ARTHROPOD-FRIENDLY GARDENS

A MODEL FOR PRIORITIZING SMALL-PATCH HABITAT DESIGN AND CERTIFICATION

GREEN CITY STUDIO
CALIFORNIA STATE POLYTECHNIC UNIVERSITY, POMONA

Cover Photo: California Carpenter Bee, by Damiana Aldana

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Special thanks to:
Damiana Aldana

The Mission of Clean & Green Pomona is to clean up and green up Pomona's industrial zone and neighborhoods. They work to improve environmental quality, safety and appearance of Pomona's industrial zone and adjacent neighborhoods to benefit the quality of life and health of all Pomona residents and workers.

ACKNOWLEDGMENTS

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- Duane Smith
- Jude and John Tiersma-Watson

We truly appreciate you welcoming us into your homes and sharing your lives with us. We hope you find benefit in the designs we've developed for your spaces.

Most contributors to this report, along with members of our partner organization, *Clean & Green Pomona*. Photo by Claire Latané.

About the Green City Studio: The Green City Studio is a project of the Department of Landscape Architecture at California State Polytechnic University, Pomona, led by Dr. Kyle D. Brown, dedicated to contributing to community resiliency and opportunity. Projects, publications, and articles are prepared by students in Dr. Brown's courses, and published for public distribution on the Green City Studio web site (https://greencityblog.com/).

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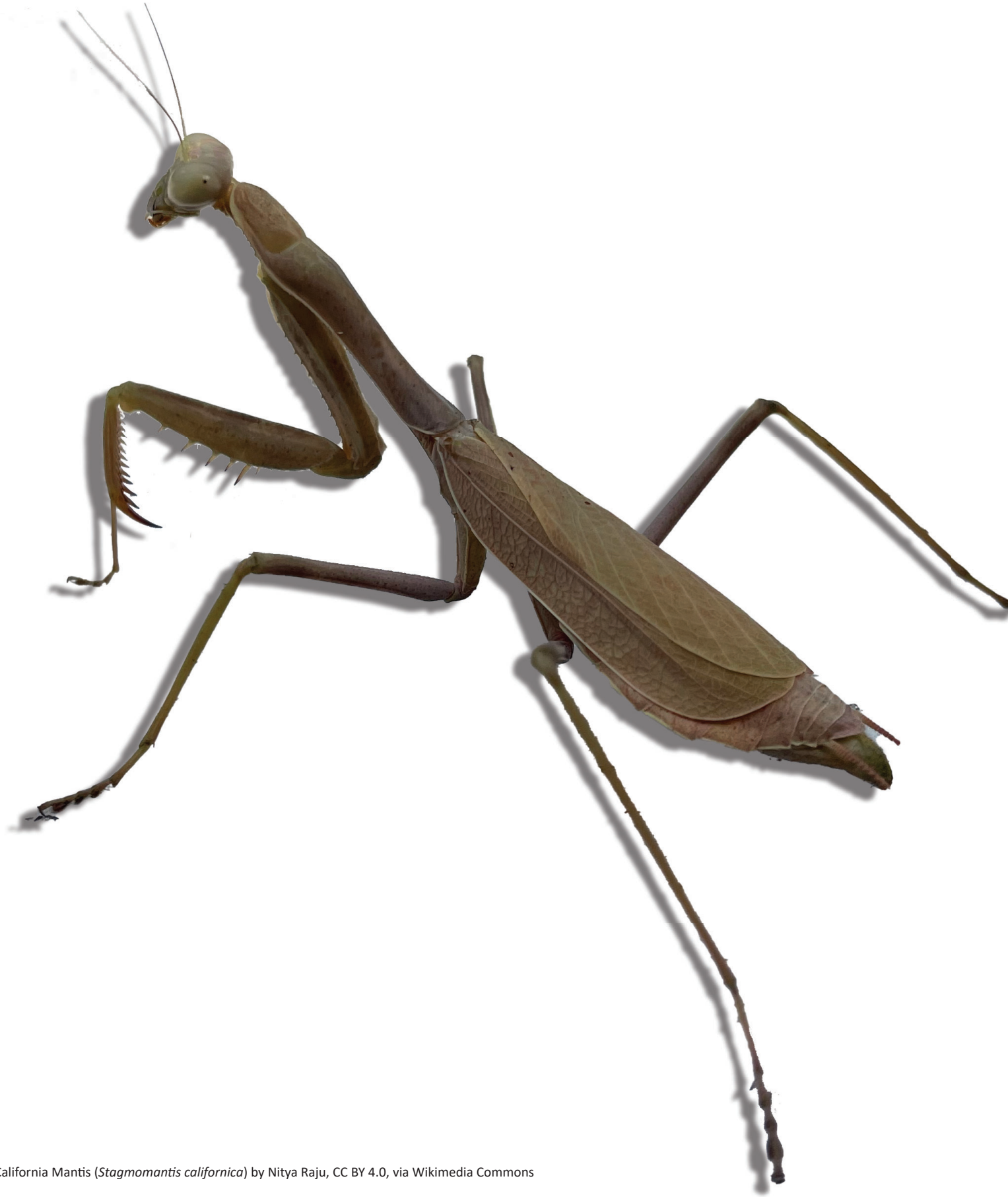


California Mantis (*Stagmomantis californica*) by Nitya Raju, CC BY 4.0, via Wikimedia Commons

INTRODUCTION

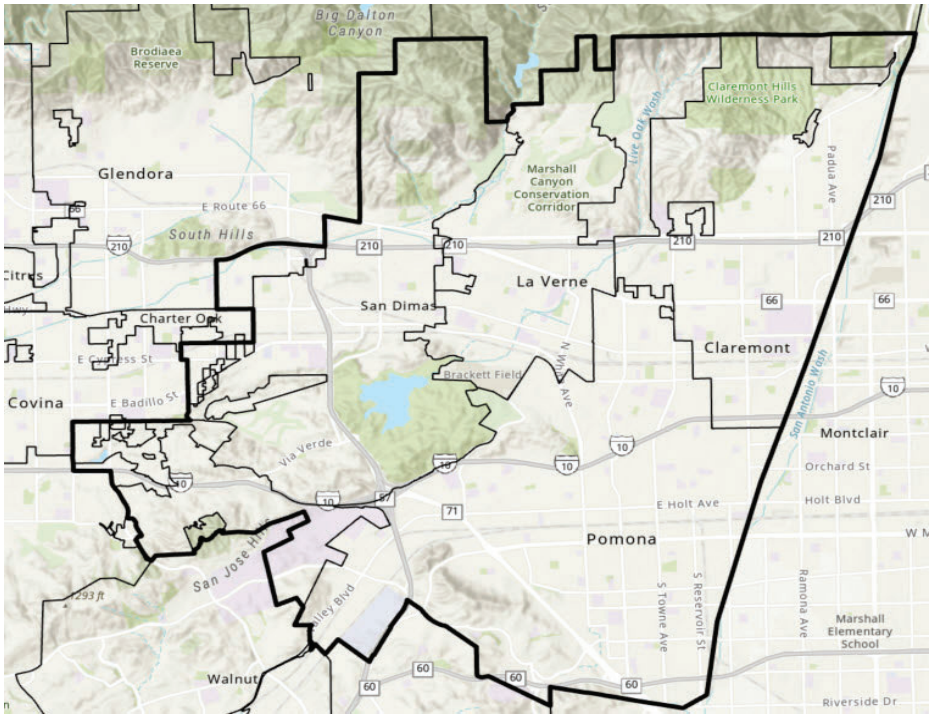
Coarse-scale landscape planning has drawn upon a wealth of landscape ecological research over the past 40 years, to develop strategies to preserve, restore and re-establish habitat for a variety of species. Oftentimes, targeted species tend to focus on rare or endangered species threatened by urbanization, and large predators. This work has been important in enhancing large habitat patches and providing critical linkages to expand ranges of these "umbrella" species, as evidenced by the construction of a land bridge crossing for mountain lions over the 101 freeway in Agoura Hills.

While serving the needs of these species is vitally important work, and it is recognized that these efforts serve the needs of many more species in the food web, these planning activities often leave out heavily urbanized communities, which may be devoid of large patches of natural vegetation, or not positioned to play a critical connecting role between large patch habitat. As a result, habitat concerns are often given little attention in community planning efforts in these urban environments. This reality is striking, considering the growing body of research highlighting the role of systemic racism and exclusionary practices that have disconnected low-income communities of color from the natural environment.

Given these realities, what is the role of urban environments in the management of ecosystems for biodiversity? Richard Forman's work gives us a clue, suggesting that "heterogenous bits of nature" throughout the urban matrix are an indispensable ecological pattern to be maintained and/or developed. These small-patch habitats provide important supplemental benefits to ecosystem function, facilitating movement of species across the matrix, habitat for edge species, and habitat for small-patch-restricted species. Arthropod species, including moths, butterflies, ants, bees, spiders, flies and other insects, represent foundation species that have potential for re-establishment in small patch habitats within a heavily urban matrix.

This document is a product of the Green City Studio effort at Cal Poly Pomona, and explores the potential for small-patch habitats to be developed with the intention of supporting a variety of arthropod species. A local, community-based non-profit organization, Clean & Green Pomona, has expressed interest in promoting arthropod-friendly landscape design, perhaps through the establishment of a garden certification program, focused on the Pomona Valley, a region that includes the entire cities of Pomona, Claremont, La Verne, San Dimas, and portions of Glendora, Covina and unincorporated Los Angeles County. This report:

- *Identifies indicator arthropod species that may be targets for design*
- *Develops a model to prioritize areas of the Pomona Valley for this work, based on ecological integrity and socio-economic characteristics*
- *Develops a conceptual certification program*
- *Illustrates certified design concepts for various landscape types.*



The Pomona Valley, including Pomona, Claremont, La Verne, San Dimas and portions of Glendora, Covina and unincorporated Los Angeles County, is the focus of this project.

California Bumble Bee (*Bombus californica*) by Rhododendrites, CC BY-SA 4.0, via Wikimedia Commons

INDICATOR SPECIES

Indicator species provide vital information about the condition of a particular habitat, and its capacity to support a complex web of biotic life. The assumption is that if habitat is able to support indicator species, it is likely to support other species of plants and animals, upon which these species depend, and perhaps organisms which may predate on these species. This makes them a useful target to accommodate in ecological planning and design.

Insects of the Los Angeles Basin, Third Edition by Charles L. Hogue (Los Angeles County Museum of Natural History, 2015) describes several indicator Arthropods for specific macrohabitats of Southern California. Their list for macrohabitats found in the Pomona Valley were the primary basis for identification of the Arthropod species profiled in this report.

A total of 16 species are profiled. Information about their physical description, range and climate preferences, life cycle, reproduction characteristics, diet, shelter, predation and threats, and critical plants or other structures is provided, along with several images.

This compendium of indicator species is by no means exhaustive, but is intended as a starting point for understanding species which may be targeted in Arthropod-Friendly small-patch habitat establishment.

Macrohabitat	Indicator Plants	Indicator Arthopods
Coastal Sage Scrub: clay slopes of high inland hills; open growth of small shrubs	California Sagebrush (*Artemesia californica*), Black Sage (*Salvia mellifera*), California Buckwheat (*Eriogonum fasciculatum*), Chaparral Yucca (*Hesperoyucca whipplei*)	Chalcedon Checkerspot (*Euphydryas chalcedona*), California Mantis (*Stagmomantis californica*), Yucca Moth (*Tegeticula maculata*)
Chaparral: mountain slopes mostly above 1,000 feet; dense growth of tall thick-leaved shrubs	Chamise (*Adenostoma fasciculatum*), Nuttall's Scrub Oak (*Quercus dumosa*), California Lilacs (*Ceanothus*), Manzanitas (*Arctostaphylos*)	Timemas (*Timema*), Ceanothus Silk Moth (*Hyalaphora euryalus*), Pale Tiger Swallowtail (*Papilio eurymedon*)
Southern Oak Woodland: inland valleys and canyons; trees with grass beneath	Coast Live Oak (*Quercus agrifolia*), Valley Oak (*Quercus lobata*)	California Oak Moth (*Phyrganidia californica*), Diabolical Ironclad Beetle (*Phloeodes diabolicus*)
Walnut Woodland: dense growth of Southern California Black Walnut on steep hillsids	Southern California Black Walnut (*Juglans californica*)	Walnut Underwing (*Catocala piatrix*)
Grass-Herbland: intermittent patches between areas dominated by coastal sage scrub; native perennials outnumbered by introduced grasses	Native perennial herbs, introduced annuals and grasses	California Trapdoor Spider (*Bothriocyrtum californicum*), Large Crane Flies (*Tipula*)
Riparian Woodland: along streams and around ponds; trees with herbaceous or shrubby undergrowth	Western Sycamore (*Platanus*), Alders (*alnus*), Maples (*Acer*), Cottonwoods (*Populus*), Bays (*Laurus*), Stinging Nettle (*Urtica dioica*), *Baccharis* and Willow (*Salix*) undergrowth	Lorquin's Admiral (*Limenitis lorquini*), Velvety Tree Ant (*Liometopum occidentale*), Wester Tiger Swallowtail (*Papilio rutulus*), California Glowworm (*Ellychnia californica*)
Dry River Beds: washes, arroyos and basins below mountains where water is only seasonally present; vegetation is partly riparian, partly coastal sage scrub, but very sparse	Partly riparian, partly coastal sage scrub (sparse)	Velvet Ants (*Dasymutilla*), harvester ants (*Pogonomyrmex*), Behr's Metalmark Butterfly (*Apodemia virgulti*)
Aquatic Areas: natural streams, ponds, lakes and unchannelized waterways	Willows (*Salix*), Mule Fat (*Baccharis salicifolia*), Rushes (*juncus*)	Backswimmers (*Notonecta*), Slender -Horned Dobsonfly (*Neohermes filicornis*), Giant Western Crane Fly (*Holorusio hespera*)

Adapted from CL Hogue. 2015. *Insects of the Los Angeles Basin, Third Edition*. Natural History Museum of Los Angeles county

CALIFORNIA TRAPDOOR SPIDER

Bothriocyrtum californicum

The Trapdoor Spider in its Burrow (Boaz Benaiah Solorio-iNaturalist Research Grade, CC BY-NC 4.0)

Male (Boaz Benaiah Solorio-iNaturalist Research Grade, CC BY-NC 4.0)

Female (Rachel Romine-iNaturalist Research Grade, CC BY-NC 4.0)

(Top) Camoflauged Trapdoor
(Bottom) Trapdoor Opened (Marshal Hedin iNaturalist Research Grade, CC BY-NC-SA 4.0)

Trapdoor Spider Eggs (Dustin Wood-iNaturalist Research Grade, CC BY-NC 4.0)

CALIFORNIA TRAPDOOR SPIDER

Bothriocyrtum californicum

Physical Description

California Trapdoor Spiders physical characteristics vary from one population to the next though they all have heavy digging spines on their chelicerae and on the first two pairs of legs for excavating (1) and hunting. Adult females are light mahogany to dark chestnut brown with darker legs. Adult males are dark brown to black with grayish-pink to brick-red abdomens (2)

Size: 15 to 28 mm (.6 to 1.1 in.) (1)

Range & Climate

This spider once thrived in native vegetation found in what is now the metropolitan Los Angeles area (LA). Urbanization threatens its natural habitat throughout the LA Basin (1). It is tolerant of arid environments similarly found in northern Baja California, Mexico, north through Santa Barbara County coast, and to Kern County inland (3).

Male (Tobiashaysi-Naturalist Research Grade, CC BY-NC 4.0)

Life Cycle

The female lays a batch of several hundred eggs within the depths of her burrow. When the spiderlings hatch, she cares for them and feeds them over the first winter before they leave to create a home of their own (3); It has been observed that juvenile spiders tend to settle closer to their maternal burrows (4). Maturing in age, their growing organs force them to shed their exoskeloton in a process called molting (5). This vital part of living happens several times over its 5-20 year life span (6).

Reproduction

In late Fall and early Winter, after years of maturing, male trapdoor spiders leave the burrow in search of a female. While the female remains in its burrow, the males long pedipalps are thought to aid in reaching deep into the burrow for courtship and mating. Though there is little information how they incubate their eggs, Aliatypus, a trapdoor spider within the same family Ctenizidae, hangs its pendulous egg sac from the walls of the burrow using silk suspension lines. Around the beginning of the winter rainy season, the baby spiders emerge and leave the burrow (4).

Diet

Trapdoor spider have perfected the art of invisibility. Hidden within its camouflage burrow, it extends its front legs to grab its prey without the assistance of a web. Once within its hold, its prey is dragged into its burrow where the spider will feed on its own time (4). Living its life at ground level, the spider primarily feeds on insects and arthropods that share its habitat (5). Once their prey is digested, they perform a kind of projectile defecation away from their burrow, leaving no signs of the presence (4).

Shelter

Unlike spiders that hang from webs, this species spends its entire life on the the ground, building its home in a burrow. When excavating a new burrow or enlarging an existing one the spider flicks the dirt away or mixes it with webbing to easily be pulled up-and-out (7). It constructs the door and reinforces the walls with the same method, compacting soil and silk (1). Some spiders place moss on top of their trapdoors for added camouflage (3). These doors are masterfully crafted to fit snug at the entrance of the burrow and are hinged on the uphill side (2).

Predation and Threats

The California Trapdoor Spider is commonly parasitized by spider wasps (Pedinaspis planatus) and the small-headed fly (Ocnaea smithi). The process of parasitism is similar, however the wasp stings and paralyzes the spider before it plants its eggs either near or inside of its body. Once their eggs hatch, the larva seek out the helpless spider and feed on its body (3). The ultimate threat to the spider however is urbanization. Anthropogenic forces continue to threaten its habitat leading them to be classified as one of the nine species of spiders most likely to be endangered (1).

Critical Plants or Structure

Bothriocyrtum californicum lives on its own and rarely leaves its burrow voluntarily (4). It inhabits a variety of habitats, including oak scrub, chaparral, dry grasslands, and deserts. Their burrows, up to a foot long, are commonly found on moderately steep hills or south-facing slopes, where thick coverings of short grasses and low herbacious plants prevail in the spring (2). These locations are believed to help the spider maintain consistent temperatures and humidity levels in hot, dry areas.

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RED JUMPING SPIDER

Phidippus johnsoni

Adult Female Jumping Spider
(Kaldari, CC0 1.0, Via Wikimedia Commons)

Adult Female Jumping Spider
(Zhongqi Wang, CC0 4.0, Via Wikimedia Commons)

Phidippus johnsoni mating
(Kaldari, CC0 1.0, Via Wikimedia Commons)

Adult Male
(Kaldari, CC0 1.0, Via Wikimedia Commons)

Adult Female
(Kaldari, CC0 1.0, Via Wikimedia Commons)

Adult Male in Defensive Pose with Fangs
(Kaldari, CC0 1.0, Via Wikimedia Commons)

RED JUMPING SPIDER

Phidippus johnsoni

Physical Description

Phidippus johnsoni vary in size and color depending on gender. Adult males are between 1/4" - 1/2" in body length and adult females are 1/4" - 3/4" in length [4]. Both males and females have a body that is primarily black with a bright red abdomen and teal chelicerae (mouthparts)[1]. Females can be identified by a black stripe that runs through their red abdomen.

Range & Climate

The Red Jumping Spider's habitat has a large range from Canada to Mexico and from the Great Plains to the Pacific Ocean [2]. They can be found in a variety of climates, but primarily dwell in xeric zones (low annual rainfall) like oak woodlands, coastal dunes, and granite domes [4]. Though they prefer dry climates, *Phidippus johnsoni* is not found in the desert. Colder climates decrease the length of the mating season for the spider [5].

Adult Female
(Kaldari, CC0 1.0, Via Wikimedia Commons)

Life Cycle

Females can reproduce several times throughout their lives, with a single copulation allowing for up to five fertile ovipositions in the spider's nest [2]. Roughly one month passes between copulation and the first oviposition, with eggs hatching three weeks after being laid. About one month will pass between each oviposition batch. About three weeks after hatching, spiders will leave the nest after their first molt [2,4]. Six to nine molts will occur before the spider is a full-grown adult, with males having fewer total molts in their lifetime [4]. Life expectancy for adults is between three to four months [2].

Reproduction

Mating can occur both inside and outside of nests, with the former being most common [3]. During copulation, the male will make contact with the female using one of two of his palps (male reproductive organ). Copulation can last between 20 seconds to 8 hours, and each session will have at least 1 palp application, though multiple applications are common. Females may mate with more than one male in their lifetime, and favor males that engage in longer copulation. Males will often compete in combat to win over a female, with the largest male typically winning [5].

Diet

The spider's diet consists mostly of Diptera species (flies), but they occasionally eat Homoptera, Lepidoptera, Hymenoptera, Coleoptera, Dermaptera, and other Araneae [6]. As diurnal vagabond hunters of their prey, this species rarely uses its nests for capturing food and instead relies on its adept visual system [5]. Prey is often 1/4 to 3/4 the size of the spider. Males do not feed as frequently as females [6].

Shelter

Spiders retreat to their nests in the evenings, mate there, and molt there [2]. Nests consist of white silk-like sheets with a hollow interior and designated entrance/exit points referred to as doors. These nests range in shape depending on the material they are built on. Most nests resemble an "I" shape and are tube-like, though some have "arms" that break up the nest into segments. Each nest type regardless of shape has between 2-3 doors. Nests are high in density, are usually 2 to 3 times longer than the length of the spider, and are created on the sides of rocks or fallen wood pieces greater than 5cm in size.

Predation and Threats

This spider is vulnerable to predation by Hymenoptera, other Araneae, and in some cases, Acrocerids [5,6,7]. Hymenoptera species feed on adult Arachnids or their eggs [7]. Acrocerids are internal parasitoids of Arachnids, like *Phidippus johnsoni*, attacking both juveniles and adults [7]. They do so in the larval state, by injecting themselves into the spider's body. The spiders are typically still alive until the Acrocerid larva's last molting period. At this time, the larva consumes the contents of the host spider's body, leaving only an exoskeleton of the spider behind.

Critical Plants or Structure

Certain landscape elements like wooden boards, fence posts, dead trees, loose bark, and rock piles can all provide nesting locations for the spider [2]. Additionally, *Phidippus johnsoni* can benefit from nesting near milkweed plants, as the plant supports insect species the spider can feed on [6].

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CALIFORNIA GLOWWORM

Ellychnia californica

Cricket Raspet - CC by NC 4.0 via iNaturalist

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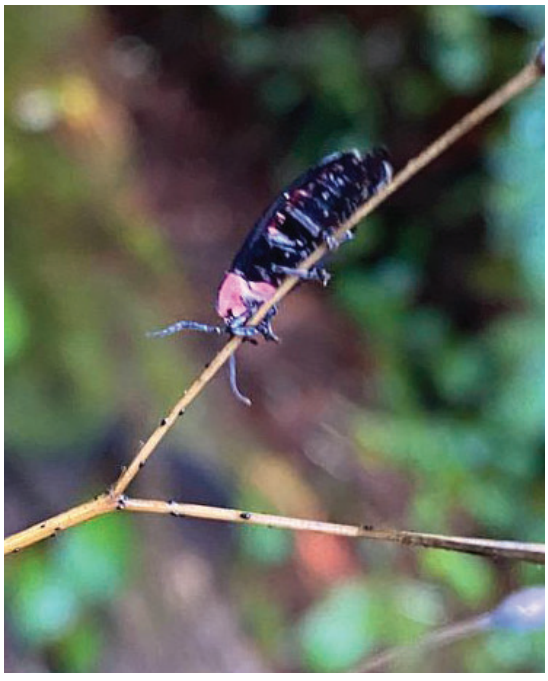

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CALIFORNIA GLOWWORM

Ellychnia californica

Physical Description

This is a diurnal species of the beetle family *Lampyridae,* found throughout the west coast. It is characterized by a black body with red stripes on its head (roseate pronotal sublateral vittae). It ranges from 3/8" - 3/4 " in length. [1] Both males and female adults are winged, and take flight over short distances.[2] The California glowworm is actively glowing only in its larval phase, when it is noctournal and subterranean.[3]

Range & Climate

Ellychnia californica has been found as far north as the Cascade Mountains in British Columbia [1] and south reaching to various Los Angeles canyons, such as Tujunga, Rustic canyon, and Arroyo Seco. [4] Its climate is mountainous and riparian; favoring oak and willow lined streams 3,000-4,000 ft. in elevation.[1]

Eugene Zelenko - CC by NC 4.0 via Wikimedia Commons

Life Cycle

All beetles undergo four stages- egg, larvae, pupae, and adult. The cycle can take a few months or several years; the Lampyridae family is sensitive to aridity and heat and conditions must be right to emerge from its larval phase. The larvae glows both day and night to ward off predation. Studies indicate that toads, birds, and ants reject luminescent prey. [6] The larval form dwells underground for up to two years. Adults pupate and find their homes in understory plants. Wet springtimes yield a higher number of these beetles. [5]

Reproduction

Ellychnia californica communicate with their mates via pheromones, with males seeking a certain scent and the females emitting this from the ground, where they are ready to mate and lay eggs. [5] The flashing families of glowworms and fireflies attract mates with their lantern signal rather than pheremones. This supports the theory that the glowing behavior in earlier stages is motivated by protecting the vulnerable larval form. Studies have shown the glowing has an adverse effect on various potential predators.[6] Most beetles in the *Lampyridae* family lay 50-100 eggs.

Diet

In their glowing larval phase, this species is a voracious predator, and feeds on soft invertebrates such as earthworms and slugs. They typically hunt at night in moist soils, using their mandibles to immobilize the snail using neurotoxins. Then they secrete digestive enzymes that liquefy the prey prior to devouring them. [3] Adult beetles often live long enough only to mate, requiring only nectar, pollen, and tender plant material. [5]

Shelter

After emerging from its subterranean habitat, *Ellychnia californica* can be found in logs, grass shoots, and leaves. Adults can fly short distances but do not migrate. They linger around tender, shady ferns and other creek adjacent material, seeking their mates and sustaining themselves on relatively light fare compared to their youthful appetites. At night, they take cover on the underside of leaves, logs, and bark.[2]

Predation and Threats

Ellychnia californica, like many other species of firefly and glowworm, have experienced a shrinking of population due to habitat loss of riparian areas. Data on this particular species is lacking with regard to predators. The *Lampyridae* family are blessed with a compound called a lucibufagin [2] which is like a steroid. This compound coats the exoskeleton and makes them taste bad to predators. In larval form, frogs and birds learn to avoid the glowing phenomenon. [6]

Critical Plants or Structure

In the southern California region, the riparian zones are characterized by alders, Western sycamores, cottonwood, bay trees, various ferns, stinging nettles, and willow undergrowth. [4] Unfortunately, this particular climate of wetland and creeks is imperiled throughout the world due to human activity and invasive species, so this once endemic glowworm species is less numerous than it was when first recorded. [1],[5]

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DIABOLICAL IRONCLAD BEETLE

Phloeodes Diabolicus

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Phloeodes Diabolicus calls numerous ecosystems home, but are more common in arid regions.

DIABOLICAL IRONCLAD BEETLE

Phloeodes diabolicus

Physical Description

Phloeodes diabolicus, commonly known as the "ironclad beetle," is easily identifiable by its robust and textured body, covered with small, rounded projections called tubercles. This beetle features a white vestiture, setting it apart from other species in the Zopherini tribe. Males exhibit distinct femoral characteristics, including nodules and cuticular pores visible under magnification, the beetles only grow half an inch in length. [3][1]

Range & Climate

The Beetles can be found in the semi-arid mediterrenean climates of Southern and Eastern California, they more notably can be found in the California Floristic Province where they seek refuge under decaying matter. They can be found as far south as Baja California [1]

Wikimedia commons

Life Cycle

There is not much available information about the lifecycle, however like the order *Lepidoptera* (butterflies and moths), *Coleoptera* is holometabolic and undergoes full metamorphosis meaning its life cycle can be divided into four stages including an egg, larva, pupa, and adult stages. [1] The ironclad beetle has a lengthy lifespan of 2-8 years, in comparison to other members of *Coleoptera* which tend to have lifespan averages that fall within weeks or months. [2]

Reproduction

No reputable information can be sourced regarding the specifics of the reproductive behaviors and biology of this incredible arthropod, this is due to the overwhelming interest of the weight-bearing capabilities of the beetle's exoskeleton. Jesus Rivera from the University of California Riverside, discovered the material science and engineering potential of the Diabolical Ironclad Beetle after running it over with his car to find that it survived the impact. The beetle can withstand over 39,000 times its own body weight [4]

Diet

Phloeodes diabolicus primarily feeds on decomposing wood and associated fungi. Adults are typically found under the bark of decaying trees and other woody materials from various species. The larvae are adapted for a wood-boring lifestyle, characterized by an enlarged thoracic region and reduced legs. They have been observed feeding on logs and roots of different trees, indicating their role as non-specific decomposers. Additionally, while rotting wood is the primary substrate for many larval Zopherinae, their diet may also include associated fungi, particularly white rot fungi. [1][3]

Shelter

Adults of Phloeodes Diabolicus are typically found beneath the bark of decaying oak (Quercus sp.) and cottonwood (Populus sp.) trees. They are also associated with woody materials from willow (Salix sp.), alder (Alnus sp.), sycamore (Platanus sp.), walnut (Juglans sp.), eucalyptus, cedar (Cedrus sp.), pine (Pinus sp.), madrone (Arbutus sp.), and laurel (Umbellularia sp.). Additionally, they can be found under various shrubs (including Salicornia sp. and Baccharis sp.), on fungi, in leaf litter, and under rocks. [1]

Predation and Threats

There is no information regarding direct threats and specific animals that predate on *Phloeodes Diabolicus*, however it is broadly mentioned that birds find it challenging to consume the insect as their aforementioned exoskeletons are so durable that they are peck-proof and hard to swallow. The California Sage Scrub is one of the fastest vanishing ecosystems in the U.S due to urban development, agriculture and other human activity which can also threaten the populations of this hardy beetle species [1][3][5]

Critical Plants or Structure

Aside from they keystone oaks, walnut and cotton wood species, they are also associated with woody materials from willow (Salix sp.), alder (Alnus sp.), sycamore (Platanus sp.), walnut (Juglans sp.), eucalyptus, cedar (Cedrus sp.), pine (Pinus sp.), madrone (Arbutus sp.), and laurel (Umbellularia sp.). Many of these trees not only function as shelter for the Diabolical Ironclad Beetle, but they also depend on the decaying matter that they provide to sustain the population. This arthropod can be found along Coastal Sage Scrub, Oak Woodland, and Baja desert ecosystems.[1][3]

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LARGE CRANE FLIES

Tipula spp.

Cranefly in flight with buddleia
Battell, M., Battell R. (2017) [Online image]. Moorhen. https://www.moorhen.me.uk/

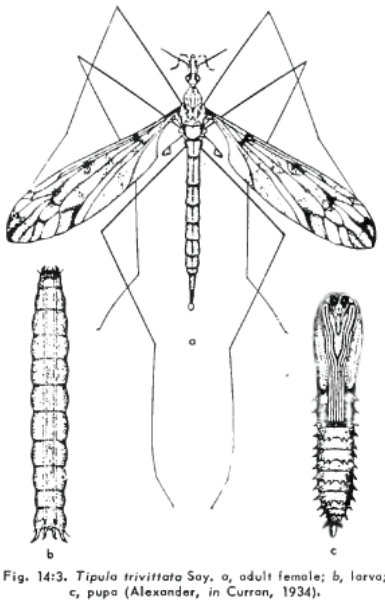


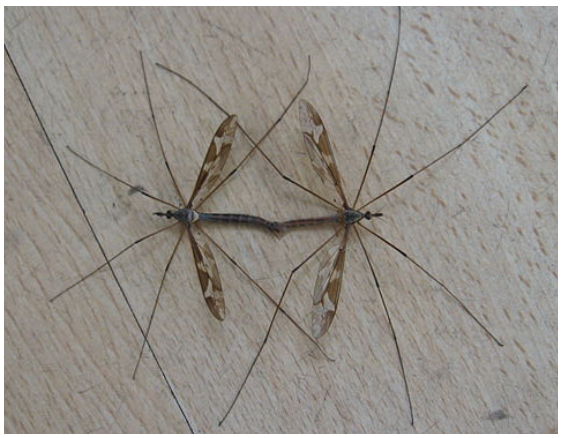
Fig. 14:3. *Tipula trivittata* Say. a, adult female; b, larva; c, pupa (Alexander, in Curran, 1934).

Usinger, R. L. (1956). *Aquatic insects of California, with keys to North American genera and California species*. Public domain.

Tipula larvae are sometimes referred to as leatherjackets.
(SimonLH64 is licensed under CC BY 2.0)

(Thomas Bresson, CC BY 3.0 via Wikimedia Commons)

Unidentified aquatic Tipula larva
(Takimata, CC BY 3.0 via Wikimedia Commons)



A pair of *Tipula maxima* mating.
(Richard Avery, CC0 1.0 via Wikimedia Commons)

Tipula oleracea female (Linnaeus 1758)
(Michael Gäbler, CC BY 3.0 via Wikimedia Commons)

LARGE CRANE FLIES

Tipula spp.

Physical Description

Large crane flies, often confused for mosquitoes, are known for their six long, delicate legs [1]. The adult body is narrow and brown, orange or black in color. They have one pair of wings which are clear or brown-tinted, sometimes with brown markings and veins. Identification of genitalia by an expert is the most reliable way to determine species and sex.

Size: 15-20mm (0.5-0.8”) in length, not including extremities.

Range & Climate

This widespread genus comprises 1/6 of all known crane flies, with over 170 species known in California [1], [2]. Larval habitats vary greatly amongst species. Some are fully aquatic while others live in soil of pastures or meadows. They prefer damp conditions and can be found near streams, under rotting leaves, or in dead wood. [3]. Adults are often sighted mating near meadows, wet lawns, or herbaceous vegetation [4].

Tipula (Hesperotipula) californica
(Hailey Adler, CC-BY-NC via iNaturalist)

Life Cycle

The crane fly will spend most of its life as a grub, experiencing four instars (periods between molting). This stage can last from six months to five years. [3]. Most terrestrial to semiaquatic species live within 50 mm (2”) of the substrate surface, regardless of climatic conditions. Adults emerge between April and October, usually in warm, humid weather, depending on the species. Their flight is clumsy, making them easy prey for insects, birds, and fish. They typically do not feed and live no more than a week, just long enough to mate and deposit eggs under water, in soil, or decaying wood [4].

Reproduction

The lifespan of an adult crane fly is only a few days. Shortly after emerging from the pupa stage, they immediately begin mating and ovipositing. Many species are polyandrous and sex-ratios at oviposition sites are male-biased [6]. Because of this, the last male to mate with a receptive female is most likely to fertilize the ova. After mating, males will guard females to defend against other males, ranging from genital linkage to distant surveillance. Sperm volume and number of eggs varies between species.

Diet

Tipula larvae typically feed on decaying organic matter, but some are predaceous or feed on living plants such as mosses [2]. Terrestrial species that live in pastures and meadows consume roots and young grass shoots. During favorable years with large broods, they can be considered a pest to lawns and certain crops. Adult crane flies occasionally feed on plant nectar, but they typically do not eat owing to their reduced mouths [1]. It is worth noting that they cannot eat mosquitoes or bite humans for this reason.

Shelter

Adult female crane flies will sometimes deposit eggs in rotten wood [1]. Ensuring the availability of decomposing organic matter, such as leaf litter and decaying logs and branches, can contribute to favorable conditions for crane flies. Attention to the ground plane is important, given the crane fly spends most of its life as a larva in soil or under rotting leaf mats.

Predation and Threats

As a large and abundant family of slow fliers, adult *Tipula* are an important food source for bats, birds, lizards, spiders, and predatory insects such as praying mantids and beetles [1]. Birds will hunt terrestrial crane fly larvae in lawns and pastures. In addition to birds, the use of nematodes in residential lawns has become a popular way of managing larval numbers. Steinernema spp. infect and kill crane fly larvae [5].

Critical Plants or Structure

Grass roots and shoots, as well as decaying material like leaf litter and rotting wood, provide food and shelter for larvae. Cultivating a diverse ground plane beneficial for egg-laying stages. Grass-herbland is an important and largely extinct plant community for this genus [7]. Beneficial plants may include:

- *Festuca californica* (California fescue)
- *Stipa pulchra* (Purple needle grass)
- *Achillea millefolium* (Common yarrow)

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CALIFORNIA BUMBLE BEE

Bombus californicus

(c) Madeleine Claire, some rights reserved (CC BY)

Kiloueka, CC0, via Wikimedia Commons

Rhododendrites, CC BY-SA 4.0

(c) sprcrkwild, some rights reserved (CC BY)

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CALIFORNIA BUMBLE BEE

Bombus californicus

Physical Description

The California Bumble Bee (Bombus californicus) is a medium to large bumblebee species found in the western United States. It has a black head, a black thorax with a yellow band, and an abdomen marked by alternating black and yellow bands. Covered in dense, fuzzy hair, this bee has transparent wings with a brownish tint and black legs equipped with pollen baskets. It is typically seen in meadows, gardens, and agricultural areas, where it plays a crucial role in pollination, flying slowly and deliberately as it to collect nectar and pollen.

Range & Climate

The California Bumble Bee (Bombus californicus) is primarily found in the western United States, ranging from southern California to Washington and into parts of Nevada and Oregon. This species thrives in a variety of climates, including coastal, Mediterranean, and temperate regions. It is adapted to environments with mild to warm temperatures, and it can be found in areas with a mix of dry summers and wet winters. [1]

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Life Cycle

The life cycle begins in early spring when the hibernating queen emerges and searches for a suitable nesting site. She lays eggs that develop into female workers, who take over foraging and nest duties as the colony grows throughout the summer. By late summer, the queen produces new queens and males, who leave the nest to mate. After mating, the males die, and the newly mated queens find places to hibernate. The original queen and remaining workers die off in the fall, with the new queens hibernating to restart the cycle the following spring.

Reproduction

Reproduction of the begins in late summer when the queen starts producing new queens and males instead of workers. These reproductive bees leave the nest to mate, with males dying shortly after and mated queens seeking sheltered sites to hibernate through the winter. The mated queens are the only colony members that survive, emerging in spring to establish new colonies and restart the life cycle. This process ensures the species' continuity and its role in pollination.

Diet

Primarily feeds on nectar, which provides energy, and pollen, which supplies protein for developing larvae. As generalist foragers, they visit a wide range of flowers, including wildflowers, garden plants, and crops. They collect pollen using specialized structures on their hind legs and often exhibit flower constancy, repeatedly visiting the same flower type during foraging trips. This diverse diet and foraging behavior make them important pollinators in various ecosystems. [2]

Shelter

Typically nests in a variety of natural shelters, including underground burrows often abandoned by rodents, which provide protection from predators and harsh weather. They may also nest above ground in dense vegetation, under logs, in rock crevices, or within piles of leaves and other natural debris. Occasionally, these bees utilize man-made structures like compost piles or old sheds. Their nests are lined with soft plant materials to create a comfortable environment for raising their young. [3]

Predation and Threats

Faces predation from birds, skunks, spiders, and insects like robber flies and wasps. Its major threats include habitat loss due to urbanization and agriculture, pesticide exposure (especially neonicotinoids), climate change, and competition for resources. Additionally, diseases and parasites, such as Nosema bombi and parasitic mites, pose significant risks to their populations. [4]

Critical Plants or Structure

Some critical plants that support Bombus californicus are those rich in nectar and pollen, often native to their habitat in the western United States. [5]

- *sage (Salvia officinalis)*
- *blueberry bushes (Vaccinium)*
- *med clover (Trifolium pratense*

Relies on a variety of flowering plants for food. They feed on nectar for energy and collect pollen to feed their young.

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VELVET ANTS

Dasymutilla spp.

Dasymutilla sackenii CC BY 4.0, Rachel Allingham, iNaturalist, 2023

Dasymutilla occidentalis (male), CC BY-SA 2.0, Wikimedia

Dasymutilla sackenii PDM 1.0, Joshua Tree National Park

Dasymutilla magnifica, CC BY-NC-ND 2.0, Benson, 2017

Dasymutilla gloriosa CC0

Dasymutilla aureola CC0

VELVET ANTS

Dasymutilla spp.

Physical Description

Velvet Ant species in Southern California have black or reddish brown bodies covered in setae (hair). Setae color ranges greatly; white, yellow, orange, and bright scarlet red; between species and between males and females [1]. Males have black transparent wings, the females are wingless. Females have a curved stinger at the tip of the abodomen.
Size: 1/4-1" long, females are slightly larger than the males.

Range & Climate

Present throughout the US, Mexico, Central America, South American and southern Canada. Most of the species known to occur in California are found in the desert or more arid regions [2]. Can be found mid-morning and later in the day before sunset. More than half the species are nocturnal, avoiding the desert sunlight.

Dasymutilla Gloriosa, PDM 1.0, USGS Bee inventory

Life Cycle

As they are parasitic they lay eggs on immobile, immature-stage (pupae) ground-nesting *Hymenoptera* (bees, wasps, ants, hornets). The egg is laid on the exterior of the host, once hatched the larva feed on the host. It is believed that the adult stage velvet ant digs to the surface and emerges July-October. It is believed that females can live up to 12 months, though a shorter life span 2-2.5 months is more common. It is believed that the males tend to have a shorter life span than the female [3]. More research is needed to fully understand the life cycle.

Reproduction

Females need to mate only once to obtain the sperm she will need for her entire life. To have male offspring, a female can lay an egg without fertilization, creating a haploid egg that develops into a male. To have female offspring she can fertilize the egg with the sperm she has stored. [1] Males seek females by flying low over the ground. The initial interaction has also been recorded to take place after a female has climbed onto bush branches, attracting multiple males to the plant. [4]

Diet

In the larva stage the velvet ant feeds on a host, most likely a ground-nesting *Hymenoptera* (bees, wasps, ants, hornets) species. Adult males and females feed on nectar, extrafloral nectaries, and collect honeydew, a liquid left behind by aphids. Females also feed on pollen in host cells as well as the fluids of hosts. [5]

Shelter

Since they are parasitic, they do not build their own nests. They seek out ground-dwelling bee's and wasps nests, using the host nest to lay eggs. This allows the larvae to feed on the host pupae until they reach adulthood. The size of the adult velvet ant relates to the size of the cells of the host nest, causing it to range greatly in size. They prefer open spaces, sandy or stony, low grass or brush. [1]

Predation and Threats

There are few if any documented predators possibly due to its hard exoskeleton, bright coloring of the setae in some species, and the painful sting from the female. People are a threat by manicuring lawns, and "pest management" methods that discourage ground nesting bees and wasps. Can also be considered a pest due to their painful sting, and are nicknamed in some areas as "cow killers".

Critical Plants or Structure

Generalist flower visitors of plant families Apiaceae, Asteraceae, Euphorbiaceae, Rhamnaceae, Polygonaceae, Cleomaceae, Cactaceae, Crassulaceae, Passifloraceae [5]. It was widely believed that *Dasymutilla gloriosa* mimic the fruit of the creosote bush, however recent studies have questioned this relationship. It is possible the white coloring could be an evolutionary response to heat. More research would be useful to better understand their relationships to specific plants. [6]

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HARVESTER ANTS

Pogonomyrmex spp.

"Maricopa harvester ant (Formicidae- Pogonomyrmex maricopa; 31538269553; cropped)" by Insects Unlocked is marked with CC0 1.0.

"red harvester ant" by Jonghyun Park is licensed under CC BY 4.0.

"Harvester Ant, Key's Ranch, Joshua Tree National Park, CA (10)" by Ranger Robb is marked with Public Domain Mark 1.0.

"Harvester Ant on Eriogonum microtheca. Dry Valley, San Juan County, UT_2" by Ranger Robb is marked with Public Domain Mark 1.0.

"Western Harvester Ant (Pogonomyrmex occidentalis) at Seedskadee National Wildlife Refuge Wyoming" by USFWS Mountain Prairie is marked with Public Domain Mark 1.0.

HARVESTER ANTS

Pogonomyrmex spp.

Physical Description

As their common name implies, these ants regularly include seeds as part of their diet. In addition, *Pogonomyrmex spp.* workers scavenge for dead arthropods. Pogonomyrmex workers are large, up to 0.4 in length. Most are light red or brown, although the gaster of some species may be dark brown to black. These ants are identified by the presence of a psammophore, a fringe of hairs on the underside of the head. [4]

Range & Climate

These ants are found in open, warm, and sandy areas, often constructing nests with entrances surrounded by loose sand arranged in a circular or semicircular pattern. *Pogonomyrmex californicus* thrives in temperatures between 82-85°F. Their nests require humidity levels of 60-75%. Although they do not undergo true hibernation, they benefit from a diapause period of 2-3 months at around 59°F to stimulate brood production. [2]

Life Cycle

1) Eggs: After mating, wingless queen ants lay small, white eggs in nests. Worker ants protect and tend to these eggs, which hatch in 2-4 weeks. 2) Larvae: Legless, worm-like larvae are fed by workers and grow through several molts over 2-4 weeks before pupating. 3) Pupae: Larvae transform into pupae within silk cocoons, undergoing significant development over 1-2 weeks. 4) Adults: Fully developed ants have distinct body parts and mature over a few weeks. Workers live weeks to months, while queens can live years and lay eggs to sustain the colony. [1]

Reproduction

The most common *Pogonomyrmex spp*. In Califnoria is the *Pogonomyrmex californicus. Pogonomyrmex californicus* colonies are facultatively polygynous, meaning they can have multiple queens. However, most colonies are founded and sustained by a single queen. Occasionally, multiple queens cooperate in colony founding, a phenomenon known as pleometrosis. Reproduction peaks around July when reproductive individuals are present. [2]

Diet

Pogonomyrmex californicus ants are primarily seed harvesters but also prey on arthropods such as raisin moth larvae. They forage during the day, either individually or in groups, forming columns. They require a diet of seeds, nuts, grains, protein, and water. [2]

Shelter

Harvester ants construct their nests in dry, sandy to hard soils. The entrance to the nest is often marked by a crater or a cone in the center of a slight mound, usually surrounded by a pile of small stones. Some species in hot deserts can lack a mound. The nest can be 3-30m in diameter with tunnels extending down to 5 m or more. The area around the nest is usually completely devoid of vegetation. [2]

Predation and Threats

Many insectivorous birds and lizards prey on harvester ants; some are obligate predators including several horned lizards that are species of concern for conservation. [6] Arthropods, birds, lizards, and small mammals, harvester ant workers are an abundant food source. Some species of horned lizards are entirely dependent on harvester ants as a source of food. Harvester ants are also an important food source for the endangered sage grouse—which, incidentally, also likes to climb on top of ant mounds when it dances for mates. [5]

Critical Plants or Structure

The workers are assiduous harvesters; they forage all day, except during the hottest hours. Seeds are harvested in great numbers, notably those of *Phacelia spp., Aristida sp*., and *Sarcobatus vermiculatus*; the mounds are often surrounded by the bracts of these and other seeds. [3]

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CALIFORNIA CARPENTER BEE

Xylocopa californica

(I, Pompilid, CC BY-SA 3.0)

(Insects Unlocked, CC0)

(Insects Unlocked, CC0, via Wikimedia Commons)

Female California Carpenter Bee - note yellowish hairs on top of head.
(Holly Cheng - Own work, CC BY-SA 4.0)

Examples of nests excavated in dead wood by Carpenter Bees. Note the cells created for the hatching of offspring, separated by partition walls. (Stephen Buchmann, USDA Forest Service)

(Joshua Tree National Park, Public domain, via Wikimedia Commons)

CALIFORNIA CARPENTER BEE

Xylocopa californica

Physical Description

California Carpenter Bee bodies are dark blueish or black, but may reflect other colors in different light. They have fine hair on their heads, with females tending to have black hair, while males' hair is yellowish [1]. Females have stingers but are not aggressive. Males do not have stingers.

Size: 13 - 30 mm (1/2 - 1 1/8") in length [2]

Range & Climate

Native to California, much of the Western USA, and Northern Mexico. It is found in the Pomona Valley, most commonly at higher elevations. It thrives in hot, dry environments, and has been documented to fly in temperatures as high as 48 degrees C (125 degrees F) [3]. It does not tolerate temperatures lower than 10-15 degrees C (50-60 degrees F, typically seeking shelter in these cool temperatures. They are most active March to August.

(Damiana Aldana)

Life Cycle

Females lay eggs in partitioned cells within bored nests, which hatch in about 7 days [4]. The 7 mm larvae consume pollen and nectar stores for 22-28 days, before entering the pupal stage, which lasts 40-45 days. An adult emerges from its partitioned cell 70-80 days after eggs are laid, and begins seeking food, first within the nest before eventually leaving the nest in search of nectar and pollen. Male carpenter bees live for approximately one year and will die shortly after mating. Female carpenter bees can live for 2 years or more and will use the same nest from the previous mating season.

Reproduction

Males hover next to active nests and pursue females, particularly those not carrying pollen loads, as the females enter or leave the defended nests [5]. Mating presumably occurs after a male locates a partner near the nest. Males generally return repeatedly to the same hovering station for daily bouts of nest guarding. Some males, however, have two territories that they shift between while still others appear to engage in nonterritorial "traplining" among many sites. The distribution of potential mates appears to determines the evolution of male competitive tactics.

Diet

Carpenter bees are opportunistic, and consume pollen and nectar from a wide variety of plants. They are highly effective pollinators. They don't produce honey, but rather larvae are supported by "Bee Bread" consisting of pollen, nectar and saliva. Available pollen and nectar supplies appear to limit the density of nests in a given area [6].

