Plant Life

Whether it's a towering redwood, a delicate bleeding heart, a snatch of lichen, or a scruffy coyote brush, there are things that all plants have in common: they make their own food. Their differences, on the other hand, are vast and varied. The aquatic duckweed that spreads over the surface of the pond differs in many ways from a ponderosa pine which prefers a sandy, dryer habitat. Differences in adaptations, reproductive techniques, habitat requirements, and other variations are what make the world of plants fascinating and fun to learn.

What is Photosynthesis?

Science tells us that life is on this planet because energy and matter are present. Matter cycles over and over within the system, and energy flows through the system, dissipating as it goes. Said another way, matter becomes the building blocks and energy powers the system. This means that an **ecosystem**, or the living and non-living components of an interacting unit in nature, depends on a constant transfer of energy. This energy transfer occurs in three steps:

- ✓ the sun shines,
- ✓ plants photosynthesize, and
- ✓ animals respirate.

The sun is the main energy source available for life on the earth's surface. It is a burning ball of hydrogen gas undergoing nuclear fusion. This means that it acts like a nursery for elements, as hydrogen atoms are fused together into other heavier elements, in a process that also gives off heat, light, and radiation. As this energy radiates out and strikes our planet, it provides the power for life.

Green plants take this sunlight and convert it into food in a process called **photosynthesis**. The process takes place in the leaves, stems, or any part of the plant that contains the pigment **chlorophyll**. Chlorophyll is what makes plants green, and are located in a part of the plant called **chloroplasts.** These chloroplasts, filled with chlorophyll, become like a factory site with the sun as its power source. There are other leaf pigments too, such as yellow xanthophylls and red, orange, or yellow carotenoids that can become apparent in the autumn when the chlorophyll degenerates and leaves change to their "fall colors".

Within this chlorophyll factory, raw materials are received in the form of carbon dioxide (CO_2) from the air, and water (H_2O) from the soil, and the finished products become carbohydrates (CH_2O), or food, and oxygen (O_2). The entire process can be written with the following formula:

$$CO_2 + H_2O \xrightarrow[\text{chlorophyll}]{\text{light}} CH_2O + O_2$$

Viewed this way we can see that carbon (C), oxygen (O), and hydrogen (H) are being rearranged into other forms. The specific carbohydrate molecule that is being produced is a simple sugar called glucose ($C_6H_{12}O_6$).

Now, animals can enter the picture and introduce a process called **respiration**. They breathe in the oxygen and consume the food produced by plants, converting them to carbon dioxide which is exhaled, water which is shed, and energy which they can use to grow, move, or think. The process can be symbolized in this way:

$$CH_2O + O_2 \rightarrow\rightarrow\rightarrow CO_2 + H_2O + \text{energy}$$

Animals are not the only organisms that respirate. At night, when the sun is no longer shining, plants will respirate too. The cyclical nature of photosynthesis and respiration is obvious. The raw materials for one, are the end products of the other. The energy entering and leaving the system is the ingredient that must be constantly replenished or the system fails.

Plant Parts

Once upon a time, this planet was covered with nothing but rocks and water. Then, about a billion years ago, seaweed began clinging to the shore at low tide, followed by terrestrial plants covering the rocks with a green film, about a half a billion years ago. Some of the simple, single-celled plants eventually evolved into more complex ones – no longer able to function autonomously as one cell, but surviving only through numerous cells cooperating with each other and dividing labor into different areas of specialty.

This division of labor was born out of the need to obtain water, carbon dioxide, and light – the materials necessary for the process of photosynthesis. In order to obtain these ingredients, a **shoot system** evolved to acquire the carbon dioxide and light which could be found above ground. Water – the most limiting of the ingredients – was found in the soil, requiring a **root system** to obtain it. However, there were some plants that did not require a root system, absorbing water directly through the leaves and stems. These plants are known as **bryophytes**, and include the mosses, hornworts, and liverworts.

