowers	40 ft		L							X	X	X	-	provides food resources that would be used by butterflies and nectar-eating birds, such as hummingbirds, as well as moderate year-round cover for birds
Callistemon citrinus	crimson bottlebrush	N	Sun / Part shade	Evergreen, showy red flowers in spring or summer	25 ft		L							X	X	X	-	provides food for nectar and insect eating birds, nectar for butterflies and bees; year round cover and nesting sites for a variety of birds
Callistemon viminalis	weeping bottlebrush	N	Sun / Part shade	Evergreen, showy red flowers in spring or summer	15 ft	S	L							X	X	X	-	provides food for nectar and insect eating birds, nectar for butterflies and bees; year round cover and nesting sites for a variety of birds
Celtis sinensis	Chinese hackberry	N	Sun to shade	Gold foliage in fall	40 ft		L							X	-	-	-	provides food resources that would be used by fruit-eating birds; moderate seasonal cover and nesting sites for birds; and tall perching sites for birds
Corymbia ficifolia	red-flowering gum	N	Sun / Part shade	Evergreen, showy orange, pink, red, or rose flowers	25-40 ft		L							X	X	X	-	food for nectar and insect eating birds and adult butterflies; year round dense cover and nesting sites for a variety of bird species
Crataegus laevigata	English hawthorn	N	Sun / Part shade	Showy white to pink flowers	25 ft		M							X	-	X	-	provides resources that would be used by butterfly larvae and fruit-eating birds, and moderate seasonal cover and nesting sites for a variety of bird species
Crataegus phaenopyrum	Washington hawthorn	N	Sun	Showy white flowers, prolific red pome	25-30 ft		M							X	-	X	-	provides resources that would be used by butterfly larvae and fruit-eating birds, and moderate seasonal cover and nesting sites for a variety of bird species
Fraxinus dipetala	California ash	N	Sun / Part shade	white flowers March - June	10-12 ft		L											
Geijera parviflora	Australian willow	N	Sun / Part shade	white flowers	20 ft		M							X	-	-	-	provides food resources that would be used by fruit-eating birds, and year-round cover and nesting sites for a variety of bird species
Lagunaria patersonii	primrose tree	N	Sun / Part shade	pink to white flowers; red, gold, orange, or multicolored fall foliage	20 ft		L							X	-	-	-	provides food resources that would be used by fruit-eating birds, year-round dense cover and nesting sites for a variety of bird species, and tall perching sites for birds
Liriodendron tulipifera	tuliptree	N	Sun / Part shade	Bronze or gold fall foliage	40 ft	L	M							X	-	-	-	provides food resources that would be used by seed-eating birds and small mammals, moderate seasonal cover and nesting sites for birds, and tall perching sites for birds