Shelter

Carpenter Bees carve their nest in some native and introduced softwoods, although they do not eat the wood. They dig a tunnel in live wood, dead wood, or hollow stems of the Yucca and Agave plants, which seems to be a favorite in Southern California. Their nest's success depends on the available pollen and nectar found in the area [6]. A suitable nest substrate is needed for their reproduction and survival; the quantity of nest substrate in the area is important in determining their total nest density. Carpenter Bees are typically solitary with no more than a few individuals in any nest.

Predation and Threats

California Carpenter Bees do not have many predators, but the ladder-backed woodpecker, *Dryobates scalaris*, has been observed to attack their nests, primarily in desert locations [6]. The bee fly, *Anthrax simson*, is a parasite which may feed off immature bees in the nest. Carpenter Bees are perceived as pests in some areas due to their occasional nesting in structural timber, including wood structures, utility poles and fencing material. As such, pest control may pose a threat in the absence of education.

Critical Plants or Structure

Will consume pollen or nectar from a variety of plants, but records indicate particular attraction to [7]:

- *Cercis occidentalis* (Western Redbud)
- *Parkinsonia florida* (Palo Verde)
- *Salvia Spp.* (Sages)
- *Phacelia tanacetifolia* (Tansy-Leaved Phacelia)

For nesting, dead wood is good substrate. Particular affinity for dead Yucca and Agave stalks.

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PENITENT UNDERWING

Catocala piatrix

(Judy Gallagher, Flickr CC)

(Ben Meredyk, iNaturalist CC)

(Cam Fox, iNaturalist CC)

(Philip Stepnowski, iNaturalist CC)

(Kat B, iNaturalist CC)

PENITENT UNDERWING

Catocala piatrix

Physical Description

The Penitent Underwing is a moth that has brown and gray forewings that enable the moth to be camouflaged while in various woodland habitats. Its boldly striped orange and black hindwings are a key indicator of the species [1]. These distinctive colors are only displayed when the moth has its forwings open, usually while it's in flight. The larva of this moth are green and brown. The wingspan of mature moths ranges from 64 to 84 millimeters (2.52"-3.30")[3].

Range & Climate

This moth is prominent throughout the Los Angeles Basin and large parts of California with a majority of observations occurring near Black Walnut and Oak habitat. The range of this moth also extends through a large portion of the Midwest and East Coast of America [4]. Penitent Underwings can tolerate a range of different climates, but they are most active during the hottest months of the year from July through August.

(jonnx12, Flickr CC)

Life Cycle

Eggs of the Penitent Underwing have been found to be laid on the underside of leaves or within the bark crevices of the larval host trees [2]. Once the eggs hatch the caterpillars feed on leaves of the host tree, experiencing multiple molts and increasing in size at a rapid pace. The caterpillar forms a pupa where its organs and tissues reorganize as it undergoes transformation into its adult moth form. The adult moth emerges from the pupa hardened with wings and functional reproductive organs.

Reproduction

While in its adult form reproduction is the main focus of the moth. These nocturnal moths are active at night, communicating and locating other moths using ultrasonic clicking [2]. This sound that is inaudible to human ears is used to avoid echolocation from bats.

Diet

The diet of the Penitent Underwing larva consists of foliage of deciduous host trees [5]. In their western range these trees are usually Black Walnuts, Cottonwoods, and Willows [2]. The adult moths feed on nectar from various different flowering plants. Other moths in this genus have been found to feed on tree sap [6].

Shelter

The larva of the Penitent Underwing camouflages well with its host plants, taking shelter within tree bark or leaves during the day and feeding on the host plants at night. When the larva begins its transformation it creates a pupa within these same places that it had been taking shelter during the day. Adult Underwing moths have been known to take shelter during the day while laying on the underside of tree branches [2].

Predation and Threats

Larva of the Penitent Underwing faces predation from birds, frogs, toads, spiders, and other insects while adult moths face predation from bats, birds, rodents, and spiders. A considerable threat to these populations is urban development and habitat loss [2]. One of the primary host plants to this species, The Southern california Black Walnut (Juglans californica) is listed as threatened within several counties in California showing that a correlation between population decline between these two species could be likely.

Critical Plants or Structure

In its western range the critical plants associated with the Penitent Underwing are:

- *Juglans californica (Southern California Black Walnut)*
- *Populus fremontii (Fremont Cottonwood)*
- *Salix spp. (Willows)*

Nesting is common within the bark and leaf litter of these trees.

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CHALCEDON CHECKERSPOT

Euphydryas chalcedona

(Eugene Zelenko, CC BY-SA 4.0)

(Public Domain, via Wikimedia Commons)

Checkerspot Caterpillar (Jerry Kirkhart, CC BY 2.0)

Chrysalis (David Hoffman, CC BY-NC-ND 2.0)

Checkerspot Caterpillar (Franco Folini, CC BY-SA 2.0)

(CountryMouse13, CC BY 2.0)

(Tyler Karaszewski, CC BY 2.0)

CHALCEDON CHECKERSPOT

Euphydryas chalcedona

Physical Description

The Chalcedon Checkerspot's appearance is highly variable. Its dorsal wings range from a burnt umber to a deep black, with red, yellow, and white checkered spots [1]. They are considered medium-sized butterflies, with a forewing range of 15-30 mm (0.6-1.2 in) [2]. Their larvae are mostly black with orange, and sometimes white, markings [3]. Populations around California may vary slightly in appearance based on their locations.

Range & Climate

They can be found all along the coast of western North America, from Alaska to Mexico [4]. They are also present in the lower elevations of the Sierra Nevadas [3], Santa Ana Mountains, and Laguna Canyon [1]. They thrive in a variety of habitats, like chaparrals, riparian canyons, and grasslands [3]. Their overlapping habitats lead to frequent hybridization with *Euphydryas colon* and *Euphydryas anicia* [2].

(Sandy/Chuck Harris, CC BY-NC 2.0)

Life Cycle

Checkerspots have one brood a year, around the months of April to July [3]. Unusual for lepidoptera, checkerspots lay their eggs in clusters and can remain in groups during the larval stage, when they communally spin webs onto their host plants [2]. They often split from the group upon entering diapause, when they slow their metabolic rate for winter. Diapause ends around February [4], weather permitting, and they begin pupation as early as mid-April. Checkerspots eclose into butterflies around April-June, and their lifespan of an adult is 15 days.

Reproduction

The males perch territorrially on foodplants to find females for mating [3]. Courtship for the Chalcedon Checkerspot lasts for roughly a minute, during which male checkerspots deposit a spermatophore, a solid sperm package, into the female's bursa copulatrix [5]. Females are physically capable of remating, with some having been observed to have remated three times; however, male checkerspots insert mating plugs into females after mating, which prevents copulation.

Diet

A wide variety of plants make up the checkerspot's diet, however, the most common foodplants for Chalcedon Checkerspot include Pentsemons (*Keckiella antirrhinoides*), Figwort (*Scrophularia californica*) and Monkey Flower (*Mimulus aurantiacus*), all of which grow commonly in California [1]. As larvae they eat and live on these plants, and as adults, eat the nectar. Other popular foodplants for the checkerspot include Chinese houses (*Collinsia spp.*), *Plantago spp.*, Indian paintbrush (*Castilleja spp.*), and wild honeysuckle (*Lonicera spp.*).

Shelter

They are born in egg clusters, and continue to live in groups with other larvae until entering diapause [2]. These larvae weave silken webs on their host plants together. During diapause, checkerspots leave their webs and host plants to reside on the ground under rocks, pinecones, litter [2], dead bark, or hollowed stems [4]. Common host plants include Monkey Flower (*Mimulus aurantiacus*) and Indian paintbrush (*Castilleja spp.*) [1].

Predation and Threats

The highest rates of mortality for checkerspots occurs during the larval stage [2]. The most common causes of death are predation from spiders, insects and parasites, and starvation; though larval dessication, pathogens, cannibalism, and consumption by competititve herbivores also occur. Though the Chalcedon Checkerspot is suffering from habitat loss, its wide range of habitats makes it still a common species.

Critical Plants or Structure

The Chalcedon Checkerspot is closely tied to the following host plants in California:

- Monkey Flower (*Mimulus aurantiacus*)
- Pentsemons (*Keckiella antirrhinoides*)
- Figwort (*Scrophularia californica*)
- Indian paintbrush (*Castilleja spp.*) [1].

As larvae they eat these plants and weave silk webs for habitat [2]. As adults, they partake in the plants' nectar and mate upon them.

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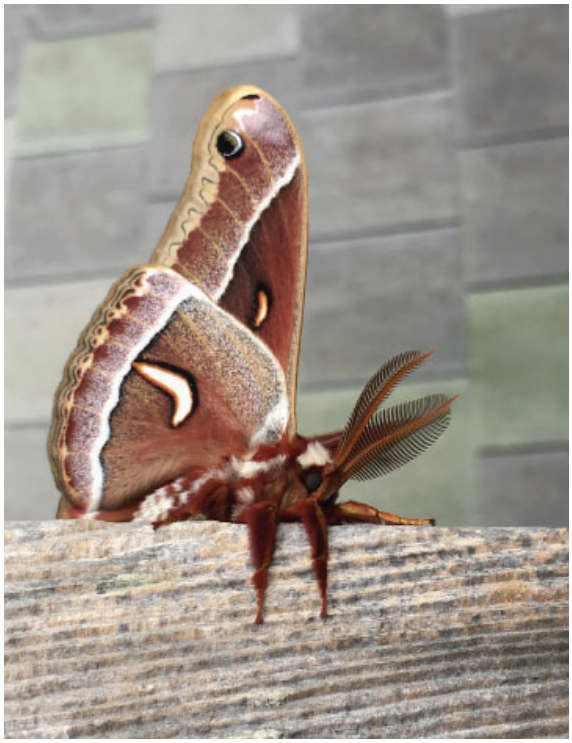
CEANOTHUS SILK MOTH

Hyalophora euryalus

(c) Laura Gaudette, some rights reserved (CC BY), CC BY 4.0, via Wikimedia Commons



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(Nathan Earley, CC BY 4.0, Wikimedia Commons)

Ceanothus Silk Moth - Hyalophora euryalus (Robin Gwen Agarwal - ANudibranchMom on iNaturalist, CC BY-NC 2.0)

(Madeleine Claire, CC BY 4.0, via Wikimedia Commons)

Ceanothus Silk Moth, Hyalophora euryalus (Caterpillar) (J. Maughn, CC BY-NC 2.0)

CEANOTHUS SILK MOTH

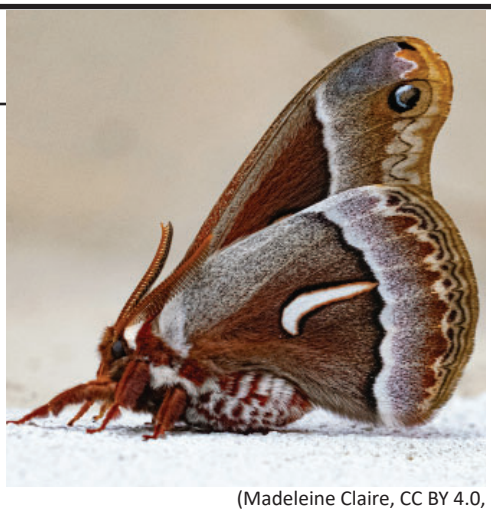
Hyalophora euryalus

Physical Description

The adult *Hyalophora euryalus* has wings that are usually around 4 inches across, with some ranging up to 5 inches. The wings are primarily deep rust (though their color ranges from true red to brownish red and dark red) with white streaks and black eyespots. The hindwing discal spot (shown prominently in the image to the right) is comma-shaped, elongated, and touches or pierces the white postmedial line, distinguishing it from other species [1].

Range & Climate

The Ceanothus Silk Moth inhabits the full length of the Pacific Coast, from British Columbia to Baja California. They live across a range of diverse plant communities (desert, dry chaparral, moist conifer forests). In southern California, they can be found from the Coast Range to the Transverse Ranges and Peninsular ranges, though not in desert mountains. They also span from the Coast Ranges inland across the Central Valley in riparian habitat [1].



(Madeleine Claire, CC BY 4.0, via Wikimedia Commons)

Life Cycle

The caterpillar goes through five phases called instars, during which they change color and texture. With each phase, the larval babies shed their skin or molt to reveal their new coloring. Their cocoon is oval-shaped and sharply pointed at the valve end, with a coloring of dull gray to brown. They tend to spin their cocoons in the fall. Adults emerge as early as January in coast ranges of Southern California. Adult moths will only live 1-2 weeks maximum, with their sole aim being to mate and reproduce [2].

Reproduction

To attract a mate, female moths send out a chemical scent and sexual stimulant from glands at the tip of their abdomen. The scent moves on air currents until reaching a male, who flies to the female and they mate speedily [3].

The moth lays its ova singly or in small groups on leaves of the host plant. These will hatch in 9-14 days. The larvae are able to feed on many different types of plants.

Diet

As larvae, the moth eats leaves of the host plant, which may be one of a variety of sclerophyllous plants. Coastal and coast range populations in California tend to feed on species of ceanothus and California coffeeberry, while interior valley populations feed on willow. Southern California populations also feed on laurel sumac & even the California pepper tree.

The adult moth has no mouth or digestive system, and therefore does not feed [3].

Shelter

Like most moths, *Hyalophora euryalus* are nocturnal. In the Los Angeles area, they tend to inhabit foothill and canyon areas composed of chaparral community, occasionally appearing in suburban areas [3].

When spunning their cocoons, the moth will usually select a region in the outer foliage of the host plant, rather than closer to the stems.

Predation and Threats

Moths of the genus *Hyalophora* rest butterfly-like, meaning that they hold their wings vertically. This makes them more susceptible to avian attacks, as birds may attack resting butterflies just after daybreak [4]. In some regions, such as east of the Rocky Mountains, the larvae may be susceptible to indigenous pathogens due to a lack of defenses. Further, populations of *Hyalophora* that inhabit mountainous terrain may be particularly vulnerable to habitat destruction and the effects of climate change [5].

Critical Plants or Structure

Though the moth prefers plants in the Rhamnaceae family (of the genus *Ceanothus* and *Rhamnus*) and Ericaceae family (of the genus *Arctostaphylus* and *Arbutus*), the caterpillars feed on a variety of trees and shrubs [6].

Other critical plants include bitterbrush (*Purshia*), gooseberry (*Ribes*), oak (*Quercus*), willow (*Salix*), maple (*Acer*), and birch (*Betula*). Moths that live from the mid-Sierra Nevada northward may also be drawn to Douglas fir (*Psuedotsuga menziesii*).

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WESTERN TIGER SWALLOWTAIL

Papilio rutulus

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Papilio rutlus larvae, Cslucasn via CC BY-SA 4.0

Cottonwood (Populus deltoid), Matt Lavin is licensed under CC BY-SA 2.0.

Thistle by tdlucas5000 licensed under CC BY-SA 2.0.

Papilio rutulus court, edward_rooks licensed under CC BY 2.0.

WESTERN TIGER SWALLOWTAIL

Papilio rutulus

Physical Description

The adult Papilio rutulus gets its name from the black and yellow "tiger" like stripes. The underside of the forewing has visible separate yellow spots on the marginal band & Hindwings have narrow spots with only 2 spots near the end of inner margin and no orange tint. [1] This species has many similar features to other Papilio species. It has a much deeper yellow and slight differences in pattern. [6] Wing Span: 2 3/4"- 4" (7 -10 cm)

Range & Climate

Native to Western North America across British Columbia, New Mexico and Baja California, Western South Dakota and rare sightings in central Nebraska.[1]

Flight occurs from early spring to midsummer with some ending late fall but can be seen all 12 months in CA.[6] Some Papilio rutulus are seen at higher altitudes to avoid competition with other species. [3]

Papilio rutulus via wikimedia commons public domain

Life Cycle

P. rutulus mimics bird feces during the larval stage to avoid attacks although larger larvae are less convincing. [5] After the larval stage which lasts about 10 days, they enter a pupa stage to achieve metamorphosis lasting 7-14 days.

Adult butterflies emerge in spring and summer with a lifespan of about 1-2 weeks. Seasons and altitude levels influence mating and egg laying. [3]

Reproduction

Males search for receptive females in canyons and hilltops. Females lay about 50- 300 eggs singly on surface of host plant leaves. [1]

Papilio rutulus is closely related to Papilio glaucus. These two species can interbreed to produce hybrid offspring. [2]

Diet

Caterpillars consume leaves of Willows (Salix spp.) as they are near water sources, Cottonwood trees (Populus deltoides & Populus nigra), and leaves of Aspen trees (Populus tremuloides). [1]

Adults have a long tube-like structure used to consume nectar from bright colored and scented flowers including Abelia, Zinnia, Thistles, Yerba Santa and California Buckeye.

Shelter

Caterpillars (larvae) shelter in curled leaves of host plants. They are found in woodlands near streams, rivers, wooded suburbs, parks, canyons, oases and roadsides.[1]

P. rutulus can be found in urban parks, riparian habitats, and gardens. [6] Caterpillars feed on host plant leaves and rest on silken mats as a shelter. [1]

Predation and Threats

Predation may occur from birds feeding on the same plants as insects such as butterflies.[4] P. rutulus is very social prior to mating which poses a risk as they are more vulnerable in open spaces that attract predators. Females are more often predated than males. Other threats may occur from related species which feed on similar species such as P. multicaudata (Two tailed Swallowtail) which causes competition for food.[3] Habitat loss due to urbanization is a risk factor as this species prefers habitats near streams and riparian areas.

Critical Plants or Structure

[6]Caterpillar host plant leaves of:

- *Cottonwood and aspen (Populus)*
- *Willows (Salix)*
- *Ash (Fraxinus)*
- *Wild Cherry (Prunus)*
- *Oak (Quercus)*

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CALIFORNIA OAK MOTH

Phryganidia californica

A male California Oak Moth caught in a spiderweb
("Caught in the spiderverse" by TJ Gehling, CC BY-NC-ND 2.0, via Flickr)

A California Oak Moth in it's larval stage
(©2007 Gary McDonald)

A female California Oak Moth
("California Oak Moth, TJ Gehling, CC BY-NC-ND 2.0, via Flickr)

Uneaten leaves of the Coast Live Oak
("Coast Live Oak Quercus agrifolia", TJ Gehling, CC BY-NC-ND 2.0, via Flickr)

California Oak Moths in their pupal cases
("California oak moth chrysalises", CountryMouse13, CC BY-NC-ND 2.0, via Flickr)

CALIFORNIA OAK MOTH

Phryganidia californica

Physical Description

The body of the California Oak Moth often measures around half an inch. Their wingspan is usually 1 to 1.25 inches long. They are often one color, usually a tan, grey, or silver. The males have feathery antenna, while the females do not. The larvae of the Oak Moth, sometimes referred to as the California Oakworm, measure from around 0.1-1.0 inch at full size. They are usually a yellow/green color and have large, beaded brown heads [1].

Range & Climate

The California Oak Moth occurs only in California. Their range occurs from South of Humboldt County and to Southern Los Angeles County. Outside of this range, there are populations in Northwest California and have been reported to exist in San Diego [2]. They are most active, and "destructive", in the San Francisco Bay and Monterey regions [1].

(Image by CountryMouse13, CC BY-NC-ND 2.0)

Life Cycle

California Oak Moths are multiolvine, meaning they have two broods each year, a 3 month summer and 9 month winter brood [2]. In Southern California, there is more variability when broods occur given the warmer weather. Generally, in the fall, adult moths from the summer brood lay eggs on the underside of oak leaves. Weeks later, the eggs hatch, and begin to eat the tree's leaves. The larvae themselves go through five stages of growth, known as instars. Around May or June, the larvae develop a pupal case and go through metamorphis. They hatch in June and July [1].

Reproduction

Information regarding reproductive habits of the California Oak Moth are sparse. However, reproductive behaviors in their order, Lepidoptera, have been studied. Soon after eclosion, or emergence from the pupal case, females use visual and chemical cues to attract their male counterparts. Males locate the female, and return other visual and chemical cues. Mating lasts one or more hours, and then the male departs in search for other mates, while the female locates a site to lay eggs. In the case of the California Oak Moth, females lay eggs on the underside of oak leaves [3].

Diet

The California Oak Moth is aptly named due to its diet of native deciduous and evergreen oak tree leaves. A reason California Oak Moths are often viewed as pests are for their highly specific appetites. Once in a while, although this behavior is lacking understanding, broods do occur in extreme numbers. When this happens, they can wipe out a whole oak tree and stands. Healthy oaks will more than always be okay with this leaf devouring, and eventually rebud and re-leaf. Older and trees under stress may have a harder time rebounding [1].

Shelter

Oak Moths spend the majority of their life on the oak leaves in which they are feeding on. When *Phryganidia californica* reach their terminal instar, they travel downwards on the tree towards the lower trunk. It is here that they develop their pupal case and finish their metamorphisis. Sometimes they will find their way to manmade structures to create their pupal case (e.g. the pupal case picture on the previous page). There is not much information on the adult sheltering habits of the California Oak Moth [2].

Predation and Threats

Birds, spiders, and other insects are some of the predators of the Oak Moth. Insects such as the Green Lacewig and Yellowjacket are important predators during the larval stage. Parasitic wasps also utilize the oak moth pupal cases to provide a place for their own species to grow [1]. An anthropogenic threat to the species is the spraying of trees with pesticide. Some individuals do not like the aesthetic of a leafless oak. Individuals who spray their tree with pesticide on unhatched eggs or larvae will kill a population from a tree [4].

Critical Plants or Structure

California oaks are extremely important for the development of Oak Moths.

- *Quercus Agrifolia (Coast Live Oak)*
- *Quercus Lobata (Valley Oak)*

Whereas Coast Live Oaks provide food and leaves all year round, Valley Oaks are decidious. If adults lay their eggs on Valley Oaks in the fall, the leaves fall and ultimately destroy that trees' brood [5].

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CALIFORNIA MANTIS

Stagmomantis californica

(Alan Schmierer, CC0 1.0 Universal, via Flickr)

Instar mantids. (Alan Schmierer, CC0 1.0 Universal, via Flickr

Mantis ootheca (egg case) on Palo Verde Tree. (Amy Garza)

Spiky raptorial forelegs help grab prey. (BJ Stacey, CC BY-NC, via iNaturalist)

Birds will prey on mantids. (Becky Matsubara, CC BY 2.0, via Flickr)

Mantis camouflaged on plant. (Bobby McCabe, CC BY, via iNaturalist)

CALIFORNIA MANTIS

Stagmomantis californica

(Sing to the Mountain Studio, CC BY-NC, via iNaturalist)

Physical Description

California mantis adults are thin and long and can be brown, green, and yellow, or a mottled variety of those colors. The head is triangular in shape with large, protruding eyes. It has 6 legs total and the 2 front legs are raptorial (folded like a pocket knife) with sharp spines used for predation. They have wings, but are rarely seen flying. Females are generally larger than males [1].
Size: 50-64 mm (2-2.5 inches) in length [6]

Range & Climate

California mantids are native to Western United States. They live in lower elevation desert and arid landscapes found throughout Southern and Central California [6].

Life Cycle

Mantids go through incomplete metamorphosis that includes egg, nymph and adult. Females lay eggs in a frothy secretion that hardens into a styrofoam-like egg case (an ootheca). There can be 12-400 eggs [4]. The eggs overwinter within the ootheca and hatch into a nymph when temperatures are warmer, which resembles a miniature version of an adult but do not have wings and may be different in color. They grow in size (shedding about 6-7 times) and eventually develop wings until they reach adulthood in late summer or fall [1, 3].

Reproduction

Adult mantids mate in the fall and females lay eggs in an ootheca (case) attached to a plant stem [1]. Female mantids have been known to eat the male's head after the mating process, but contrary to popular belief it is not a common practice in natural settings. Adults die off a few weeks after mating and cannot survive the winter. Eggs will remain in the ootheca over the winter and hatch in the spring. California mantises have one generation per year [3].

Diet

Mantids are carnivorous insects that are indiscriminate predators, meaning they will eat anything available to them [5]. They commonly eat locusts, crickets, fruit flies, cockroaches, caterpillars, moths, and butterflies but have also been known to eat small birds, reptiles, amphibians and other mantids. Mantids are ambush predators; they lie in wait motionless for their prey and attack when they come into their proximity. In addition, mantids use their habitat as camouflage and live on plants they naturally blend in with.

Shelter

Mantids choose a natural habitat that is conducive to their predatory habits. This includes plants that are similar in color so that the plant acts as a natural camouflage [4]. Many California Mantids are green in color so they will often be found on green, leafy trees and bushes. Mantids are also found where prey is known to frequent, such as citrus tree flowers or lamp posts [5]. Mantids will seek shelter from bad weather in trees, bushes, and woody structures [4]. They will also seek shade in very hot weather.

Predation and Threats

Birds, spiders, bats, or fish will sometimes prey on Mantids [1]. Mantids use their natural habitat of trees and bushes to camouflage themselves from these potential predators. Since mantids will cannibalize other mantids, their population is naturally limited, especially within small areas. Furthermore, they are territorial so there tends to be only one mantis on a plant [4].

Critical Plants or Structure

California Mantids prefer trees and shrubs in the coastal sage scrub plant community [6]. They also like to hunt prey on flowering plants [5].

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TIMEMAS

Timema spp.

Public Domain

Stick insects mating CC BY-SA 2.0

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TIMEMAS

Timema spp.

Physical Description

Timema spp. differ from other Phasmatodea in that their tarsi have three segments rather than five. For stick insects, they have relatively small, stout bodies, they are wingless and look cryptically colored. Their coloration is a mixture of brown, green and gray which helps them camouflage effectively. Their legs and antennae are also adapted to enhance their mimicry. Timema display sexual dimorphism. Males are ~ 2cm long, compared to ~ 3cm in females. [1]

Range & Climate

Timema are found primarily in North and Central America. In the United States, mainly in southern California, extending into parts of Arizona and Nevada. Timema species typically inhabit areas with a Mediterranean climate characterized by hot, dry summers and mild, wet winters. Timema are adapted to survive in relatively arid conditions with occasional rainfall. [5]

Public Domain

Life Cycle

The eggs are laid by the female and can take several months to hatch, depending on environmental conditions. After hatching, the nymphs resemble miniature adults but usually go through several molts as they grow. This stage can last a few months. Once the final molt is completed, the insect becomes an adult. The lifespan of adults varies by species but typically ranges from 6 months to a year. [6]

Reproduction

Most Timema reproduce sexually, with males and females mating to produce eggs. However, some species are capable of a form of asexual reproduction called parthenogenesis, where females produce eggs without fertilization by a male. Their eggs are soft, ellipsoidal, and about 2mm long, with a lid-like structure at one end through which the nymph will emerge. Timema females use particles of dirt, which they have previously ingested, to coat their eggs. [2]

Diet

Timema are known to be herbivorous, feeding on various types of leaves from their host plants. They typically feed on the leaves of shrubs and trees of their host plants. They have specialized mouthparts adapted for chewing plant material. Timema are generally nocturnal feeders, using their camouflage to avoid predators while they feed. Their diet may also be influenced by the seasonal availability of different plants. [3]

Shelter

Timema stick insects primarily use their environment for shelter and camouflage. Their natural habitat includes a variety of environments where they can blend in with their surroundings. Examples: Leaf Litter, Vegetation, host plants, bark and branches, and sometimes under stones. Some of the host plants of Timema include: Douglas fir *(Pseudotsuga menziesii)*, California redwood *(Sequoia sempervirens)*, oak *(Quercus spp.)*, Chamise, *Ceanothus.* [5]

Predation and Threats

Timema have faced various predation pressures and threats, both natural and anthropogenic. Their predators include birds, spiders, and other insectivorous animals. Timema rely heavily on their cryptic coloration for camouflage, but they can still fall prey to more adept predators. Additionally, habitat loss due to human activities, such as deforestation and urban development, poses significant threats to their populations. [4]

Critical Plants or Structure

Timema species often rely on specific host plants for their survival, feeding, and reproduction. For example:

- Timema primarily feeds on California buckthorn *(Rhamnus crocea)*
- They are also associated with California buckwheat *(Eriogonum fasciculatum)*
- The Chaparral is the most common habitat for Timema species. Spatial distribution of host plants affects the balance of their gene flow and natural selection. [7]

Sources

[1] Borror, Donald J.; Richard E. White (1998). A field guide to insects: America north of Mexico. Houghton Mifflin Harcourt. p. 86.

[2] Grimaldi, David (2005). Evolution of the Insects. Cambridge Press. p. 213.

[3] Crespi, B.J.; C.P. Sandoval (2000). "Phylogenetic evidence for the evolution of ecological specialization in Timema walking-sticks" p.249 – 262.

4] Cruz, J., & O'Neill, S. (2018). "Predation and Camouflage in Stick Insects: An Overview of Timema." Journal of Insect Conservation 22(3), 456-467.

[5] Wygodzinsky, P. & R. M. D. A. (1967). "The Stick Insects of the Genus Timema." University of California Publications in Entomology.

[6] J. R. D. L. McGhee and S. A. Smith (2020). Timema stick insects: "Behavioral and evolutionary ecology", Journal of Insect Behavior.

[7] Carroll, S. P., & McCormick, J. K. (1998). "The evolution of host plant use in stick insects: Timema cristinae and its relationship to the *Rhamnus crocea.*" *Evolutionary Ecology Research, 1(3), 221-234.*

Western Tiger swallowtail (*Papilio rutulus*) by Kevin Gill from Los Angeles, CA, United States, CC BY 2.0, via Wikimedia Commons

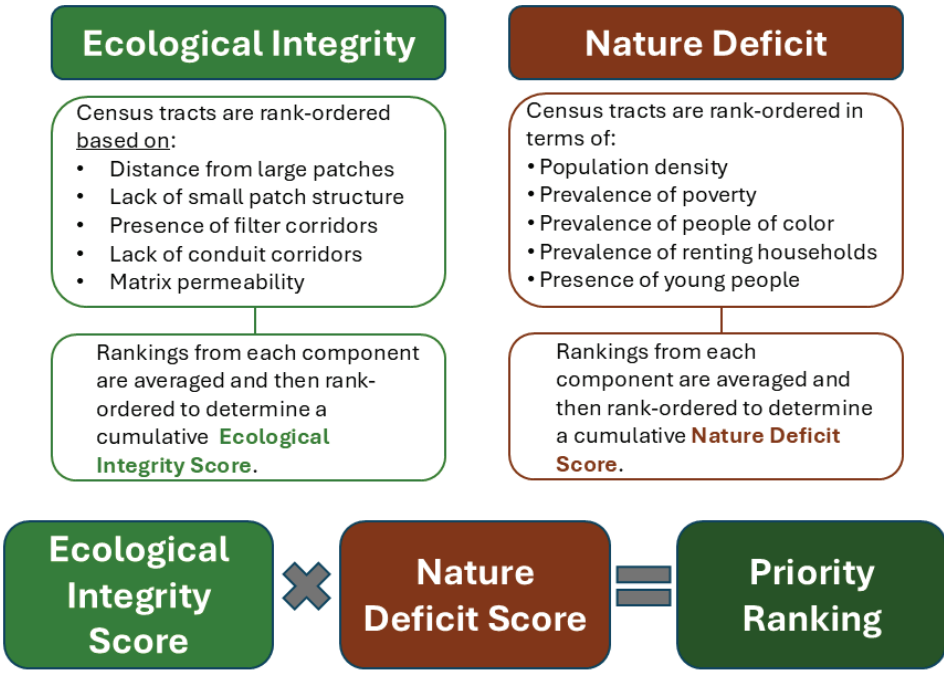
PRIORITIZING SMALL-PATCH REESTABLISHMENT AND ENHANCEMENT

In developing a strategy for reestablishment and regeneration of Arthropod species in an urban envrionment, we need to prioritize the areas of greatest ecological need, as well as social benefits that can be derived from the re-introduction of nature. Small-patch habitat provides important supplemental benefits to ecosystem function, facilitating movement of species across the matrix and habitat for small species, including Arthropods.

At the same time, there a numerous potential social benefits to providing these "bits of nature" throughout the Pomona Valley. Numerous studies describe a "Nature gap" experienced by individuals whose local circumstances deny them opportunities to experience natural environments and disconnect them from natural processes. Neighborhoods have been found to have a greater likelihood of being denied access to natural experiences, based on population density, prevalence of poverty, race, and home ownership status. Nearby nature opportunities are believed to be particularly critical for younger populations during critical development stages.

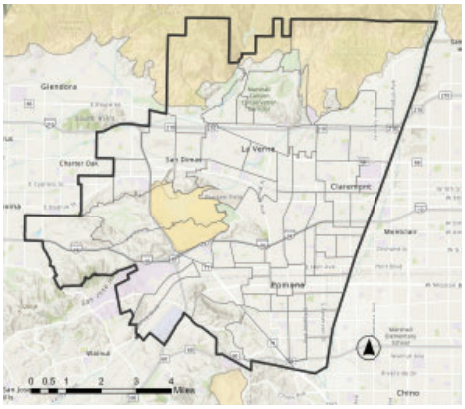
To understand where within the Pomona Valley we should focus the establishment of Arthropod-friendly small-patch habitat, we built a prioritization model that considered ecological integrity and nature deficit factors. To determine ecological integrigy, census tracts within the study Area were rank-ordered in terms of their proximity to large patches, their lack of small-patch structure, the presence of roadways and other corridors which filter species movement, the lack of corridor structure such as streams that promotes species movement, and the permeability of the overall urban matrix. The model assumes areas with stronger ecological integrity are more suitable for the establishment of small-patch Arthropod habitat.

This data was combined with socio-economic data indicating the likelihood of nature deficits in the population of each census tract. The result is an overall ranking of each census tract in the study area, to identify neighborhoods to prioritize in habitat re-establishment and enhancement.

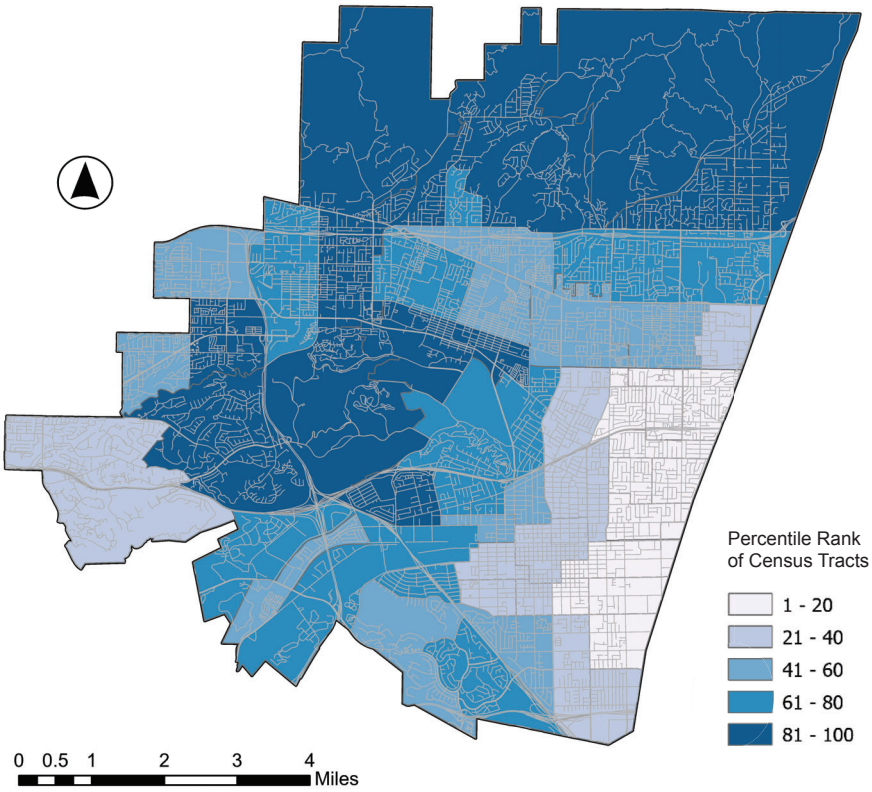


ECOLOGICAL INTEGRITY ASSESSMENT

Our investigation into the ecological integrity of our study area focuses on identifying census tracts with the greatest structural support for Arthropod populations, even if ideal habitat conditions are not fully met.



Locations of large patches (≥1,500 acres).

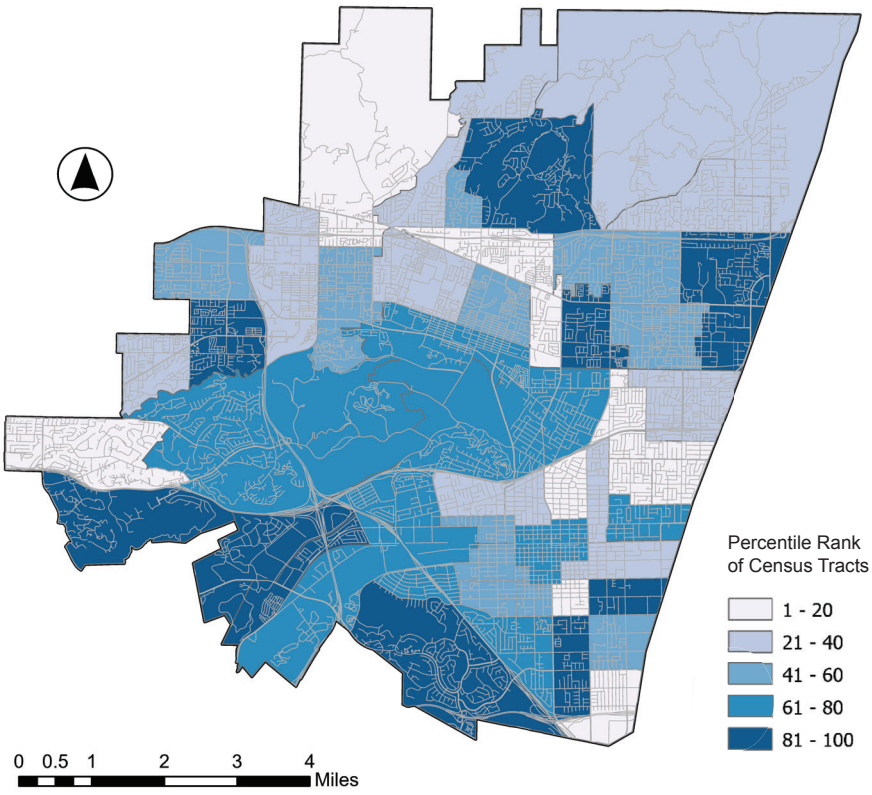


Percentile ranking of census tracts in study area according to proximity of large patches.

Large Patch Proximity

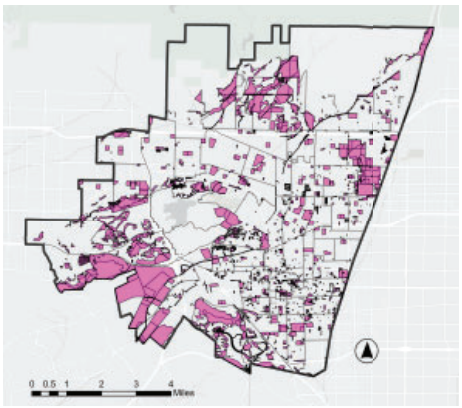
Access to large patches of potential habitat is extremely important for Arthropod species. Large patches provide a greater area of habitat, and in turn, a greater variety of habitat, leading to larger populations. We defined a large patch as any continuous area of green land (park, forest, green space) greater than, or equal to, 1,500 acres.

Using data from Los Angeles County to identify recreation spaces, and visual aids from Google Maps and Google Earth, we determined 3 large patches to include in our study. Bonelli Park is completely within the boundaries of Pomona Valley, National Forests (Angeles and San Bernardino) exist both inside and outside the valley borders, and Firestone Scout Reservation lives outside the boundary. Although it is outside the Pomona Valley, the Firestone Scout Reservation is still close to tracts in the valley, and we deemed it necessary to include. We then calculated the geographic center of each census tract in Pomona Valley. With the center, we calculated the distance to the nearest large patch, in miles. From there, we ranked each tract based on its distance to a large patch. The closest was ranked (58), while the farthest away (1). These distances



Percentile ranking of census tracts in study area according to density of small patches.

were used to calculate percentiles. The closer a tract is to a large patch, the more viable a census tract is, and the higher the percentile ranking.



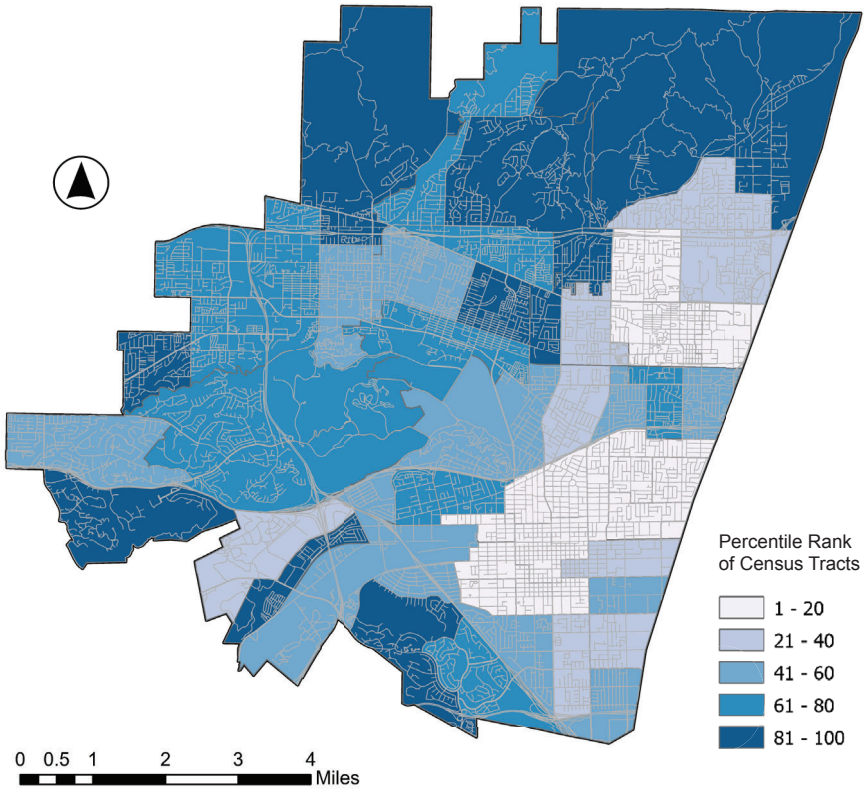
Locations of small patches (≤ 1,500 acres).

Small Patch Denstiy

The density of small patches in a given census tract demonstrates the region's suitability as a habitat for migratory and edge species that may use these patches as stepping stones across a landscape. The higher the density of small patches, the greater matrix heterogeneity, increasing the opportunities for habitat, escape, or protection in an otherwise harsh urban environment. These small habitats in close proximity may assist in species dispersal and increase genetic variation within a given species, allowing the population to be more adaptable to change or disturbance.

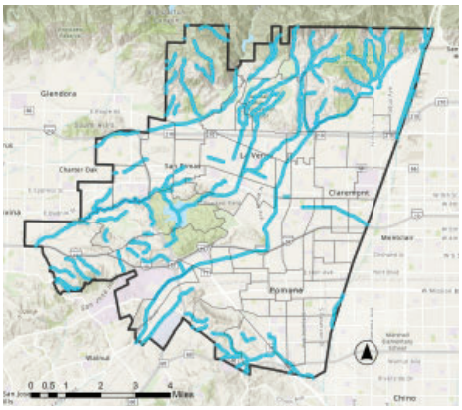
To best analyze small patch density, we began with the Pomona Valley Land Use dataset sourced from the Southern California Association of Governments. We isolated land area that was designated "Open Space and Recreation," "Education," "Undevelopable," "Vacant," or "Water." Regions of land categorized in this way suggest potential small patch habitat, as it is highly likely that they include wider patches of green space than industrial, commercial, or residential areas. This data was cross-referenced with the land that was determined to be encompassed by large patches. Any land that fell into these land use categories but was also encompassed by large patch habitat was removed from the small patch dataset, as we wanted to analyze these factors independently.

Once the small patch regions were isolated determined the approximate amount



Percentile ranking of census tracts according to surface area of watercourses with 100 meter buffer zone.

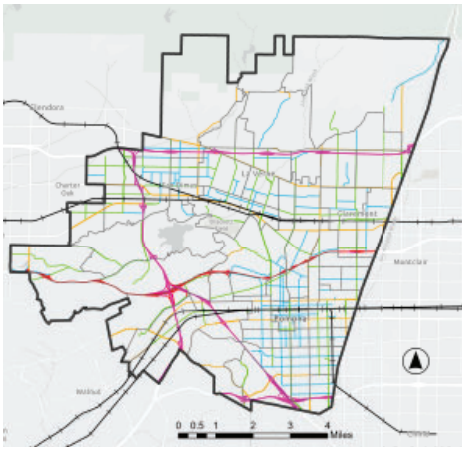
of small patch habitat in each census tract. The area of small patch habitat was calculated per tract (in acres) and then divided by the overall area of each census tract, resulting in the density of small patch habitat per tract. Each track was ranked according to density (the tract with the highest density was ranked 58, second highest 57, etc.) and these rankings were used to calculate the percentiles for each tract. The final map visualizes the range in small patch density per tract.



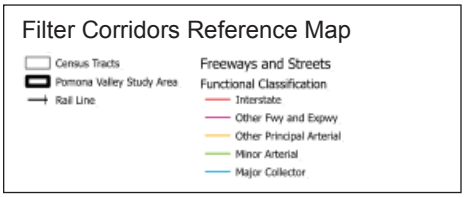
Watercourses with 100 meter buffer zone.

Corridor Conduit Function

Conduit corridors function as pathways connecting various habitats and ecosystems. These corridors enable wildlife to have connectivity in disrupted and fragmented ecosystems, ultimately supporting animal and plant populations and bolstering biodiversity. Watercourses, forests, hedges, overpasses, and underpasses are some examples of urban conduit corridors. Due to a lack of data on different corridor types of the Pomona Valley our data was collected on watercourses only. Focusing solely on watercourses as conduit corridors for Arthropod species, our group mapped out watercourses using the California Natural Resource Agency's data for the Pomona Valley. We used a 100 meter buffer zone around these watercourses to represent potential viable corridor areas running within and adjacent to these waterways. We then calculated the surface area of each buffer zone and created percentages for the watercourse surface areas within each census tract. These percentages were then used to calculate factor rank and factor percentage of each census tract. Our model depicts corridor effectiveness based on the factor percentage which is done through various shades of blue on the map.



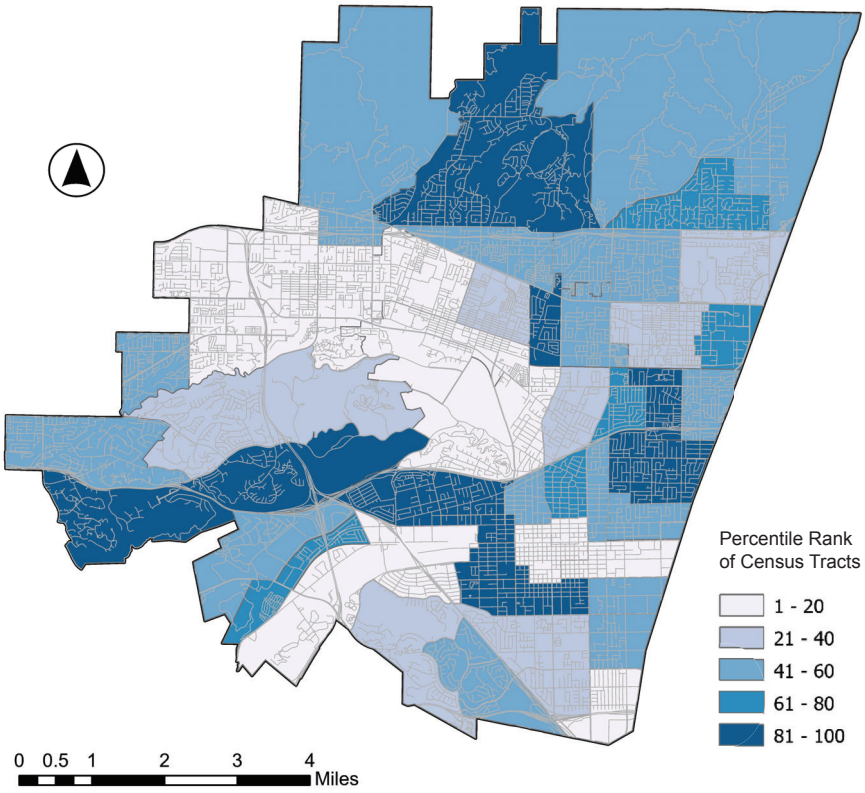
Freeways, other roads, and rail lines in study area.



Corridor Filter Function

Corridor filters act as barriers to movement across a landscape, which can affect species composition and genetic differentiation. To determine the effects of filter corridors on census tracts, we focused on the prevalence of roadways and rail lines in each tract. Caltrans identifies seven road classifications: 1) Interstates, 2) Other Freeways or Expressways, 3) Other Principal Arterials, 4) Minor Arterials, 5) Major Collectors, 6) Minor Collectors, and 7) Local Roads. We chose to omit local roads from our calculations, as they do not inhibit connectivity as much as other road types. Minor collectors were also omitted as there were few occurrences in the study area.

To gather data on the prevalence of roadways per census tract, we totaled the number of roads per class that crossed through each census tract. When a road defined the border between two census tracts, the road was counted twice, once in each of the two tracts. After totaling the number of roads per class in each census tract, we then chose to weight the data depending on the scale of road class. Interstates, Other Freeways and Expressways, and Other Principal Arterials were sorted as “Major Filters” and received a score of “2” each time they were noted in a census tract. Minor Arterials, Major Collectors, and Rail Lines were sorted as “Minor Filters” and received a score of “1” when they were noted in a census tract. This is because the Major Filters have a more



Percentile ranking of census tracts according to presence and function of filters , including streets & rail lines.