Later, as plants began crowding each other, competition for light necessitated a structure more efficient at collecting it – leaves – while stems allowed a plant to get closer to the light, shading out those below. There was good news and bad news about the evolution of stems allowing plants to gain in height. The good news was that these taller plants became more efficient at collecting sunlight energy, however, the transportation of necessary water and nutrients to these upper portions of the plant became a challenge. In response to this problem, plants evolved a vascular system in which specialized cells developed to transport material up and down the plant. **Xylem** is the tissue designed to transport water and nutrients up the stems to the chlorophyll in leaves where the process of photosynthesis will take place. The tissue which transports the glucose, or simple sugars, down the stems to nourish the root system is called **phloem**.

The transportation of materials up and down the plant becomes an amazing feat, especially when you think of it occurring in a 300-foot-tall redwood tree. That is where the cohesive qualities of water come in handy (see the chapter on Shaping Our Environment, hydrology section). Think of a glass of water almost filled to overflowing. The water will actually bow over the top of the glass adhering to itself as it climbs above the rim. This same stickiness works in plants as **stomata**, or leaf pores, open and allow water vapor as well as oxygen to escape. Water and nutrients are sucked up the xylem tissue like soda in a straw, spreading through thousands of tiny vessels, to those photosynthetic chloroplast sites, allowing the plant to make food.

As the evolution of plants continued, it eventually produced such a tall stem that a different type of structure was necessary to support its height. These plants are trees, and contain a very sturdy collection of xylem cells called **wood**. If we were to look at a cross-section of a tree trunk, we would see **bark** on the outside for protection. Next, would be the phloem tissue, followed by a thin layer where cells are produced, called the **cambium**. This reproductive layer produces phloem cells on one side and xylem cells on the other. The xylem tissue is divided into **sapwood**, or that part of the wood that is actively transporting materials, and **heartwood**, or the inner portion of non-conducting, dead wood needed for support.

Trees can live for a long time, creating a local history book in the growth patterns of its wood. Most of us know that you can tell the age of a tree by counting the rings in its wood – the lighter colored wood being the fast, spring growth with large, thin-walled cells and the neighboring dark rings showing smaller cells with thinner walls grown during summer when growth is slower. Studying patterns in the wood will also reveal weather patterns, with thicker rings signifying a wetter year and better growing conditions. Fire scars, old branch growth, and other irregularities will also give a clue to past conditions and occurrences.

Plant Reproduction

Whether they use fruit, cones, spores, runners, bulbs, cutting, or other reproductive method, plants have a variety of ways of populating themselves. Some of those methods are **asexual**, or sometimes called vegetative reproduction, and occur when a plant has only one parent. Examples include runners as in lawn grass, bulbs like onions, stem cuttings like with many house plants, or grafting as done with many fruit trees.

Sexual reproduction takes place when a plant develops from fertilization involving two parents, with the resulting offspring being different from either parent. There are two groupings of plants that use sexual reproduction:

- ✓ **Angiosperms** is a Greek term meaning a seed born in a vessel. These are flowering plants which have a seed encased in an ovary.

- ✓ **Gymnosperms,** which is Greek for “naked seed”, refers to a seed plant that is not enclosed in an ovary. Conifers with their “cones” are the most common example.