Scientific Name	Common Name	Native	Sun/Shade Tolerance	Color/Seasonality	Canopy Width	Salt Tolerance	WUCOLS	Mixed Riparian Woodland	Mixed Oak Woodland	Oak Savanna	Bayside Scrub	Wet Meadow	Dry Meadow	Birds	Hummingbirds	Butterflies (Larvae and/or Adult)	Beneficial Insects	Observations
Magnolia grandiflora 'Sam Sommers,' 'St. Mary,' 'Majestic Beauty,' 'Little Gem', 'Russet'	southern magnolia	N	Sun / Part shade	Showy flowers, prolific fruit	20-50 ft	S	M							X	-	-	-	provides food resources that would be used by fruit-eating birds and small mammals, and moderate year-round cover for a variety of bird species
Melaleuca ericifolia	swamp paperbark	N	Sun / Part shade	Evergreen; Yellow to white flowers			L							X	X	X	-	provides food resources that would be used by nectar- eating birds, bees, and butterflies, and insect-eating birds, as well as year-round dense cover and nesting sites for a variety of bird species
Melaleuca linariifolia	cajeput tree	N	Sun / Part shade	Evergreen; white flowers			L							X	X	X	-	provides food resources that would be used by nectar- eating birds, bees, and butterflies, and insect-eating birds, as well as year-round dense cover and nesting sites for a variety of bird species
Melaleuca styphelioides	prickly paperbark	N	Sun / Part shade	Evergreen; white flowers			L							X	X	X	-	provides food resources that would be used by nectar- eating birds, bees, and butterflies, and insect-eating birds, as well as year-round dense cover and nesting sites for a variety of bird species
Metrosideros excelsa	New Zealand Christmas Tree	N	Sun / Part shade	Evergreen; red flowers			L							X	X	X	-	provides food resources that would be used by nectar- eating birds, bees, and butterflies, and insect-eating birds, as well as year-round dense cover and nesting sites for a variety of bird species
Prunus serrulata 'Kwanzan'	Japanese flowering cherry	N	Sun / Part shade	Showy pink flowers; Bronze or gold fall foliage	25-30 ft		M							X	-	-	-	provides food resources that would be used by fruit-eating birds and small mammals, and limited seasonal cover and nesting sites for a variety of bird species
Quercus suber	cork oak	N	Sun / Part shade	Evergreen	40-70 ft	S	L							X	-	X	-	provides food resources that would be used by butterfly larvae and acorn-eating birds and small mammals, and moderate year-round cover and nesting sites for a variety of bird species.
NONNATIVE MIDSTORY																		
Amorpha californica	California false indigo	N	Part sun / Shade	purple flowers	-		L									X		Larval food source for the California dogface butterfly, flowers attract adult butterflies and bees
Arbutus unedo	strawberry tree	N	Sun to shade	Evergeen; showy white flowers, prolific orange or red berry.	15 ft	S	L							X	X	X	-	provides food resources that would be used by nectar- eating birds and butterflies, and year-round dense cover and nesting sites for a variety of bird species
Buddleja davidii	butterfly bush	N	Sun	Lilac to purple flower with central orange spot; May - Sept	-	-	L							-	-	X	X	attracts butterflies and bees, can naturalize in riparian areas and should only be used in the campus interior
Ceanothus arboreus x thyrsiflorus var. griseus 'Ray Hartman'	Ray Hartman ceanothus	N	Sun	blue to purple flowers	10-20 ft	-	L							X	-	X	X	provides food resources that would be used by butterfly larvae and nectar-eating birds and butterflies, and year-round dense cover for birds; attracts bees
Cephalanthus occidentalis	common buttonbush	N	Sun / Part shade	cream flowers Aug to Oct	-		M							X		X		Flowers attract butterflies, plant provides some cover for birds
Cornus nuttalli	Pacific dogwood	N	Part Shade	showy white flowers	-	-	M							X		X	X	
Eriogonum giganteum	St. Catherine's lace	N	Sun	Small white to rose flowers	-	-	L							-	-	-	X	attracts bees
Keckiella cordifolia	climbing penstemon	N	Sun / Part shade	red flowers March to Aug	-		L								X	X	X	Flowers attracts hummingbirds, bees, and butterflies

LEGEND

Salt Tolerance
S: plant has moderate or high salt tolerance
R: plant is tolerant of recycled water
L: plant has low salt tolerance

WUCOLS (Water Use Classification of Landscape Species)
H: high water use; M: moderate water use
L: low water use; VL: very low water use

An 'X' in any category indicates that the plant is either associated with that habitat type or provides a benefit to the indicated wildlife.

Scientific Name	Common Name	Native	Sun/Shade Tolerance	Color/Seasonality	Canopy Width	Salt Tolerance	WUCOLS	Mixed Riparian Woodland	Mixed Oak Woodland	Oak Savanna	Bayside Scrub	Wet Meadow	Dry Meadow	Birds	Hummingbirds	Butterflies (Larvae and/or Adult)	Beneficial Insects	Observations
Rhus ovata	sugar bush	N	Sun / Part shade	White to pink petals with red sepals; Mar-May	-	S	L							X	-	-	-	fruits provide food for birds and small mammals
Ribes alpinum	Alpine currant	N	Sun / Part shade	Greenish yellow flowers April	-	S	na							X	-	X	-	attracts birds and butterflies
Romneya coulteri	matilija poppy	N	Sun / Part shade	White flowers; Mar-Jul	-	-	VL							-	-	-	X	attracts bees; spreads by rhizomes, can be aggressive if over irrigated
Rosmarinus officinalis	rosemary	N	Sun	pale blue to white flowers; winter to spring	-	S/R	L							-	-	-	X	flowers attract many insects and bees
NONNATIVE UNDERSTORY																		
Achillea 'Moonshine'	moonshine yarrow	N	Sun	bright yellow June-Sept	-	-	L							-	-	X	X	attracts bees and many insects
Baccharis pilularis 'Twin Peaks'	groundcover coyote brush	N	Sun	evergreen	-	S	na											usually only male plants are cultivated for landscaping
Berberis aquifolium	Oregon grape	N	Sun / Part shade	Yellow flowers Feb-April	-	L	L							X	-	X	X	shade-tolerant
Bouteloua gracilis	blue grama	N	Sun	Textural	-	S	L							X	-	-	-	seed provides food source for birds and small mammals
Calamagrostis foliosa	leafy reed grass	N	Sun / Part shade	Textural	-	-	L								-	-	-	
Cistus salviifolius 'Prostratus'	sageleaf rockrose	N	Sun	white spring	-	-	L							-	-	-	X	flowers attract many insects
Cyperus involucratus	umbrella plant	N	Sun / Part shade	Textural year round	-	S/R	H											can naturalize in riparian areas and should only be used in the campus interior
Erigeron karvinskianus	Santa Barbara daisy	N	Sun to Shade	white, pink Apr-Aug	-	-	L							-	-	-	X	attracts bees
Eriogonum crocatum	saffron / conejo buckwheat	N	Sun	yellow Apr-July	-	-	L							-	-	X	X	flowers attract many insects
Eriogonum grande var. rubescens	rosey buckwheat	N	Sun / Part shade	pink, red, rose Apr-Sep	-	-	L							-	-	X	X	flowers attract many insects and bees
Gaillardia x grandiflora	blanket flower	N	Sun	Yellow, orange, red Jun-Sep	-	-	L							-	-	-	X	attracts bees
Heuchera caespitosa	urn-flowered alumroot	N	Sun / Part shade	pale pink to white flowers May to Aug	-	-	na							-	-	-	X	shade-tolerant
Heuchera maxima	corral bells	N	Sun / Part shade	white, pink Apr	-	-	M										X	shade-tolerant
Lavandula 'Goodwin Creek Grey'	lavender	N	Sun	violet flowers year round	-	-	L							-	-	-	X	attracts bees