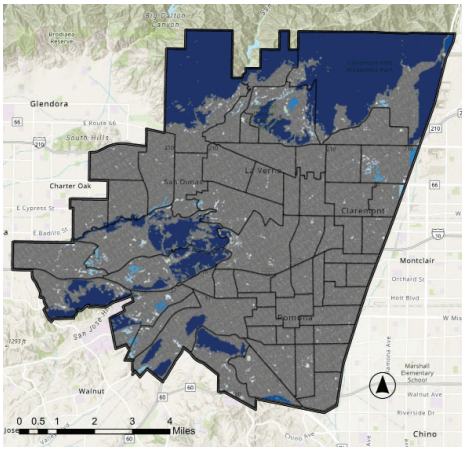
significant footprint in a census tract in terms of width and vehicle traffic level. Minor Filters are easier for Arthropods to cross through, as they tend to be smaller in width and lower in vehicular traffic level.

Upon weighting the data, Major and Minor Filters were summed to illustrate which census tracts contain the largest presence of filtering corridors. Census tracts with the lowest corridor filter score were deemed to be most viable for Arthropod habitats.

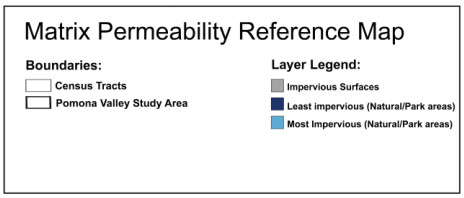
Matrix Permeability

The Matrix Permeability map highlights regions with the highest concentrations of any type of artificial surface and material that does not allow for water infiltration, plant growth, or denies Arthropods the ability to conduct burrowing/nesting behaviors. Some of these surface types and materials include but are not limited to roads, buildings, homes, freeways, and any type of hardscape surface. The raw data on the Matrix Permeability Reference Map display the overall presence and collections of hardscape segments/blocks, as well as the zoning for parks/natural spaces and their respective percentage of hardscape throughout the Pomona Valley. Hardscape cover can be found throughout the valley, with the highest concentrations of impervious surfaces being present along the Southeastern census tracts of Pomona, and the second highest region of impervious surface density was found to be Covina, both of which are notable for their presence of commercial areas and larger residential zoning districts.

There is a clear correlation between population density per census tract, the density of impervious surfaces, and the overwhelming lack of pervious surfaces in the urban realm which may hold the potential to create habitat area to perpetuate the survival of Arthropod species. In regard to areas with the least impact from the construction of buildings and establishment of hardscape surfaces, the region with the highest distribution of permeable surfaces and natural ground is found to the north of the project study area which includes the foothills of San Dimas, La Verne, and Claremont. Much of this natural area remains undeveloped due to loose soils, proximity to designated natural areas, and potential flood hazards due to proximity to mountains which has the potential to damage infrastructure. The second largest Natural area with less impervious surfaces is Bonelli Park and its surrounding census



Permeable and impervious surfaces in study area.

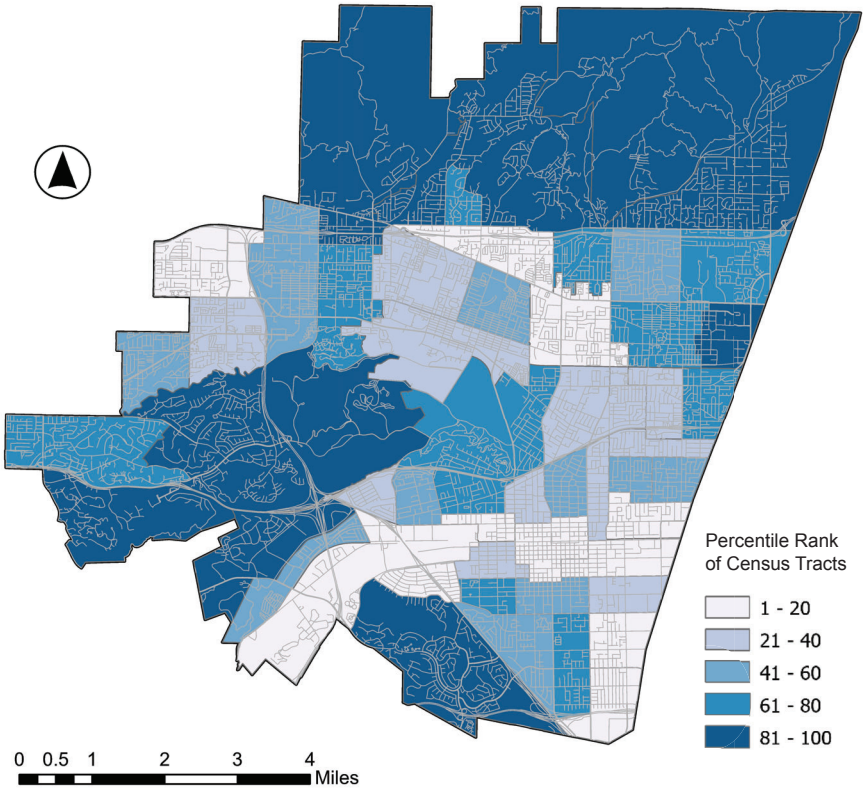


tracts. With this data, the relationship between urban development and land use make it clear that the areas with the least ground cover are sparsely inhabited or designated by zoning entities to be protected areas.

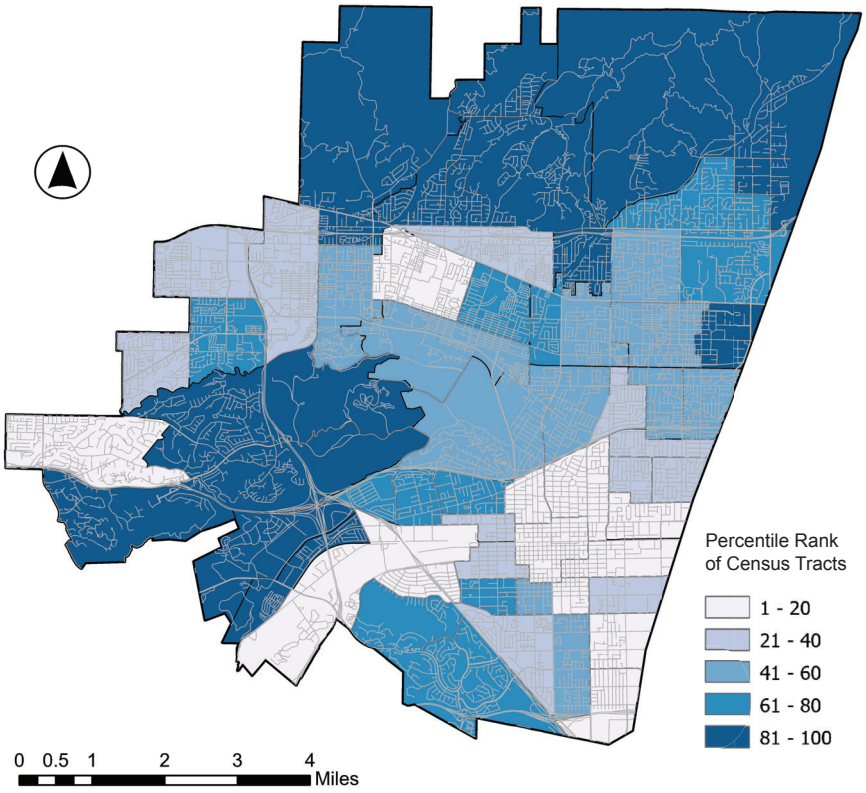
Composite Assessment

When we combined all factors, we determined the ecological integrity for each census tract in the Pomona Valley. Areas with high proximity to large patches, high density of small patches, effective corridors, minimal filtering barriers, and high matrix permeability are more likely to support robust Arthropod populations and overall ecological health. These areas are indicated with the darkest blue color.

Each census tract began with five sets of percentile rankings, which we then averaged to create an aggregate data set. The same methodology applied to factor percentile calculation was used for combined factor rankings. The census tracts that fell into the highest range of percentile rankings (81-100) were determined to have the greatest likelihood of viability for Arthropod habitat in the region. The census tracts that fall into the lower ranges of percentile rankings do not necessarily lack viable habitat for Arthropods. While our analysis was comprehensive with available data, more research needs to be done to understand the ecological integrity of particular areas. We believe that these lower-ranked census tracts should not be ignored, but simply need closer study.



Percentile ranking of census tracts according to permeability of the matrix.



Percentile ranking of census tracts according to combined factors of ecological integrity.

NATURE DEFICIT ASSESSMENT

"Systematic inequities have profound impacts on global biological change and biodiversity loss. Many emergent social inequity patterns are principally driven by systemic racism and white supremacy. Hence, centering racial and economic justice in urban biological research and conservation is imperative." [1]

Our team looked at the concept of Nature Deficit as a way of describing the condition of lack of park space found in specific neighborhoods in the Pomona area. This is based on the assumption that encouraging biodiversity is imperative, and that the systemic racial and economic inequality which defines urban areas[1] is also unequal with regard to people's access to "nature". [2] The way we approached this matter is by examining census tract data. The hypothesis being tested was that there would be an uneven distribution of animal & arthropod habitat linked to a number of socially determined factors. This lack of access is concerning- both from an ecological standpoint and a public health perspective. Moreover, the absence of green open space has been shown to foster a deep seated discomfort with "nature" in general across populations. [2]

Categories
Our model identifies areas most in need of parkland. We chose the following five categories to map the social geography of the Pomona valley region, and broke up the resulting data into quintiles, with highest percentiles (81-100) being most under-resourced.

Density

Population modeling describes the number of humans per acre. Density identifies where humans require some breathing room. Our data is drawn from the United States Census Bureau 2022 American Community Survey, referencing

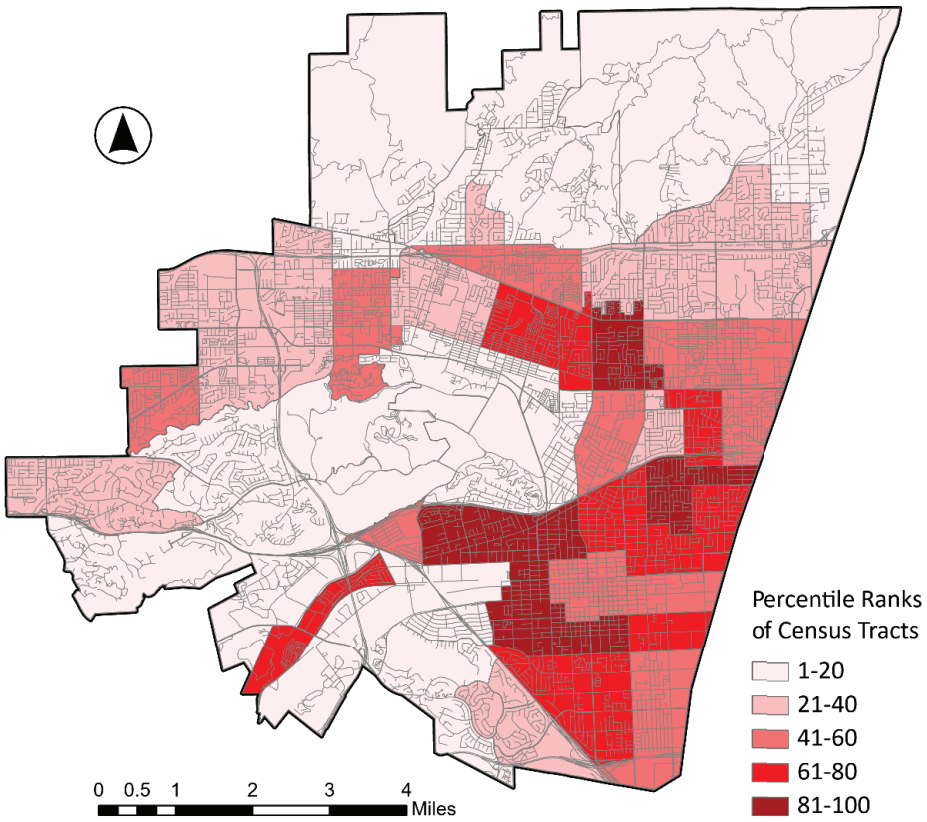


Figure 1: Percentile Ranking of Census Tracts Based on Percent of of Population Density

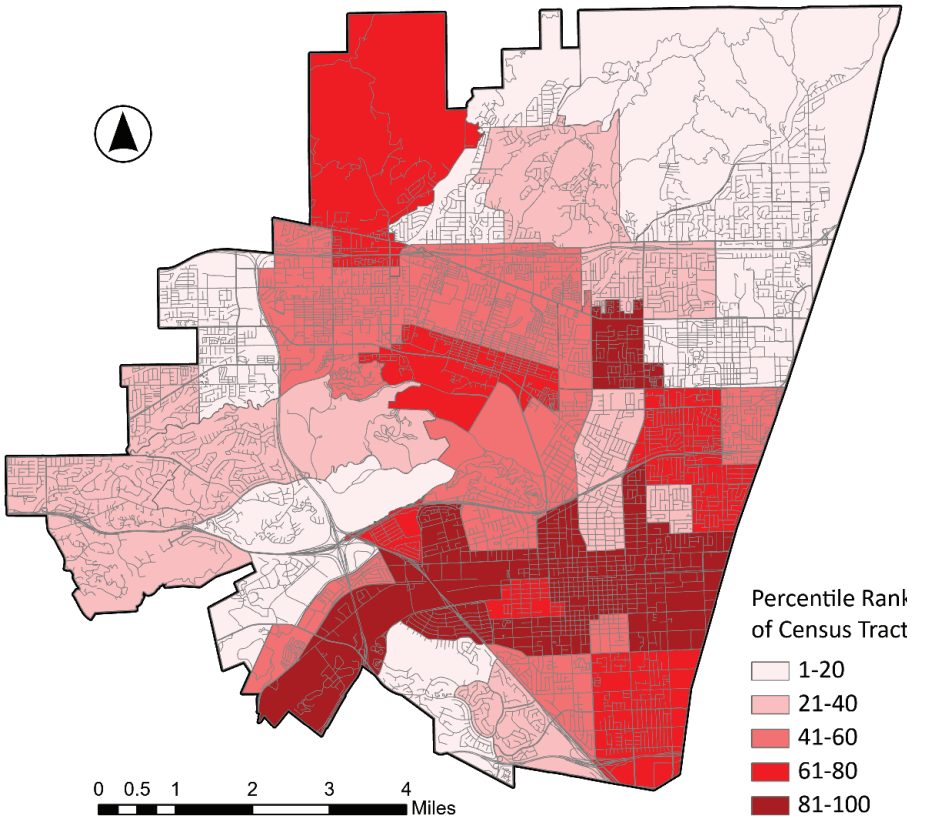


Figure 2: Percentile Ranking of Census Tracts Based on Percent of of Population Living in Poverty

[1.] Schell, C. J., Dyson, K., Fuentes, T. L., Roches, S. D., Harris, N. C., Miller, D. S., Woelfle-Erskine, C. A., & Lambert, M. R. (2020). The ecological and evolutionary consequences of systemic racism in urban environments. Science, 369(6510). https://doi.org/10.1126/science.aay4497
[2.] Taylor, D. E. (2019). College students and nature: differing thoughts of fear, danger, disconnection, and loathing. Environmental Management, 64(1), 79–96. https://doi.org/10.1007/s00267-019-01172-9

Table S0101. We divided population by the acreage of each census tract. The least dense, most open areas, shown in lightest color on the map. The darkest colors represent the densest census tracts in the Pomona Valley.

Poverty

Poverty is a crucial factor in nature deficit because it significantly influences access to natural spaces and opportunities to connect with nature. The concept of nature deficit dictates how we experience our environment based on social economic characteristics. In this case, economic stress can shape cultural attitudes toward nature. In some communities, prioritizing basic needs overshadows the importance of nature experiences.

The data used for this analysis was collected from the U.S. Census Bureau using the American community survey of 2022. The percentage of households living in poverty is included for the different census tracts. The federal government defines poverty based on family size and income. If a family's total income is less than their poverty threshold, they are considered in poverty. According to the United States Census Bureau, a family of four would be considered in poverty if their annual household income was $26,500 or less before taxes.

It is estimated that ~16% of the households in Pomona live below the United States poverty level, while 40% are low-income families. In analyzing poverty levels, we found that the majority of residents in south Pomona Valley fell in the 81st to 100th percentile of the United States poverty line, while to the northeast and south west, the majority of residents fell in the 1st to 20th percentile or the 21st to 40th percentile.

Race

According to Alvarez et al., "Latinx communities tend to be found in areas that lack green spaces compared to non-Latinx communities." This article corresponds with the idea that communities of color may lack the opportunity to experience nature. Our analysis in the race factor is focused on the percentage of population who identify as non-white and Hispanic or Latino origin. The data originates from the 2022 US Census Bureau American Community Survey Table "B03002: "Non-White Population" was extracted and divided by the total population in the tract which determines the percentage. On the map, we found that the darkest areas resulted in a higher concentration of census tracks of all races except those who identify as white only. In contrast, the lightest shade shows communities with the lowest percentage of pekoe of color.

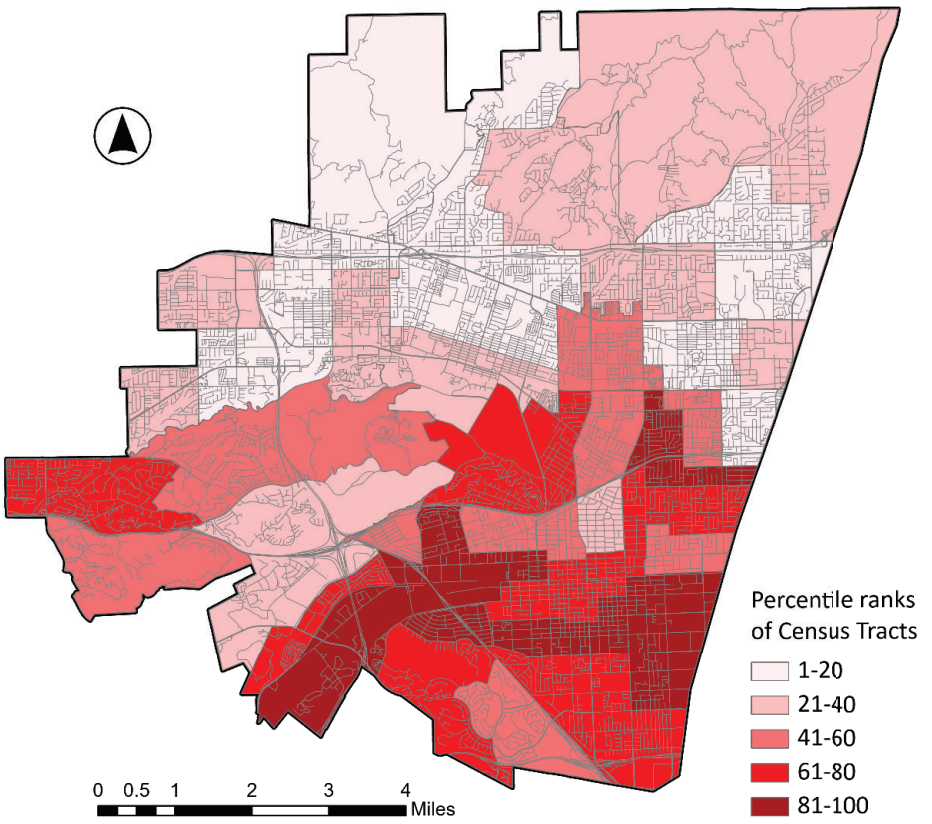


Figure 3: Percentile Ranking of Census Tracts Based on Non- White Population

Housing Tenure

For our purposes, tenure is the type of property occupation, in other words owner vs. renter occupancy of a property. Property ownership is a socio-economic factor that affects nature in urban spaces. It is positively correlated with vegetation cover and urban forest distribution (1). Therefore, renter occupancy is negatively correlated with access to nature. This could be for many reasons. First and foremost, people who rent may have limited or restricted ability to add or manage the green space where they live. For example, apartment building common areas are usually managed by the apartment and tenants are not able to make changes. In addition, landscaped common areas often have strict management requirements that include limited species variety and traditional maintenance guidelines. People who rent may live in single family homes but are more likely to live in multi-family homes, such as apartment buildings. This means that people who rent in an apartment building share common green space and the square footage per person is lower. To map housing tenure, we have used

[1.] Schell, C. J., Dyson, K., Fuentes, T. L., Roches, S. D., Harris, N. C., Miller, D. S., Woelfle-Erskine, C. A., & Lambert, M. R. (2020). The ecological and evolutionary consequences of systemic racism in urban environments. Science, 369(6510). https://doi.org/10.1126/science.aay4497
[2.] Taylor, D. E. (2019). College students and nature: differing thoughts of fear, danger, disconnection, and loathing. Environmental Management, 64(1), 79–96. https://doi.org/10.1007/s00267-019-01172-9

data from Table S1101 of the American Community Survey of the U. S. Census Bureau for 2022. Specifically, we used the "Renter-occupied housing units" and the "Total households" data sets. With this information, we were able to calculate the percentage of rental households in the study area for each census tract. We ranked the data into equal percentile ranges and mapped the percentiles of each census tract with a coordinating shade of red as seen in the legend. The darker the red color, the higher the percentage ranking, meaning more presence of renter occupied homes. The darkest red areas are in the south-eastern and south-central region of the study area. This tells us that this is where the highest concentration of renter occupied homes are and where there is a high likelihood of less access to nature.

Youth

Youth, defined as members of the population aged 18 and under, were chosen for this model as a subsect of the population with a greater need for nature spaces. This is backed by research that demonstrates that the holistic positive effects of nature have greater influence on youth members of the population, with additional exposure to natural spaces at a younger age having lasting positive effects in later life.

The youth data was sourced from The United States Census Bureau's American Community Survey in 2022. We specifically pulled the number of persons under 18 within each census tract and divided that by the total population of each tract within the area of interest. Tracts with higher percentage of people ages 18 and under were assigned a higher ranking and are thus reflected as a higher percentile.

Our mapped data reflects higher rates of youth populations in our area of interest's south-eastern census tracts, which are in South Central Pomona. The only tract in this region not having high youth population is the downtown Pomona area. There is an outlier tract with a high proportion of youth in the northern portion of the research area, by northern

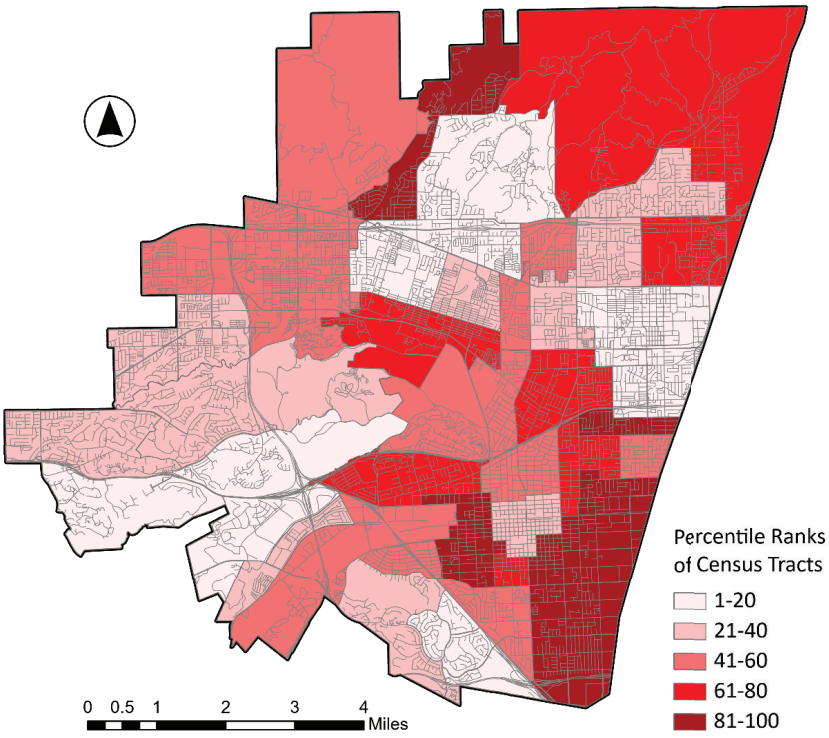


Figure 4: Percentile Ranking of Census Tracts Based on Percentage of Renter- Occupied Housing Units

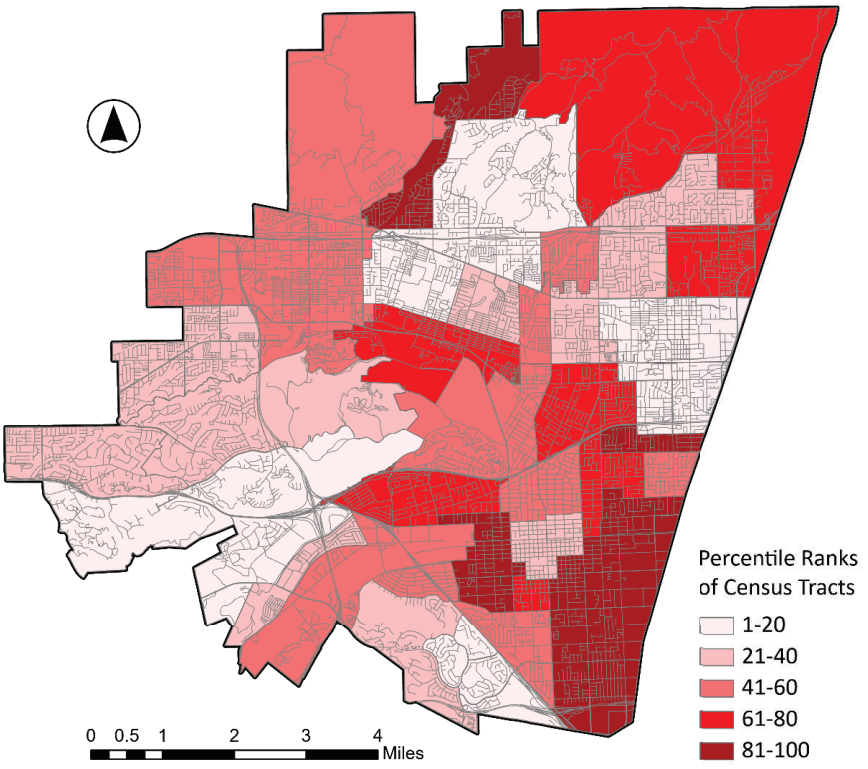


Figure 5: Percentile Ranking of Census Tracts Based on Percentage of Youth Population

[1.] Schell, C. J., Dyson, K., Fuentes, T. L., Roches, S. D., Harris, N. C., Miller, D. S., Woelfle-Erskine, C. A., & Lambert, M. R. (2020). The ecological and evolutionary consequences of systemic racism in urban environments. Science, 369(6510). https://doi.org/10.1126/science.aay4497
[2.] Taylor, D. E. (2019). College students and nature: differing thoughts of fear, danger, disconnection, and loathing. Environmental Management, 64(1), 79–96. https://doi.org/10.1007/s00267-019-01172-9

Composite Assessment

La Verne. The tract containing Cal Poly Pomona is the largest tract to have a low youth population, which can be explained by its student body being mostly over 18 years of age.

Our final map shows a composite of the five nature deficit factors we mapped (density, poverty, race, housing tenure, and youth). For each factor, we ranked the data into percentile ranges. Then we combined those scores, giving each equal weight and again ranked the data into percentile ranges. This gave us the final values for the composite map of nature deficit factors.

The density, poverty, race, and housing tenure maps show similar concentration of the highest percentiles occurring in the southern and southeastern portion of our study area. Poverty and housing tenure also show some higher percentiles in the northwestern section of the study area. The youth factor does not exhibit as strong of a pattern on the map as the other four factors. The highest percentiles occur in the central, south/southeastern, and northern portions of the study area. Therefore, when these factors are combined, they show a strong pattern of high percentiles in the central, southern, and southeastern regions of the study area. These areas show the highest need for access to nature based on socio-economic factors.

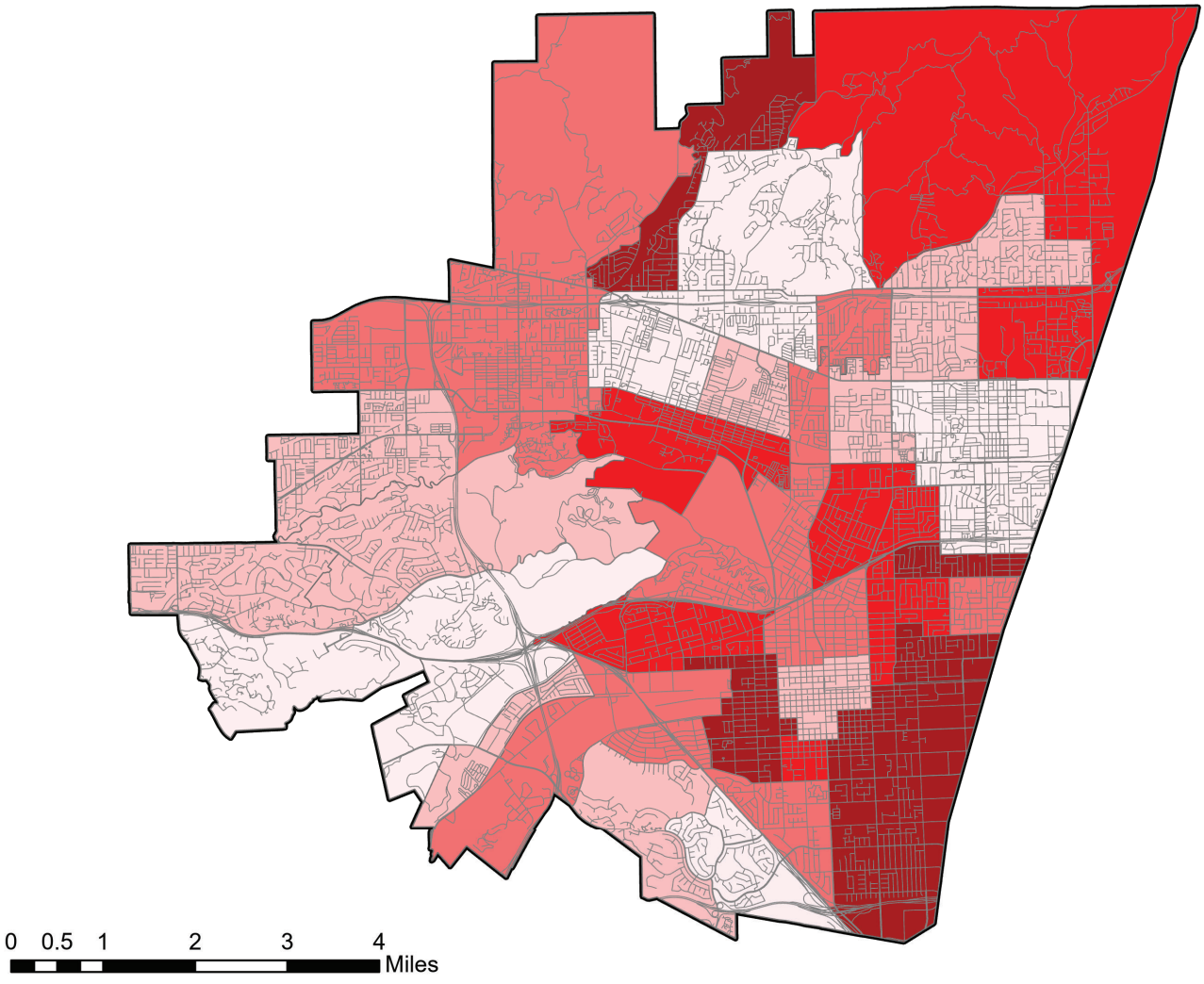


Figure 6: Composite Assessment

SMALL-PATCH HABITAT PRIORITY INDEX

Pomona Valley is a region that faces both challenges in maintaining ecological connectivity and providing equitable access to green spaces for its diverse population. This report includes key assessments: ecological integrity and nature deficit, evaluate connectivity, quality of natural habitats for Arthropods and social issues. By combining these factors, we can identify priority areas for future interventions that foster Arthropod habitats and equitable access to nature.

A priority index was developed by integrating both the ecological integrity and nature deficit assessment factors. Each factor was scaled 0 to 100 using percentiles, where 0 represented the lowest possible score (least desirable) and 100 represented the highest score (most desirable) for intervention. The final priority index score was calculated by multiplying the composite data of ecological integrity and nature deficit, giving a final composite value for each census tract.

The percentile rankings were then assigned a color scheme to represent percentile scores based on the average rankings of ecological integrity and nature deficit assessments. In this map, the lightest colors represent the least desirable, while the darkest colors represent the most desirable places for intervention.

Top 20% of Census Tracts: Priority Areas for Design:
The top 20% of census tracts identified through the priority index reveal the areas most in need of future planning and design interventions. These regions represent locations where both ecological degradation and significant nature deficit intersect, with the potential for integrated solutions that enhance both ecological function and human well-being. The priority areas are included:

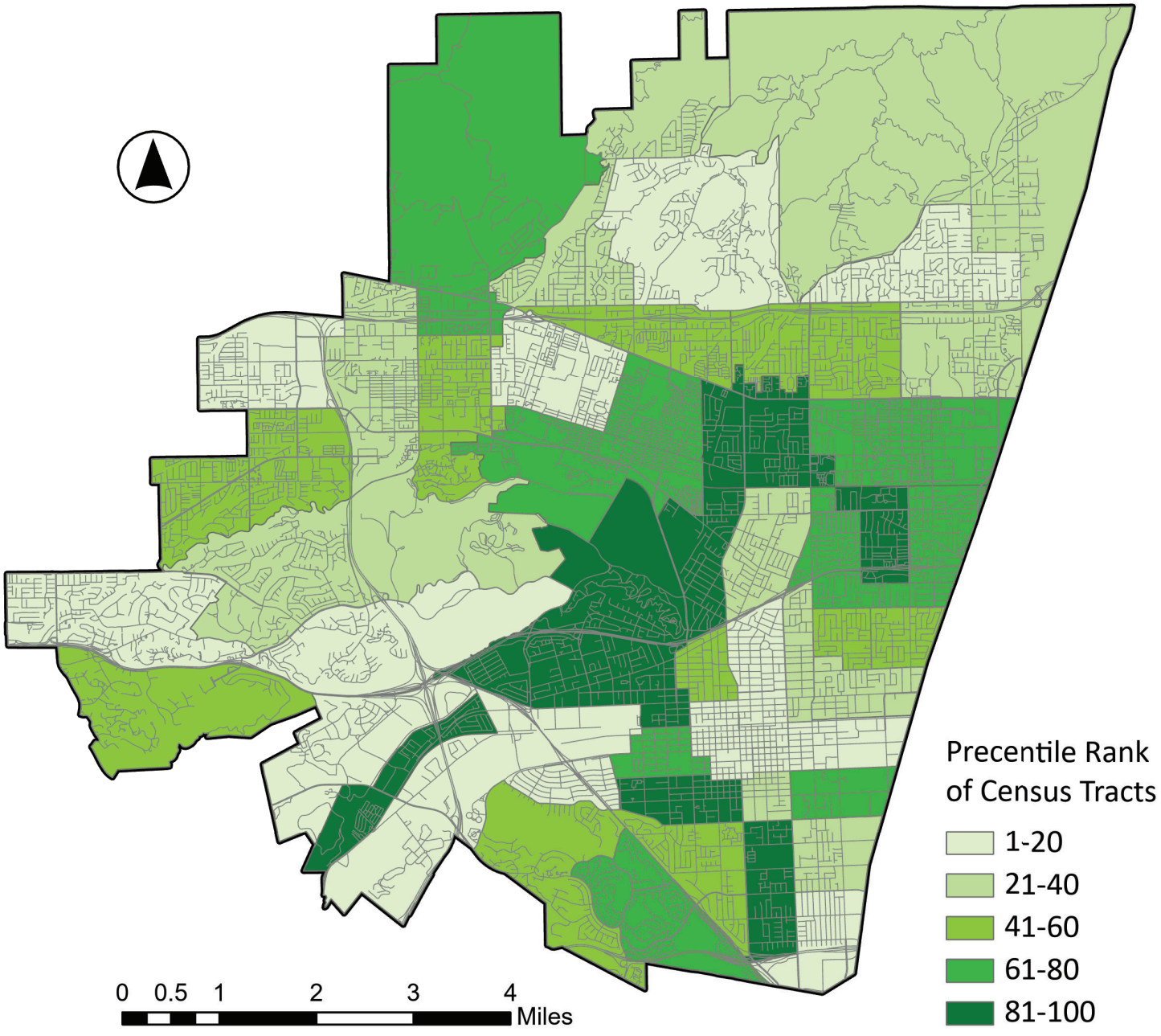
Central Pomona Valley: These areas have a high population density and are characterized by both low levels of nearby natural habitat and a low density of small habitat patches. They are also homes to a high percentage of renters and low-income families, contributing to limited access to outdoor spaces. These tracts are a key target for creating urban green corridors that could enhance ecological connectivity while addressing community needs for nature access.

East Pomona Valley: These tracts have a high poverty rate and a large minority population. They also have a low corridor conduit function, indicating that the local green infrastructure is less sufficient in supporting wildlife movement. Enhancing green corridors and establishing pocket parks could help bridge the gap between ecological restoration and community needs.

Northwest Pomona Valley: These areas are a blend of urban development and small residential spaces. Despite its proximity to some large habitat patches, it has a moderate ecological integrity score, that may be influenced by high corridor filter function. The children in these areas may lack opportunities for nature-based recreation. A combination of greenway enhancements and small community parks would address both ecological and socio-economic needs.

Southwest Pomona Valley: These areas are marked by high racial diversity, low income, and insufficient access to parks. It has low scores for both small patch density and large patch proximity. Integrating nature-based solutions like ecological restoration, new park developments, and improved corridor systems could significantly improve the living conditions and ecological health of this region.

This priority index of the Pomona Valley highlights the areas where the need for ecological restoration and equitable access to nature intersect. By focusing future design efforts on the top 20% of census tracts, we can address both ecological health and social equity. These priority areas present a unique opportunity for creating solutions that improve community well-being and promote a sustainable coexistence between people and nature.


Precentile Rank
of Census Tracts
1-20
21-40
41-60
61-80
81-100
0 0.5 1 2 3 4
Miles

AN ARTHROPOD-FRIENDLY HABITAT CERTIFICATION PROGRAM

Certification programs for landscape designs that provide certain benefits have been common, particularly in recent years. A number of programs have been developed to promote desirable plant and animal species, including mammals, birds, butterflies and bees. To date there has not been a comprehensive program aimed at certifying small-patch habitat for arthropod species.

Our review of similar habitat certification programs revealed a number of motivations driving organizations to create such programs. These included desires to promote their organization, raise awareness about the importance of target species and their habitats, promote "best practices" for supporting target species populations, establish performance-based standards for design and management, and provide community members with positive feedack and reward for their commitment.

Our community partner, Clean & Green Pomona, expressed an interest in a program targeted on certification of Arthropod habitats within the Pomona Valley. They shared many of the same motivations as other groups who set up such programs, but expressed particular interest in having rigorous criteria, which educated users as they sought certification and raised awareness about the importance of Arthropods within the broader community. They also valued the prioritization of communities and residents that may have limited access to nature opportunities and which lack "bits of nature" in their neighborhood. To this end, the proposed program is inclusive of a wide variety of garden types and sizes, ranging from small container gardens for apartment balconies and patios, residential yards, and public park landscapes.

Our program uses criteria in three categories to determine certification:

- The provision of food, water and shelter opportunities for target Arthropod species
- Management practices that support Arthropod populations
- Access to the public and/or education to raise awareness of Arthropod species and their habitats

Opposite: California Oak Moth (*Phyrganidia californica*) by Guersk, CC BY-SA 3.0, via Wikimedia Commons

FOOD, SHELTER, AND HABITAT

While developing criteria for our certification program, we felt that understanding plant communities historically present in the Pomona Valley was important to the educational ethos of our work. The certification project operates as an avenue for education on the natural environment and cultivates an appreciation for the larger ecologies of the region. Food and shelter categories are combined because many plants provide both functions to Arthropods simultaneously; a plant may host an Arthropod, and that species may feed on the plant while living there. Habitat features that are not encapsulated in the native plant options of our certification are described under "Supplemental Habitat Features," where a handful of features must be selected depending on the size of one's space.

Garden Type

We aim for this certification program to be accessible to apartment dwellers, renters, homeowners, and community organizations on whichever scale is appropriate. We divided the "garden types" that could be certified into three categories: Container, Residential, and Public. These categories encapsulate both different kinds of gardens and different sizes of gardens. Specifically, we indicate which species are viable for container gardens with an asterisk, since some plants are much more likely to survive when planted in a container or need more space than a container garden permits. Within the types of plants that are viable for container gardens, different species within a genus may have different needs, so we chose to include a note about working with a nursery specialist to find appropriately sized plants.

Plant Type

The system we used for categorization involves placing plants in one of these three categories: trees, shrubs, or annuals/perennials. We did this to indicate the size comparisons between plants to assist people in planning their garden (if their garden is new). This system also allows us to designate the appropriate amount of plants in each category that would suit gardens of varying sizes. It was important to us that this certification program felt attainable to people of all backgrounds and living situations, meaning that different sizes of plants would be more or less applicable to a space or environment.

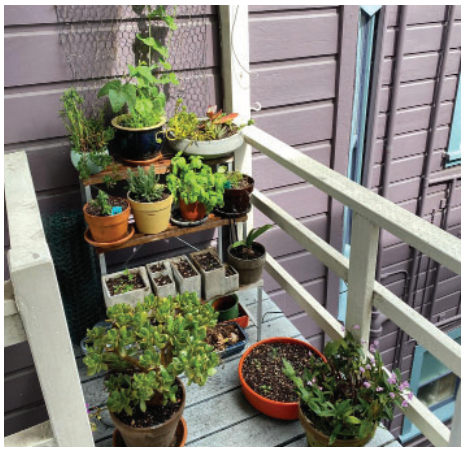
Native Plants

After reviewing our species compendium and cataloging all of the plants used for food or shelter by various Arthropods, we excluded non-native species from our final plant list. It was important to our team that we encourage native planting and understand our work in relation to habitat restoration, focused on creating spaces for Arthropods that are also native to the region. Any Arthropods that are known to utilize non-native plants for food or shelter are known as generalist species, meaning they can survive on a wide range of environmental conditions and eat a variety of foods. Therefore, generalists use what is at their disposal, whether it be native or non-native plants. We also wanted to draw attention to the historical ecology of the Pomona Valley, and we did so by indicating how each plant species appears in distinct plant communities: Riparian, Woodlands, Coastal Sage Scrub, and Chaparral. While there are no requirements as to how these plant communities appear in individual gardens, we aim to give people a strategy for developing a plant palette in conversation with their environment.

Replicating natural habitats can provide a multitude of food and shelter-related benefits to several Arthropod species, creating a thriving ecosystem where one insect's food source can also be its home. native plants in undisturbed habitat not only provide spaces for Arthropods to live, but also drop leaf litter, produce decomposing logs, and ground vegetation that offer essential habitats for several ground-dwelling species like beetles, ants, and glow worms. Curled leaves and dense canopy foliage are crucial for canopy-dwelling insects such as swallowtails and silk moths, offering safe sites for egg-laying and protection from predators. Bark, tree trunks, and dead wood serve as vital shelters for species that tunnel or nest in these structures, like carpenter bees and ironclad beetles. Burrows and underground cavities are indispensable

Quercus agrifolia (Coast Live Oak), (c) Artemesia Tridentat, CC BY-SA 4.0

Insect Hotel, (c) Rob Young, CC BY 2.0



Container Garden, (c) davitydave, CC BY-NC 2.0

Penitent Underwing on Black Walnut, (c) Whitney Cranshaw, Colorado State University, CC BY 3.0 US

for burrowing species, such as trapdoor spiders and bumble bees, providing them with safe nesting sites and protection from environmental extremes.

Additionally, specific host plants are critical for species that rely on them for food and shelter. For example, the Oak Moth relies on Coast Live Oak trees, which are prevalent in woodland ecosystems, for both its larvae (who feed on the leaves) and the adults (which use the canopy for shelter). The Penitent Underwing finds its hosts in Fremont Cottonwood and Southern California Black Walnut, using these trees for daytime shelter on their bark and as food sources for the larvae. By planting these native species, we create a supportive environment that meets the diverse needs of these Arthropods, promoting their survival and contributing to the overall health and biodiversity of the ecosystem.

Plant Availaibility

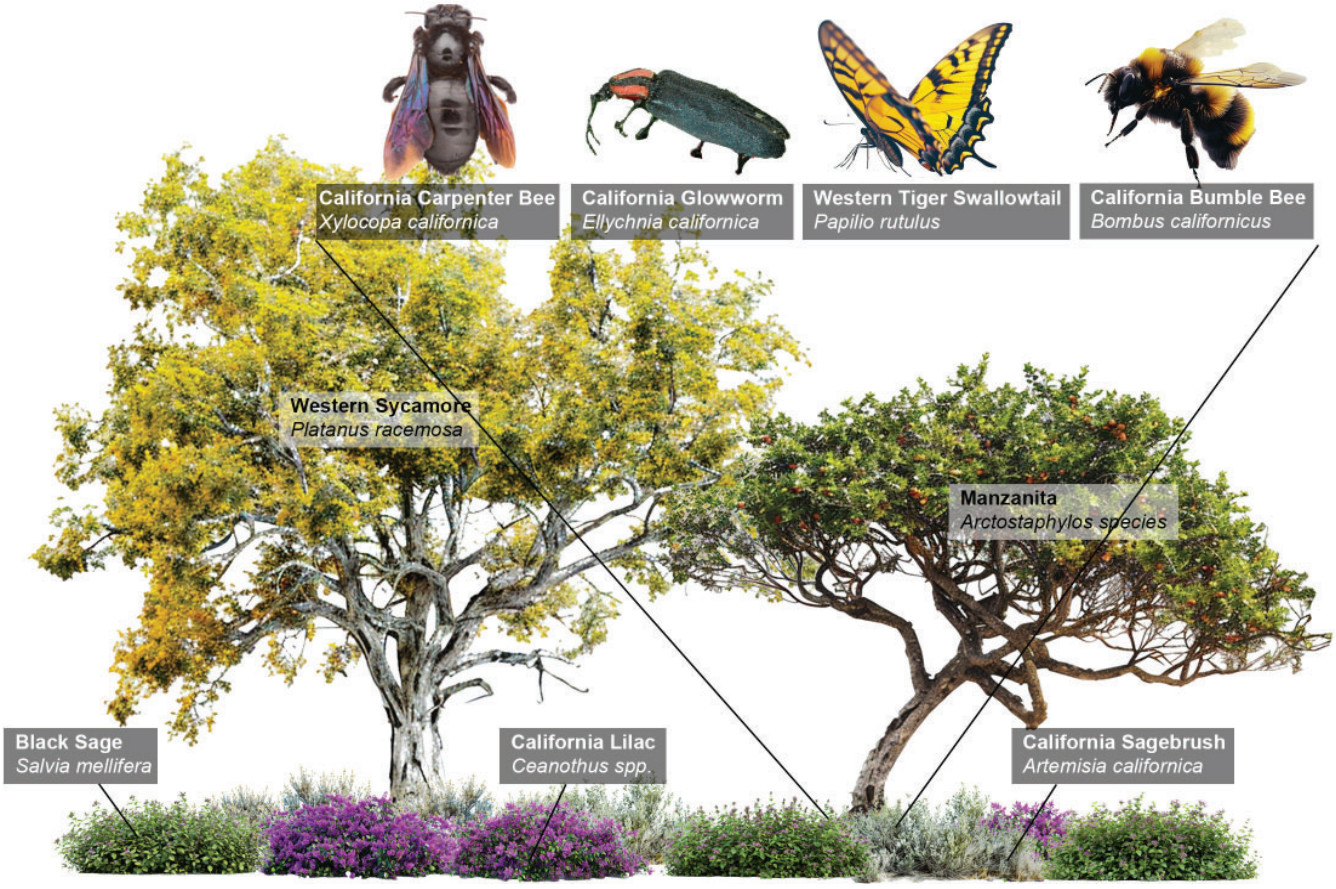
Most of the native plants that we recommend are not readily available at big-box commercial nurseries. Therefore, we suggest utilizing local native plant nurseries for these plants. Furthermore, some of the native plants that benefit local Arthropods can be very difficult to find even at local, native nurseries, so we include only plants that are fairly easy to acquire. As mentioned previously, we highly recommend consulting with a specialist at a local native nursery for assistance in selecting plants that work best with the conditions of their particular garden (space, soil, sun exposure, etc.).

Multi-Species Benefit

Our plant list also focuses on species that benefit multiple Arthropods in our compendium. For example, oaks, cottonwood, and willows support four or more Arthropod species and are integral to many Arthropod habitats. With this in mind, someone could build a habitat of any scale that could attract multiple species. Furthermore, we understand Arthropod gardens as beneficial to species beyond the Arthropod community. Birds that feed on Arthropods or native plants may also find substantial food sources or habitat in a garden that is certified through our program. We wanted to invite people to develop a native garden that will have expansive effects beyond Arthropod communities.