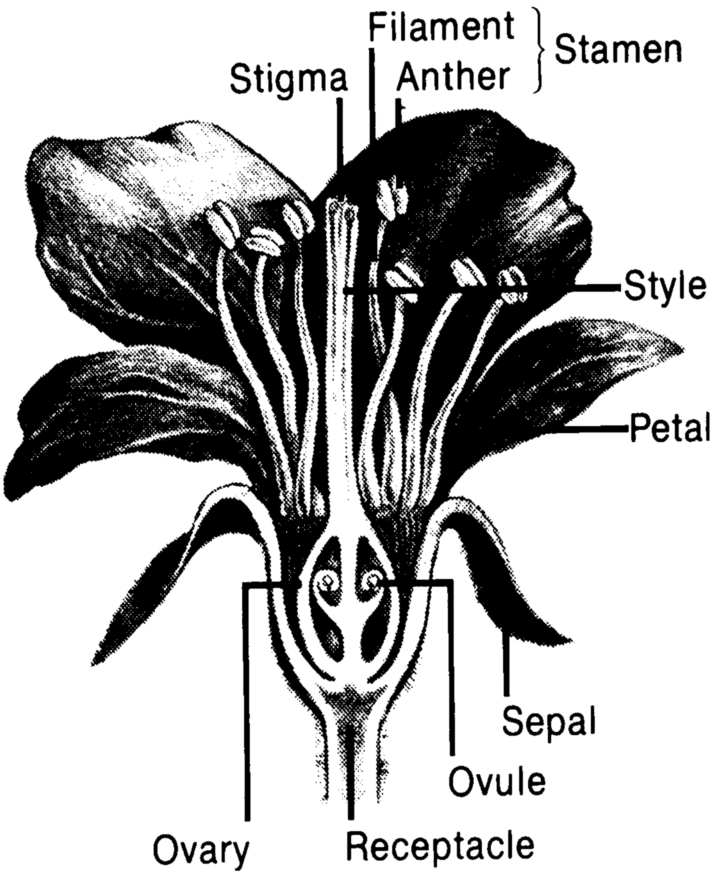
Some plants use a combination of these two methods. The bryophytes, along with the “seedless” plants, like ferns, horsetails, and others, have developed a reproductive process that alternates between distinct sexual and asexual phases. This “alternating” reproductive cycle is called **alternation of generations** and consists of generation “A” producing spores that grow into generation “B.” The “B” individuals are able to produce eggs and/or sperm which, when fertilized, produce generation “A” again and the cycle continues.

Flowers as Parents in the Plant World

(This section was adapted from *Hands-on Nature*, Jenepher Lingelback, editor)

“The earth laughs in flowers.” - Ralf Waldo Emerson

From the wilted handful of dandelions presented by a young child to its mother, to the glorious bouquet of red roses given to someone special, flowers have long been considered one of nature’s most perfect gifts. It’s hard to believe, when looking at the soft lavender blossoms of an iris or smelling the heavy sweetness of Western Azaleas, that these beautiful flowers exist for one purpose only: to produce seeds. How they are shaped, their color, size, and smell all contribute to success in this vital mission.



The structure of a typical flower includes all the parts necessary for producing seeds, although there are many variations. In the center is the **pistil**, or the seed producing organ. At its tip is the **stigma** which is sticky or feathery to trap the pollen which lands there. It is held aloft by a stalk called the **style**. At the base of the pistil is the **ovary** where the ovules with their egg cells await fertilization.

The male parts of the flower, which produce the pollen needed for fertilization, are called the **stamens**. As the pollen must travel to the stigma of another flower, the stamens are placed where they will be the most exposed to whatever agent will carry the pollen, whether wind or insect. The pollen is formed in the **anther** at the tip of the stamen. When it is ready for dispersal, the anthers split open and curl back to release it. Under a hand lens many of the anthers look like canoes or hot dog rolls. The anther is held aloft by the **filament**.

The **petals** are usually the most conspicuous part of the flower, and purposely so, for they serve as a banner to attract insects and also as a landing platform. Many petals even have lines on them to guide the insects to the nectar, encouraging them to brush against the pistil and stamens as they go. Wind pollinated flowers, like those of coyote brush, have very unobtrusive petals or none at all. Beneath the petals are green leaf-like structures called **sepals**, which once enclosed and protected the bud.

A typical flower has all the parts so far described, however, the arrangement of the parts varies considerably with a gradual streamlining of design having occurred among flower families over the millions of years flowering plants have existed. The early types of flowers – similar to buttercups – had numerous pistils and many stamens. Since then, many kinds of flowers have reduced the number of their flower parts by joining the pistils together into a single multi-chambered pistil. Examine a lily and notice the three-chambered pistil. When the ovary has ripened to a fruit, the pattern of the seeds within, reflects the original design of the pistil. Cut an apple horizontally in half to see the five-pointed, star-shaped seed container echoing the five compartments in the pistil of the apple blossom. The number of stamens has also been reduced with more efficient placement within the flower.