Scientific Name	Common Name	Native	Sun/Shade Tolerance	Color/Seasonality	Canopy Width	Salt Tolerance	WUCOLS	Mixed Riparian Woodland	Mixed Oak Woodland	Oak Savanna	Bayside Scrub	Wet Meadow	Dry Meadow	Birds	Hummingbirds	Butterflies (Larvae and/or Adult)	Beneficial Insects	Observations
Lavandula latifolia	spike lavender	N	Sun	lavender to purple flowers summer	-	-	L							-	-	-	X	flowers attract many insects
Lavandula stoechas	Spanish lavender	N	Sun	Purple	-	-	L							-	-	-	X	flowers attract many insects
Muhlenbergia rigens	deer grass	N	Sun / Part shade	Texture Jun-Sep	-	S/R	L							X	-	-	-	seed provides food for birds and small mammals
Nepeta cataria	catnip	N	Sun / Part shade	White Jul-Sep	-	-	L							-	-	-	X	attracts bees
Nepeta x frassenii	cat mint	N	Sun / Part shade	blue to violet flowers May to Sept	-	-	L							-	-	-	X	attracts bees
Penstemon centranthifolius	scarlet bugler	N	Sun	red Apr-Jul	-	L	L							-	X	X	X	
Penstemon eatonii	firecracker penstemon	N	Intermediate Shade Tolerance	Red Jun-Jul	-	-	L							-	-	-	X	attracts bees
Ribes viburnifolium	Catalina currant	N	Part Sun / Shade	Red Feb-Apr	-	-	L							-	X	-	X	attracts bees
Rosmarinus 'Prostratus'	creeping rosemary	N	Sun	blue flowers	-	-	L											
Salvia apiana	white sage	N	Sun	white, lavender Apr-Aug	-	L	VL							-	-	-	X	attracts bees
Salvia 'Bee's Bliss'	bee's bliss sage	N	Sun	purple flowers	-	S	L							-	X	X	X	flowers attract hummingbirds, butterflies, and many insects
Salvia elegans	pineapple sage	N	Sun	red flowers Aug to Oct	-	-	M							-	X	-	X	
Salvia greggii	autumn sage	N	Sun / Part shade	pink to red flowers	-	-	L							-	X	-	X	attracts bees
Salvia leucantha	Mexican sage	N	Sun	white and purple	-	S	L							X	X	X	X	flowers attract hummingbirds and many insects
Salvia microphylla 'Hot Lips'	little-leaved sage	N	Sun / Part shade	red / white flowers Apr-Jun	-	-	?							-	-	-	X	attracts bees
Salvia officinalis	culinary sage	N	Sun	purple	-	-	L							-	-	-	X	attracts bees
Sporobolus airoides	alkali sacaton	N	Sun	Textural	-	S	L							X	-	-	-	seed provides food for birds and small mammals
Stachys byzantina	lamb's ears	N	Sun	purple-pink May to July	-	-	L							-	-	-	X	attracts bees

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Douglas iris (*Iris douglasiana*)

Appendix A: Landscape Design and Management Checklist

Project Name: _____

Project Owner: _____

Project Designer: _____

Location: _____

Date: _____

Goals and Priorities

1. What type of habitats will this project establish (e.g. oak woodland, shrub understory, wetland, etc.)? What is the estimated acreage for each habitat type?