Supplemental Habitat Features

Arthropods also rely on habitat elements beyond native plants, and other components can be added to a garden to provide water and shelter resources. Structures like insect watering stations or puddling stations are created by filling a shallow dish or depression with water and adding rocks, pebbles, shells and twigs, allowing insects to land safely and drink without drowning. Cricket Water Pillows and water retaining mulch may also provides hydration sources, supporting biodiversity and facilitating social behaviors among insects. However, we chose not to require a water source explicitly because many Arthropods obtain water through the plants they consume. Mounds of loose soil, leaf litter, bare or mulched areas, untreated wood, and empty upside-down pots also provide vital habitats, along with structures like Insect Hotels or Bee Blocks. Together, these features support biodiversity and ecological balance alongside native plants.



California native Arthropods find food and shelter in a garden of California native plants. Diagram by Daniel Bautista.

MANAGEMENT

We emphasize management over maintenance in garden care. Native plants often require less frequent attention than introduced species, benefiting from minimal leaf-blowing, selective pruning, and thoughtful watering. For instance, care of native gardens requires a shift in thinking from considering all dead material 'waste' to a discernment of what supports local flora and fauna and what competes with it. While weekly care is necessary for any garden, the workload is lighter when incorporating native plants and supporting local wildlife. In this approach, less is often more.

Due to the complex nature of reinforcing management practices, this section of the certification is pledge-based. Through the infographic and pledges, we aim to educate applicants on practices to implement and those to avoid. Certification provides a foundation for learning about Arthropod-friendly garden care.

Applicants must commit to at least three checklist items. The practices we promote include mulching, reducing outdoor lighting, avoiding pesticides and herbicides, minimizing leaf blower use, and removing invasive plants. These are essential for creating a habitat that supports diverse Arthropod species. Proper care is crucial not only for Arthropods but for the overall health of the ecosystem. Our goal is to establish key practices that promote the long-term health and vitality of the Arthropods in these gardens.

Mulching

Mulching with leaves and tree bark is a foundational step in creating proper habitat for Arthropods. Using natural mulch materials helps to retain soil moisture, regulate temperature, and create organic layers that provide shelter and nourishment for a variety of Arthropod species. Unlike decomposed granite or other groundcovers, which aren't as effective at promoting habitat for Pomona Valley specific arthropod species, natural tree-based mulches enhance soil health and create habitat. This supports important ecological functions, including decomposition and habitat creation, both of which are critical to a balanced garden environment for Arthropods. Mulching can be done once or twice yearly or at seasonal intervals.

Reduce Outdoor Lighting

Reducing outdoor lighting and opting for warmer-toned lights is an important practice for maintaining a garden that is beneficial for nocturnal Arthropods. Bright lighting can disrupt nighttime Arthropod activity, interrupting natural behaviors such as mating and pollination. By minimizing outdoor lighting and using warm tones of light, gardeners can help reduce light pollution that negatively impacts these species. Warmer lights such as oranges and reds are less disruptive to Arthropod behavior, creating a more supportive night garden environment. We recommend LEDs that are 2700K and lower. Restricting and limiting the use of outdoor lights and utilizing warmer light tones aid in creating a garden that benefits a more diverse range of arthropods, ultimately strengthening overall ecosystem health.

Restrict Use of Pesticides and Herbicides

Avoiding general-use insecticides and systemic herbicides is an important aspect to maintaining an Arthropod-friendly garden. These chemicals not only target pest species but also harm various wildlife, especially soil-dwelling Arthropods in the process. Systemic herbicides, which are absorbed by plants and remain in soil, disrupt Arthropod health by contaminating soils, plants, and other habitat. Through utilizing alternative pest and weed management practices, gardeners will be supporting a diverse range of arthropods and maintaining a healthier ecosystem. Restricting the use of these harmful chemicals in the garden is central to protecting the diversity of Arthropod species that contribute to a balanced ecosystem.

Eliminate Leaf Blowers

Avoiding the use of leaf blowers is critical for preventing disturbance within Arthropod-friendly habitats. Leaf blowers not only remove essential organic matter like leaves and soil cover, but also create strong wind gusts that can harm or displace

Pesticide Free Zone ("Pesticide Free" by Seattle Parks & Recreation is licensed under CC BY 2.0.)


Mulch ("Shredded bark mulch" by Crinklecrankle.com is licensed under CC BY 2.0.).


Warm Outdoor Light ("EXT: Alley" by work the angles is licensed under CC BY-NC-ND 2.0.)


Leaf Blower ("Leaf blower, Homewood Cemetery" by Cbaile19 is marked with CC0 1.0.)

Invasive Monoculture ("Flowers_Minnewawa_IGP5176" by niiicedave is licensed under CC BY-SA 2.0.)

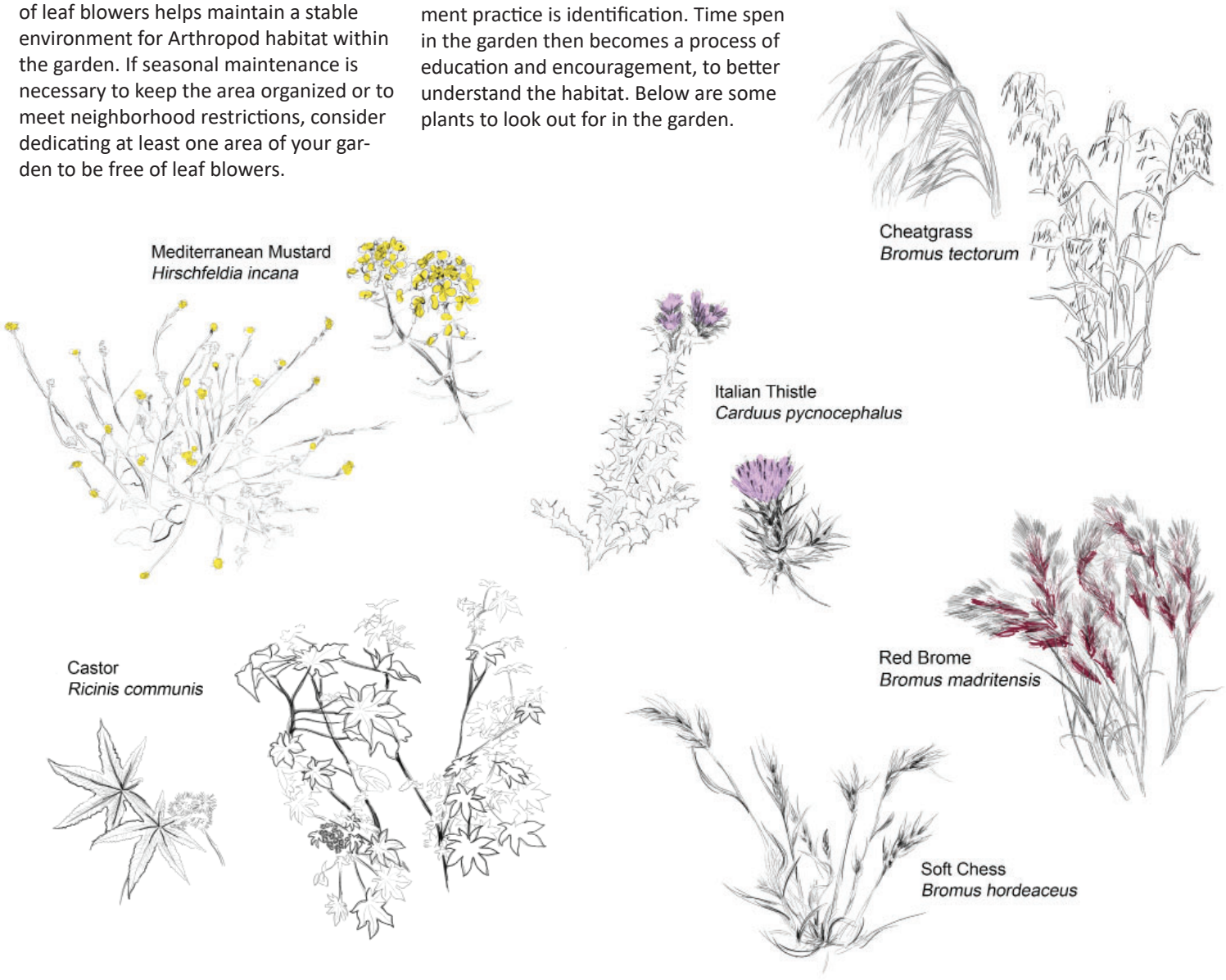
ground-dwelling Arthropods. By allowing leaves and natural debris to be left undisturbed, gardeners create microhabitats that support ground-dwelling Arthropods vital to the ecosystem. Preventing the use of leaf blowers helps maintain a stable environment for Arthropod habitat within the garden. If seasonal maintenance is necessary to keep the area organized or to meet neighborhood restrictions, consider dedicating at least one area of your garden to be free of leaf blowers.

Identify and Remove Invasive Plant Species

Monitoring for invasive plant species is essential for maintaining an Arthropod-friendly garden. This practice involves identifying and removing invasive plants, with a focus on uprooting entire root systems to prevent regrowth and spread. Invasive species can disrupt native plant communities by outcompeting native species, thereby reducing the food sources and habitats necessary for local Arthropod populations. By removing invasive plants, gardeners not only protect space for native flora but also help maintain a balanced ecosystem where Arthropods can thrive. This practice ensures that harmful species do not dominate, supporting the overall health and sustainability of the garden. The key factor in this management practice is identification. Time spen in the garden then becomes a process of education and encouragement, to better understand the habitat. Below are some plants to look out for in the garden.

Additional Management Tips

- Use ollas, a traditional irrigation method, for efficient water distribution in both ground and raised beds, conserving moisture and supporting root growth.
- Avoid over-pruning or deadheading; let branches and dried flowers remain in the garden to create habitats for Arthropods and small fauna.
- Leave some areas unmulched to support California's ground-dwelling bees, which comprise up to 70% of the state's bee species.



Common invasive species in the Pomona Valley. IIllustrations by Issy Cassou.

PUBLIC ACCESS AND COMMUNITY ACTIVATION

For Certified Arthropod Habitat Gardens to succeed in the Pomona Valley, participants must be willing to follow plant species and maintenance recommendations. To encourage stewardship post-certification, a community of Arthropod-friendly gardeners needs to be established. Additionally, socioeconomic disparities within the Pomona Valley require another layer of understanding.

Public Access and Community Activation includes both mandatory and optional requirements throughout the habitat criteria checklist. By addressing things like housing status, available capital, physical ability, and language barriers, we attempt to create an equitable certification process that is inclusive of all individuals in the Pomona Valley.

Garden Type: Container, Residential, and Public Space

To account for differences in home-ownership status, land permeability, and availability of capital for garden construction and maintenance, we have divided the certification into three possible habitat garden types: Container Gardens, Residential Gardens, and Public Gardens.

The container certification is for individuals who rent properties, don't have permission to alter the landscape permanently, and/or lack permeable land to plant in-ground. Plants within containers provide vital habitat for Arthropods. The use of container plants, and other modular habitat features, will increase participation and promote alternative and nontraditional methods of gardening and conservation.

The residential certification is for those who own or rent residential properties and can alter their land. By encouraging these individuals to create a more permanent habitat on their parcel, we hope to see an increased number and variety of plant species.

The public space certification is for entities that have large parcels of green space that are open to the public, and who want to use a portion (or all) of it for a certified Arthropod habitat. Including public spaces in the certification program allows individuals who are unable to participate in certification to still experience these gardens. These public gardens will be required to feature more habitat elements than other gardens as a response to the larger parcels of land and the assumed increased availability of capital.

Accessible Signage

By providing signage for the certification program, we increase the visibility of the certified habitats, educate community members on native flora and Arthropods, and publicize Clean & Green Pomona. Using yard-staked signs, window decals, stickers, and door hangers, we allow participants of all garden types to bring visibility to their gardens. QR codes will be included on all signs, for people to instantly access more information on Arthropods and Clean & Green Pomona. All signage will be available in both Spanish and English, ensuring that the large population of Spanish speakers in the Pomona Valley isn't excluded.

Garden Tours

After completing the habitat certification, garden owners can opt into an annual Pomona Valley Arthropod Garden Tour hosted by Clean & Green Pomona. These garden tours will be open house style, where community members both with and without a certified habitat can come view habitat garden examples. This event will allow holders of a habitat certification to connect with other habitat garden owners and inspire those who do not yet have a garden to pursue certification. Garden tours also provide a way for people who are unable to have a garden to participate in the community. Tours should be held in the Spring, as the majority of plants will be in bloom and temperatures will be mild.

Balcony Garden (Jnzl's Photos, CC by 2.0, via Flickr)

CA Natives (Veronica Bowers, CC by 2.0, via Flickr)

(JKehoe_Photos, CC by 2.0, via Flickr)

(Constance Vadheim, CC by 2.0, via Flickr)

Moth on Flower (Carl Mautner, CC by 2.0, via Flickr)

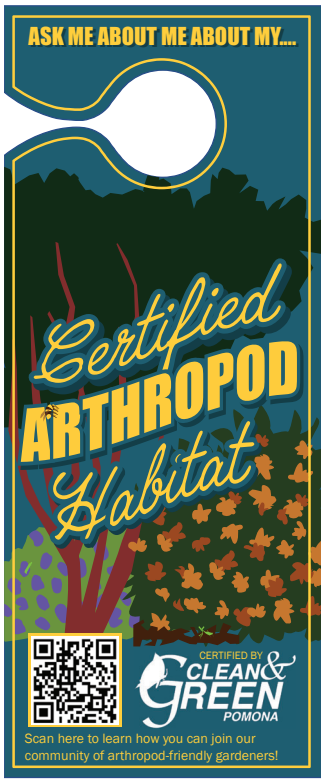
Online Registry

After completion of Arthropod habitat certification, garden owners are asked to upload photos of their garden to an online registry or Facebook page monitored by Clean & Green Pomona. This registry of Arthropod gardens will motivate others to pursue habitat certification, as it illustrates the different sizes of gardens possible. Connections among Pomona Valley community members will increase as they interact with and comment on each other's photos. This is a great way for those who are starting to build their garden to pull inspiration from others. The garden registry will also include a downloadable PDF scavenger hunt sheet for people to identify Arthropod and plant species.

Mentorship and Volunteers

There are many barriers to constructing and maintaining a garden. While it may be easy for those who have a background in gardening to transform their current space into an Arthropod-friendly garden, we assume that there are a great deal of residents in the Pomona Valley who need help getting started. Understanding design principles, knowing how to source and establish new plants, practicing proper irrigation habits, and other gardening tasks can be daunting to the first-time gardener. By encouraging individuals who have certified gardens to become mentors, we hope to use their knowledge to lessen these barriers. Mentorship helps foster a community of collaboration, whether that be through hands-on teaching, conversations, or other means of mentoring prospective certified garden maintainers.

We hope to eventually integrate a volunteer program to involve a more diverse group of individuals. Not everyone has the physical ability to construct or tend to a garden, and we one day hope to introduce a program where individuals who need physical help can receive it. Additionally, not everyone has the capital to purchase tools, plants/seeds, and other gardening necessities required for constructing or maintaining a garden. To address this, we hope to eventually introduce a program that will provide a tool and plant/seed exchange, or offer free or subsidized gardening supplies. Lastly, not everyone is in a position to garden at all, and by offering volunteer opportunities, we give those individuals a stake in the Arthropod program.



Left: Sample Door Handle Placard
Right: Sample Yard Placard

ARTHROPOD GARDEN CERTIFICATION APPLICATION

GARDEN TYPE

What type of garden are you certifying? (If you are certifying a public garden, please consider community approval processes that may need to be followed)

☐ Container Garden ☐ Residential Garden ☐ Public Garden

FOOD AND SHELTER

Arthropod species in the Pomona Valley rely on predominantly Native plants as sources of food and shelter. The following species support at least one local Arthropod species. We have also indicated various plant communities that have been historically present in the region. Please refer to the Informational Graphic on the Clean & Green Pomona website for more information.

Minimums indicate required species numbers; we recommend planting multiples of your selected species when you have the space.

TREES

Minimum: Container (0), Residential (1+), Public (2+)

☐ Alder (R W C)
Alnus species

☐ Black Walnut (R W)
Juglans californica

☐ California Laurel (R W C)
Umbellularia californica

☐ California Buckeye (W)
Aesculus californica

☐ Cherry (S R W C)
Prunus species

☐ Cottonwood (S R W C)
Populus species

☐ Oak (S R W C)
Quercus species

☐ Western Sycamore (R W C)
Platanus racemosa

☐ Willow (S R W C)
Salix species

SHRUBS

Minimum: Container (1+), Residential (2+), Public (5+)

☐ Buckwheat* (S W C)
Eriogonum species

☐ California Lilacs* (S W C)
Ceanothus species

☐ California Sagebrush* (S C)
Artemisia californica

☐ California Scrub Oak (S C)
Quercus berberidifolia

☐ Chamise* (C)
Adenostoma fasciculatum

☐ Chaparral Yucca (S W C)
Hesperoyucca whipplei

☐ Coyote Brush (S W C)
Baccharis pilularis

☐ Gooseberry (S R W C)
Ribes species

☐ Manzanitas (S W C)
Arctostaphylos species

☐ Mule Fat* (S R W)
Baccharis salicifolia

ANNUALS/PERENNIALS

Minimum: Container (2+), Residential (3+), Public (5+)

☐ Beardtongues* (S C)
Penstemon species

☐ Milkweed (S C)
Asclepias species

☐ Monkeyflower (S R W C)
Diplacus species

☐ Phacelia (S R W C)
Phacelia species

☐ Rushes (R)
Juncus species

☐ Sages* (S W C)
Salvia species

☐ Yarrow* (S R W C)
Achillea millefolium

☐ Yerba Santa (C W)
Eriodictyon californicum

☐ Western Columbine (R W C)
Aquilegia formosa

☐ Arroyo Lupine (W C)
Lupinus succulentus

** Indicates plants that are appropriate for container gardens.*

Please check with your local nursery specialist for specific advice.

California Mantis
Stagmomantis californica

California Carpenter Bee
Xylocopa californica

Diabolical Ironclad Beetle
Phloeodes diabolicus

California Oak Moth
Phryganidia californica

Plant Communities

- (S) Coastal Sage Scrub
- (R) Riparian
- (W) Woodlands
- (C) Chaparral

SUPPLEMENTAL HABITAT ELEMENTS

These habitat features provide additional water sources or shelter for various Arthropods.
Minimum: Container (2+), Residential (4+), Public (6+)

☐ Insect watering stations*
☐ Puddling station*
☐ Cricket water pillows*
☐ Water retaining mulch
☐ Mounds of loose soil/dirt piles
☐ Areas accumulated with leaf litter/small branches/natural plant debris
☐ Open bare soil or mulched areas
☐ Untreated wood/logs/bark on the ground
☐ Empty upside down pots*
☐ Flowering plants for pollinators*
☐ Insect hotels/butterfly house*
☐ Bee blocks*
☐ Sparsely planted containers with sections of bare soil*
☐ Compost boxes*
☐ Stone/brick/cinder block piles
☐ Underground nesting holes
☐ Native grasses (i.e. purple needle grass, fescue, sedge grass)

* Indicates structures that are appropriate for container gardens

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MAINTENANCE PLEDGES

Please carefully read through the following maintenance strategies and pledge to implement at least 3 of these strategies in your garden.

☐ Mulch with recommended materials: leaves, bark, compost.
☐ Monitor for invasive plant species, removing the root will prevent regrowth and limit their spread.
☐ Reduce outdoor lighting and utilize warmer toned lights.
☐ Avoid all general use insecticides and systemic herbicides.
☐ No leaf blowers.

COMMUNITY CARE PLEDGES

These pledges ensure connection between our community of Arthropod-friendly gardeners.

☐ (Required) Post provided Clean & Green Pomona signage (i.e yard pickets, door hangers).
☐ (Required) Submit an image of my completed garden to Clean & Green Pomona.
☐ (Optional) I allow Clean & Green Pomona to post images of my garden on their website.
☐ (Optional) Join Clean & Green Pomona's Facebook community of Arthropod-friendly gardeners.
☐ (Optional) I am interested in joining gardening mentorship programs as a mentor.

CONTACT INFORMATION

Please provide your contact information so that we can confirm your certification and send you your habitat signage.

NAME:_____

EMAIL OR PHONE NUMBER: _____

MAILING ADDRESS: _____

TO SUBMIT: Please return the completed form via email (cleangreenpomona@gmail.com), or mail it to

ARTHROPOD FRIENDLY GARDENS

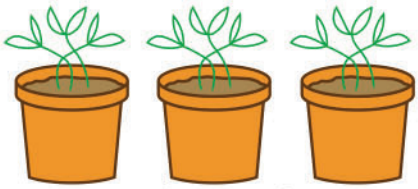
What is an Arthropod? Arthropods are organisms that have hard outer shells, segmented body parts, and jointed legs. Arthropods include insects and spiders.

Why Arthropods? Extremely important to ecosystems around the world, including Pomona Valley, they are pollinators, a food source for animals throughout the food chain, produce things like honey, and have countless other benefits.

Anthropogenic (influenced by humans) factors have led to a decline in viable arthropod habitat. By creating an arthropod friendly garden, we can conserve and create habitats for these critters!

GARDEN TYPES

All types of gardens can participate in the Arthropod Habitat certification program!



Container Gardens
pots and planters on a balcony or patio

Residential Gardens
created in permeable yard space

Public Gardens
publicly accessible habitat gardens

NATIVE PLANT COMMUNITIES

Collections of plants that exist together in the natural environment. Planting them together creates communities that Arthropods, birds, and wildlife can recognize as their native habitats.

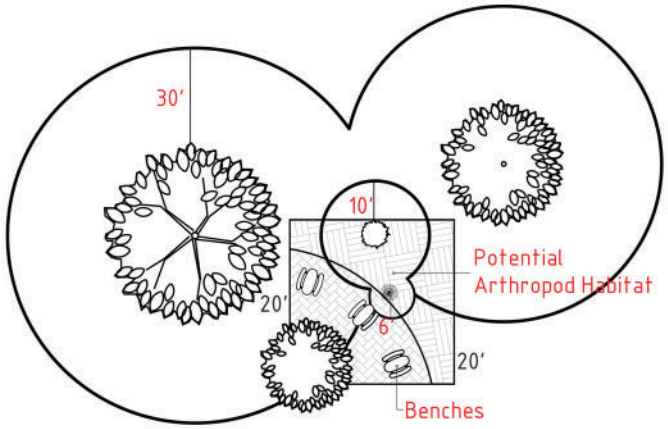
Match plant communities to Arthropods

Coastal Sage Scrub: Chalcedon Checkerspot *(Euphydryas chalcedona)*, California Mantis *(Stagmomantis californica)*, Yucca Moth *(Tegeticula maculata)*, California Trapdoor Spider *(Bothriocyrtum californicum)*, Large Crane Flies *(Tipula)*

Chaparral: Timemas *(Timema)*, Ceanothus Silk Moth *(Hyalaphora euryalus)*, Pale Tiger Swallowtail *(Papilio eurymedon)*

Woodland: California Oak Moth *(Phyrganidia californica)*, Diabolical Ironclad Beetle *(Phloeodes diabolicus)*, Walnut Underwing *(Catocala piatrix)*

Riparian: Lorquin's Admiral *(Limenitis lorquini)*, Velvety Tree Ant *(Liometopum occidentale)*, Western Tiger Swallowtail *(Papilio rutulus)*, California Glowworm *(Ellychnia californica)*, Velvet Ants *(Dasymutilla)*, Harvester ants *(Pogonomyrmex)*, Behr's Metalmark Butterfly *(Apodemia virgulti)*



When planting consider proximity to already existing native plants; trees (30ft), well established shrubs (10ft), dense plantings and groundcovers (6ft). To find an optimal planting area, find the overlap.

MANAGEMENT

To provide a successful Arthropod Habitat, proper garden management is integral. These methods often require less tending than traditional gardening practices.

Before planting, clear the area of weeds. Avoid the use of herbicides.

Prevent regrowth using cardboard (flattened with tape removed) or several layers of newspaper. Avoid deadheading and pruning until the fall, and leave pruned branches and dried flower heads in a pile to function as additional arthropod habitat.

Arthropods benefit from piles of mulch to burrow or nest in. Make piles from existing leaves, bark, and compost from your garden. To maintain mulch zones, avoid leaf blower use.

Avoid chemical pesticides like RoundUp, Scott's Turf Builder, or Ortho brand products. Use water or rags to physically remove pests from plants.

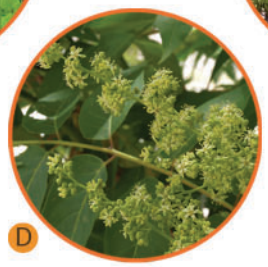
If pest management is needed in your garden, natural pesticides such as plant-based oils (neem, canola, citrus,) and soaps can be used. Check product labels and follow application instructions. Identification of the pests is key.

Minimize outdoor light use through use of timers to preserve Arthropod's natural circadian rhythm and navigation. Opt for warm-toned lights rather than cool lights.

INVASIVE SPECIES REMOVAL

Invasive plants can outcompete natives for vital resources, alter soil chemistry, and increase the risk for wildfire. Below are common invasive species to be on the lookout for! **Some of these invasives require extra care when removing, always be sure to use the proper equipment and gear when gardening.*

A. Crofton Weed: *Ageratina adenophora*
B. Ice Plant: *Carpobrotus edulis*
C. English Ivy: *Hedera helix*
D. Tree of Heaven: *Ailanthus altissima*
E. Pampas: *Cortaderia selloana or Cortaderia jubata*
F. Castor Bean: *Ricinus communis*



CLEAN & GREEN POMONA

MORE RESOURCES

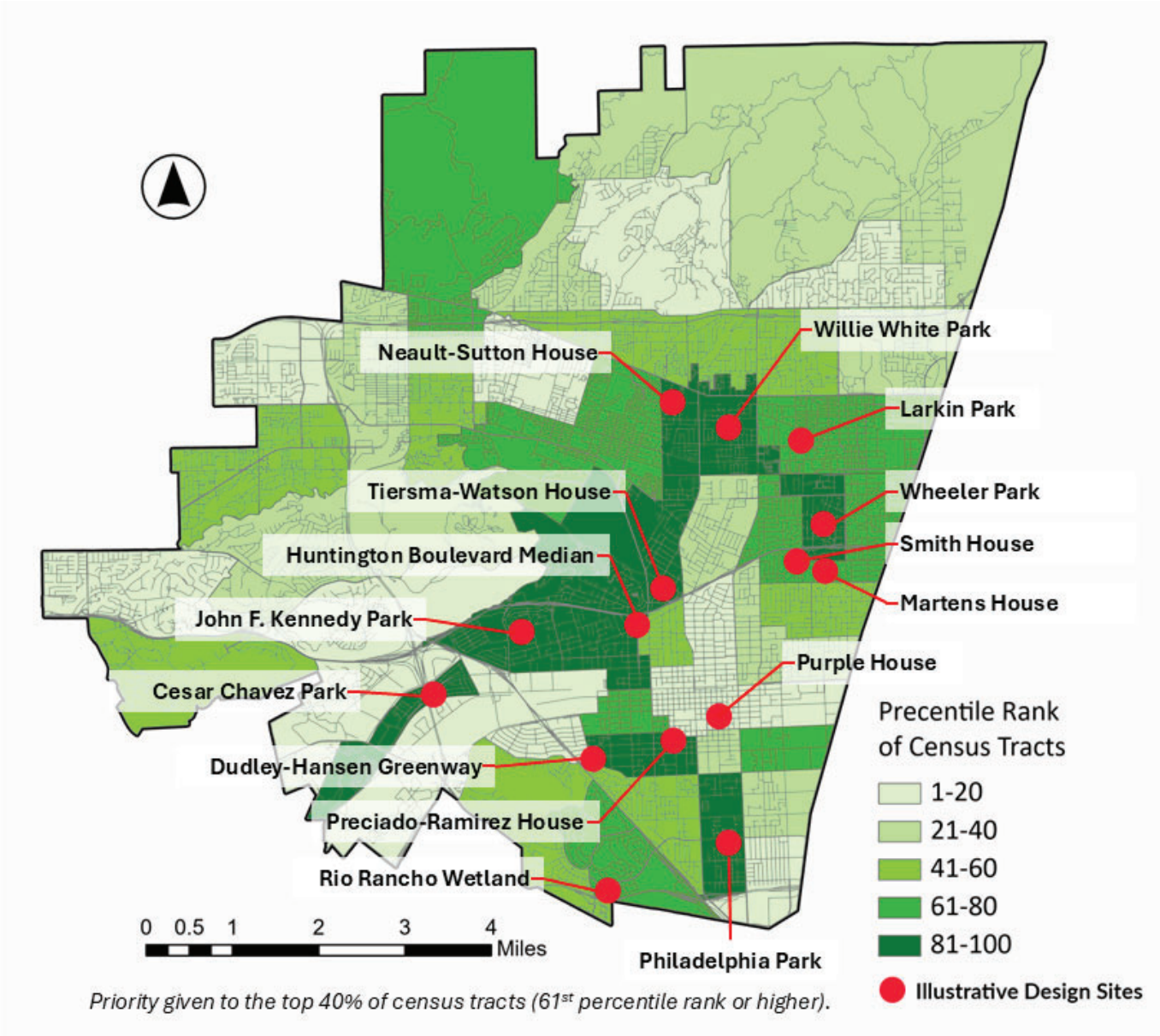
Theodore Payne: *theodorepayne.org*
Calscapes: *calscape.org*
California Native Plant Society: *www.cnps.org*
Waterwise Garden Planner: *waterwisegardenplanner.org*
SoCal WaterSmart Residential Rebates: *socalwatersmart.com*

Timema boharti by Ken-ichi Ueda, CC BY 4.0, via Wikimedia Commons

ARTHROPOD-FRIENDLY ILLUSTRATIVE DESIGNS

To illustrate the potential beauty and function of Arthropod-friendly landscapes, we selected a number of public parks and private residential sites to design based on our proposed certification program. Sites were selected based on the prioritization model we developed, emphasizing sites within the top 40% of our Small-Patch Priority Index. All but one of the sites selected match that criteria. In addition, sites were identified in partnership with Clean & Green Pomona, to reflect priorities and relationships established by this organization.

Each of the gardens which follow was created by an individual designer, striving to meet the criteria for certification, as proposed in this document.



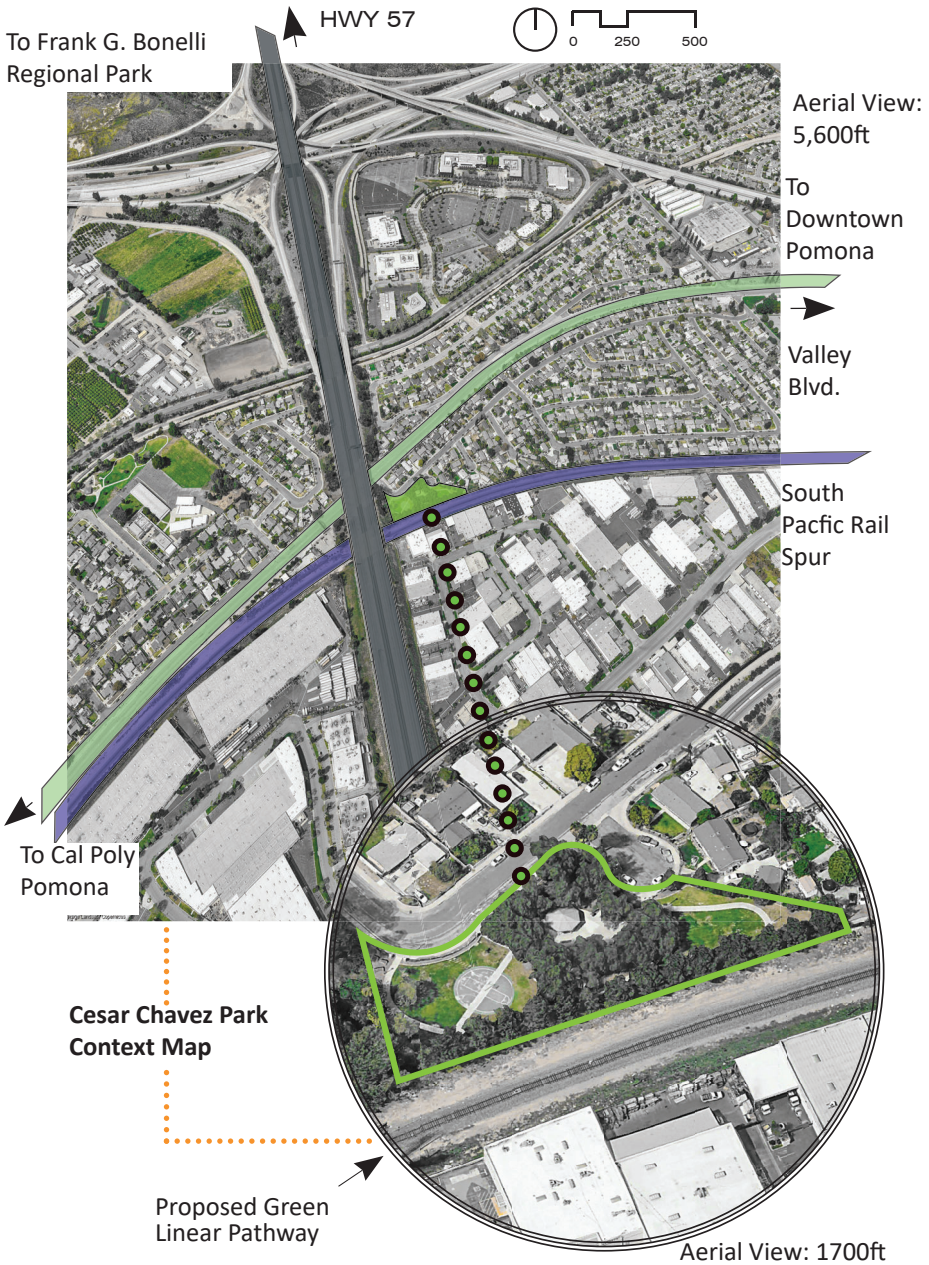
Sites within the top 40% of our Small-Patch Habitat Priority Index were evaluated for illustrative designs. Nine public parks and six residential sites were chosen.

CESAR CHAVEZ PARK

Lucas Murillo

Site Description

Cesar Chavez is a small city park located within the top 20% percentile ranking of census tracts experiencing low ecological integrity and high nature deficits. Likely established around 2002-2003 on a formerly vacant lot, the park provides rest and relaxation for hundereds of nearby residents. While taking the opportunity to walk the park, I noticed a a variety of exsiting assets like large trees, a vegetable container garden, sunny turf areas for passive recreational activities, a play structure, and a basketball court. The park is also shaded by a mature urban forest and hosts a variety of culturally inspired community art. On the other hand, the park is overshadowed on its west side by Highway 57. As the cars pass along the highway, sound carries over the entire park. At the south end of the park, there is a large cinder block wall that sperates an abondoned South Pacific Rail Spur. The neglected area behind this wall also presents an opportunity. With the addition of a proposed "green linear pathway," residents will an option to to travel through Pomona along a pedestrian pathway away from vehicle traffic. This design suggests several additions to increase recreational opportunities, Arthropod friendly habitat, and even improvements for kids to enjoy too.



Goals

1. Successional planting & selective removal of non-native species to introduce native trees and shrubs over the course of several years. Also, recycle felled trees to be used as habitat and mulch.
2. Fulfill Arthropod certification requirement.
3. Maintain visibility across the entire park. Protect existing assets.
4. Restore playground rubber surfacing with Arthropod art. Addition of "Arthropod Magnifying Viewports."
5. Remove cinder block wall at the south end and expand into the abandoned rail spur behind the park. Create a looping park trail that connects to potential green linear path.

Likely Arthropod Visitor

- Tamima argillacea (Tamima)
- Phyrganidia californica (Oak Moth)
- Stagmomantis spp. (Mantis)
- Hyalophora euryalus (Silk Moth)
- Phiddipus johnsoni (Red Jumping Spider)
- Ctenizidae spp. (Trapdoor Spider)

Native Plant Host

Sequoia smpervirens (Coastal Redwood)

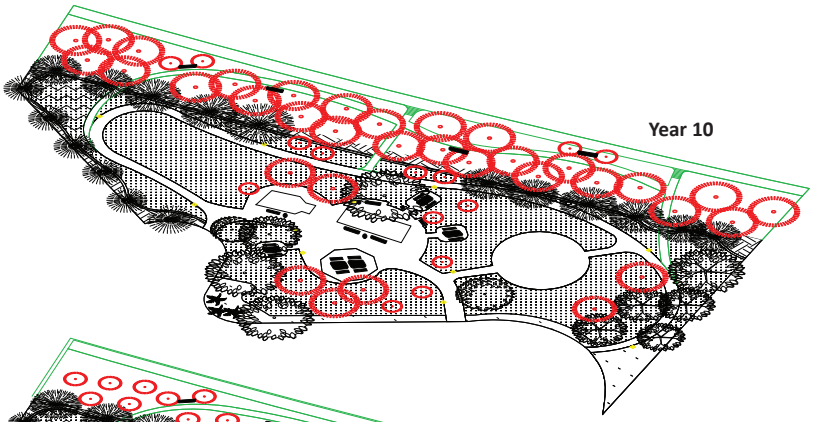
Quercus agrifolia (Coast Live Oak)

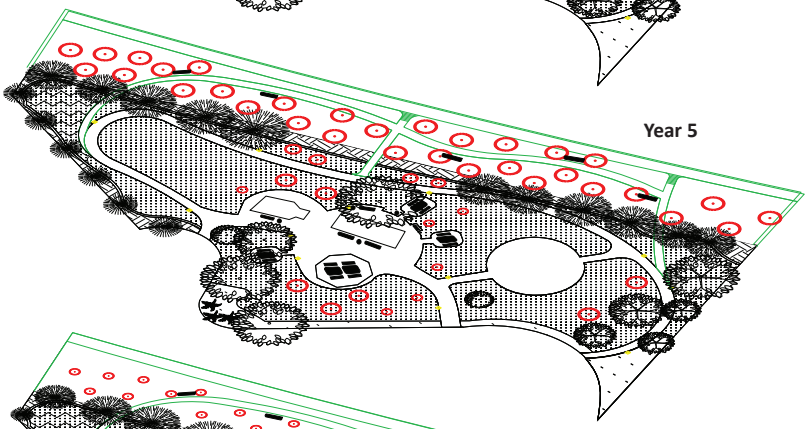
Various Native Plants

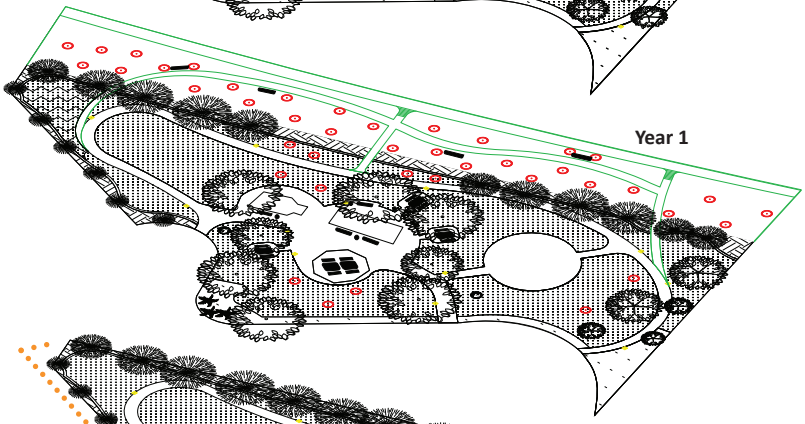
Ribes spp. (Gooseberry)

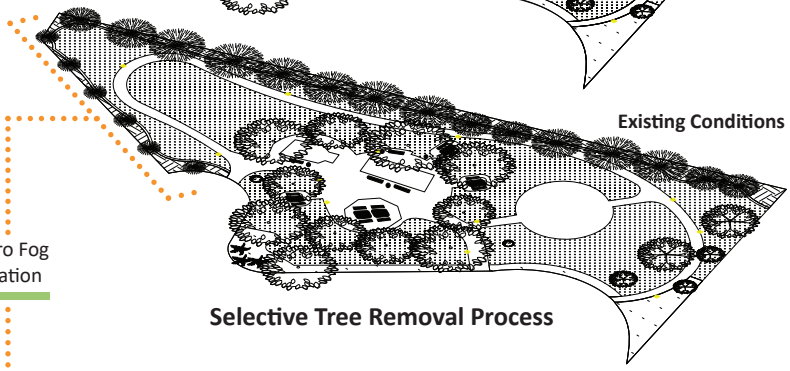
Decaying wood

Grassland and chaparral









Selective Tree Removal Process

Habitat Building

❶ Selective removal of mildly invasive trees and shrubs & the replanting of native species.

❷ Successional planting plan for linear green pathway.

❸ Preserve existing shade throughout the park and adjacent parking spaces.

❹ A living design that encourages stewardship and education with potential to become an experimental site for community organizations, the university, and the right" landscaping company.

Legend

- Mulch
- Impervious
- Grass
- Earth
- Pincnic Table
- Trash Barrel
- Concrete Bench
- Washingtonia spp.
- Schinus molle
- Platanus racemosa
- Pine
- Sequoia sempervirens
- Ginkgo biloba

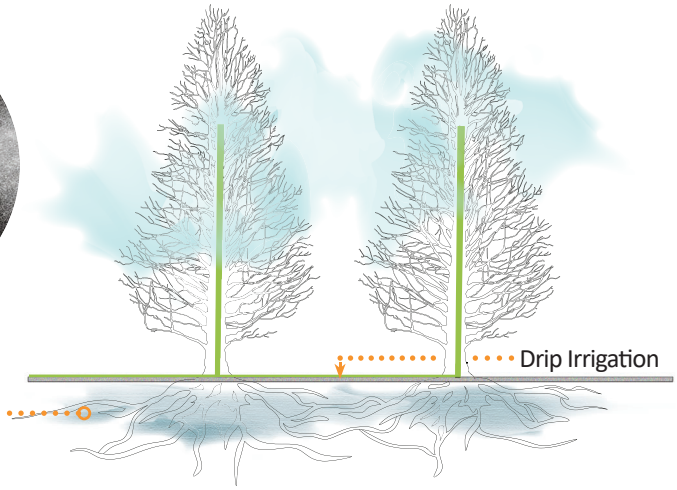
"Fool the Redwood"

Coastal redwoods are legacy trees worth saving. Although they thrive in the cool humid climates of Northern California coastal ranges where precipiation can range between 25-122 in., it has been demonstrated that they can be maintained outside of their habitat. In a project by arborist Walter Passmore of Palo Alto California, a large, 1,081 years old Coastal Redwood, planted in a local park, was preserved by simulating its native microclimate. Inspired by this project, this proposal includes the addition of drip irrigation at soil level, as well as fastening micro irrigation emitters to the trunk, and its branches to replicate the humidity levels of a redwood forest. This effort will not only help preserve these trees for future generations, it will remain potential Arthropod habitat.

Micro Fog Irrigation

Grandado. (2024). DIY outdoor misting kit [Photograph]. Grandado.

Soil becomes saturated from ground irrigation and drip from the tree canopy.

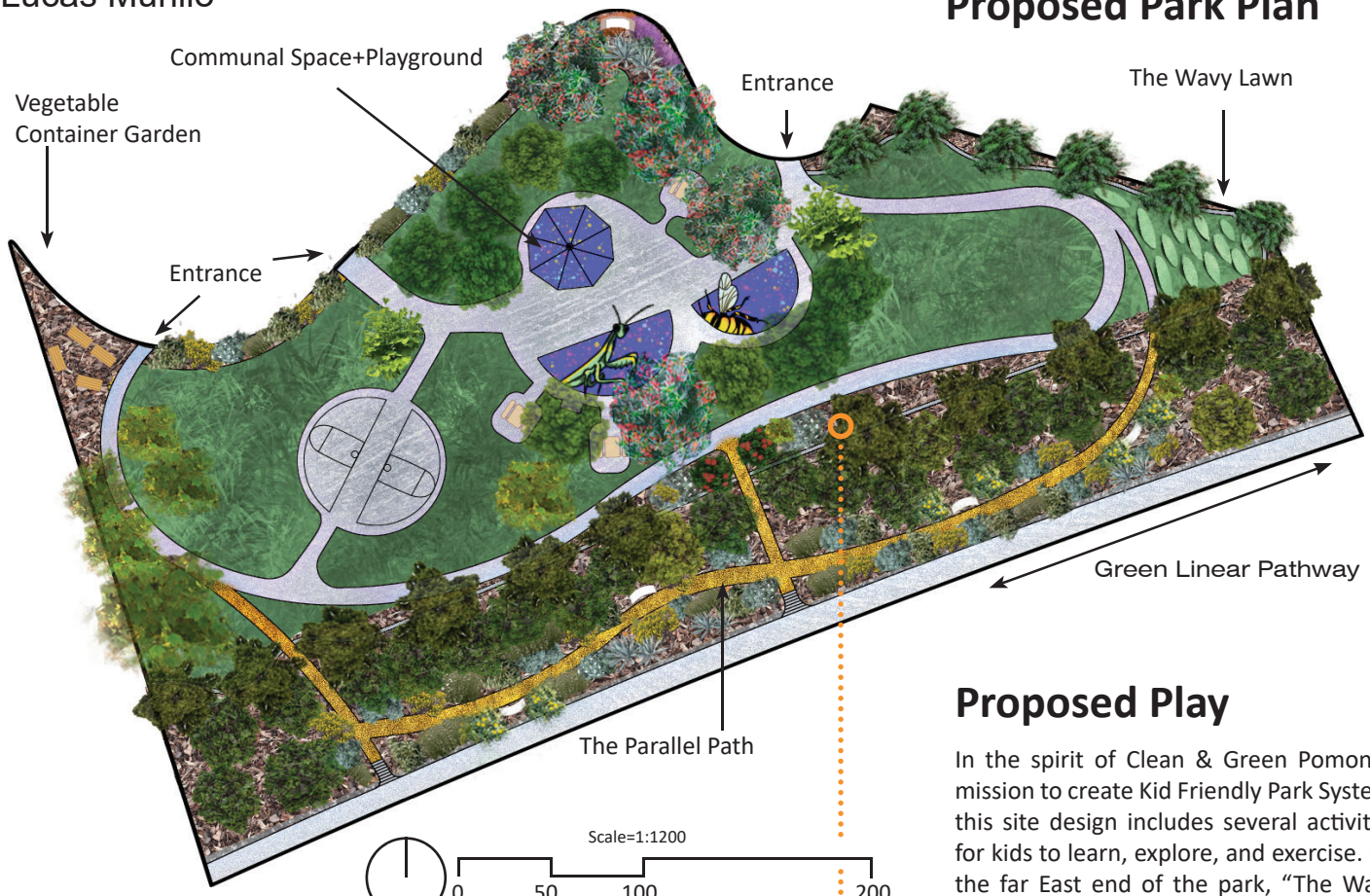


Coastal Redwood Preservation

CESAR CHAVEZ PARK

Lucas Murillo

Proposed Park Plan



Proposed Play

In the spirit of Clean & Green Pomona's mission to create Kid Friendly Park System, this site design includes several activities for kids to learn, explore, and exercise. On the far East end of the park, "The Wavy Lawn" will allow kids to explore changes in topography, sparking curiosity and imaginative play. At the existing playground, the rubber surfacing will feature labeled images of common native Arthropods as an opportunity to educate kids about their neighborhood habitat.

Within the shade of the existing trees families will encounter large natural granite boulders that providev a sensory experience of climbing and learning. Some boulders will be equipped with hinged magnifying viewports, allowing children to place things inside to view at a larger scale.