In some flowering plants male and female parts are contained on different plants, as in the case of coyote brush. Occasionally, in such plants as the California hazelnut, male and female flowers grow separately but on the same plant.

Whether wind-borne or insect-ferried, the pollen grain, once deposited on the stigma of the same kind of flower from which it came, sends forth a microscopic pollen tube to penetrate the ovary wall. Some of these tubes connect with the ovules providing passage for the male cells, which then fertilize the eggs. Once that has occurred, ovules grow into seeds and the ovary wall becomes the encasing fruit around the seeds. Picture a tomato– both ripened ovaries contain seeds. To look closely at a flower is to find perfection in miniature. To consider its transformation into fruit is to be confronted by a miracle.

Flowers and their Pollinators

(Adapted from *Docent Information Manual*, by Heidi Horvitz)

While looking at a hill colored purple by lupine or delighting in the brilliance of a single poppy, we tend to forget that flowers did not evolve merely for our pleasure. Flowers perform the special job of producing seeds for plants. Seeds cannot be made until the flower is **pollinated** – the process where pollen from a stamen reaches its own pistil or the pistil of another flower.

Flowers have different designs to lure or assist their pollinators. This remarkable assortment of colors and shapes is what we enjoy each spiring and summer. The general shape and color of a flower is often a clue to what pollinates it:

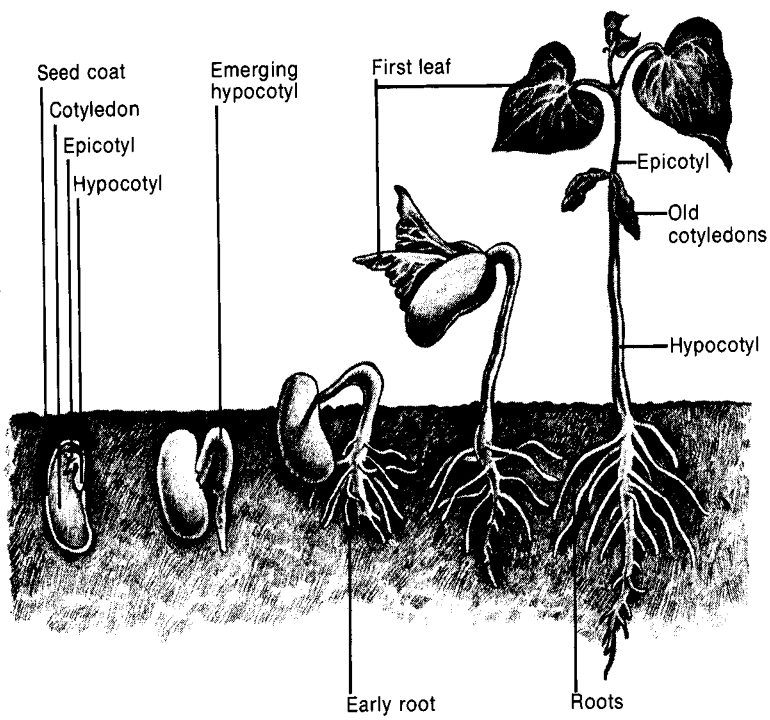
Pollinator	Flower Design	Flower Benefit	Examples
Wind	Lots of pollen; no scent; very small; inconspicuous petals.	Wind is the least accurate pollinator, so lots of pollen ensures success.	Coyote Brush & Grasses
Humming-birds	Lots of nectar; little scent; often red or bright orange; tube-shaped.	Hummingbirds have a poor sense of smell, so these flowers don't need a strong scent.	Indian Paintbrush
Flies	Unpleasant scent; open and flat; yellow, white, greenish, or blue.	Flies are attracted to the smell of rotting meat.	Wild Ginger
Bees	Blue, purple, or yellow and showy; sweet scent; nectar guides (often lines or dots); landing platform.	Bees don't see red; like other animal pollinators, they are attracted to pollen and nectar for food.	Two-eyed Violet
Butterflies	Long, slender flower tubes; brightly colored; landing platform.	Butterflies prefer sucking nectar from narrow tubes.	Lupine
Moths	Cream, white, or pale yellow; strong scent; tube-shaped.	Pale colors are easily seen in the dark.	Soap Root
Beetles	Lots of pollen; many petals; fruity scent.	Lots of pollen ensures that some will get stuck to beetles as they walk around and feed.	Yarrow