2. What types of wildlife might benefit from these new habitats?

3. What percentage of the plants proposed are native to the area?

4. What measureable native landscape goals do you hope to achieve, and when?

5. Describe any opportunities your project provides for a "peoples' science" approach to involve the community, or other community outreach benefits.

6. Are there any programs or organizations in your community that recognize/celebrate habitat and/or pollinators and the associated educational value? If so, can your project engage such programs?

Design Parameters

- [ ] Select plants that are suited to how wet or dry the site is.
- [ ] Select plants that are suited to the sun/shade conditions on the site.
- [ ] Ensure that the soil is suitable for the proposed plant palette, and make any necessary improvements to soil texture, chemistry, and drainage to ensure long term plant health.
- [ ] Ensure soil volume is sufficient to support healthy mature trees.
- [ ] Determine whether recycled or potable water will be used in the irrigation system, and ensure that selected plants are tolerant of recycled water if it will be used.
- [ ] Prioritize trees and midstory plantings for wildlife value, where compatible with space and proposed uses.
- [ ] Create visual interest in high use areas and allow the interiors of planting areas to have a more natural aesthetic.
- [ ] Protect public safety by preserving sight lines in heavily used areas and in areas where conflicts may exist between pedestrians, bicyclists, and/or vehicles.
- [ ] Incorporate native oaks (re-oaking).
- [ ] When possible, choose plant combinations that mimic locally native habitats.
- [ ] Prioritize use of trees that provide high habitat value (willow, oak, cottonwood, etc.).
- [ ] Prioritize the use of native plants, but if a native plant does not meet the project needs, use a non-native plant with some wildlife value.

Landscape Management

- [ ] Utilize a landscape maintenance crew that has training in the management of native landscapes.
- [ ] Develop a strategy for nonnative and invasive plant control that does not rely on the use of chemical herbicides, pesticides, or other chemicals.
- [ ] Ensure that the project's irrigation regime aligns with the water-use needs of the plants.
- [ ] Periodically flush soils if using recycled water for irrigation.
- [ ] Carefully consider the factors that may have led to plant mortality when re-planting, and adjust the species composition if necessary.

Appendix A: Bird-Safe Design Checklist

Bird-Safe Design for Buildings

Bird-Safe Architectural Lighting

- [ ] Turn lights off at night (except in areas with human activity or areas requiring lighting for safety purposes).
- [ ] Pull shades after dark to reduce light pollution.
- [ ] Direct lighting downwards rather that up or outwards.
- [ ] Use strobe or non-static lighting if possible.
- [ ] Use blue or green light instead or white or red light.

Bird-Safe Architectural Surfaces

- [ ] Avoid highly reflective glass coatings throughout all glazing systems.
- [ ] Create fine-grained visual obstacles with patterned glass, external blinds or shades, or shading integrated into the glass.
- [ ] Eliminate atria and courtyard designs that trap birds.

Bird-Safe Design for Landscapes

- [ ] Strategically place vegetation to minimize the risk of birds colliding with buildings.
- [ ] Reduce the use of artificial light in the landscape.
- [ ] Direct landscape lighting downward an shield the light from above.
- [ ] Consider the color of the project lighting.

Project Name: _____

Project Owner: _____

Project Designer: _____

Location: _____

Date: _____

Bird-Safe Construction Practices

- [ ] Schedule construction to avoid the nesting bird season.
- [ ] Conduct pre-construction/pre-disturbance surveys.
- [ ] Remove potential nesting substrates that are scheduled to be removed by the project prior to the nesting bird season in areas where construction is planned to occur.

Bird-Safe Landscape Management

- [ ] Avoid or minimize use of pesticides, fungicides, herbicides, or other chemical treatments.
- [ ] Take care to avoid impacting nesting birds while managing the landscape.
- [ ] Reduce wildlife access to human food (garbage, etc.).
- [ ] Install bird feeders.
- [ ] Install bird baths and water features.
- [ ] Install nest boxes.
- [ ] Minimize pet encroachment into habitats.

Integrating Nature into the Urban Landscape

A Design Guide

H. T. HARVEY & ASSOCIATES
Ecological Consultants