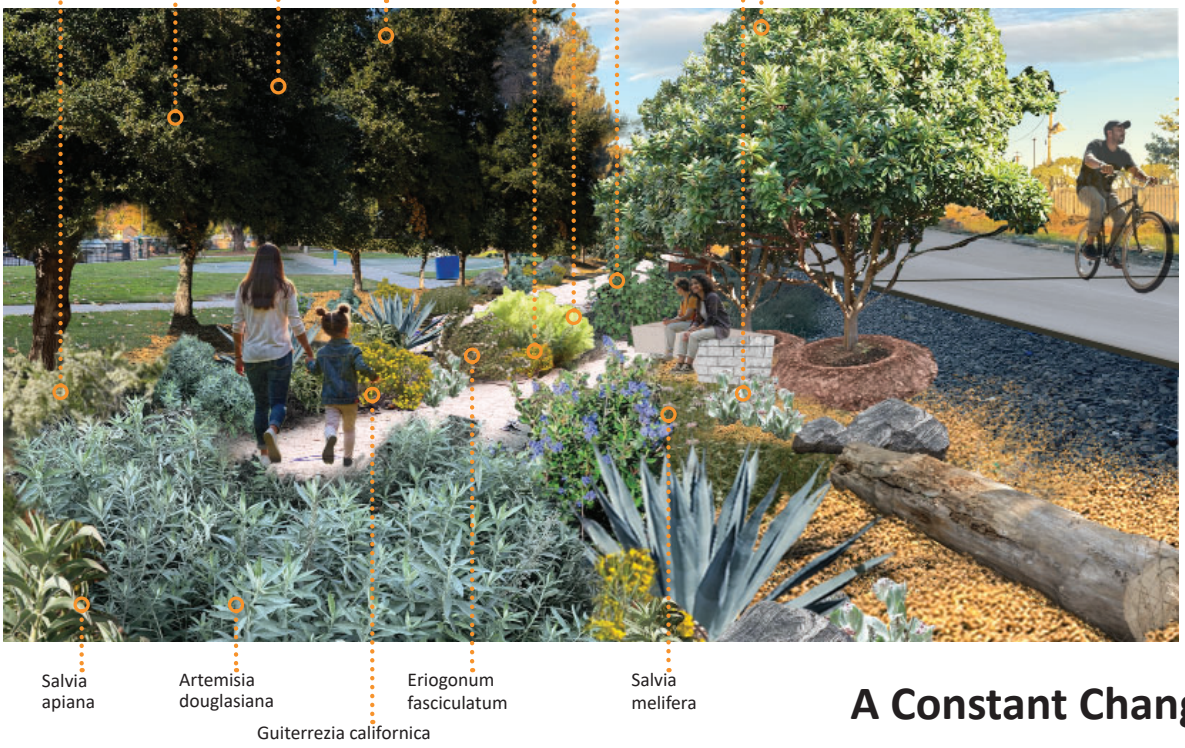
Arthropod Viewports

Arthropod Inspired Rubber Surfacing

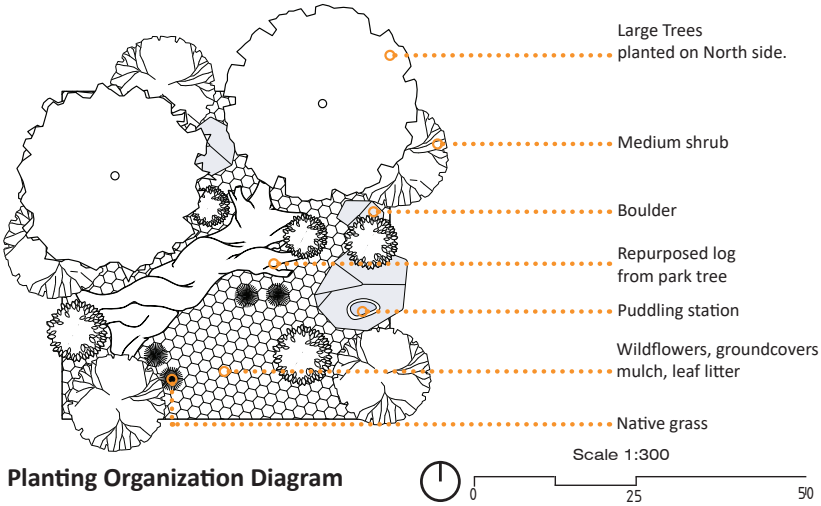
Wavy Play Lawn

Human Form Generated using DALLE-2 OpenAI (2024)

The Parallel Path



Site of Proposed Parallel Path Along Abandoned Rail Spur



Planting Organization Diagram

A Constant Change

The organization along the parallel path would most likely resemble the ecosystem between two plant communities: The Coastal Sage scrub and an Oak Woodland. As larger trees reach their full sizes, the sagescrub and smaller native herbaceous plants would gradually be replaced by large shade trees.

Resilience in this design lies in its ability to support natural plant succession, where smaller plants are gradually replaced by larger ones. The species that survive will be better adapted to the microhabitat underneath a tree canopy. As the design matures, it will stray from a traditional landscape aesthetic and benefit from a team to replace, remove, and maintain a natural look. This might be an opportunity to apply for grants with community non-profits like AmeriCorp who focus on stewardship and environmental education.

The clustered, non-uniform layout also allows space for maintainenance. Various Arthropod friendly structures will fill these gaps too. Ultimately, the planting strategy embraces the evolving nature of natural and planned landscapes, allowing users to experience the ephemeral state of some plants and the eduring qualities of others.

DUDLEY-HANSEN GREENWAY

Daniel Bautista

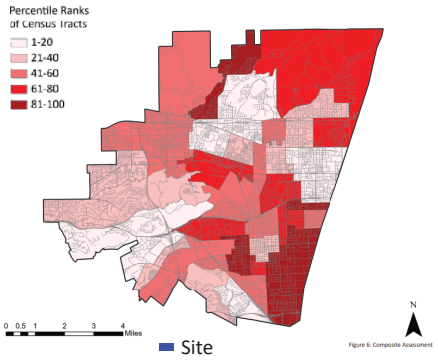
Background Info

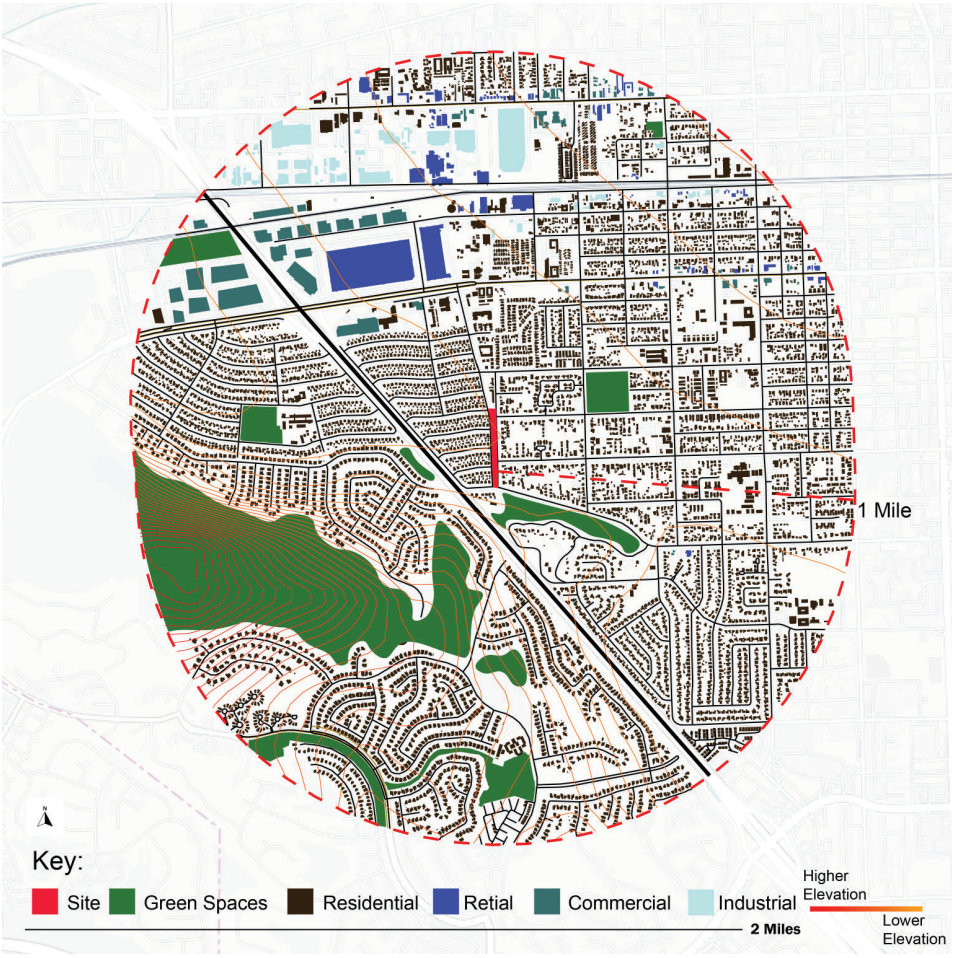
Between Phillips Blvd and Smith St., Pomona,CA 91766

A public landscape located in the top 20% of census tracts in our priority index. This interstitial strip of land is located between two housing tracts established at different times.The site is used by locals to walk dogs, and get exercise, although it is not an official park. Clean & Green Pomona is advocating for its inclusion in the park system, potentially providing a critical connection to the abandoned Palm Lakes Golf Course, which is also proposed as a park. It is characterized by numerous overhead utilities which limit the use of trees on the site. No specific areas have been determined for an Arthropod garden. (Description by Dr. Kyle Brown)

Regional Analysis

The Dudley-Hansen Greenway is in the Pomona Valley region of Southern California. This area is a hub of activity, featuring a mix of residential neighborhoods, businesses, and industrial areas. Its central location provides easy access to major highways including the 10 San Bernardino freeway to the North, the 71 Chino Valley Freeway to the West, and the 60 Pomona Freeway to the South. Based on the composite map of five nature deficit factors (density, poverty, race, housing tenure, and youth), the Dudley-Hansen Greenway is part of the top 81-100 percentile.

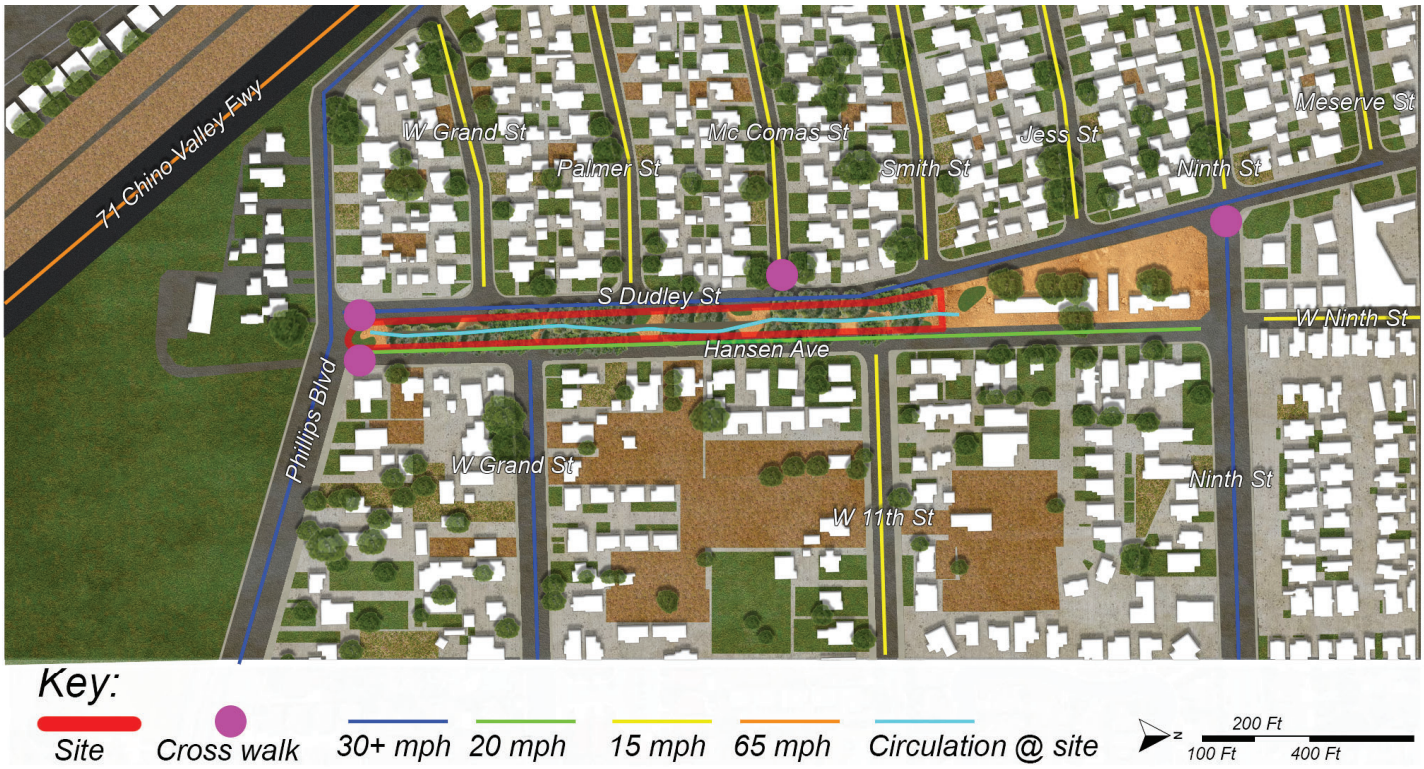




Looking closer at a half mile radius from the site, I decided to map out existing green spaces/parks. To the South of the site, there is the closed Pam Lake Golf Course, which has plans to become a public park. This is the closest “park” to the site and has the most potential to create a strong connection to the Dudley-Hansen Greenway. Ralph Welch Park, located to the East of the site, is a popular park that is used by the community. Finally, Gente Community Garden is also within a half mile radius which is a community garden opperated by volunteers. All these locations have potential to be incorporated into the Clean & Green Pomona Arthropod Friendly Habitat project.

Site Analys: Circulation

The site covers approximately 64,000 ft², measuring about 1,200 ft in length and 50 ft in width. During a site visit, I walked its entire length at a moderate pace, stopping periodically to observe the existing plant life and take photos which took approximately 33 minutes. On the second site walk at a normal walking pace, the time was reduced to about 7 minutes. Notably, the site lacks surrounding sidewalks and has limited pedestrian access, with only three crosswalks providing entry. One crosswalk is located at the intersection of McComas St and Dudley St, while the other two are located at the South end of the site on Phillips Blvd. To analyze accessibility, I mapped the speed limits of the surrounding streets. This map showed the high speeds of the adjacent streets which create unsafe conditions for accessing the site.



Site Analys: Site Photos

1: View from Dudley St with no sidewalk.
2: On site trees (Geijera parviflora and Albizia julibrissin) and shrubs (Salvia rosmarinus and Glanduiaria canadensis).
3: Crosswalk on Mc Comas and Dudley.
4: Potential site for Arthropod friendly habitat.
5: Existing rocks on site, used for seating.

DUDLEY-HANSEN GREENWAY

Daniel Bautista

Design Goals

A) Establish a sense of identity for the site by incorporating welcome signage.
B) Introduce arthropod friendly habitats to complete the Clean & Green Pomona project goal.
C) Design inviting and calm spaces that promote relaxation and comfort for visitors.
D) Install additional crosswalks to enhance accessibility and ensure safer access to the site for pedestrians.

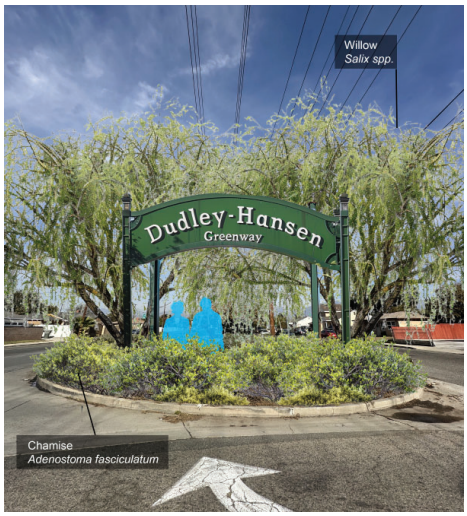
Concept Design: Points of Interest

A1 & A2: These areas of the site have potential to have signage for the site. A1 is at the South end of the site and does not have any trees. A2: is at the intersection of Hansen Ave and W 11th Ave and has no trees as well, which would be perfect to add signage.
B1, B2, & B3: These are the most important areas I located on the site that can host arthropod friendly habitats. B1: is an area that has no trees and only has Salvia rosmarinus shrubs. I propose to remove these and add a brand new arthropod friendly habitat with plants and trees based on our Arthropod-Friendly Habitat Certification Program. B2 and B3 are locations on the site where there are no existing plants. These locations are a blank slate which would be perfect to add a brand new arthropod friendly habitat.
C1 & C2: These are locations on the site I chose to create calm spaces for people to relax while visiting the site. Both spaces are surrounded by trees which provide shade and have room for the addition of seating. The seating could double as habitats for arthropods based on Arthropod-Friendly Habitat Certification Program.
D1 & D2: These intersections on Dudley Ave have the potential to be crosswalks to enhance accessibility to the site while also slowing down traffic.

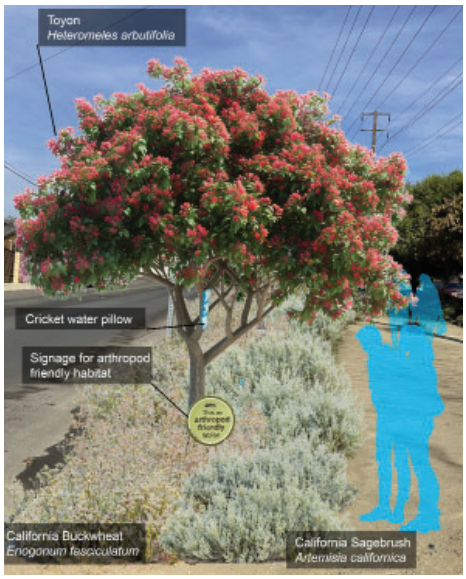
Concept Design:

My concept design for the Dudley-Hansen Greenway does not include traditional site plans. Instead, I selected 9 areas that I believe can be improved to satisfy Arthropod-Friendly Habitat Certification Program checklist for Clean & Green Pomona. In total I propose adding 2 species of trees Toyon (Heteromeles arbutifolia) and Willow (Salix spp.) 5 species of shrubs which include Chamise (Adenostoma fadciculatum), Buckwheat (Eriogonum fasciculatum), California Sagebrush (Artemisia califronica), Chaparral Yucca (Hesperoyucca whipplei), and Caterpillar Phacelia (Phacelia cicutaria). 4 species of annuals/perennials which include Common Yarrow (Achillea millefolium) Black Sage (Salvia mellifera) and White Sage (Salvia apiana). To satisfy the supplemental habitat elements, I propose adding insect watering stations, cricket water pillows, water retaining mulch, mounds of lose soil/dirt piles, untreated wood logs on ground, and flowering plants for pollinators.

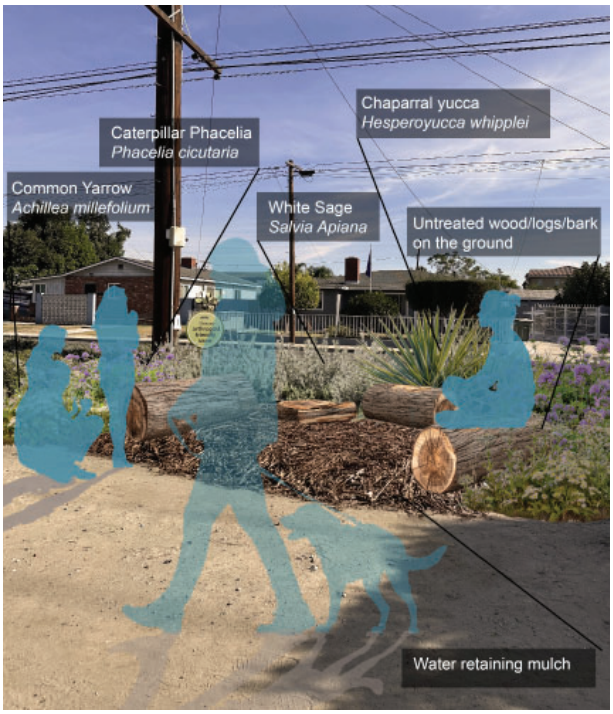
Area **A1** is located at the South end of the site. This area has no existing trees and only has Rosemary (Salvia rosmarinus) and Rock Mock Vervain (Glanduiaria canadensis) shrubs. My proposed design is to establish a sense of identity by incorporating a welcome sign. The sign in the rendering is labeled as the “Dudley Hansen Greenway” but has the potential to have a unique name. In addition to the sign, I propose to add Chamise shrubs (Adenostoma fadciculatum) and Willow trees (Salix spp.) which is to comply with the Arthropod-Friendly Habitat Certification Program checklist.



Area **B1** is located near South end of the site. This area only has Rosemary (Salvia rosmarinus) and Rock Mock Vervain (Glanduiaria canadensis) shrubs and no trees. My proposed design is to add Toyons (Heteromeles arbutifolia) since these large shrubs can act as trees and can be pruned to not get too tall. This is important because there are power lines running through the length of the site. On the Toyons, there would be cricket watering pillows which would be a supplemental habitat element to comply with the Arthropod-Friendly Habitat Certification Program checklist. In addition, I propose to remove the Rosemary shrubs to add California natives and Arthropod-Friendly Habitat Certification Program required shrubs. These include California Buckwheat (Eriogonum fasciculatum) and California Sagebrush (Artemisia califronica) which are flowering plants that are for pollinators and comply with the Arthropod-Friendly Habitat Certification Program. Additionally, the addition of signage will be educational as well as add a sense of identity to the site.



(Right) Area **B2** is located towards the middle of the site. There is no planting here which is a perfect area that can be used as an arthropod friendly habitat.
My proposed design is to incorporate California native shrubs. These include Common Yarrow (Achillea millefolium), Caterpillar Phacelia (Phacelia cicutaria), White Sage (Salvia apiana), and Chaparral Yucca (Hesperoyucca whipplei). In addition, I propose to add water retaining mulch and untreated wood logs on the ground. This area would be an arthropod friendly habitat as well as complying to Arthropod-Friendly Habitat Certification Program checklist by adding 4 shrubs and 3 supplemental habitat elements. Notably, I chose not to add trees here for more visibility to the site as well as providing a different environment for another type of arthropod friendly habitat.



(Left) Area **D1** is located at the intersection of W Grand and Dudley Ave. My proposed design is to Install an additional crosswalk to enhance accessibility to the site as well as promote more safety. This area also has a Persian Silk Tree (Albizia julibrissin) which provides shade underneath it. I propose adding supplemental habitat features like untreated logs on ground for arthropods to use as a habitat which could also be used as seating for visitors of the site. In addition, the planting of Black Sage (Salvia mellifera) will be used to comply with the Arthropod-Friendly Habitat Certification Program checklist.

HUNTINGTON BOULEVARD MEDIAN

Peter Kato

Introduction:

Huntington Boulevard Median located in Pomona California, a region characterized by its semi-arid climate, diverse ecosystems, and significant agricultural activity. In the context of landscape architecture, this area offers unique opportunities to enhance biodiversity, particularly by supporting arthropod populations, which play a crucial role in pollination, pest control, and overall ecosystem health. This report evaluates the potential for improving arthropod habitat through the lens of landscape design and the arthropod certification program that was created in class, proposing a strategy that focuses on three key arthropod species: Apis mellifera (Honeybee), Danaus plexippus (Monarch Butterfly), and Carabidae (Ground Beetles). These species were chosen for their ecological importance and their potential to benefit from thoughtful landscape interventions.

Overview of the Arthropod Certification Program.

The Arthropod certification program provides a framework for evaluating ecological practices and ensuring that landscapes contribute to environmental health.
We considered Sustainable Sites, Water Efficiency, and Materials & Resources, which can be leveraged to support arthropod habitat. While this does not specifically target arthropods, its focus on biodiversity and habitat restoration aligns with the proposed goals.
Sustainable Sites is specifically focused on sustainable land design and offers a comprehensive framework that addresses soil health, water management, plant biodiversity, and habitat creation.
This program includes specific guidelines for promoting pollinator habitats and minimizing chemical use, which would benefit the target arthropods in this project.
It also encourages the creation of habitats that support wildlife, including arthropods, by using native plants, ensuring that habitats provide food, shelter, and nesting opportunities. This is useful in guiding the creation of diverse ecosystems within a site. It provides guidelines for planting native pollinator-friendly plants, all of which align withn my proposed approach.

Key Categories for my Arthropod Habitat Evaluation (Existing Conditions).

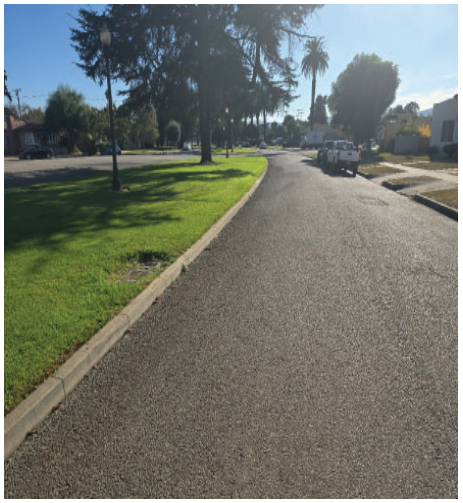
When assessing a landscape's ability to support arthropod populations, certain ecological principles and landscape elements must be prioritized. Based on the target species and the reviewed certification programs, the following categories should be considered:

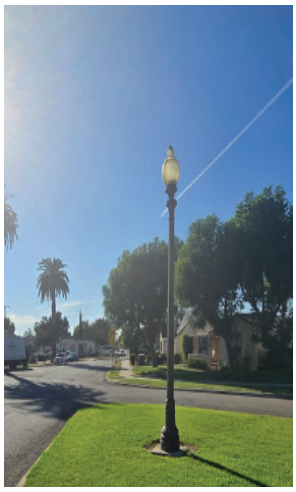
Native Plants and Vegetation: Native plants, particularly trees and shrubs, provide critical shelter, food, and nesting sites for arthropods. For honeybees, flowering plants like Salvia and Echinacea offer nectar and pollen. Monarch butterflies require Asclepias species (milkweeds) for both nectar and larval food. Ground beetles benefit from vegetation cover that provides shelter and predatory opportunities for pest management.

Shelter and Nesting Sites: This category evaluates the availability of structures like ground cover, leaf litter, tree cavities, and even man-made features like insect hotels or bee boxes. For the target arthropods, appropriate shelter throughout their life stages—from larva to adult—is essential for their survival and reproduction.

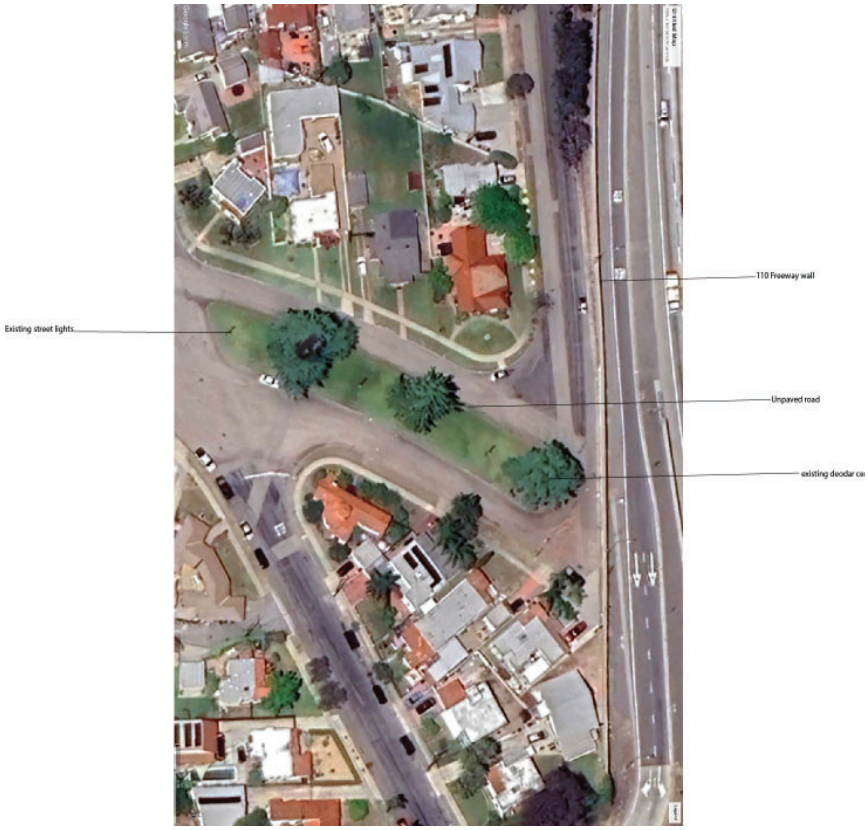
Water Management: Availability of clean water sources is crucial for arthropods. Honeybees require water for hydration, while butterflies may need it for egg-laying. Ground beetles may use water sources as part of their habitat as well. Rain gardens, birdbaths, or shallow water features can provide vital resources for these species. Given the area site I was working with, I had to consider all these factors before putting together my initial design intents.

Maintenance and sustainability: Ongoing maintenance practices can either support or hinder arthropod populations. The landscape should be designed to minimize the need for chemical treatments and excessive human intervention, allowing the ecosystem to thrive naturally. Regular monitoring of the arthropod populations can help guide maintenance and further improvements. After reaching out to some of the residents of this area, littering and dumping was not a big problem since this space is mostly used as a dog park. Cleaning is a community effort so adding communal trash cans would ease this problem.





Existing Conditions



HUNTINGTON BOULEVARD MEDIAN

Peter Kato

Proposed Landscape Conditions for my Arthropod Support.
Based on the evaluation of existing conditions and key habitat requirements, the following conditions are proposed to foster an environment conducive to the target arthropods on Huntington Boulevard median:

Native Tree and Plant Selection: Incorporate a diverse range of native plants, particularly trees, shrubs, and wildflowers that support the three target arthropods. For honeybees, focus on nectar-rich species like Ceanothus, Sugarbrush, and Manzanita. For Monarchs, ensure the presence of milkweed species (*Asclepias californica*) or Mohogany, which are essential for their lifecycle. Ground beetles will benefit from ground covers like Echinacea and Asclepias species for shelter and food.

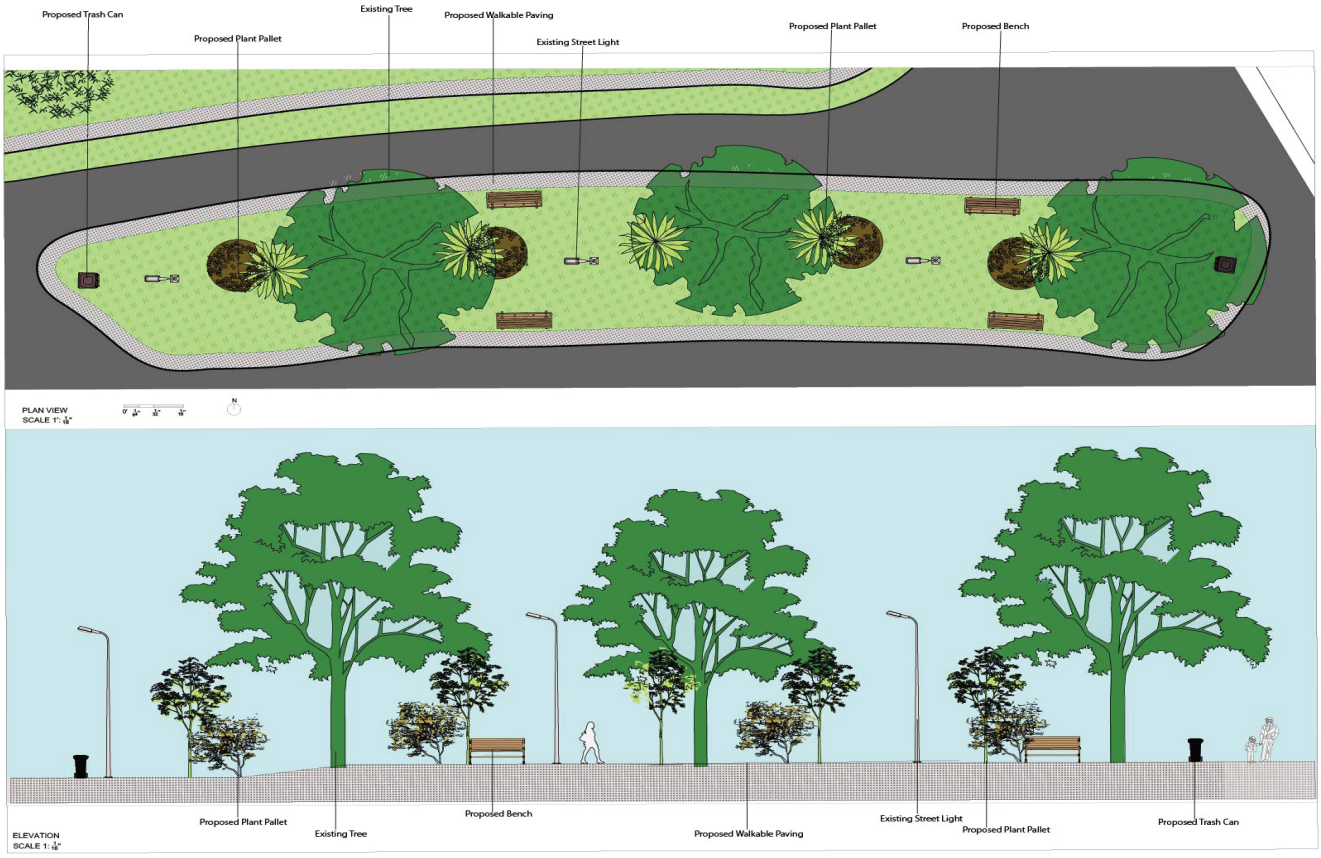
Creating Sheltered Habitats: Design features that provide ample shelter for arthropods. This includes creating areas of undisturbed soil for ground beetles to burrow and establishing shrubs or tree canopies that offer shelter for pollinators. Additionally, the installation bee nesting boxes could be an innovative way to support solitary bees and other insects. For this design, I wanted to maintain the integrity of some of the existing conditions so adding average tree shrubs seemed like the best way to go.

Water Features: Install small water features such as shallow ponds, birdbaths, or rain gardens that are easily accessible to arthropods. These features can help provide hydration, breeding grounds, and refuges during dry periods. I thought plants with thick leaves, and boldened stems and branches would act as natural water collection systems especial for the kind of insects my shelter is intended for considering some of these water features can be dangerous to insects. Implement strategies that focuses on promoting natural predators, including the target arthropods themselves.

Accessibility: In the proposed design, I added a paved walkway as part of my curb-extension as well as benches. This space can be used by both humans and animals for leisure and recreational activities as much as it plays a fundamental role in Arthropod shelter. Accessibility is essential for creating environments that are welcoming, functional, and enjoyable for everyone.

Concept Diagram

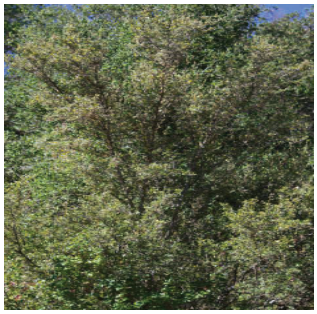
Proposed Conditions



Proposed Plant Pallets

Ceanothus

Sugarbrush



Mohogany

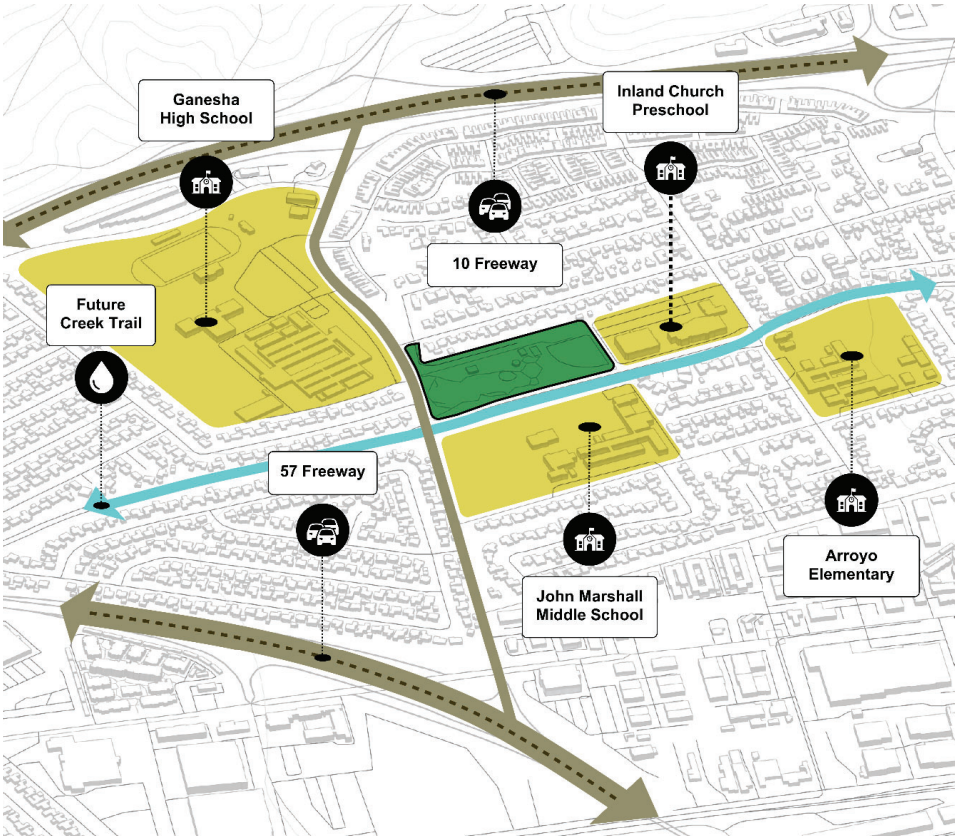
Manzanita

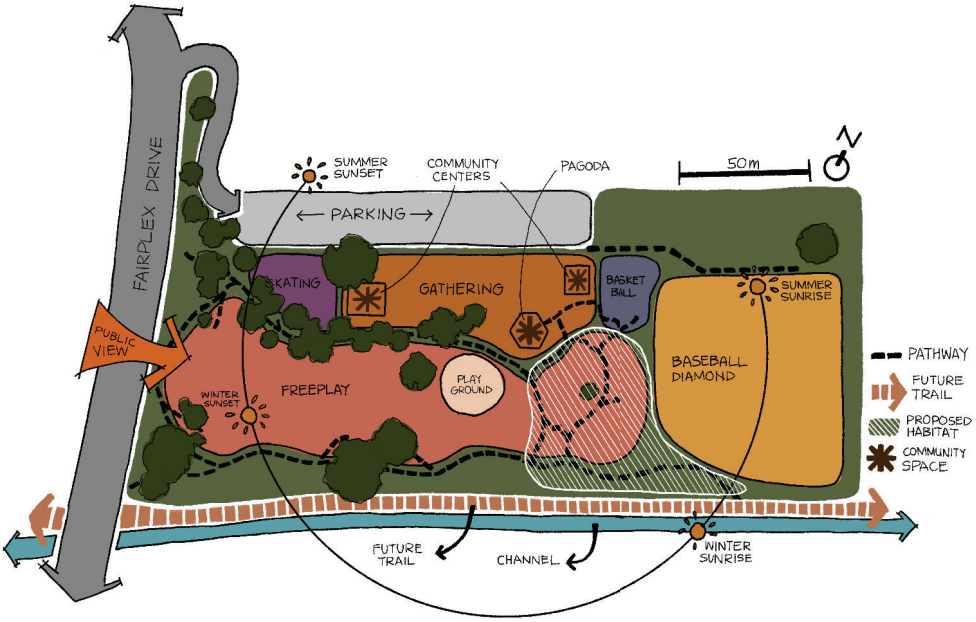
JOHN F. KENNEDY PARK

Elizabeth Ignacio

Plussing a Playful Pomona

Located at 1150 Fairplex Drive, this 7.82-acre Pomona park has served its local community for over fifty years. Its location on a main road, bookended by two major freeways, the 10 and the 57, as well as its proximity to multiple K-12 institutions makes it a hub for community events and student activity. This design for a new arthropod-friendly habitat in the southeast corner aims to enhance the existing kid- and family-friendly infrastructure by add an element of imaginative play via rocks, water, and more paths, while provide thermal comfort options to visitors in summer and opening up the park to the future creekside walking path.





Context Analysis

The context analysis of the surrounding local area reveals the target demographics of this long-standing park. The park's proximity to Ganesha High School, Arroyo Elementary School, Inland Church Preschool, and formerly John Marshall Middle School indicates a large population of children in the nearby area, who can benefit from the well-being provided by green space and opportunities for after school recreation. With the rest of the surrounding area being dense residential zoning, the opportunities to provide for local families is great. After speaking with Clean & Green Pomona representative Damiana Aldana, it was revealed that a large portion of these local families utilize this park heavily in the summer to cool down and get out of their un-air-conditioned homes. As such, additional designs to the park heavily prioritized maximizing thermal comfort in addition to other priorities.

Site Analysis

Site analysis reveals a park that is already heavily catered towards recreational activity. The park has ample table space, a playground, a baseball diamond, basketball court, and a newly built skate park. The central area of the park features a large span of turf for freeplay as well. In order to supplement existing play infrastructure, additional designs prioritized imaginative play, through the addition of more paths, which forces the element of choice; water features; and changes in topography. Site analysis also highlighted the upcoming hiking path at the southeast end of the park, which influenced the new design's goal of welcoming in hikers and bikers into the park.

Designing for a Riparian Arthopod Habitats

After establishing the use of water features to support thermal comfort of park visitors in the summer months, it became clear that the integrated arthropod habitat should feature plants from a riparian plant community (see the following page page). The new habitat focuses in on the eastern corner of the park, which is currently a dirt field, and features several outlets into the channel-adjacent walking path. This encourages hikers or bikers to take detours on their journey to meander through the habitat, withouth having to double back to continue on the path.

Design Features

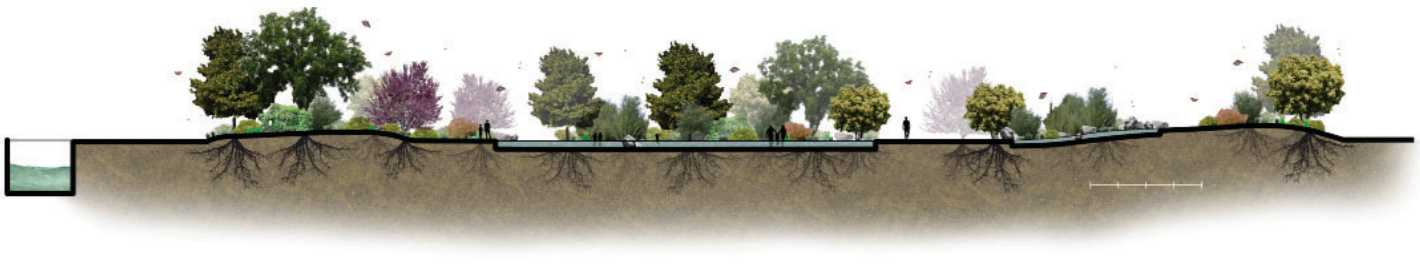
1. Shallow river with rocks for play and thermal comfort, benches nearby
2. Paved walking path branches out in multiple directions for choice of play
3. Shallow pond where kids can wade in the water, surrounded by plants
4. Planter areas contain arthropod-friendly plants and habitats
5. Insect hotels located along walking paths, along with signage for education
6. Walkway intersects with creek trail at multiple points, so hikers and bikers can pass through

Riparian Plant Palette for Arthopod Habitat

COMMON NAME	SCIENTIFIC NAME	PLANT TYPE	EST. HEIGHT	EST. CANOPY	POLLINATORS
Western Redbud	*Cercis occidentalis*	Tree	10 - 20 ft	10 - 15 ft	Bee pollinated
California Bay Laurel	*Umbellularia californica*	Tree	40 - 60 ft	60 - 70 ft	Wind pollinated
Catalina Cherry	*Prunus ilicifolia*	Tree	25 - 30 ft	6 - 20 ft	Bees, butterflies, insects
Shining Willow	*Salix lasiandra*	Tree	12 - 20 ft	10 - 25 ft	Insect pollinated
Sandbar Willow	*Salix exigua*	Tree	15 - 25 ft	20 - 30 ft	Bee pollinated
Golden Currant	*Ribes aureum*	Shrub	3 - 6 ft	3 - 6 ft	Bees, butterflies, birds
Fairy Duster	*Calliandra eriophylla*	Shrub	1 -3 ft	2 - 4 ft	Bees, butterflies, birds
Coyotebrush	*Baccharis pilularis*	Shrub	2 - 6 ft	3 - 10 ft	Bees, butterflies, insects
Coffeeberry	*Frangula californica*	Shrub	3 - 5 ft	8 - 10 ft	Beess, butterflies, birds
California Wild Rose	*Rosa californica*	Shrub	3 - 10 ft	8 - 10 ft	Bees, butterflies, insects
Bush Monkeyflower	*Diplacus aurantiacus*	Annual/perennial	4 - 8 ft	5- 10 ft	Bees, birds, insects
Narrowleaf Milkweed	*Asclepias fascicularis*	Annual/perennial	2 - 3 ft	1 - 2 ft	Monarch butterflies, etc
Soft Rush	*Juncus effusus*	Annual/perennial	5 - 7 ft	3 ft	Bees, butterflies, insects
Common Yarrow	*Achillea millefolium*	Annual/perennial	1 - 3 ft	6 - 20 ft	Bees, butterflies, beetles
Golden Yarrow	*Eriophyllum confestiflorum*	Annual/perennial	1 - 2 ft	2 - 3 ft	Bees, butterflies
Western Columbine	*Aquilegia formosa*	Annual/perennial	2 - 3 ft	1 ft	Hummingbirds

Section A-A’

Section B-B’



Perspective View

Dense Vegetation Clusters

Arthopod habitat clusters create densely packed spaces for arthropods to exist without humans trampling on their habitat. Their locations adjacent to the walking paths means that visitors can still be close to the habitats and see them flying and crawling around, however, the habitat stays well preserved.

Freeplay Within Sight

The central imaginative play areas, the pond and the river, are in the center of the dense vegetation clusters. This makes the kids feel safe and creates easy sightlines for the parents watching from the gazebo, picnic tables, and park benches.

Pathway Options

Multiple pathways with different pavement styles (stepping stones, decomposed granite, wooden bridge) create options for play and means for meandering. The paths cross the hiking trail at several points, allowing hikers and bikers to pass through and continue on their journey,

LARKIN PARK

Maia Cherin

Site Location

Larkin Park is located near downtown Claremont and is in the top 40% of priority census tracts from our model. The park is 9 acres and includes soccer fields, a softball field, basketball courts, a horseshoe court, a playground, a community center, and a senior center. It is adjacent to a middle school and senior living community.

Site Analysis

During my visit to the park, I observed that most activities were centered around the senior center and the soccer fields. Seniors relaxed on the back patio of the senior center and walked along the park's concrete paths, while parents gathered with their children at the soccer fields for practice. Between the senior center and the soccer fields, there was a spacious lawn area primarily composed of soil and a few well-established trees.

Unfortunately, this area lacked seating for seniors and families wanting to enjoy the greenery, and the only vegetation present was turf. I also noticed families navigating across the patch of dirt and lawn to reach the soccer fields, as no formal pathway connected them to one of the parking lots. I felt this area of the park would greatly benefit from a design intervention, as it is centrally located and attracts more activity than other areas.

Project Goals

My observations at Larkin Park led me to establish the following goals for my design.

1) Draw in more visitors to Larkin Park

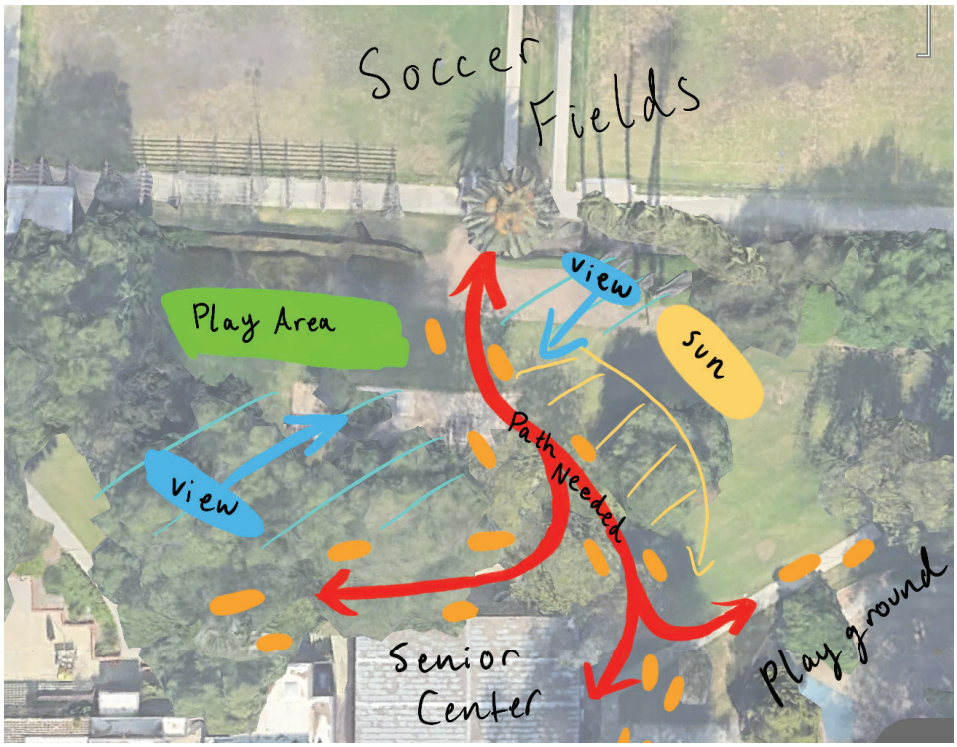
2) Create a habitat that Arthropods will thrive in

3) Design a garden that is relaxing and comforting for seniors & families

4) Encourage connection and interaction between children and seniors

5) Include educational signage on Arthropod species and habitat elements

Site Analysis Diagram



Current Site Conditions

Proposed Site Design

For my design, I adopted a curvilinear approach to circulation throughout the garden. I expanded the concrete area in front of the senior center to facilitate easier access for individuals with limited mobility, allowing them to reach the perimeter of the garden more comfortably. The remainder of the garden features decomposed granite paths alongside a wood plank walkway that runs through the center of the planting area, serving as the main route to the soccer fields.

Throughout the garden, there are multiple seating areas equipped with two-way benches and tables. This design allows visitors to choose whether they want to face the garden or away from it. Each bench includes tabletop surfaces so that people can enjoy lunch in the garden, or students from nearby schools can do their homework after school.

Two seating areas are thoughtfully placed within the densely planted sections of the garden, offering parkgoers a chance to immerse themselves in a space surrounded by greenery. I envisioned these areas as fun spots for kids waiting for their siblings to finish soccer practice. In one of these areas, there is a Manzanita tree at the center, featuring an insect puddling station underneath, accompanied by signage educating visitors about the benefits of puddling stations for Arthropod species.