It is tempting to pick wildflowers, but there are many reasons not to:

- ✓ Like most living things, plants need to reproduce. If the flower is picked, the pollination process stops and the plant cannot make seeds.
- ✓ Though some plants re-sprout yearly from underground food-storage-like bulbs or **rhizomes**, if the green, leafy flower stalks of these plants are picked, food production is reduced for next year's growth. Picking the flowers and leaves of some of these plants may halt flowering for up to 10 years!
- ✓ Wildflowers wilt quickly when cut or picked.

Seed Generation

Think of a bean: a kidney bean, a lima bean, a garbanzo bean . . . Like any other type of seed, nut, or fruit they are the beginnings of a new plant. If they fall to the ground in a place that offers just the right conditions, with luck – or, as some would say, with a bit of a miracle – it will become a new plant.



That bean contains several parts, including an infant shoot system, root system, and **cotyledons**, or embryonic seed leaves. The cotyledons contain stored food which the plant will absorb as it germinates, becoming shriveled and used-up about the time the first leaves are able to photosynthesize. The number of cotyledons an angiosperm has, will determine whether it is a monocot or dicot.

Beans are examples of **dicots**, or dicotyledons, meaning that they have two of these seed leaves. **Monocots**, or monocotyledons like corn or onion, have only one seed leaf. Angiosperms – the flowering plants – are the largest of the plant classes, numbering about 235,000 species, and of this class, dicots number 170,000 species, with the monocot subclass containing 65,000 species.

The following table outlines the basic differences between dicots and monocots:

Embryo	Stems	Leaf Veins	Root Structure
Dicots	Vascular tissue arranged around a central core.	Fan-like or feather-like	Tap or fibrous roots
Monocots	Vascular tissue scattered.	Parallel	Fibrous roots

The Fungi

Most people would consider the group of fungi a plant, however it is about as distinct from plants as it is from animals. Along with bacteria, they play an important role in food chains as a decomposer – breaking down organic material into compounds to be used again by other plants. This group consisting of mushrooms, toadstools, shelf fungi, puffballs, yeasts, molds, and others, often makes no distinction between a fallen tree in the forest and a railroad tie. They use a powerful arsenal of destructive enzymes to do their job, attacking everything from cloth, paint, film, wiring, waxes, and glass to food items like bread, fruit, vegetables, meat, and others.

Fungi are rapidly-growing, non-photosynthetic organisms that usually form highly-branched filaments called **mycelium**. In the familiar mushrooms, this mycelium grows un-seen, underground and it is only when their reproductive mushroom cap, or **basidiocarp**, emerges from the soil that spores can be released. Other fungi, like the molds and yeasts, are identified by the black coloration that appear on different plant surfaces. And still others team up with algae to create another grouping called **lichens,** which appear as a harmless, light-green, mossy covering on some plants.