Along the pathways, there are various educational signs highlighting different Arthropod species present in the garden. At the western entrance to the garden, next to the wood plank path, there will be a welcome sign displaying the Arthropod Garden Certification sign, along with a scavenger hunt list featuring images of the various Arthropod and plant species present in the garden. Additionally, the garden will include a lending library of seeds and books and an insect hotel that educates visitors on a small way to improve Arthropod habitats in their home gardens.

The selected plant species are based on the Arthropod Garden Certification prepared by our studio. Western Redbud, Laurel Sumac, Cherry, and California Buckeye trees will be planted to provide additional shade throughout the garden. The garden will be densely populated with other native species listed in the certification, primarily from the chaparral plant community.

LARKIN PARK

Maia Cherin

Perspective Sketch

Current Conditions

Certification Criteria Met

The following plant species and habitat elements were included in this design to satisfy the habitat certification criteria.

Trees/Large Shrubs (2+ required)

- *Aesculus californica* (California Buckeye)
- *Prunus* species (Cherry)
- *Arctostaphylos* species (Manzanita)
- *Malosma laurina* (Laurel Sumac)
- *Cercis occidentalis* (Western Redbud)

Annuals/Perennials (5+ required)

- *Asclepias* species (Milkweed)
- *Penstemon* species (Beardtongue)
- *Phacelia* species (Phacelia)
- *Salvia apiana* (White Sage)
- *Lupinus succulentus* (Arroyo Lupine)
- *Achillea millefolium* (Yarrow)

Maintenance & Care

- Opted into all maintenance and community care pledges
- Additional educational signage on species present in the garden
- Scavenger hunt signage
- Habitat element signage

Medium Shrubs (5+ required)

- *Ceanothus* (Lilac)
- *Artemesia californica* (Sagebrush)
- *Adenostoma fasciculatum* (Chamise)
- *Baccharis pilularis* (Coyote Bush)
- *Rosa californica* (California Wildrose)

Habitat Elements (6+ required)

- Insect watering station
- Puddling station
- Flowering plants for pollinators
- Insect hotel
- Water retaining mulch
- Stone piles on the ground

California Buckeye
(Hunt, CC BY-SA 4.0, Via Wikimedia Commons)

White Sage
(Rusk, CC Attribution 2.0, Via Wikimedia Commons)

Western Redbud
(Shebs, CC BY-SA 3.0, Via Wikimedia Commons)

California Wild Rose
(Schmierer, CC 0, Via Wikimedia Commons)

Arroyo Lupine
(The Marmot, CC Attributions 2.0, Via Wikimedia Commons)

Yarrow
(Llysmlv, CC Attributions 4.0, Via Wikimedia Commons)

PHILADELPHIA PARK

Luke Duncan

Site Background

Philadelphia Park is located in South Pomona within District 3 which is a primarily industrial area. The park is situated within a residential area and borders an elementary school. The park contains bathrooms, a community center, basketball courts, a play structure, soccer fields, picnic tables, and grills. There are two entrances into the park, one from the north side of the park with a shared parking lot of the school and one from the south side from a cul-de-sac in the neighborhood. The park is majority turf with trees planted throughout, reflecting many characteristics of a typical Pomona park.

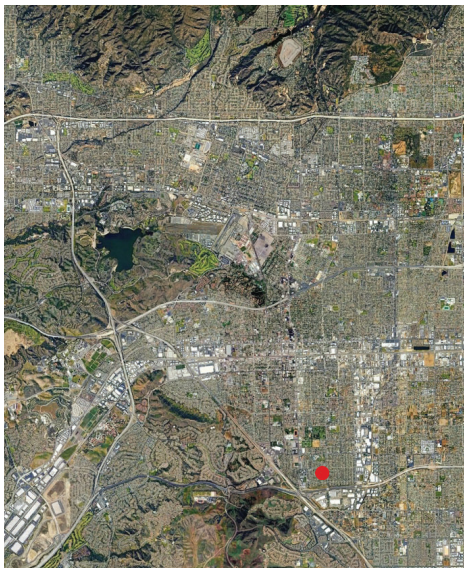
After speaking with Dr Kyle Brown and Damiana Aldana I was provided with some background on the park and its main uses as well as its significance within the community. The park is most frequently used by soccer leagues who utilize the soccer fields almost every evening and weekend. The park is additionally used by students when they get out of school and there is some after school programming offered in the community center. Every year there is an annual Easter egg hunt that draws in large amounts of children and parents into the park as well.

Council member Nora Garcia was helpful in providing background on the park and gave me a significant amount to consider when following through with the design proccess. She provided me with some insight into some changes that were in the proccess of happening regarding a new play structure being built closer to the baseball diamond. Community members had voiced concern about having their children playing at a play structure across the park while watching other kids playing baseball. With enough communityy advocacy, a new play structure was approved to be built closer to the baseball diamond. The city is in the proccess of locating cost and funding for this new addition to the park.

The background for this proccess was particularly insightful for me because of my interest in the reality of this park being

built in the near future. Council member Garcia let me know the origin of this idea and how Clean and Green had met with her to discuss the nonprofit creating this garden. It was proposed as an educational community garden that would be built as a memorial for a community member that had recently passed away. The intent was to have community members and nearby residents take part in planting and maintaining the garden, ultimately creating a space for stewardship.

Council member Garcia also let me know about areas of concern and other considerations to take while designing. One of the main areas to consider she mentioned was to ensure that the soccer games would not be negatively impacted by the garden. Because the area is mostly used for its soccer fields, preserving the use of these fields was a critical point she made to consider in my design. She additionally mentioned having the garden be relatively cost efficient as the source of funding is not yet none at this point. Prioritizing the preservation of the soccer fields and the cost of the project were to important points she made that were influential on my design.



Site Analysis

The location of my design is at the south end of the park near the entrance at the cul-de-sac. The site borders two residential properties and has easy access from the neighborhood. There are two large sport lights within the design area that are used for evening soccer practice. There is a mature ash and two pine trees in the area offering a significant amount of shade within the design area. Clean and Green recently planted three native trees in the area as well: a desert willow (Chilopsis linearis), a sycamore (Platanus sp.) and an oak (Quercus sp.).

There is an existing dirt path that runs throughout the park and is significantly degraded. This path is a defining feature of the park as I have observed people running along this path during both of my site visits. This path frames the intended design area and will additionally act as a buffer for various action from soccer games and practices.

The soil was determined to be loamy clay from a ribbon test conducted at the west end of the intended design area during a site visit.

Design Goals

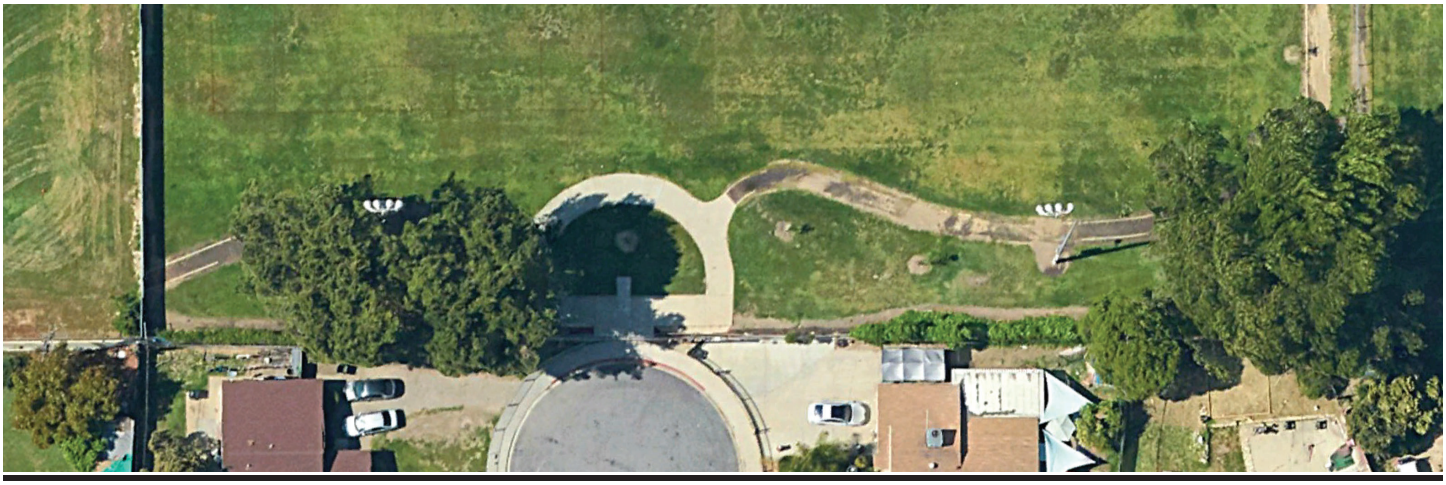
My first design goal is to create habitat that supports native ecology. My goal is to provide a foundation for arthropod species to thrive and from then on I intend for the site to become activated with birds, squirrels, lizards and other native species that reflect a healthy ecosystem.

Education is another priority of mine within this design. I aim to educate the public on insects, native plants, and ways to support arthropod populations. The education component is one of the most significant factors within my design as it will offer context for the meaning behind the garden as well as various design features that would otherwise be misunderstood, such as rock and stick piles, bare soil, native planting, and more. Through educating the public on the intentions of the garden I hope to provide a foundational space for people to learn about and connect with native ecology.

Prioritizing cost efficiency and practicality within my design is another goal that I aim to execute within my design. Because this is a park that Clean and Green plans on building in the future I intend on making it as affordable and doable as possible.

Providing a space for kids to explore, play, and learn in is another goal of mine. Because the parks close proximity to the elementary school I hope to provide a space for children to utilize and enjoy when school gets out. I additionally hope for the garden to be used by siblings during soccer games and act as a place of refuge for kids looking to escape the noise of soccer games.

My final goal is to foster a sense of stewardship for the garden among nearby residents. This is a very important goal as I intend to create a space that the community can take ownership of. Through getting the community involved in the planting install and maintenance of the garden I hope to create a space where people can reconnect with and learn about the importance of native ecology.



PHILADELPHIA PARK

Luke Duncan

Concept Plan

My concept plan depicts a planting plan utilizing over 16 species of native plants with callouts for additional design features.

The planting of this design utilizied all of the necessary planting from the arthropod certification document. The design additionally features two native trees which was another requirement of the certification document. Because of the large shaded areas within this design I have utilized many shade tolerant species as well as sun tolerant planting in the unshaded areas. The area bordering the residential property utilizes taller shrubs that can additionally serve as privacy screens for these homes.

The design features a refurbished decomposed granite path around the upper perimeter. This path is intended to be compacted decomposed granite offering ADA accessibility throughout the entirety of the path within the park.

A new path runs through the middle of the largest planting area. Within this path I have included untreated wood stumps and logs that will serve a dual purpose as seating and arthropod habitat.

The trails utilize untreated wood edging which will additionally serve a dual purpose as trail edging and insect habitat.

Arthropod nesting habitat (rock pile), Photo: Tracy O (Flickr)

Eriogonum fasciculatum, Photo: Jason Hollinger (Flickr)

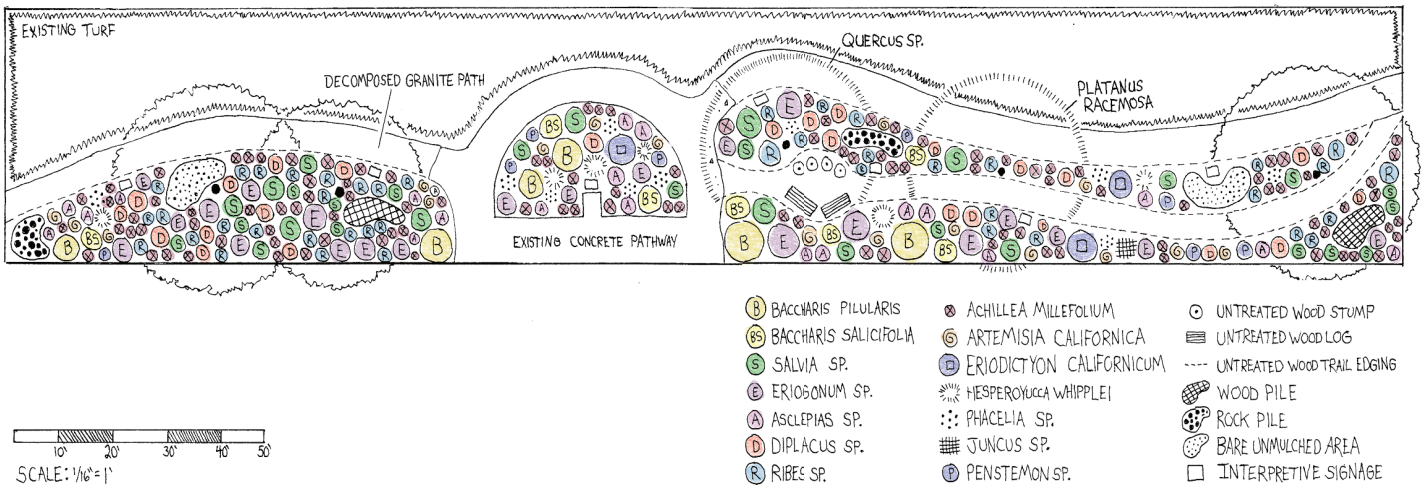
Rock piles, wood piles, and bare unmulched soil areas were placed throughout the design and will function as areas to support various nesting arthropod species.

Interpretive signage is another design feature that will be utilized throughout the site to provide context for various design features. This signage will help educate the public on native ecology and the importance of arthropods.

Baccharis pilularis, Photo: Franco Folini (Flickr)

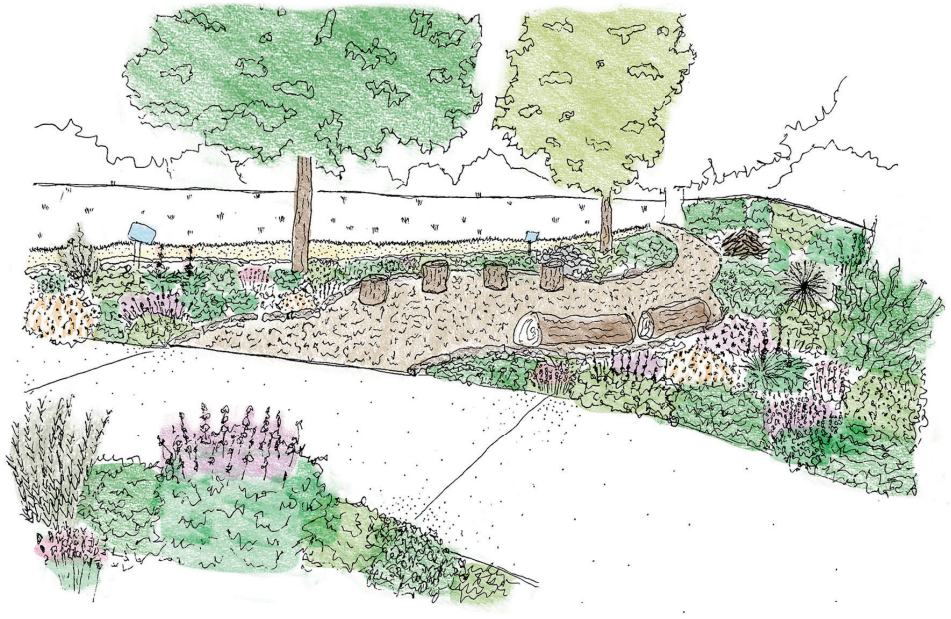
Quercus agrifolia, Photo: Henrik Kibak (iNaturalist)

Salvia mellifera, Photo: Unknown (Wikimedia Commons)



Concept Drawings

My first perspective drawing (right) depicts a view looking north east within the site. This perspective shows the shredded wood mulch trail running through the largest planting area. Within this area the untreated logs and stumps are depicted. This area is intended for resting, informal small community gatherings, and volunteer gardening days. The untreated wood trail edging can be seen throughout this perspective as well, offering a a border for trail and planting areas. The compacted decomposed granite path is visible in the background as well as mature versions of the native trees planted by Clean and Green.



My second perspective drawing (below) shows the semi-circle planting area in the foreground with decomposed granite path and additional planting area in the background. This drawing depicts a clear representation of the interpretive signage throughout the garden as well as one of the many stick piles located throughout the design. This drawing shows a clear representation of the dense layered planting that provides optimal habitat for arthropods and other animal species.

Both of these drawings depict a central view within the site, offering a perspective of how the garden will look from within the design area.

Advocacy and Action

After meeting with council member Nora Garcia, she provided me with a framework for how a project like this would become a reality.

She stated that the most importat step towards bringing this project to life would be gaining community support. Garcia recommended pitching the design to nearby residents, people involved in the soccer league, elementary school families, and various other community members.

After gaining support from community members, advocacy would need to occur from a variety of different perspectives to show the support for the design and necessity of this addition to the park. These community members would need to advocate to city officials and council members in order for the city to view this as a priority.

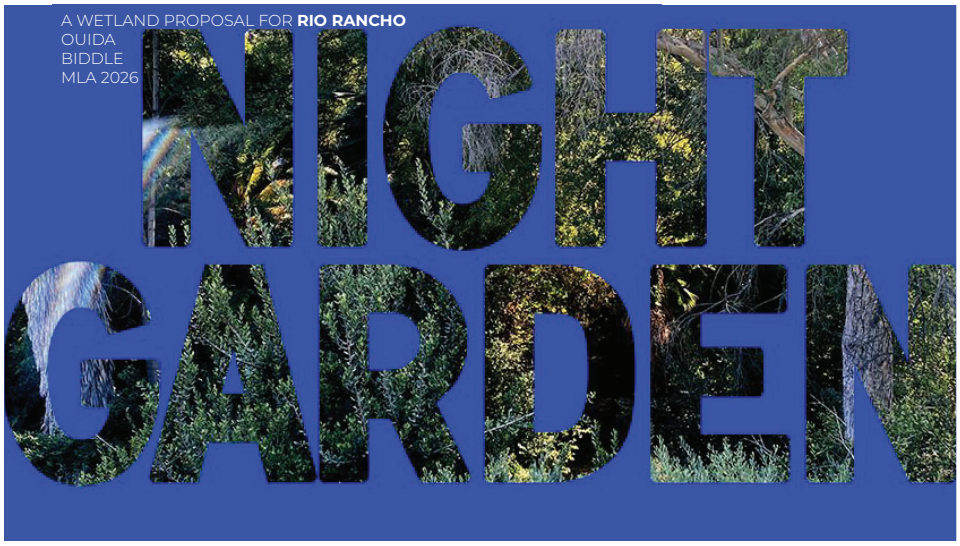
Once the community members have organized and advocated for the cause, the city will then decide on whether the idea is worth prioritizing.

Once the project gets city approval, determining the project cost will be the next step. The city will have an estimate put together for the cost of this project and will then move on to locate funding. Funding can come in a variety of forms from federal, state, and city grants to donations to nonprofit support. In this instance it is likely that Clean and Green will provide some of the funding.

Once the funding is located then construction can begin. In this case construction will not require any heavy machinery and can be entirely done through the labor of volunteers. These volunteers would ideally be the community members and nearby residents who supported the project and would offer an opportunity for community members to take ownership of the space and become stewards of this garden.

RIO RANCHO WETLAND

Ouida A. Biddle



A Proposal for a Night Garden

We propose to name the park the Night Garden wetlands. This is intended to connote a number of impressions: an air of mystery, good lighting, perhaps an atmosphere less designed for humans and more considering the needs of nocturnal creatures. An area looked after, cared for, and used in the capacity of natural trails to be occupied during the day by humans, and left alone at night for the animals. The agenda is to be a pro- active preserve.

The Rio Rancho subdivision was established sometime after 1965 during the development of suburbs occupying a parcel of Phillips Ranch. This parcel was in turn named after the richest man of the 1890s in Los Angeles County.

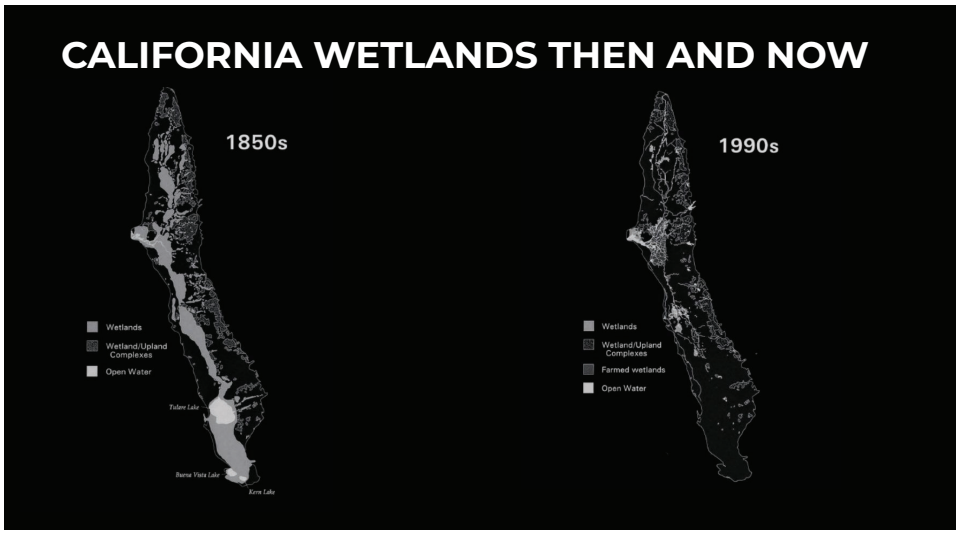
California's Wetlands

Between the 1850s and the 2020s, California has lost 90% if it's wetlands due to unchecked sub, bourbon development, and the dominance of monocultural agricultural practices which have prioritized human development at the expense of critical ecosystems.
Cultural perception of the value of wetlands didn't begin to shift or even have a language before bird migratory paths were mapped in the 1920s. Farmers were paid by the federal government to drai estuaries and use them as farmland. [1 The public viewed such areas as swamp murky and fearful.

The state of earth's biodiversity, habita and freshwater systems is far beyond a local issue. As such, there is extensive international interest in fostering both public interest in wetland conservation and funding new models of restoration

Site Context

The site is 15 acres, with a total of thre miles of trail that could be looped into additional three and a half miles of par path across Phillips Rd. The site already has an impressive stand of a wide variety of mature trees, both native and invasive. Care should be taken to root out invasive



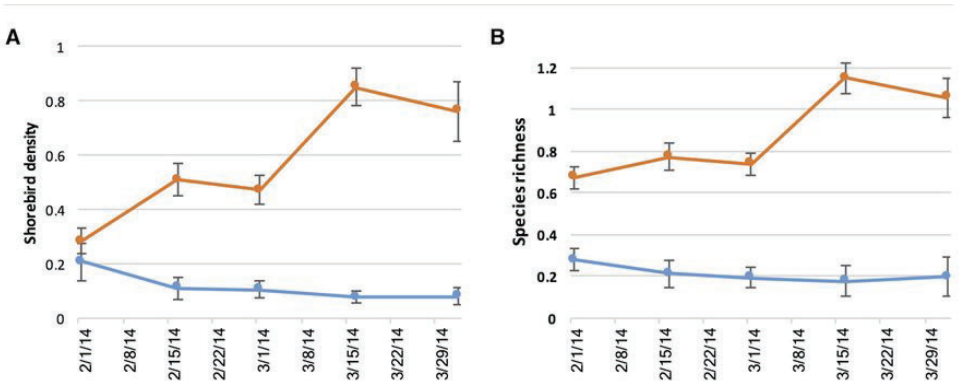


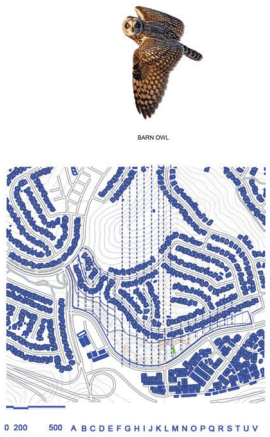
Fig. 4 Observed shorebird densities and species richness.
Biweekly shorebird densities per hectare (**A**) and species richness (**B**) in enrolled fields (orange) and unenrolled fields (blue) for 2 February to 12 April 2014 (mean ± SEM).

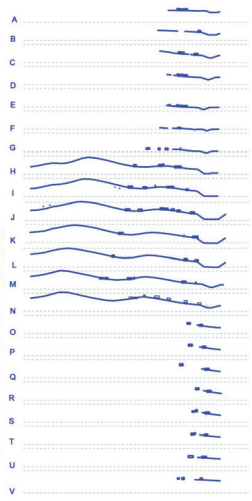
[1] Garone, Philip. The Fall and Rise of the Wetlands of California's Great Central Valley, University of California Press, 2011. ProQuest Ebook Central

[2] Cole, Lorna J., et al. "Managing Riparian Buffer Strips to Optimise Ecosystem Services: A Review." Agriculture, Ecosystems & Environment, vol. 296, July 2020, p. 106891. ScienceDirect, https://doi.org/10.1016/j.agee.2020.106891.

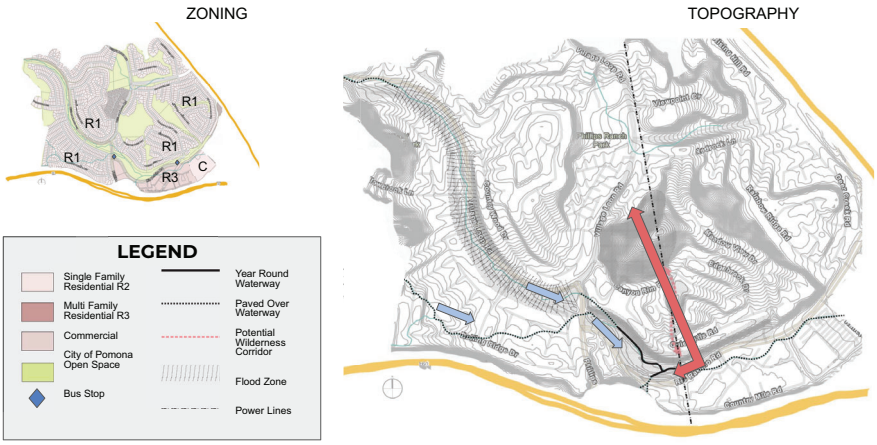
[3] Reynolds, Mark D., et al. "Dynamic Conservation for Migratory Species." Science Advances, vol. 3, no. 8, Aug.

WILDERNESS CORRIDOR





ANALYSIS: SITE CONDITIONS



xpansion into the new flooded area. The te is bisected with a utility easement, nd is also adjacent to a public park. here is a swale that dips below street lev- , and some grade running north- south.

he Night Garden project aims to offer esidents access via trails to the site while nriching the existing habitats and offer- g an up-to-date dry toilet system and mposting center, which will cultivate ative plants to both the wetland habitat nd act as an education center for the eneral public. Study show that both iodiversity and density of bird popula- ons creases greatly in the presence of etlands, [2] and that wetland restoration rojects benefit from the use of green- house by allowing insects to pupate and younger plants to mature more quickly with composting prior to planting.[3]

In addition to being a naturally successful potential site for wetland reclamation due to its existing open string water fed by the Chino Creek, this site also has potential as a wilderness corridor spanning sever- al miles thanks to the utility easement. Raptors, songbirds, bats, coyotes, moths, and butterflies are just a few examples of creatures who might benefit from this corridor, and offer their capacities for pollination and pest control.

Built Systems

We propose a six stall public restroom and greywater system for sink water, as well as a two story split composting chamber. The design is an earthen building con- structed of stacked tubes, and an open air ventilation structure assisted by fans and separate ventilation for the lower cham- bers. These are aerated and mixed with mulch before being integrated into dirt for planting. Consideration has been given to the topography of the site ensuring the wetland zone is at a good distance and elevation from the facilities.

2017, p. e1700707. DOI.org (Crossref), https://doi.org/10.1126/sciadv.1700707.

[4] Hartin, Janet, et al. Sustainable Landscaping in California. Mar. 2014. escholarship.org, https://doi.org/10.3733/ucanr.8504.

[5] di Prima, Diane, Revolutionary Letters, 2007, https://theanarchistlibrary.org/mirror/d/dd/diane-di-prima-revolutionary-letters.pdf

RIO RANCHO WETLAND

Ouida A. Biddle

Life Chant by Diane di Prima (1971)

cacophony of small birds at dawn
may it continue
sticky monkey flowers on bare brown hills
may it continue
bitter taste of early miner's lettuce
may it continue
music on city streets in the summer nights
may it continue
kids laughing on roofs on stoops on the beach in the snow
may it continue
triumphal shout of the newborn
may it continue
deep silence of great rainforests
may it continue
clumsy splash of pelican in smooth bays
may it continue
astonished human eyeball squinting thru aeons at astonished nebulae who squint back
may it continue
may the wind deal kindly with us
may the fire remember our names
may springs flow, rain fall again
may the land grow green, may it swallow our mistakes
we begin the work
may it continue
the great transmutation
may it continue
a new heaven and a new earth
may it continue
may it continue [5]

PROJECT GOALS + OPPORTUNITIES

LOOP: Offer residents **access** to site while enriching existing habitats

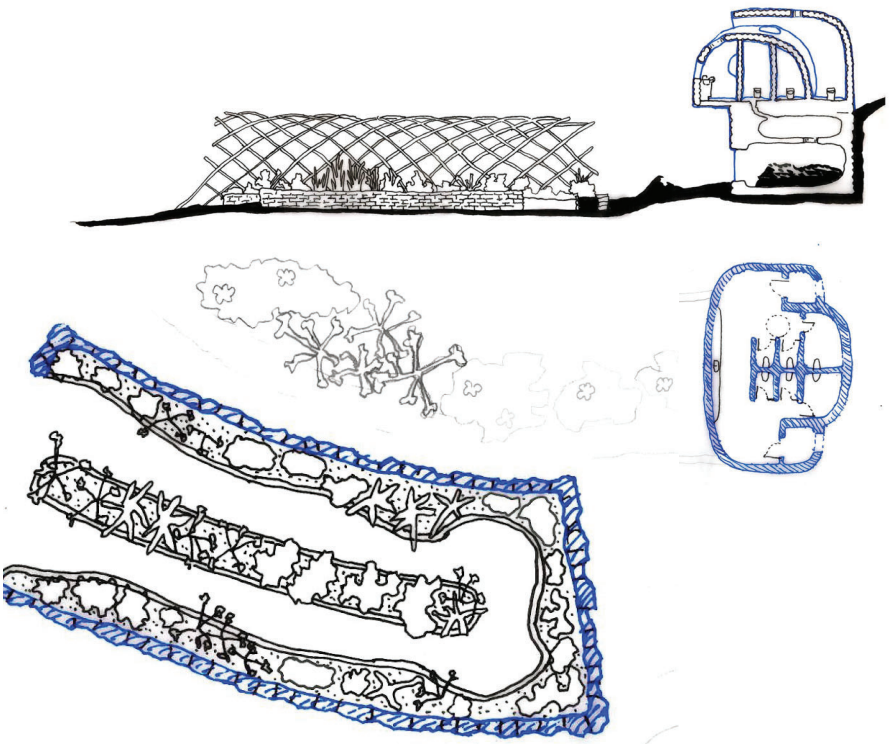
BUILDING: Create seating, composting restroom, and greenhouse situated around a wetland pond designed to support **arthropods**, **birds** and **bats**

OPPORTUNITY: The Nature Conservancy and Dynamic Habitat Funding

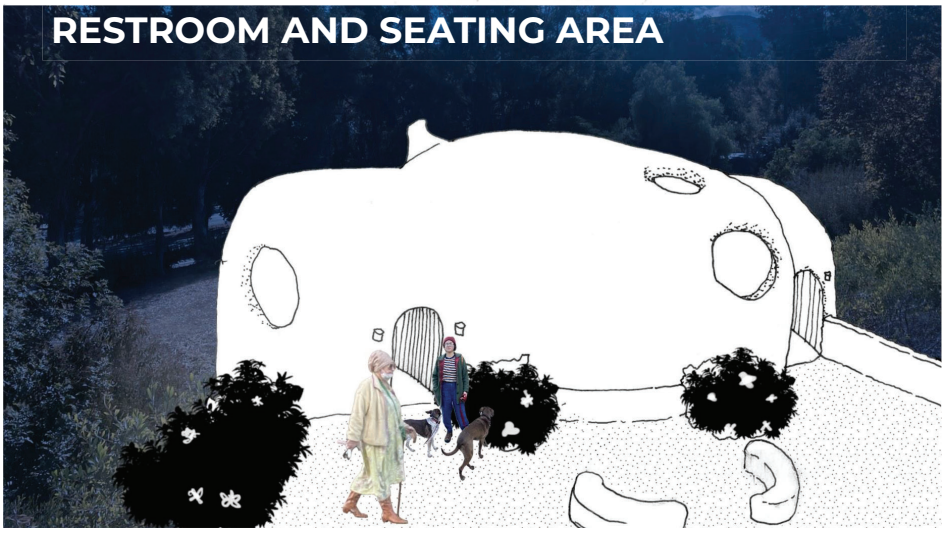
FIELD REPORT: EXISTING HABITAT

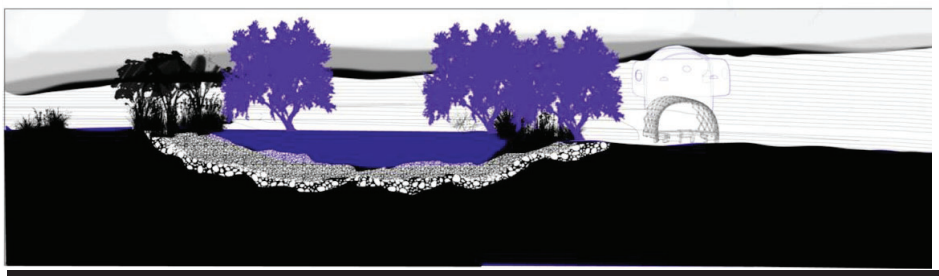
Area: 15 Acres
Date / Time: November 11, 2024, 2 pm
Weather: Sunny, 68, low wind

RESTROOM AND GREENHOUSE



RESTROOM AND SEATING AREA





Certification

As trees are so numerous on site, most recommended planting would be wetland grasses and supporting understory.

Trees

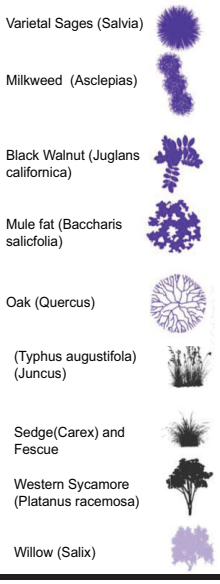
Alder
Oak
Willow
Sycamore
Sumac

Shrubs

Buckwheat
Lilacs
Baccharis
Bladderpod
Bladderwort
Rosa Californica

Grasses

Fescue
Milkweeds
Penstemon
Bulrush



WHEELER PARK

Sergio Saldana

Site Analysis

Located in Claremont, Wheeler Park is sandwiched between residential areas on all sides and is situated right next to an elementary school. The park features typical amenities commonly found in most parks, such as a playground, a community building, a mural created by children from the neighboring school, a pickleball court, and a baseball field. It also has various open grassy spaces with numerous trees throughout, including California sycamores and black walnuts.

Though the park is welcoming and open, there are opportunities to implement an anthropod garden and create a habitat that is inviting to both humans and arthropods.

An arthropod garden at Wheeler Park could support pollinators and educate the community, enhancing both biodiversity and the park's appeal.

Project Goals

Goal #1: Collaborate with the nearby school to create student-designed murals.

Partner with the local elementary school to engage students in designing and painting murals. This project would beautify the park, reflect community culture, and foster pride and creativity through workshops with local artists.

Goal #2: Establish a public community garden.

Develop a garden where residents can grow fruits, vegetables, and herbs. The garden would promote sustainability, healthy eating, and social interaction while hosting workshops on gardening and composting.

Goal #3: Incorporate a dome-shaped gathering area and playful mounds.

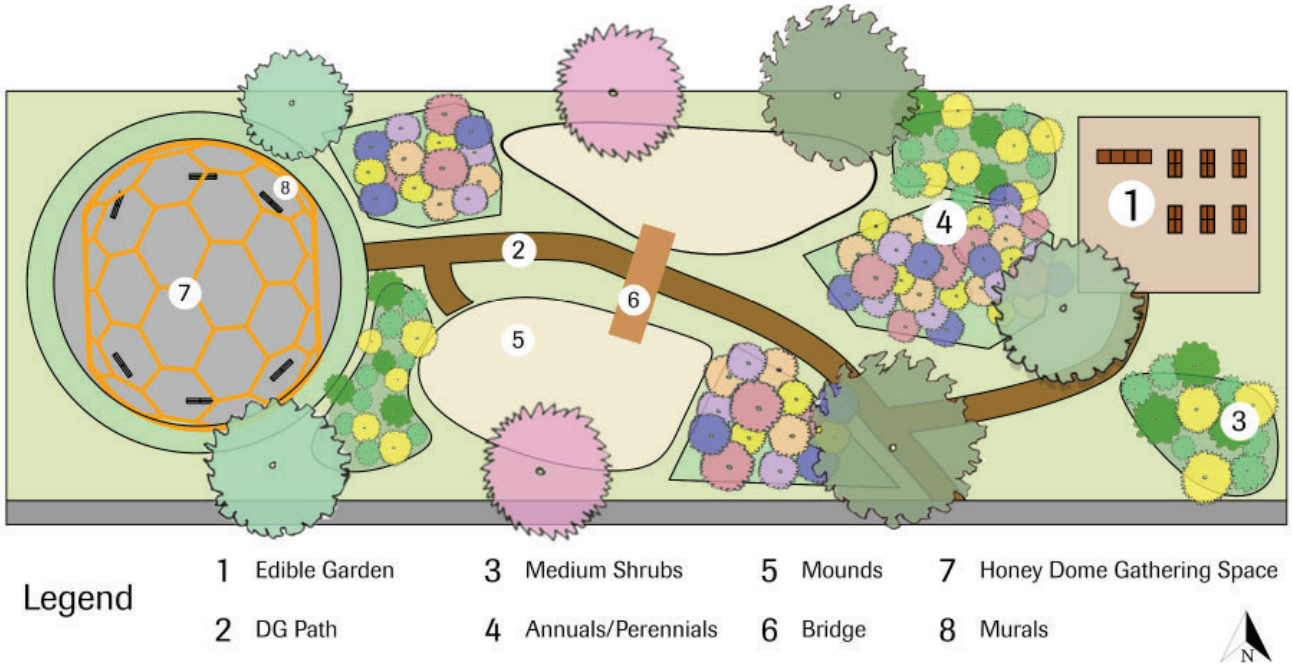
Add a shaded dome for community gatherings and undulating mounds for children's imaginative play. These interactive features would create a dynamic and welcoming space for visitors of all ages.

Goal #4: Develop a certified pollinator-friendly garden.

Create a native plant garden to support bees, butterflies, and other beneficial insects. Educational signage and workshops would promote awareness of pollinators while enriching the park's biodiversity and ecological value.

Wheeler Park will include murals, a garden, interactive spaces, and a pollinator garden to engage the community and support biodiversity.

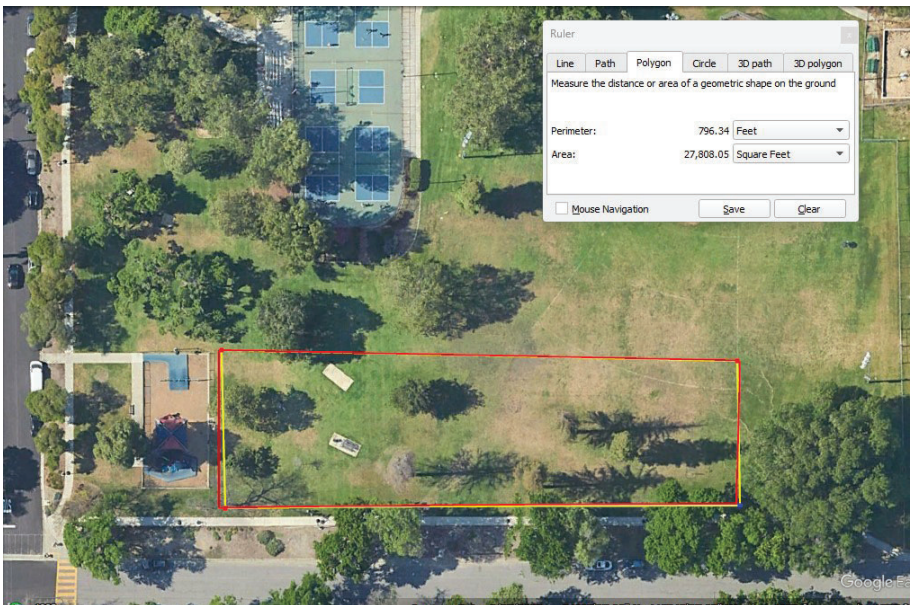
Site Plan



This site plan represents a thoughtfully designed outdoor space that combines functionality, aesthetics, and community engagement. At the heart of the design is the **Honey Dome Gathering Space (7)**, a circular structure featuring a honeycomb theme that serves as a focal point for visitors. Surrounding the Honey Dome are **artistic murals (8)**, enhancing its visual appeal. **A Decomposed Granite (DG) Path (2)** winds through the site, connecting key areas and ensuring accessibility.

To the right of the plan, the **Edible Garden (1)** offers a practical space for growing edible plants, while **Medium Shrubs (3)** and **Annuals/Perennials (4)** are strategically placed to add greenery and bursts of color throughout the site. **Natural Mounds (5)** create gentle landscape variations, and a **Bridge (6)** provides a crossing point along the DG path, adding both functionality and charm.

The layout balances natural elements, like shrubs and flowers, with functional spaces, promoting community interaction, aesthetic enjoyment, and practical use. Overall, the design creates an inviting and accessible environment that encourages gathering, exploration, and appreciation of nature.



Location

This aerial image highlights a rectangular plot of land outlined in red, measuring approximately **27,808.05** square feet with a perimeter of **796.34** feet, as calculated using the ruler tool. The area is relatively open, featuring scattered trees and a few small structures, likely benches or fixtures.

The plot appears to be part of a larger park or recreational area, as evidenced by surrounding green spaces, pathways, and adjacent urban infrastructure. This size and layout make it suitable for community use, outdoor gatherings, sports, or potential landscape development.

Perspectives

These images highlight the Honey **Dome Gathering Space (7)**, an open, geometric structure with **murals (8)** showcasing nature-themed artwork as a focal point for gathering and engagement. The layout invites visitors to explore, relax.

The second image shows the **DG Path (2)** weaving through lush **gardens (4)** and **gentle mounds (5)**, adding natural variation to the landscape. Visitors are seen walking, playing, and enjoying the vibrant plantings, enhancing the site's visual appeal and accessibility. Together, these features reflect the site plan's vision of creating an inviting space for recreation, community, and connection to nature.

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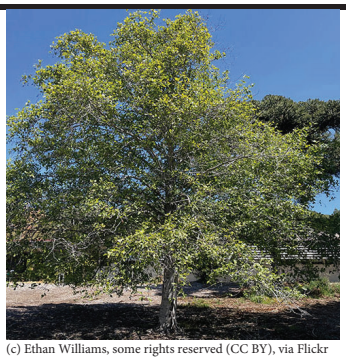
(c) Isabella Carter, CC0, via Pixabay reserved (CC BY)



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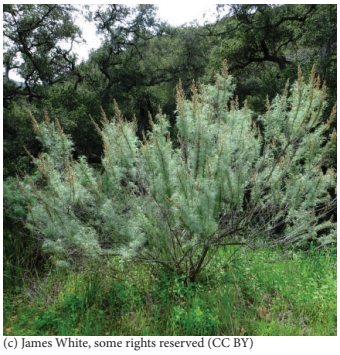
(c) Madeleine Claire, some rights reserved (CC BY)

(c) Kiloueka, CC0, via Wikimedia Commons some rights reserved (CC BY)

Dawn Endico, CC BY-SA 4.0reserved (CC BY)

(c) Mary, some rights reserved (CC BY), CC BY 4.0

(c) Jane S. Richardson, some rights reserved (CC BY)



(c) James White, some rights reserved (CC BY)

(From left to right) This plant list includes a variety of native trees, shrubs, and perennials that provide vital support for arthropods, including pollinators and other beneficial insects. Trees like the California Black Walnut, Western Sycamore, White Alder, and Western Redbud offer essential habitat, shelter, and food sources, such as leaves and flowers that support specialist insects and caterpillars. The Western Redbud, in particular, produces bright pink flowers that attract bees and butterflies in early spring.

Shrubs like California Wild Rose, Fairy Duster, California Lilac, and Buckwheat provide abundant nectar, pollen, and shelter, enhancing biodiversity and serving as a food source for a variety of insects. Perennials and annuals, including Milkweed, Monkey Flower, Yarrow, and California Sagebrush, play a critical role in attracting pollinators like bees, butterflies, and hummingbirds. Milkweed, for example, is essential for monarch butterflies, serving as a host plant for their caterpillars. Together, the combination of trees, shrubs, and flowering plants creates a rich habitat that supports pollination, pest control, and overall ecosystem health, ensuring a thriving environment for arthropods and the wildlife they sustain.

WILLIE WHITE PARK

Amy Garza

Site Selection & Existing Conditions

The Willie White Park is a public city park located in the top 20% of census tracts in our priority index. Away from any main roads, it is tucked in a quiet neighborhood nearby Harrison Elementary School. There are entrances off Valera Avenue and Battram Street as well as entrances from Verdugo Avenue and Sumner Avenue, which end in cul-de-sacs.

It currently features a community center, traditional playground with play equipment, small basketball court, concrete walking paths with lighting, and a gazebo with seating.

The landscaping is primarily turf grass and trees, with very little diversity. Most of the trees are large, mature Canary Island Pine trees with a few California Sycamore and Velvet Ash trees. These trees are large and offer plenty of shade nearby, however, further away from these trees the sun exposure is harsh. New trees were recently planted in the open areas that lack shade cover. The trees are mostly native Valley Oak species and will grow quickly reaching about 40 feet diameter in just 10 years' time.

During my site visits, the park did not have a lot of activity, but I spoke to community members who report frequent activity at the park, including use of the community center, playground, and open play areas. The park is sectioned off into four main turf sections by the concrete walkways that meander throughout. The section to the east is the largest and gets the most activity, including dog play and sports play. The two sections to the west side of the park are less utilized and tend to be vacant. The far southwest corner of the park backs up to Harrison Elementary School and at one point there was pedestrian access, however that has since been closed and there is now a cinder block wall. This creates some isolation in this corner that has led to some unwelcome visitors in the past. Occasionally homeless encampments have set up in this area, but now it is currently vacant.

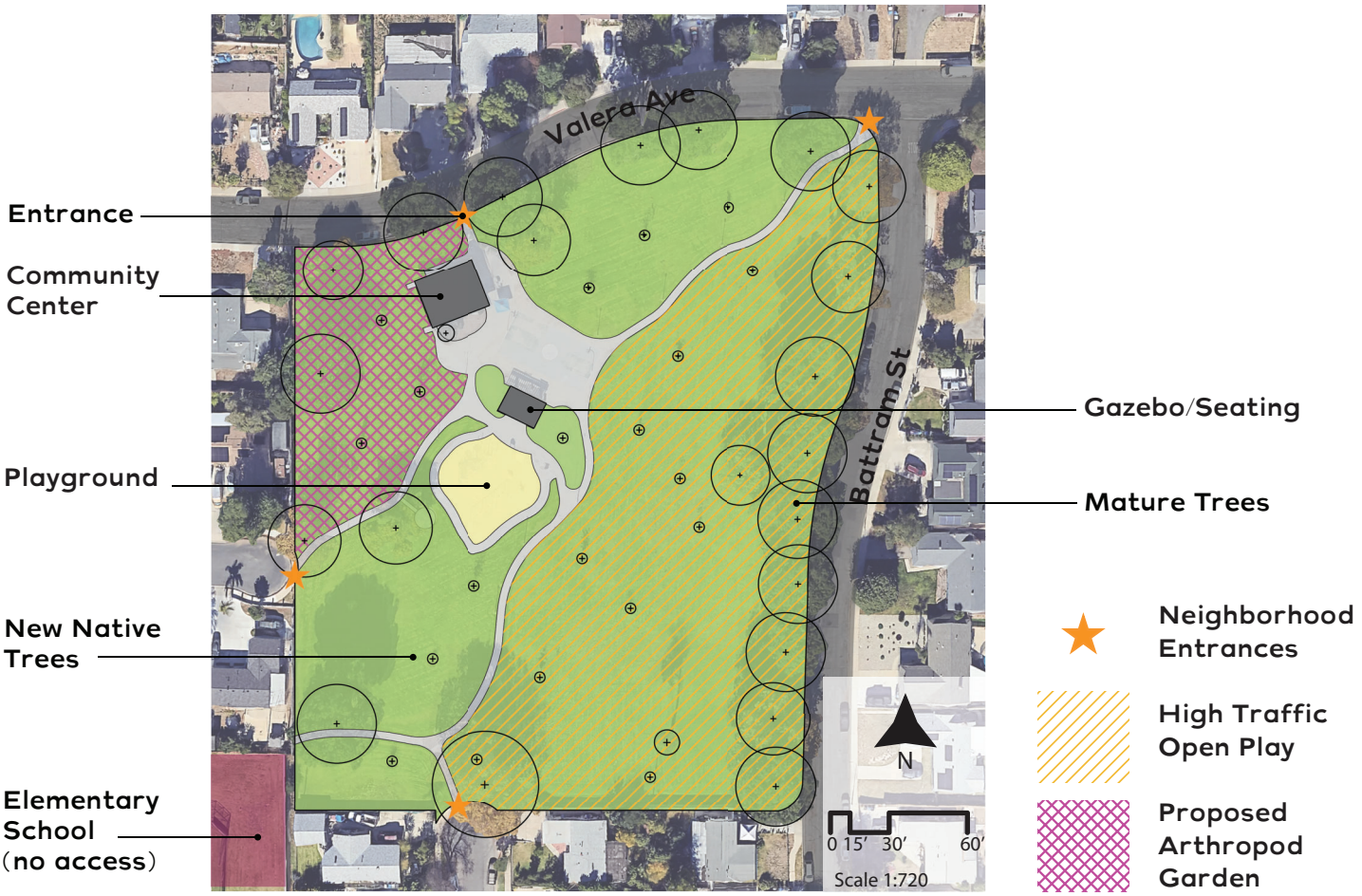
The main focus of activity seems to be centered around the community center and playground. These were both the focus of an art project completed last winter (2023) by artist RFX1 entitled "Sunshine & Sunbeams." The artist painted the community center building, concrete walkway surrounding the playground, and the gazebo pillars with murals featuring nature images in bright and fun colors.

Goals

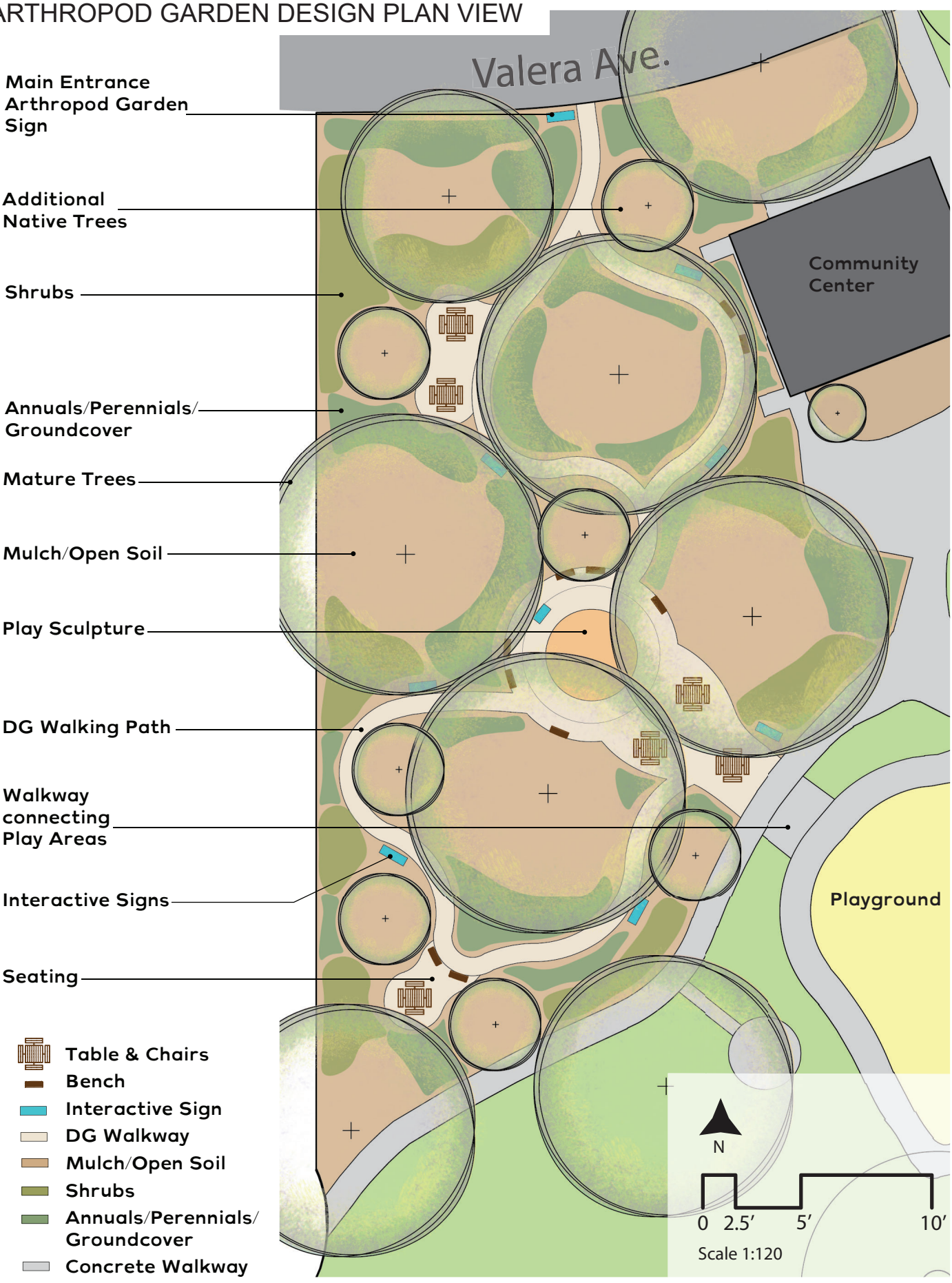
- Create an Arthropod Habitat
- Community Education & Engagement
- Activate the Space

I think a section of this park needs a purpose to increase use and activity in the underused areas. The section on the northwest corner of the park would be an ideal setting for Arthropods

EXISTING CONDITIONS PLAN VIEW



ARTHROPOD GARDEN DESIGN PLAN VIEW



WILLIE WHITE PARK

Amy Garza

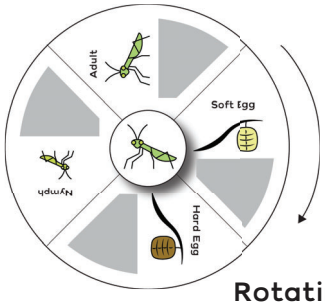
Main entrance sign for Arthropod Garden.

to thrive. Furthermore, we can use this space to educate the community about Arthropods and encourage community members to build their own Arthropod Gardens at home. too much open space and some of the space needs more purpose to increase activity and use. I suggest using the section on the northwest side of the park for an Arthropod Garden. The Arthropod Garden would create an ideal setting for Arthropods to thrive. In addition, the garden can be an opportunity to educate the community about arthropods. I also think the garden can serve as an example for how to build an Arthropod habitat in community members' own yards.

Features

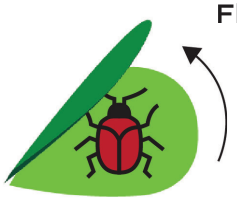
The target audience for this garden will be families with children aged K thru 8th grade. It will feature interactive educational signage that will coordinate with the current art featured at the park, including nature themes and bright colors

3D Relief Sculpture

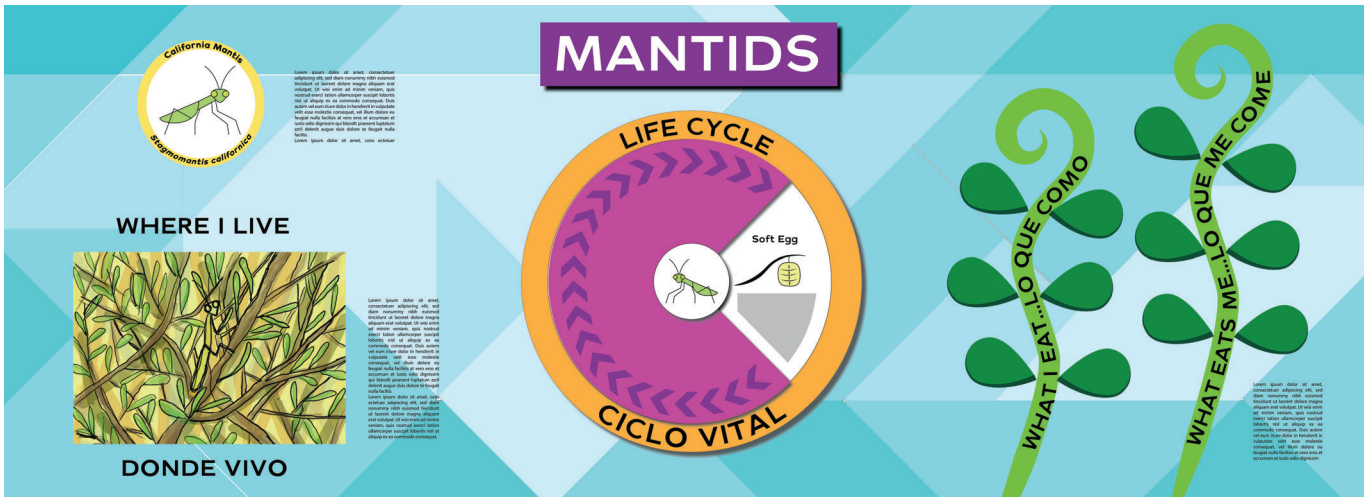


Rotating Wheel

Flip Sign



72''



24''

Interactive educational signage.

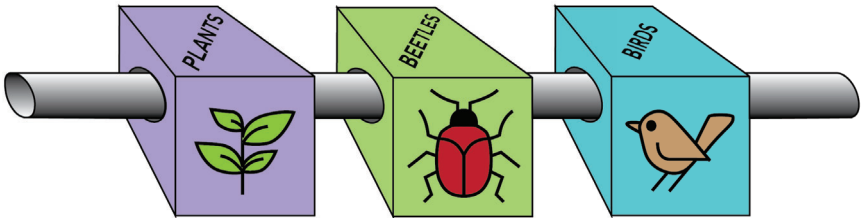
to attract people. The signage will be easy to read, be in English and Spanish, and encourage participation through touch. Signage will include a main entrance sign that introduces viewers to Arthropods and answers important questions: What are Arthropods? Why are Arthropods important? How to create an Arthropod garden. And where to find out more information.

Seven additional signs will be placed throughout the garden featuring information on specific Arthropod Orders, including Spiders, Beetles, Flies, Ants & Bees, Moths & Butterflies, Mantids, and Stick Bugs. Each sign will include information about that Arthropod's habitat, life cycle, food, and predators. It will also include information on local native arthropod species, such as the California Mantid. These signs will include a 3D relief sculpture, a rotating wheel, and flip signs to convey the information.

This garden will feature a play sculpture aiming to teach the community about the food web and have them explore the interconnectedness of life through play. The sculpture features a variety of intertwining aluminum bars similar to a jungle gym with large beads on each bar. The bars and beads represent food web connections, for example plants, arthropods, and birds.

The garden will feature a meandering path through densely planted native plant species. Additional seating will encourage viewers to sit, relax, and enjoy the views. Plants appropriate for the space will be used that will also attract and support local arthropod species. To further encourage community engagement through smell and sight, I recommend selecting plants that are fragrant and have showy blooms. Signs noting common and botanical names of plants will be placed strategically throughout the garden to educate viewers about native plant species. Plants I recommend using are California Black Walnut trees, Western Redbud trees, Buckwheat, California lilac, Rushes, Milkweed, Yarrow, Sages, and Arroyo Lupine.

There will also be additional features to benefit Arthropods. Water retaining mulch will be used around plantings and when possible, leaf litter will be allowed to remain on the ground to decompose naturally. In addition, I recommend restricting use of leaf blowers and motorized landscaping equipment which could damage or disturb arthropod habitats.



Beads demonstrating food web connections.

Play Sculpture with native plants and benches in the background.

THE MARTENS HOUSE

Rebecca Giesking

Site Analysis

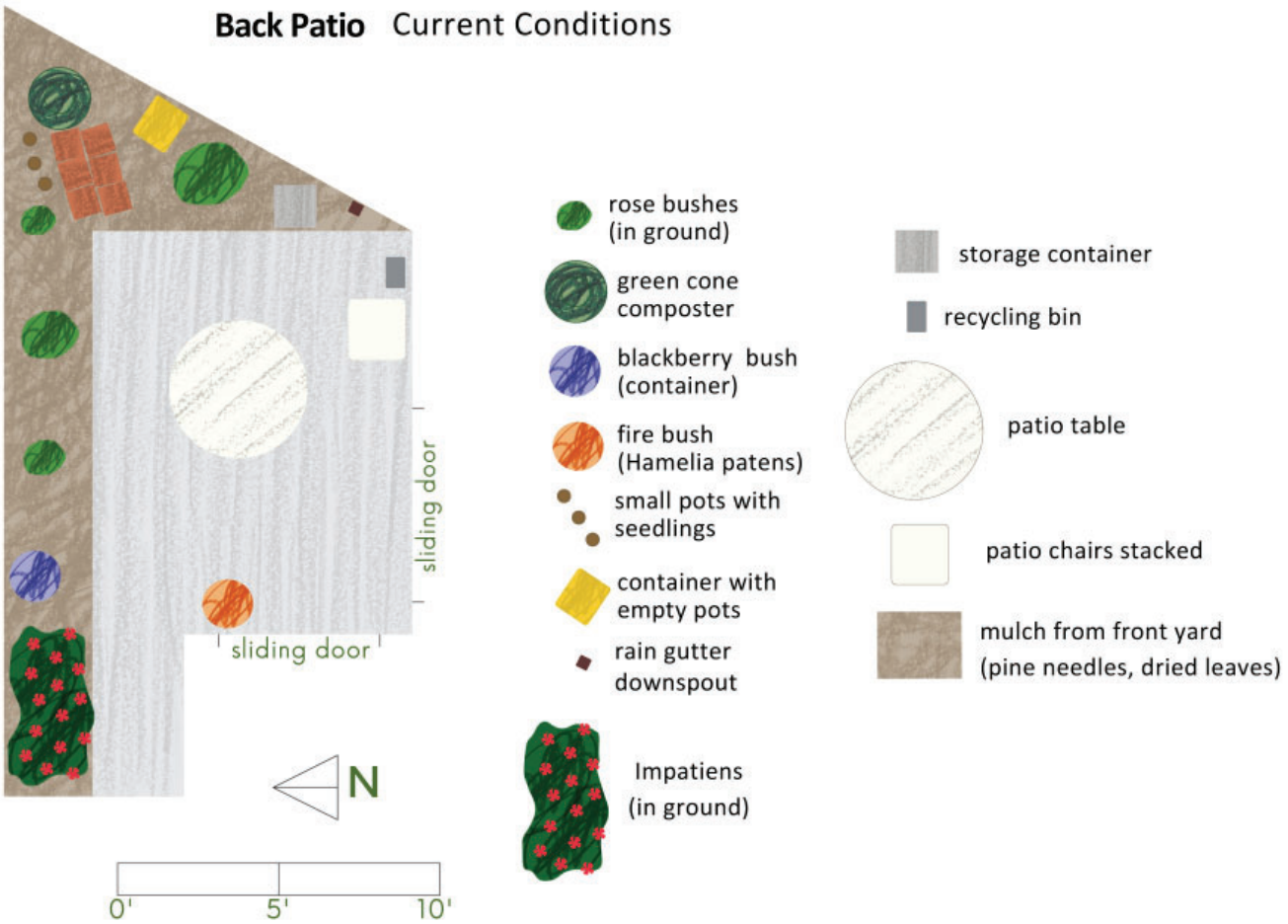
The Martens residence is located in a condominium community in the top 40% of the priority index, located just south of the 10 freeway and takes up about two blocks. Across the street to the south is an Elementary School, directly to the north is a shopping center including a grocery store and multiple car dealerships and the 10 freeway. There are a couple of small parks within walking distance that are primarily grass and sports fields.

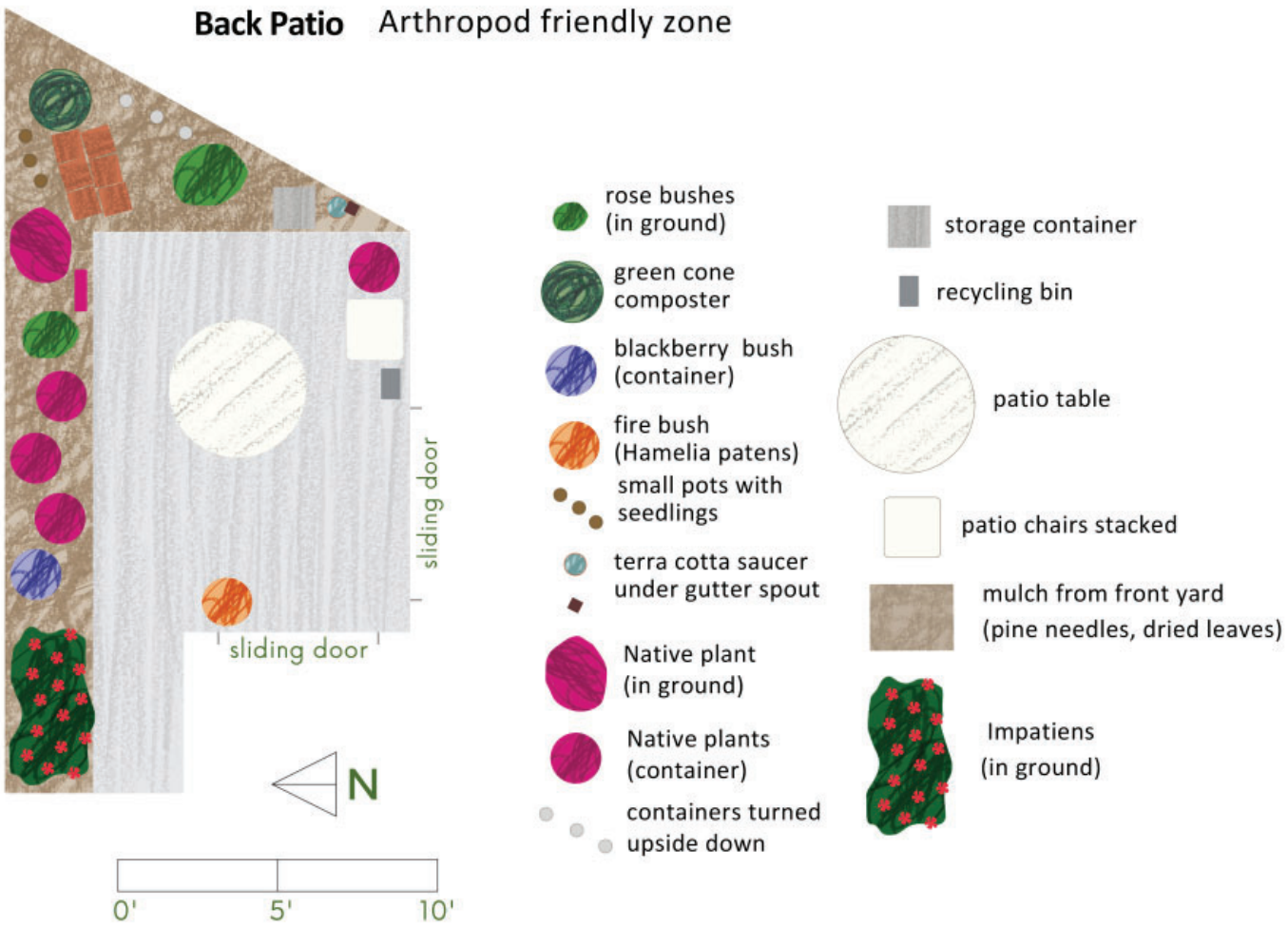
The Martens residence like the rest of the condominiums are grouped together with five other condo's, each having their own patio space and sharing a courtyard. For each group of six condos they share two small front yard spaces. After visiting the site, talking with the owner and taking into consideration the wishes of Clean and Green Pomona I chose to focus on the back patio space and the small front yards located throughout the community.

Back Patio

The back patio for the Martens residence is located on the north side of the building, is surrounded by a fence and is primarily paved. A small patio garden bed runs along the edge of the fence and is covered in leaf and pine mulch the owner has gathered from the front yard. There are currently four rose bushes, impatiens, and a green cone composter installed in the patio garden bed. There are two medium sized plants in containers, a blackberry bush and a firebush. There are a few containers with small seedlings growing, a couple of empty plant containers, and a bin full of small plant containers. There is a downspout drain from the roof that drains into the patio bed garden.

Based on the conversation with the owner and the Arhtropod certification checklist I encourage the following adjustments. Addition of one in-ground plant by the green cone composter and an additional four native plants in containers. Suggested native shrubs appropriate for containers in shade include *Eriogonum fasciculatum* (buckwheat), and *Ceanothus* 'Frosty Blue'. Suggested native annual/ perennials include *Achillea millefolium* (yarrow), *Salvia spathacea* (Hummingbird sage). The owner would already satisy the supllemental habitat elements required by choosing a flowering plant for a pollinator and the areas accumulated with leaf litter, but could also implement a water station by placing a terra cotta saucer with rocks in it under the downspout to catch water, place some of the empty plant continers upside down, and create a bug hotel from left behind items such as roof tiles, bricks, wood, pine cones, leaf litter, twigs, etc. The owner already satisfies the management pledges of mulching with the recommended materials, monitoring for invasive plant species, avoiding insecticides and herbicides and not using a leaf blower.

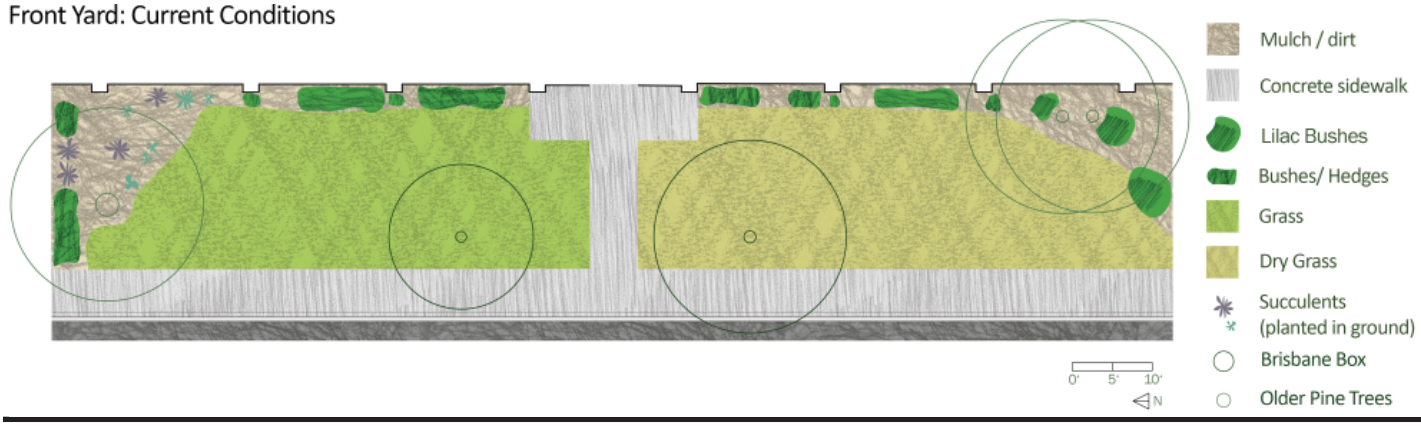




Front Yard

Current conditions for the front yards are displayed on the next page. The front yards I use as an example are west of condominium buildings. Primarily planted with grass, along with a variety of shrubs planted along the edges next to the buildings and the side edges of the lawns. There are primarily two trees planted throughout the condominium community, the Lophostemon confertus (Brisbane box) and pine trees. The pine trees appear to be the oldest trees on site, and when compared to previous years, are in the process of being replaced as needed. There are sprinklers placed throughout the complex along the center of the lawns. The front yards I analyzed had an area of mulched ground with succulents that the owner planted. The owner mentioned that the cost of maintenance of the lawn was a concern, they also mentioned that the front yard was not often used by the residents. While I was on-site both times, I saw residents out walking their pets walking along the concrete sidewalk. The owner requested that I put together four different options for the front yards that could be repeated throughout the complex that residents and the condominium board could choose from.

Front Yard: Current Conditions

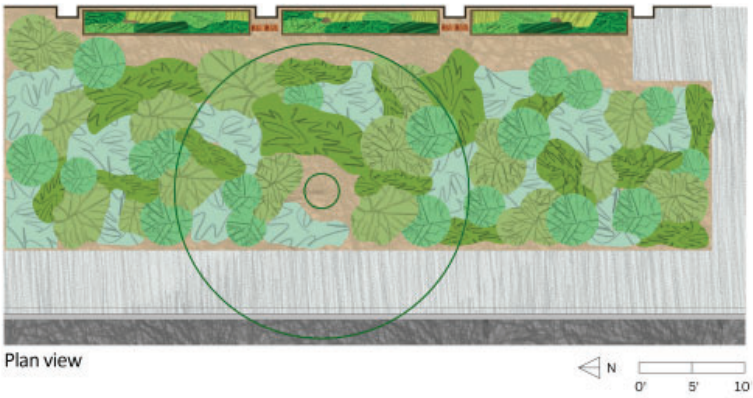


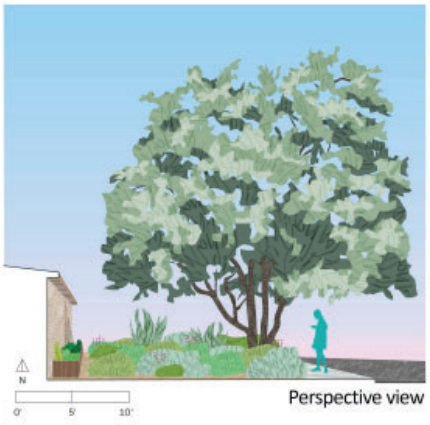
THE MARTENS HOUSE

Rebecca Giesking

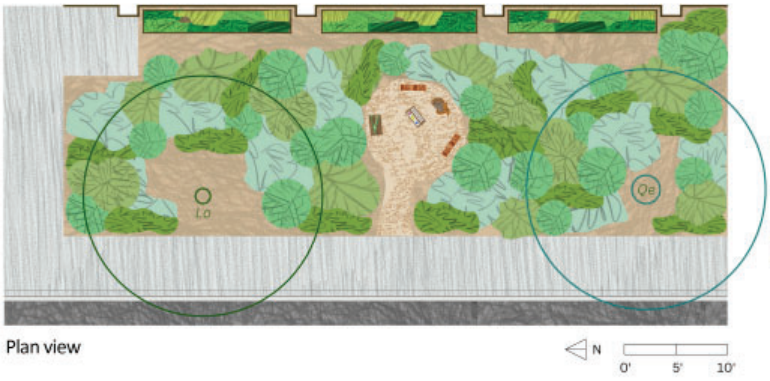
I chose to create four different options focused on providing a different benefit to the community. The first option is Native Habitat. This option focuses on expanding the native habitat space and planting within the woodland native plant community including one large *Quercus agrifolia* (coast life oak), and a variety of native shrubs, perennials and annuals. Suggested plant palette for all the front yard options would include *Baccharis pilularis* (coyote bush), *Ericameria nauseosa* (rubber rabbitbrush), *Baccharis scalicifolia* (mulefat), *Cercocarpus betuloides* (mountain mahogany), *Eriogonum fasciculatum* (California buckwheat), *Erythranthe cardinalis* (scarlet monkeyflower), *Frangula californica* (coffeeberry), *Rhus integrifolia* (lemonade berry), *Salvia spathacea* (hummingbird sage), *Solidago velutina ssp. californica* (California goldenrod). This design, as well as all the others, would also include planters, one for each condominium, that the residents could choose to take care of and plant what they like. The second option is Community Connection that would provide a community board that residents could use to post local events, as well as recent bird and Arthropod sightings, a bin to share plant clippings and seeds, a mulch pile to pull from to use for their planters or patios, and 'bug hotels' made from discarded items that residents and community members could help maintain. The third option is the Walking Path that would provide an alternative path instead of the concrete sidewalk through the front yard for those who walk their pets. The fourth option is the Outdoor Lounge that would provide multiple seating areas that residents could sit in outside. The hope is that this would encourage residents to appreciate the front yards and utilize them more, while providing an opportunity to interact with their neighbors.

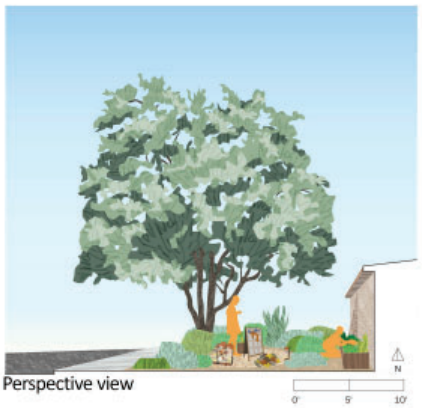
Front Yard: Native Habitat



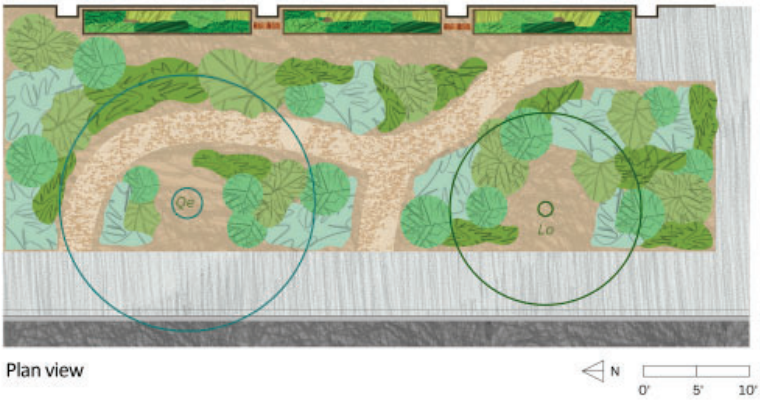


Front Yard: Community Connection





Front Yard: Walking Path

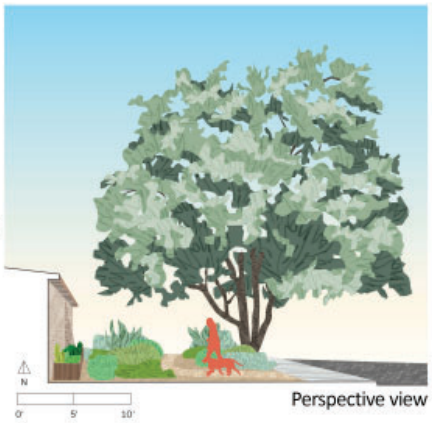


Plan view

DG path

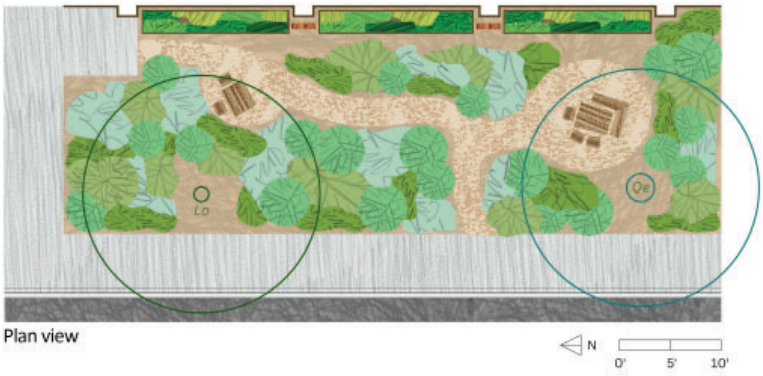
Qe *Quercus engelmanii*

Lo *Lophostemon confertus*



Perspective view

Front Yard: Outdoor Lounge



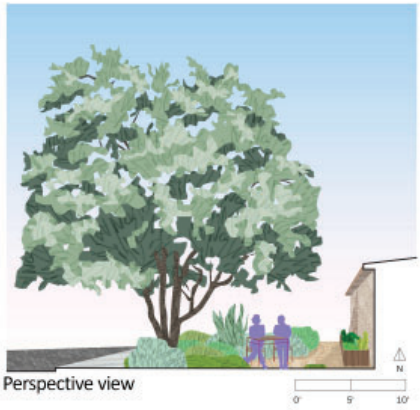
Plan view

DG path

table and chairs

Qa *Quercus engelmanii*

Lo *Lophostemon confertus*



Perspective view

Implementation and initial management would take great effort and time. I would suggest to first start with removal of the lawn through sheet mulching if appropriate for the type of grass on-site. This process takes many months, and it is suggested to start prior to summer when the heat and layers of paper/ cardboard, and organic materials will help to smother the grass. If appropriate the bushes and or pine tree could be removed prior to this process to be used as the mulch placed on top of the paper/ cardboard. This process does require some management, cnps.org provides great information about the process. This process can take up to a year depending on the grass and other conditions, so you may want to do this process in stages throughout the condominium community rather than all at once. While you are in the process of sheet mulching, the planters in front of the building could be installed to allow for residents to begin planting, or to have some planting and greenery present in case there are concerns regarding aesthetics. DG paths could already be installed as well, so that the pathway, outdoor lounge, or community connection could already be present. Once completed, this additional native habitat space could greatly increase the amount of birds and pollinators in a neighborhood lacking native habitat space.

THE NEAULT-SUTTON HOUSE

Danny Gross

The Site

The Neault-Sutton House is a single-family home located in the top 20% of census tracts in our priority index. Mike and MJ, the owners of the house, are members of Clean & Green Pomona, and excited to see their yard reimagined as an arthropod friendly habitat.

Before meeting with the homeowners, I took a quick drive through the neighborhood to better understand the landscapes in the area. I noticed a lack of native vegetation on front yards and I did not see any other certificate-based program signs. A more thorough drive could have revealed more, but time was a constraint during this meeting.

Upon meeting the homeowners, I was given a thorough tour of the property. The property outside of the house is verdant, but lacked native vegetation and arthropod friendly habitat features. A large front yard is composed of two grassy areas. A furnished patio is the focal point of a large, turf-based backyard. During our meeting, we were visited by many hummingbirds.

After speaking with the homeowners, and touring the property, I recognized three potential sites for an arthropod friendly garden. In order to better convey my designs, I named them “The Front”, “The Rose Garden” and “The Patch”.

The Front

The front of the house provides ample opportunity for the construction of an arthropod friendly habitat. It also provides a great opportunity for community education and activation with regards to wilding the yard space.

It currently is split into two by the driveway. On the larger portion sits a pecan tree, which provides great shade. The smaller portion has a young smoke tree, and the rest remains grass. It is hugged by some shrubbery at its border with the neighboring house.

The smaller patch was selected for the design. First, it is further from the house, providing an opporutinty for the public to enjoy the garden without disrupting the homeowners’ privacy. Secondly, the smoke tree is the smaller of the two trees, leaving more room for landscape changes. Lastly, the smaller size will require less capital for potential turf removal and planting.

The Patch

The Patch is a portion of the backyard measuring around 450 square feet. It is almost exactly south facing, and lacks vegetation of any sort, meaning it gets quite hot regardless of the time of year. There is a door to an extra room of the house that is located in this area. Pieces of varying sizes of concrete are laid outside the door, creating an abstract patio.

The HVAC system is also located in the Patch. A nicely-sized bougainvillea hugs the water-heater shed, while the AC condenser sits adjacent.

Unlike the rest of the backyard, this area lacks grass. It is mainly exposed ground, with the exception of a patch of artificial turf which one of the homeowners uses to practice golf.

There is not a path to get to this area of the backyard, however, two avocado trees seem to mark the transition point and could be a good place to include when re-designing the area.

The homeowners were excited at the potential for new usage in this space and also interesting in finding unique ways to lessen the impact of heat on the house and the area.

Of all three areas, the Patch seemed the most ready to start work on. First, the lack of grass meant that capital and time would be saved from removal. Secondly, of all the spaces, this space lacked an identity for the homeowners, meaning that there was the most potential for redefinition. Lastly, it had the least amount of established plants, meaning less competition for new plantings.

The Rose Garden

The Rose Garden is a series of five rose bushes that sit adjacent to the houses' patio, sitting in-between the Patch and the patio. Each rose plant is located in a 2 foot diameter, in-ground planter, marked by a circle of bricks. They are irrigated via drip.

The area marks the potential for a way to connect the Patch to the rest of the backyard, either through the removal of the roses bushes, or their inclusion.

Next to the roses, closer to the Patch, is more turf. A sharp corner of the house is located here, and could be used as an area to try to potentially "round" using different planting strategies. A window into the house looks out to the rose bushes.

The Goals

After an analysis of these three sites, I constructed four goals to help guide my design of the spaces. Not every goal is meant for each space, which is noted below.

Goal 1 (Front, Patch, & Rose Garden):
Replace the existing turf lawn (and patch) with an arthropod friendly habitat, including native plants and other bug-friendly assets.

Goal 2 (Front):
Create an educational green space for the community, aiming to educate homeowners and renters on arthropods as well as native fauna and flora, while inspiring them to reimagine their spaces.

Goal 3 (Patch & Rose Garden):
Connect the outdoor spaces through the use of arthropod friendly landscaping and smooth and round shapes.

Goal 4 (Patch & Rose Garden):

Increase uage of outdoor spaces and find a solution to lessen the impact of heat and sunlight.

THE NEAULT-SUTTON HOUSE

Danny Gross

Design #1

I decided to combine the Patch and the Rose Garden into one design for various reasons. First, by connecting the two spaces, the property adopts the feeling of an open system. Whereas prior you had to walk on the grass to get to the Patch, now a path and the garden connect the two. Secondly, it allows for easier access to the room in the back, giving the homeowners options on how to access the space.

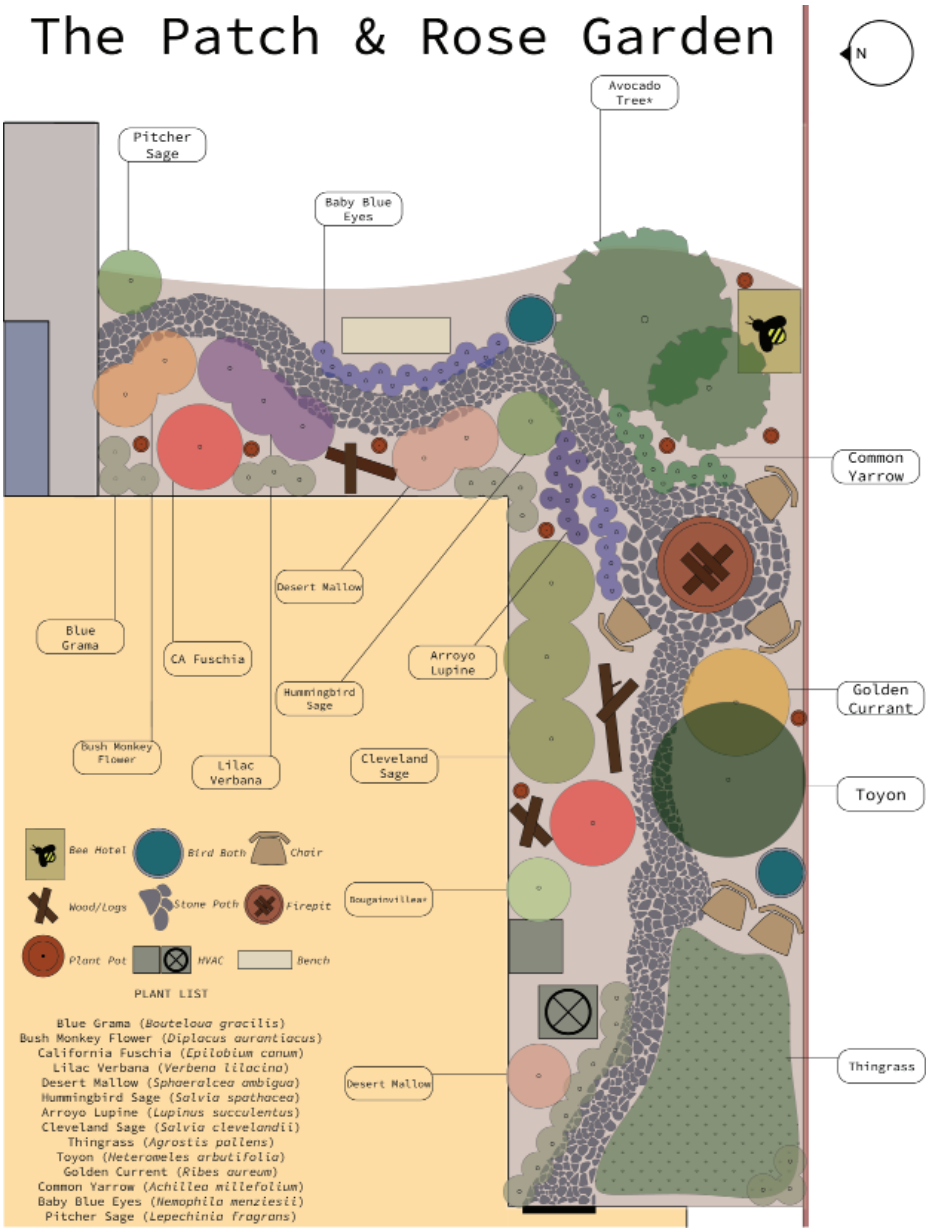
An important part of the design is the introduction of native flora. A variety of natives from the certificate program, and others from outside the program, provide vital habitat for an abundance of important arthropods and other animals.

The integration of the two avocado trees adds more continuity to the space, and pushes the space closer to the rest of the backyard. The introduction of a toyon and gooseberry will provide more shade for the south facing side of the house as they grow and establish, while the other plants will provide even more of a cooling effect for the area.

Where the roses used to live, are a palette of natives specifically chosen to integrate the hummingbird habitat that is found on the patio, into the new garden. It also provides color and habitat for arthropods. The introduction of two bird baths in the area provides more habitat for birds and insects as well.

The introduction of upside-down pots, bee hotel, and downed logs, as well as empty areas of mulch, provide habitat for the bugs, while not taking up too much visual space.

A rounded flagstone path provides a way to walk from the patio to the Patch, making a meaningful experience of the trip. With the use of round stones and circular nodes, the property is given a softer feeling through the use of soft shapes. The hope is that yarrow can be planted in between the stones to make the pathway a “living pathway” for arthrpods to live.



The introduction of a firepit provides extra use of the space, bringing the homeowners and guests into the area to enjoy the garden throughout the year.

Lastly, in order to maintain the area where golfing occurs, a patch of native grass, known as thingrass, is introduced to provide a unique and interesting way to participate in the activity while simultaneously providing habitat.

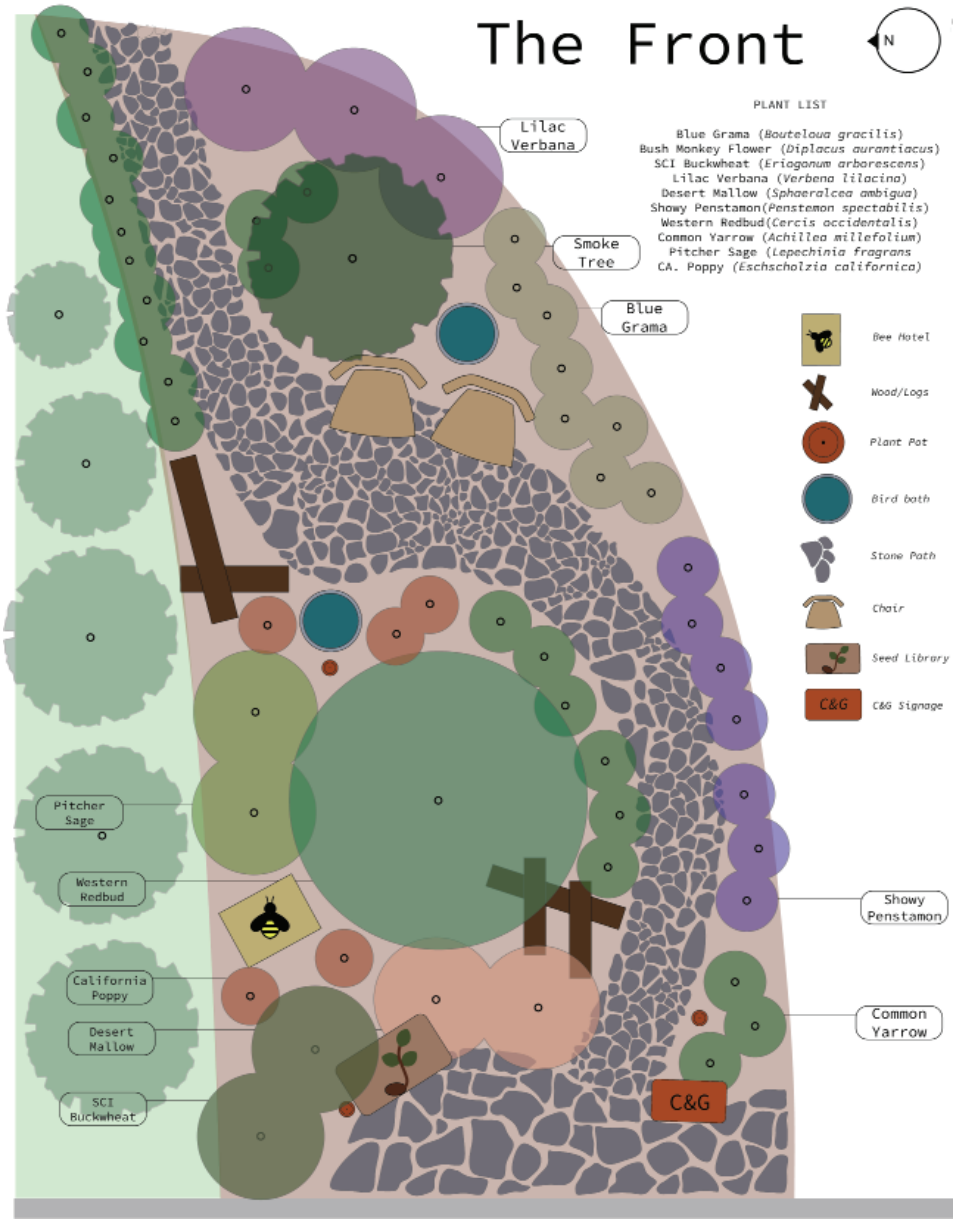
If the homeowners want to keep the roses, they can swap the golfing area with the current plants that are slated to be the hummingbird zone. The design plan is adaptable to this possiblity.

Design #2

As previously mentioned, the smaller patch of the front yard was chosen for a variety of reasons.

Similar plants were chosen for the Front in order to create more continuity from the backyard. However, more colorful plants were brought to the front of the area in order to draw in pedestrians.

By placing a western redbud in the middle of the yard, attention is drawn to the center of the garden, and those walking by will be drawn in by the sprawling tree.



Seed Library, Kebiana, CC BY-NC-SA 2.0

Bee Hotel, Jo Zimny Photos, CC BY-NC-ND 2.0

Western Redbud, David Hoffman, CC BY-NC-ND 2.0

The incorporation of the flagstone path creates a smooth transition to the backyard. Furthermore, the inclusion of a seating area within the path creates a new area for usage for the homeowners.

Connecting the path to the street allows for communication between homeowners and interested pedestrians. The design allows for privacy, while also allowing easy access to those who want a tour of the garden. It also allows for a more enjoyable way to reach the sidewalk, or for guests to approach the house.

A little patio for walker-bys promotes interaction with the space.

The Fronts location makes it a prime area to promote Clean & Greens' new program, while also educating and inspiring community members. Furthermore, the addition of a seed library creates a tangible opportunity for others interested in starting a similar garden. The Clean & Green certification sign will be front and center, providing necessary publicity for the program.

Lastly, unlike the backyard, bug-friendly assets, such as logs, bee hotel, and upside pots, are placed in the view of the public, providing additional education opportunities, and to better employ a learning environment for passerbys.

PRECIADO- RAMIREZ HOUSE

Jennifer Mejia

Site Analysis

The Preciado-Ramirez House is located in Pomona, CA east of the 57 freeway.
A single-family home, located in the top 20% of census tracts in our priority index, and in one ofthe historically “redlined” neighborhoods in Pomona. Victor is a Pomona City Councilmember and Marisol is an attorney. Their current garden features a number of dinosaur statues which must remain as part of the redesign. Victor and Marisol are particularly interested in pollinator arthopods such as butterflies, ladybugs, dragonflies and native bees as well as planting aroma blooming native species. Their design requests consist of adding in a water feature to support species and promote biodiversity. The current lawn dinosaur ornaments will remain as is in the front yard.

Location

Goals

Goal 1: Educational signage near sidewalk for passerbys in front yard.

Goal 2: Add water feature for current bees and wildlife in frontnyard and backyard swale.

Goal 3: Add native plants and natural habitats.

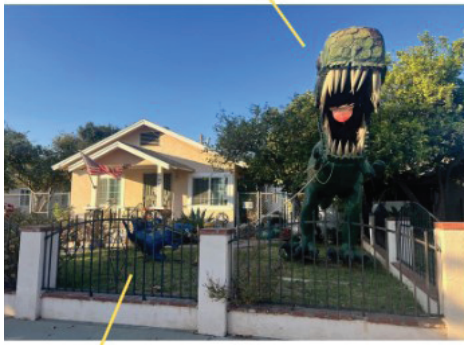
Front Yard
Current Conditions

There are several grass patches on property. For the Front Yard, I will be designing the lower left section of the property. Currently there is open space and opportunity to plant native species and input a water feature such as a bird bath. There is also a wooden lunch bench for seating. The dinosaur lawn ornaments are currently located only in the front yard and will not be moved.

The image above shows the smaller lawn ornaments that will stay in place in the front yard area. The bottom left image shows the walkway with potential areas for native planting. The bottom middle shows the dinosaur lawn ornament locations and the bottom right image shows the potential location to add a water feature and and plant native species along the fences.

POTENTIAL FOR NATIVE PLANTINGS

DINOSAUR STAYS IN PLACE



SMALLER DINOSAUR LAWN ORNAMENTS CAN BE MOVED

WOODEN PICNIC TABLE FOR SOCIAL GATHERING

POTENTIAL LOCATION FOR HABITATS AND WATER FEATURE

PRECIADO- RAMIREZ HOUSE

Jennifer Mejia

Front Yard Concept

Bird bath water feature to support local athropods and visiting pollinators.

Informational signage containing information about native species and importance of arthropods.

Native Species

Large Dinosaur Lawn Ornament Stays in Place.

Small Dinosaur Lawn Ornaments Move Closer to Fence

Native species will be planted along the fences of the yard around the front perimeter.

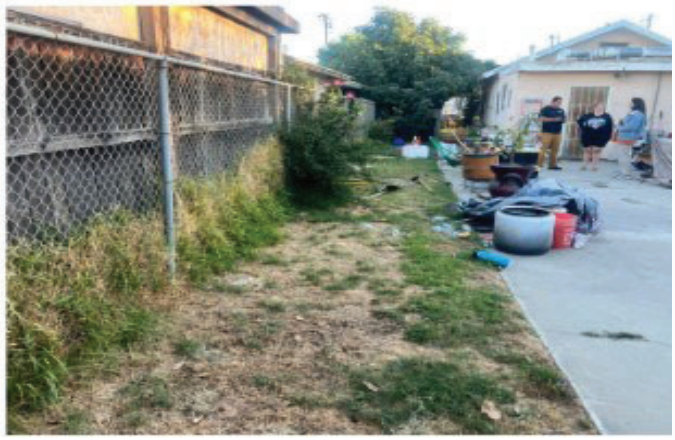
EDUCATIONAL SIGNAGE

ARTHROPOD HOTEL

HOTEL WITH PLANTER

Backyard Current Conditions

EAST FACING VIEW OF PATCH



PATCH IS 7' WIDE X 58' LONG

Backyard Concept

The backyard grass patch will have a swale running from the south to the north end. A gutter will collect rainwater and will run through the swale to support the biodiversity and native species in the patch. Overflow of rainwater will drain to the alley on the north end of the property. The precedents to the right show the inspiration of the swale in the backyard.

Swale Precedents

Einstein Infiltration trench by Montgomery County Planning, under CC BY-SA 2.0.

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THE PURPLE HOUSE

Kat Chavez

Mosaics + Networks

The Purple House is a residential property at the center of the city of Pomona, owned by Pomona City Councilmember Victor Preciado. At the moment, three people live in the house, but the yard and overall lot are utilized as a community space. Events of all kinds are hosted there, and a local nonprofit organization, Food Cycle Collective, operates out of the space. This organization manages parts of the outdoor area and has done some planting.

The map to the right highlights the land use of the surrounding area, which is very mixed. Within just a couple of blocks are commercial sites, educational institutions, facilities, office space, and more. The closest public park space is Centennial Park, which is very small and dominated by trees and turf, creating very little habitat for Arthropods.

The Purple House is also located at the corner of an intersection where it is surrounded by vacant lots across each street. This has actually been a positive for the space in some ways when it comes to hosting events; the community gathers for a car show and small festival once a month, where the vacant lots make a perfect viewing space for vehicles.

To the right are a few recent images of the site. We can see that most of the yard is mulched, with some built-in planters, a few concrete pads (including a stage area for performance), and an area behind the house used mainly for storage. We can also see that the parkways between the yard and the streets are nearly empty, aside from a couple of utilities. On the north side parkways, two crape myrtle trees were planted recently, but I'd propose removing these in favor of native plants with more ecological benefits.

The west edge of the lot has a row of fruit trees planted within the past few years, lining a cinder block wall. There is a large oak tree planted at the northeast corner of the house, which provides substantial shade to the yard and east side parkway.

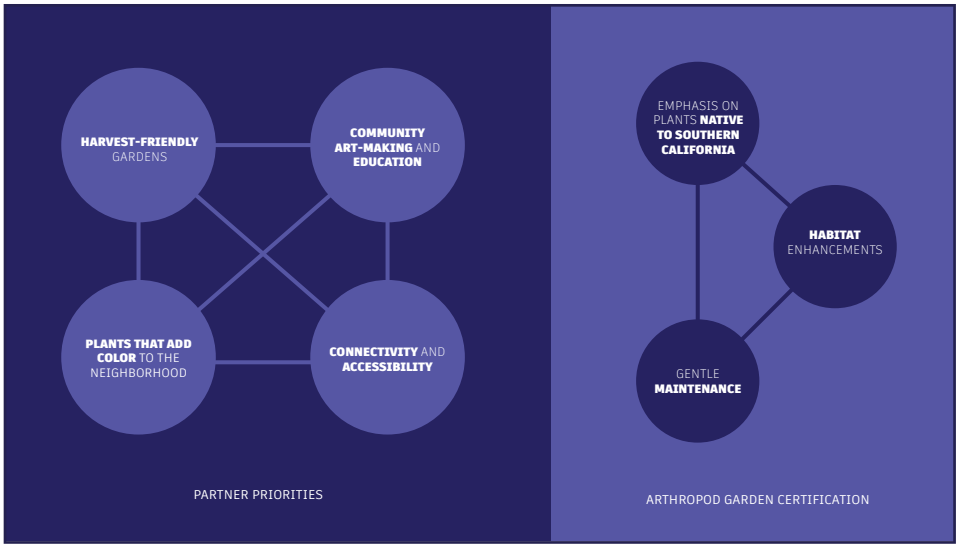
A small space behind the oak and between the fence and house includes a concrete pad, two large cacti, and an additional built-in planter. There is a small edge of open mulched soil where some planting could be done.

Victor also noted that during the car shows, they close down the street that lines the north side of the site. This increases foot traffic along the parkways, so it is important to keep the event in mind when developing the plans.

Priorities + Goals

In my meetings with Victor and Elinor (who leads Food Cycle Collective), I gathered that the following were important priorities for them: harvest-friendly gardens, community art-making and education, plants that add color to the neighborhood, and improving connectivity and accessibility. For this studio course, we also had our priorities with regards to Arthropod gardens: planting more native plants, adding features to enhance habitat as necessary, and engaging in gentle maintenance.

My goal in this project was to find connections between all of these priorities and implement various design features that could serve dual purposes.



Color + Plants

One aspect of site analysis that I found particularly interesting was color. As the name suggests, the house is purple, and it is flanked by yellow-green trim and blue accents, such as a fence on the east side. These bright colors framed my ideas for the plant palette, where I started to think about native plants that would complement and expand the rainbow of the site. Further, it was important to my community partners that the plants chosen for the parkways add vibrancy to the neighborhood, and I wanted to convey that native plants could achieve this while also providing new Arthropod habitat. In the diagram below, the first column uses the color range of the existing structure, and this second column mirrors that with complementary colors.

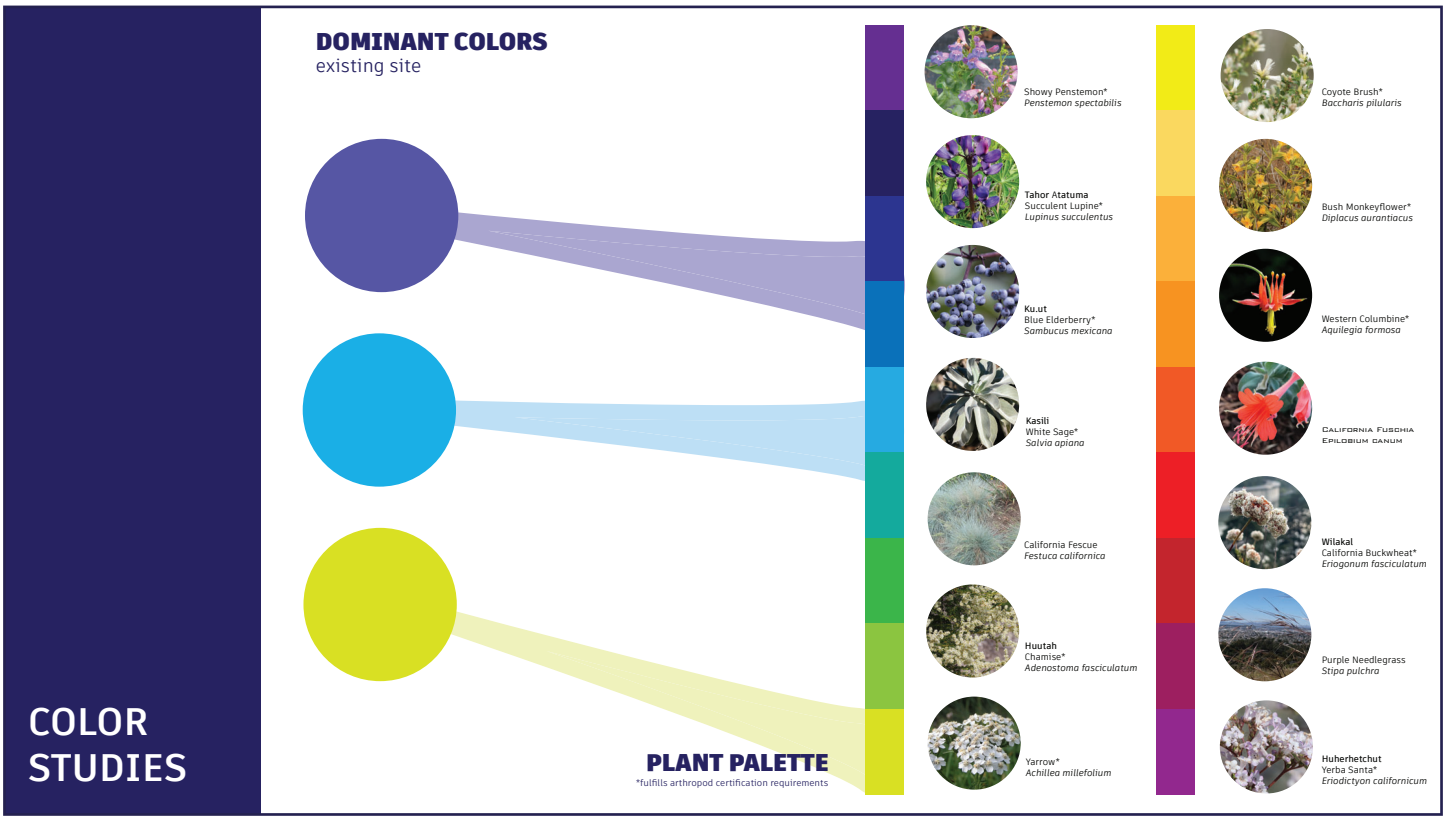


Image Sources: "Penstemon spectabilis" by peganum and "Sticky Monkey-Flower - Diplacus aurantiacus" by Björn S. are licensed under CC BY-SA 2.0. "Lupinus succulentus" by night owl naturals is licensed under CC BY-NC-ND 4.0. "Blue elderberry Sambucus mexicana berries close" by Dcrjsr is licensed under CC BY 3.0. "Salvia apiana" by briweldon and "Coyote Bush (Baccharis pilularis)" by jkirkhart35 are licensed under CC BY 2.0. "Chamise, Adenostoma fasciculatum" by J. Maughn and "California Buckwheat Plant - Hollywood Reservoir - Los Angeles, California" by ChrisGoldNY are licensed under CC BY-NC 2.0. "Achillea millefolium bloem" by Pethan is licensed under CC BY-SA 3.0. "Aquilegia formosa #2" by J.G. in S.F. is licensed under CC BY-NC-ND 2.0. "California Fuschia" by outdoorPDK and "purple needlegrass (Stipa pulchra)" by western goblin are licensed under CC BY-NC-SA 2.0. "CALIFORNIA YERBA SANTA (Eriodictyon californicum) (6-21-2021) 5000 ft, bear mt - jawbone rd jct, smith river nat rec area, del norte co, ca -01" by sloalan is marked with CC0 1.0.

THE PURPLE HOUSE

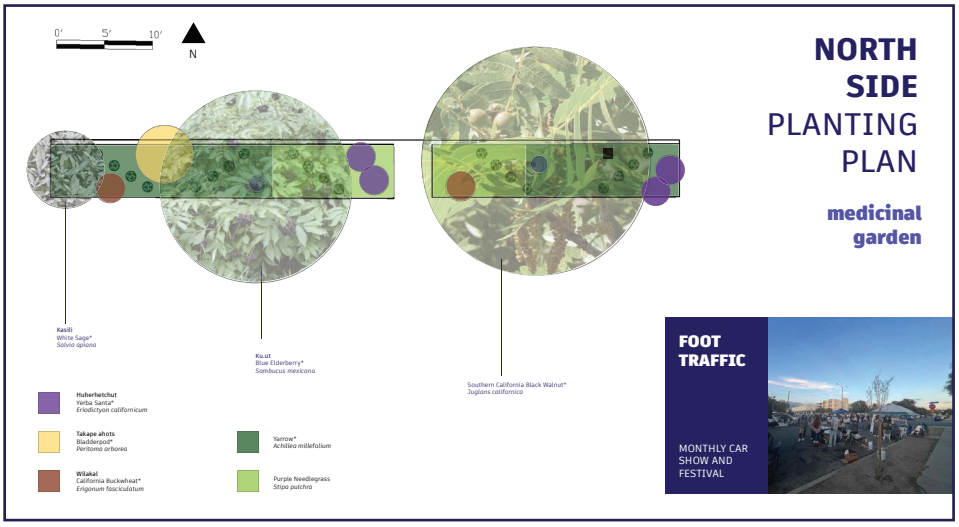
Kat Chavez

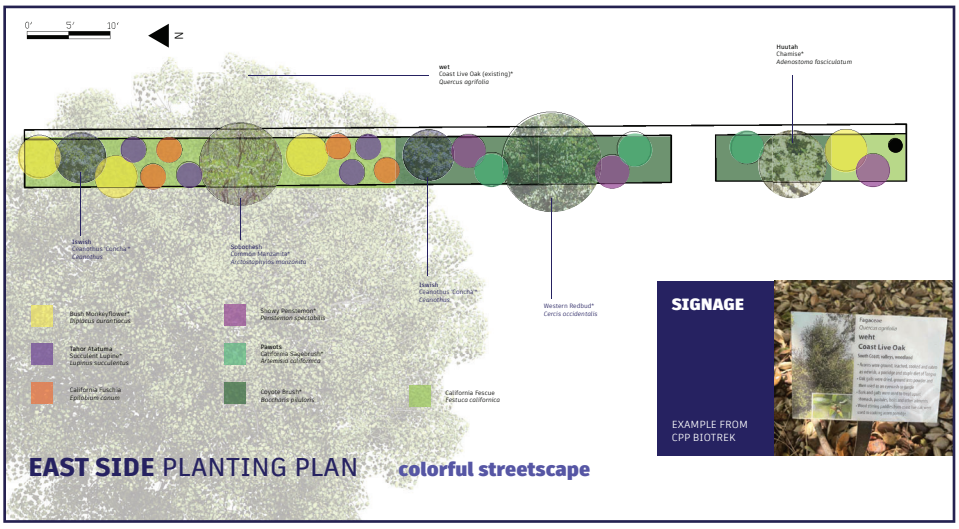
Design + Vision

My overall plan (seen on the page to the right) shows a number of features that I've proposed for the site. On the northwest corner, there is the potential for a wall garden along gaps in the cinder block wall. This could create a lush backdrop for the small corner stage, and it could be planted with culinary herbs or small flowers, depending on the needs or interests of the community. Food Cycle Collective would also like to develop a system for home composting, so we located a site that would be ideal for the compost boxes. On the west side of the lot, there is a line of various fruit trees, which (as some of my classmates pointed out) is a great opportunity for drawing Arthropods. Therefore, I proposed a couple of container gardens to sit on the concrete pad that lines the house on the west side. I also proposed planting a row of milkweed in a small planter that could be created in the space between the new path and the house. Emphasis here is placed on attracting pollinators.

A large portion of the yard is mulched and open, and we wanted to maintain this to a certain extent, both because it allows for tables and chairs to be set up in the yard for various events and because this provides habitat for some Arthropods. However, I did add two kinds of additional pathways: one that is marked by stepping stones along the northeast corner, which I propose could be community-made mosaics, and one in the northwest corner composed of recycled concrete that connects the existing concrete entry walkway to the stage and back yard. These pathways also increase access to the planters lining the fence in the front yard. My partners at Food Cycle Collective wanted to explore how we might increase the flow between the front yard and back yard of the site, and together we developed this possibility.

There was also interest in creating a rainwater harvesting system, so I've located two barrels on the concrete pad on the east side, which could be accompanied by collection equipment

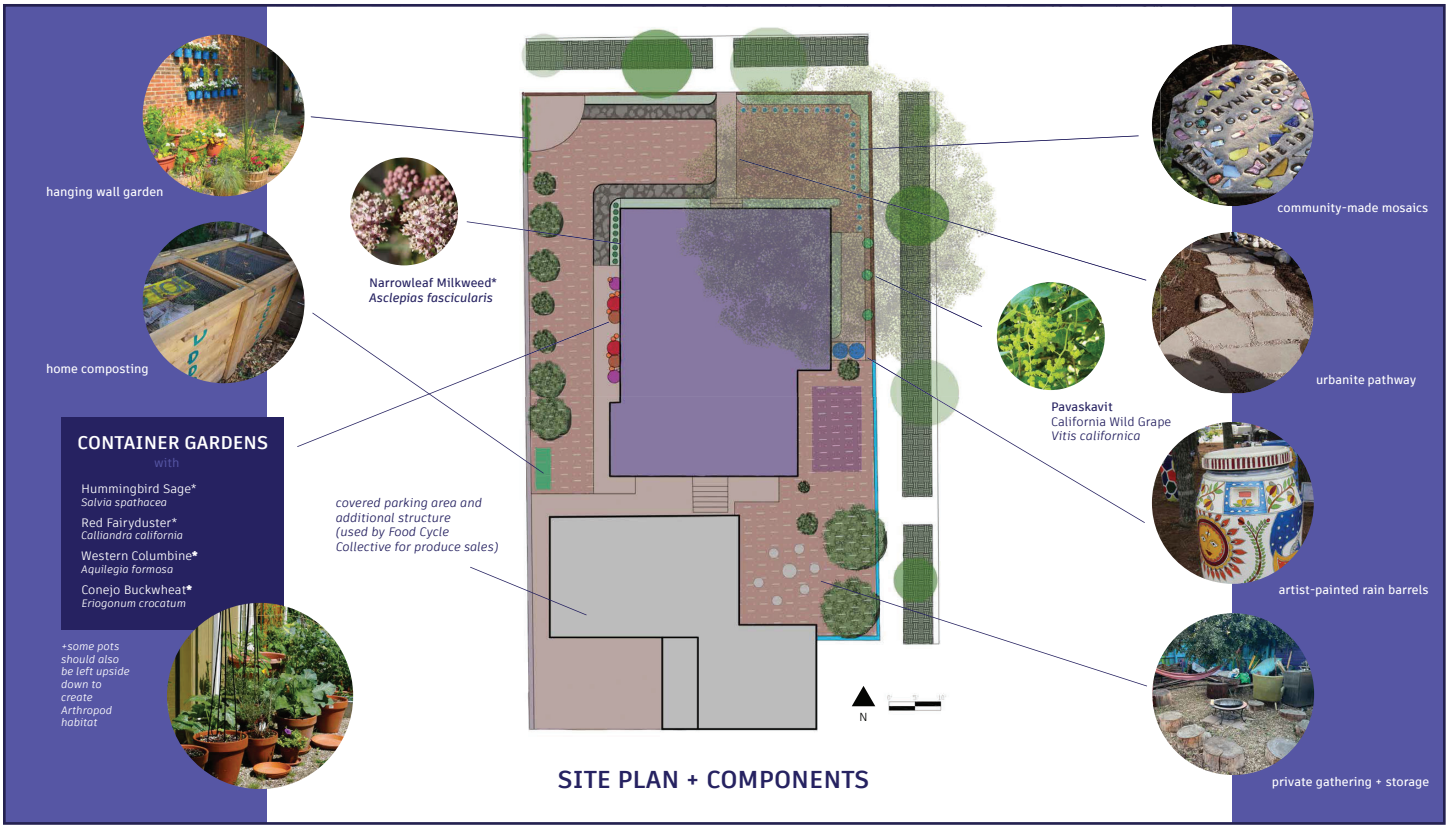




lining the roof nearby. These barrels also offer an opportunity to commission or invite local artists to paint small murals, as I know this is one of Victor's passions. I also proposed planting a few California Wild Grapes in this side area, which could be grown over the fence to add more greenery to the pedestrian experience.

My two planting plans for this project, pictured above, are for the parkways: one on the north side and one to the east. Each had a different priority: The northside region focused on harvestable, native medicinals. We also have more community made mosaics used to create some small paths that can accomodate higher foot traffic. The east side focused on colorful plants that could survive in the shade of the large oak tree and help create a more pleasant street. We also liked the idea of incorporating plant and Arthropod knowledge into some signage around the gardens, and I've shown an example from the Cal Poly Pomona campus. As with the color diagram on the previous page, asterisks indicate plants listed in our certification checklist.

The collaged perspective on the page to the right shows the north side plantings, the additional pathway created with recycled concrete, and the milkweed with container gardens on the westside near the fruit trees. My proposal aims to bridge our focus on enhancing Arthropod habitat with preserving the multipurpose needs of the space and community, as well as the implementation of various aspirations from our partners who care for site.



Certification

This site achieves certification as an Arthropod garden with my proposed design. Some of the features that currently exist on the site already meet particular requirements (the large oak tree and open mulched areas, for example). My proposed design also excedes the necessary species count in all three plant type categories, meaning that the design could be implemented in stages and achieve certification even before full completion. The maintenance and community care pledges would also need to be discussed and agreed upon by all partners at the site (including current residents of the home), as different people have taken on different roles over time in these areas.

MEETING OUR
CERTIFICATION REQUIREMENTS

TREES/LARGE SHRUBS *(1+ required)*

Black Walnut
Coast Live Oak *(existing)*
Elderberry
Western Redbud

MEDIUM SHRUBS *(2+ required)*

Buckwheat
California Lilac
California Sagebrush
Chamise
Baccharis
Fairyduster
Bladderpod

ANNUALS/PERRENIALS *(3+ required)*

Beardtongues
Milkweed
Monkeyflower
Sages
Yarrow
Yerba Santa
Western Columbine
Arroyo Lupine

SUPPLEMENTAL HABITAT ELEMENTS *(4+ required)*

Areas accumulated with leaf litter/small branches/natural plant debris *(under large oak tree)*

Open bare soil or mulched areas

Empty upside down pots *(container gardens)*

Flowering plants for pollinators

Compost boxes

Native grasses *(purple needlegrass)*

+MAINTENANCE AND COMMUNITY CARE PLEDGES

THE SMITH HOUSE

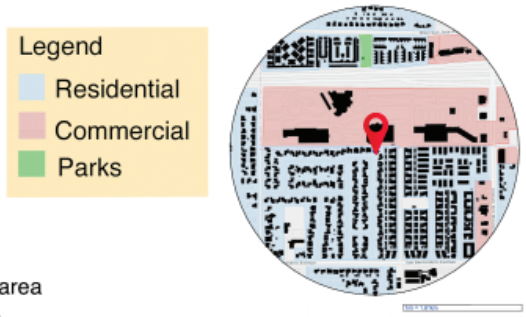
Naui Munoz

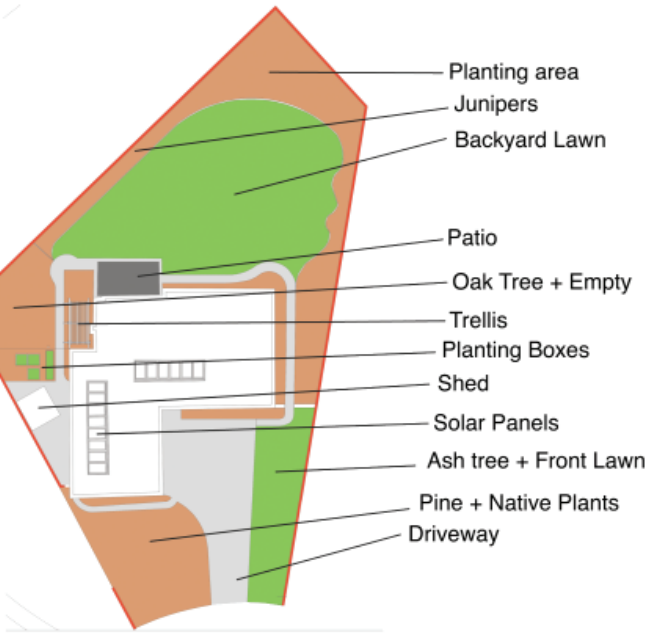
Site Analysis

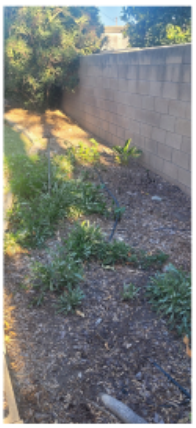
The existing conditions of Duane Smith's residence in Pomona, California, present elements that require careful consideration for the proposed design. The site features a variety of trees, including one pine tree, one ash tree, five junipers, one orange tree, and one oak tree, along with other plants such as roses, African fountain grass, hydrangeas, white-striped century plants, and English ivy. Additionally, native plants including monkeyflower, white sage, and California buckwheat have been identified on site. The soil quality across the property varies, with a foreign soil type covering four inches of the entire site, necessitating a thorough assessment to ensure the health and suitability of future plantings. Drainage patterns have been evaluated to identify any potential issues that could affect plant health and landscape sustainability. Sun exposure mapping reveals distinct areas of sun and shade throughout the day, which will influence plant selection and placement. Additionally, the property exhibits microclimates that offer unique opportunities for creating specialized habitats. The majority of the irrigation on site is drip irrigation, which is beneficial for water conservation if well-maintained. However, there is a presence of unwanted ants inside the house, which needs to be addressed. These existing conditions form the foundation for a thoughtful and sustainable landscape design that aligns with the client's preferences for low-maintenance, native plantings and an arthropod-friendly environment.

This single-family home is in the top 40% of census tracts in our priority index. His home is in a somewhat remote neighborhood, adjacent to a commercial center located along the 10 Freeway in Claremont.

Site Analysis







Project Goals

Incorporate sustainable methods to create comfortable and low-water use landscape.

Use Sage Scrub and Chaparral plants to create an extension of the pre-existing ecosystem.

Create a ecologically functional space for arthropods to thrive in all life stages.

Opportunities

Opportunity to incorporate low-cost cob design

Replicate conditions of Chaparral and Coastal Sage Scrub for both habitat and leisure

Introduce methods and techniques to create artificial homes for bees, spiders, and beetles

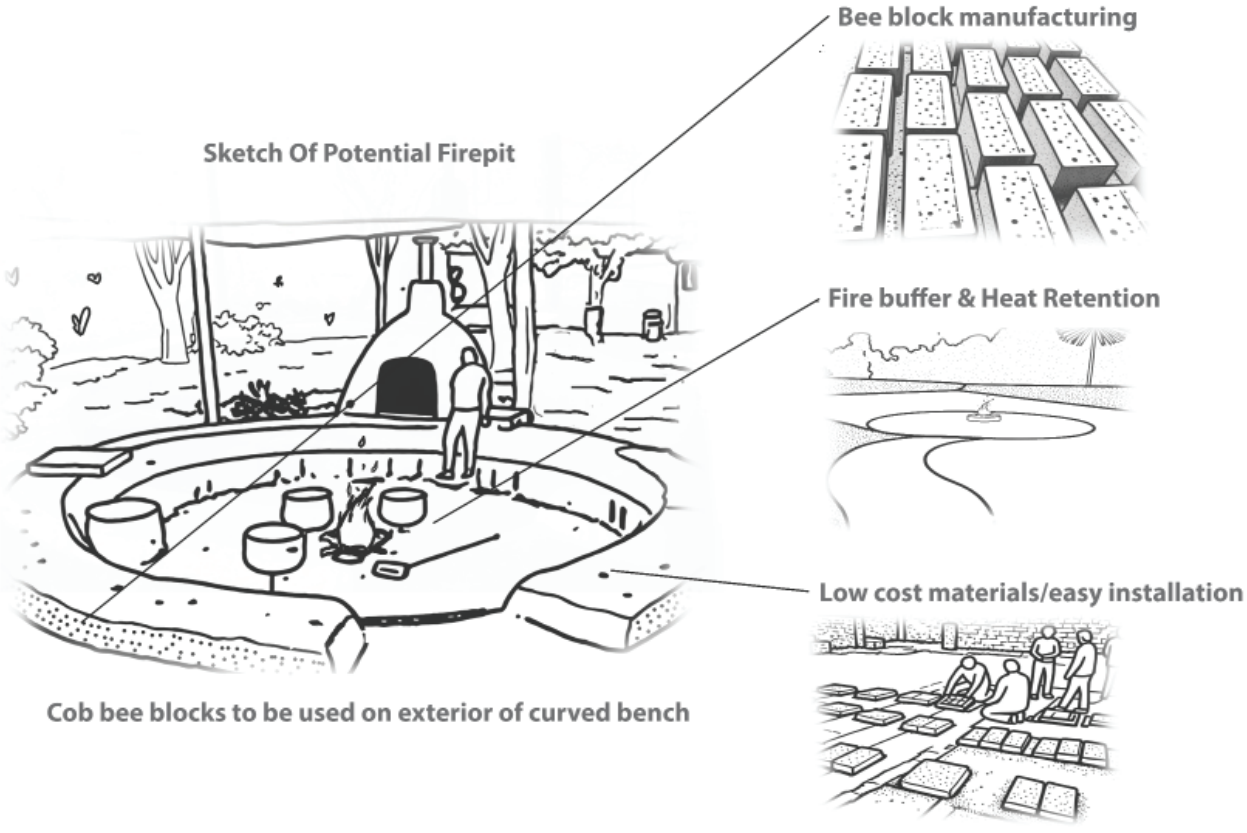
Proposed Habitat Techniques

To create an arthropod-friendly habitat in Duane Smith's backyard, the design incorporates several features aimed at supporting a diverse range of insects. Insect hotels will be strategically placed to provide shelter and nesting sites for beneficial insects such as carpenter bees, bumble bees, and California mantis. Decomposing logs and leaf litter piles will be introduced to offer habitats for decomposers like the diabolical ironclad beetle and harvester ants, which play a crucial role in nutrient cycling. Insect drinking bowls will be added to ensure that arthropods, including craneflies, have access to water.

Proposed Artificial Habitat

Incorporating cob structures offers a sustainable and multifunctional solution that benefits both humans and arthropods. Cob, made from water, sand, clay, and straw, is used to create seating structures around a firepit. These cob bricks, designed with holes, function as bee blocks, providing nesting sites for native bees like carpenter bees and bumble bees. This dual-purpose design supports local pollinator populations while offering comfortable seating for outdoor gatherings. Additionally, insect hotels are integrated to provide shelter for beneficial insects. Creating cob structures is easy and cost-effective, making it an accessible option for enhancing gardens. This approach promotes a harmonious coexistence between recreational spaces and arthropods.

Sketches



THE SMITH HOUSE

Naui Munoz

Back Yard rendering

Two Yards

Coastal sage scrub plants are an excellent choice for both the front and back yards of Duane Smith's residence. These plants, native to Southern California, are well-adapted to the local climate and require minimal maintenance. Species such as California sagebrush, black sage, and white sage not only thrive in the region's dry conditions but also provide a natural, aesthetically pleasing landscape. Their drought-tolerant nature reduces water usage, aligning with the client's preference for low-maintenance gardening. Additionally, these plants offer seasonal interest with their varied textures and colors, enhancing the visual appeal of the property while supporting local wildlife.

The use of cob in the landscape design introduces a sustainable and multifunctional element to the garden. Cob, made from water, sand, clay, and straw, is used to create a firepit and seating areas, which serve as focal points for outdoor gatherings. These cob structures are designed with holes to function as bee blocks, providing nesting sites for native bees such as carpenter bees and bumble bees. Beyond seating, cob can be creatively used to build other garden features like planters, retaining walls, and decorative sculptures, all of which contribute to the garden's unique character. The simplicity and cost-effectiveness of cob construction make it an accessible option for enhancing the garden's functionality and ecological value.

Integrating coastal sage scrub plants and cob structures significantly contributes to creating a thriving arthropod habitat. The native plants attract a variety of insects, including pollinators and natural pest predators, fostering a balanced ecosystem. The cob bee blocks and insect hotels provide essential nesting and shelter sites, supporting the life cycles of beneficial arthropods. Features like decomposing logs, leaf litter piles, and insect drinking bowls further enhance the habitat, offering food, water, and shelter. This holistic approach not only promotes biodiversity but also ensures a sustainable and resilient garden environment, where both plants and arthropods can flourish.

Front yard rendering

Coastal Sage Scrub Collage

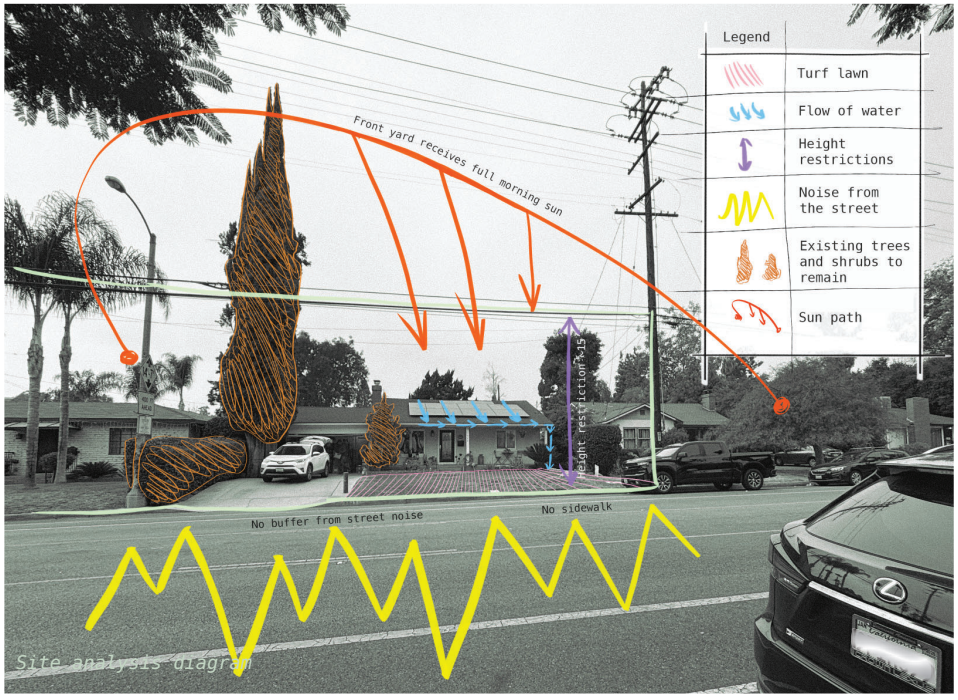
TIERSMA-WATSON HOUSE

Issy Cassou

Tiersma-Watson House
Front Yard rendering

An Arthropod-friendly, residential sage scrub garden

The Tiersma-Watson House is in the top 20% of census tracts in our priority index, located in the historic Hacienda Park district of Pomona. With four parks within a 1-mile radius of the home, there is potentially significant ecological structure to support Arthropod populations via small-patch density. Research suggests the dominant historical plant community in this neighborhood transitioned between coastal sage scrub and California grasslands[1]. The house is adjacent to the 10 Freeway on a busy two-lane street, with parking on both sides, and patchy sidewalk connections. There is no sidewalk on the Tiersma-Watson side.



Site analysis diagram

Garden Locations

Four locations were identified for design interventions—the Front Yard, a portion of the backyard I will refer to as the Shade Garden, the Side Patio, and the Planter Box. This presentation covers two proposals, one for the Front Yard and one for the Shade Garden.

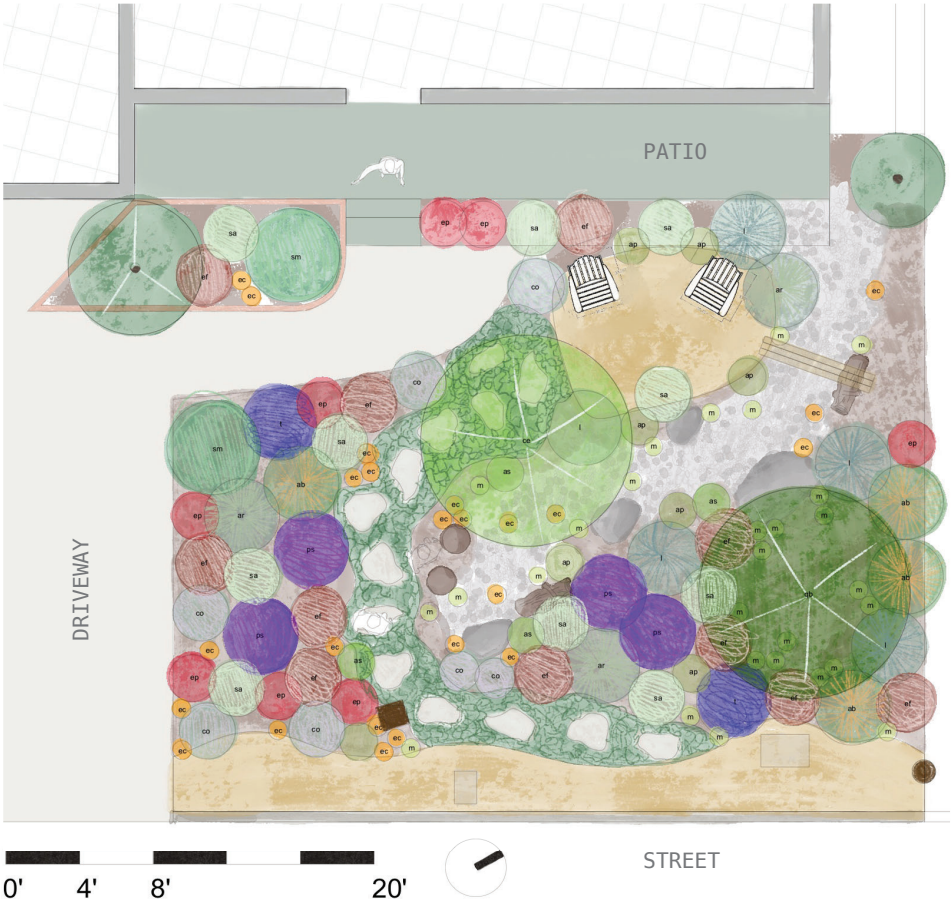
FRONT YARD
Existing Conditions

The Front Yard of the Tiersma-Watson House is currently comprised of a large turf lawn and a mixture of planted and potted succulents the homeowners have collected over the years. A sago palm is planted in the northern corner near the downspout for the roof gutter. A bougainvillea, *Lantana montevidensis*, *Agapanthus sp.*, and a young *Quercus agrifolia* (Coast Live Oak) line the northeastern property boundary. The Front Yard receives full morning sun.

As previously mentioned, there's no sidewalk and due to the lawn, there's no buffer from street noise. Overhead utilities also contribute to height restrictions, as the homeowner would like to plant two trees. Topography is largely flat, though the grade decreases towards the street.

Design Goals

After several meetings with the homeowner, we identified two major goals—capture runoff from the roof and use to irrigate yard and replace turf with waterwise native plantings. Considering the neighborhood and Arthropod communities, I added two additional goals comprised of creating a sidewalk condition for pedestrians and plant with members of the coastal sage scrub community to create Arthropod habitat.



Design Proposal

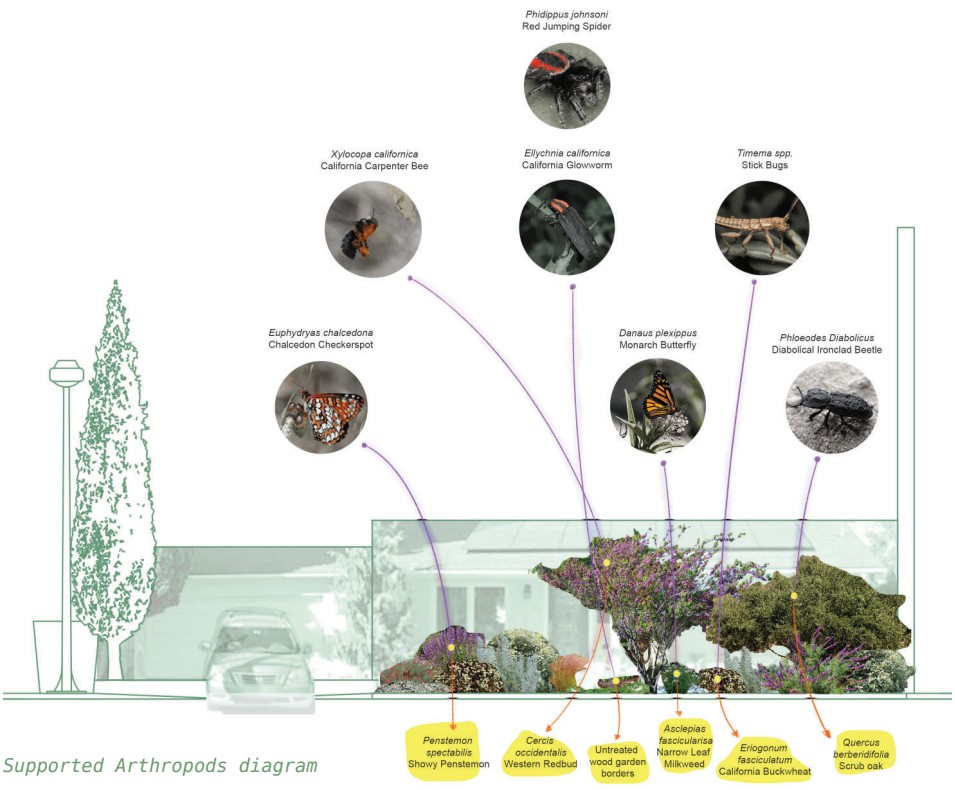
Beginning structurally with the swale and curb path design, the Front Yard was shaped by these two axes as they swirl into one another. The dry creek-style swale accomplishes several of the proposed design goals, bringing runoff from the roof into the garden and providing habitat for Arthropods in the space between cobbles. The curb path provides a preliminary structure for a sidewalk, which can be connected to adjacent properties should the neighborhood wish to build this out.

Tree Legend		
q	Quercus berberidifolia	Scrub oak
ce	Cercis occidentalis	Western redbud
	Existing tree	

Shrubs, Perennials, and Grasses Legend		
ab	Abutilon palmeri	Indian mallow
ac	Achillea millefolim	Common yarrow
ap	Aristida purpurea	Purple three awn
ar	Artemisia californica	California sagebrush
as	Asclepias fascicularis	Narrowleaf milkweed
co	Corethrogyne filaginifolia 'Silver Carpet'	Silver Carpet aster
ec	Eschscholzia californica	California Poppy
ep	Epilobium canum	California fuchsia
ef	Eriogonum fasciculatum	California buckwheat
l	Leymus condensatus 'Canyon Prince'	Canyon Prince wild rye
m	Melica imperfecta	Small flowered melica
ps	Penstemon spectabilis	Showy penstemon
sa	Salvia apiana	White sage
sm	Salvia mellifera	Black sage
t	Trichostema lanatum	Woolly bluecurls

The homeowners envision a space that not only calms the noise and activity of street but also invites birdsong—an oasis not just for them, but for a network of living beings. With this in mind, we selected *Quercus berberidifolia* (Scrub oak) and *Cercis occientalis* (Western redbud) as the two front yard trees. Not only do they serve as host plants for a variety of species in our compendium, but they also meet the height restrictions of the overhead utilities. The scrub oak, a slow growing tree that is often classified as a shrub due to its diminutive size, was an ideal choice to plant under the overhead lines. As the redbud can grow over 15' tall, it is set further back from the lines.

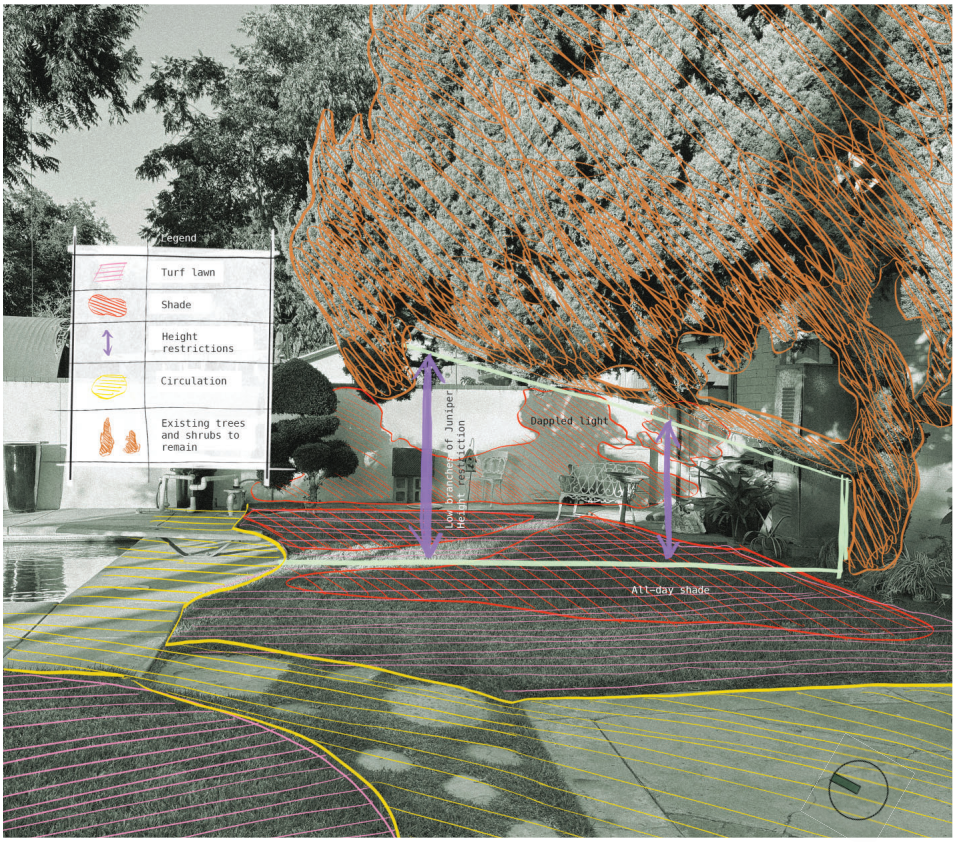
The choice of coastal sage scrub species transforms the yard into a small piece in the patchwork of habitats that dot this historic district, building structure for increased Arthropod diversity in the Pomona Valley. *Penstemon spectabilis*, for example, is a food source for the caterpillar stage of the Chalcedon Checkerspot and the scrub oak provides habitat for the Diabolical Ironclad Beetle.



Supported Arthropods diagram

TIERSMA-WATSON HOUSE

Issy Cassou



SHADE GARDEN
Existing Conditions

Located in the back yard, bordered by the pool, a 6' property wall, and the house, the Shade Garden is an additional turf lawn on the property. In full-partial shade, this area is situated under a mature juniper tree. Like the Front Yard, the topography is largely flat. Circulation design takes into account swimmers who will be using the diving board and the existing flagstone path from the patio to the pool deck.

Design Goals

A quieter, more private setting than the Front Yard, this garden allowed us the opportunity to explore texture and the senses for design. As the homeowner has a grandchild interested in Arthropods, desgin goals included encouraging exploration with mostly low-growing plants of varying textures and crisscrossing paths. Grasses, miner's lettuce, California fuchsia, and goldenrod are a few plants of this garden's palette that mix texture and structure. The creation of four distinct areas with the paths became a structurally important element of the garden.

Another driving goal for the shade garden was to select appropriate native plantings for dry shade, avoiding the use of cultivars to bolster Arthropod habitat.

Shrubs, Perennials, and Grasses Legend		
ac	*Achillea millefolium*	Common yarrow
cl	*Claytonia perfoliate*	Miner's lettuce or Rooreh
ep	*Epilobium canum*	California fuchsia
eu	*Euthamia occidentalis*	Western goldenrod
h	*Heuchera maxima*	Island Alum Root
m	*Melica imperfecta*	Small flowered melica
r	*Ribes viburnifolium*	Evergreen Currant
st	*Stipa cernua*	Nodding needle grass

Design Proposal

Responding to the need for walkable area behind the diving board, the design began with several circulation diagrams. Out of these drawings came the crisscrossed paths. This design created four distinct areas:

1. The area behind the diving board, already identified as requiring some percentage of hardy plantings that can accommodate foot traffic.

2. The northeastern corner with bench.

3. The eastern side along the home exterior that includes the juniper tree.

4. The southern portion that receives the most sun and is adjacent to the patio and the original flagstone path.

Referencing the palette of the Front Yard, *Achillea millefolium* (Common yarrow) was selected for the groundcover in section 1. Interspersed throughout is small flowered melica, miner's lettuce, and nodding needle grass to provide some texture and height variation.

Section 2 contains a decomposed granite (DG) area for an existing, white iron garden bench. Surrounded by island alum root and goldenrod, offset flowering seasons will create different highlights throughout the year.

Due to the dense canopy of the juniper, plant selection for the understory in section 3 will require follow-up to asses how the plants are growing together. *Ribes viburnifolium* (Evergreen Currant) was specified for this area.

Plantings along the patio in section 4 were chosen for their larger size and color. Goldenrod, California fuchsia, and island alum root are repeated here to create a low divide at the edge of the patio and give this area a contained sense of quiet and intimacy.

Endnotes

1 - MacDonald, B. (2023). Hypothesized Potential Natural Vegetation of the Los Angeles Region [Data set]. https://services1.arcgis.com/ZIL9uO234SBB-PGL7/arcgis/rest/services/PotentialNaturalVegetation_LALAH_MGRS1km_060923/FeatureServer

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