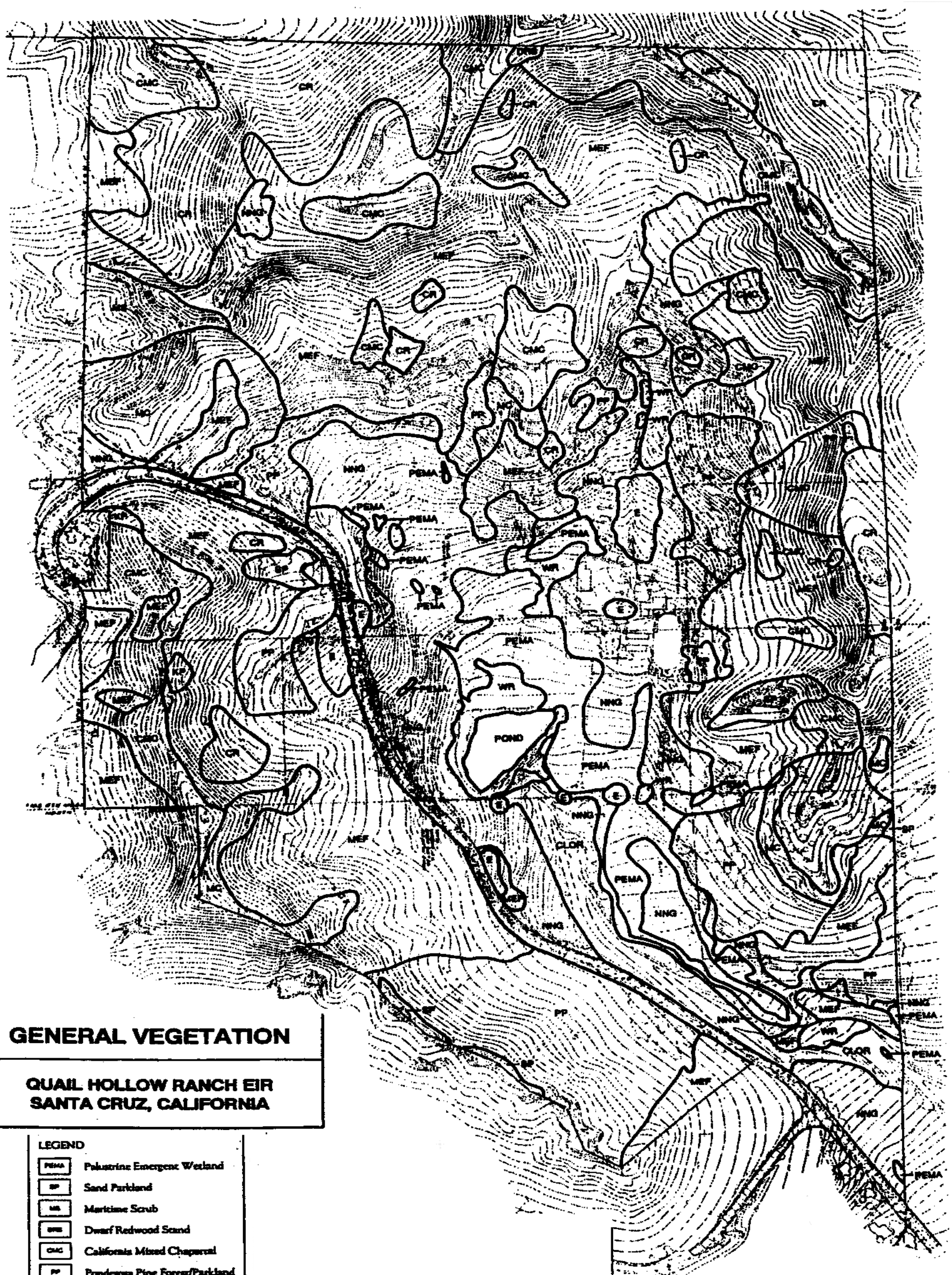
Plant Communities

For most people, the word "community" brings to mind a town, or a collection of neighborhoods. We tend to think of the communities in which we live as containing family, friends, and neighbors, often united with a similar condition, life style, or culture. The same is true in the natural world. Species of plants and animals tend to locate themselves where the conditions are right, where they "feel at home."

But a **plant community** is more than a collection of plants that live in the same place. They also have relationships that are mutually sustaining and inter-dependent, and are constantly fixing, utilizing, and dissipating energy. Generally, these communities are named for a dominant plant, which influences the general appearance of the area. It is important to note, however, that they are not absolute, with distinct boundaries, but gradually blend from one zone to another.

Within the 300-acre parcel of Quail Hollow Ranch County Park, there are 15 plant communities:

- ✓ Mixed Evergreen Forest
- ✓ Coast Redwood Forest
- ✓ Dwarf Redwood Stand
- ✓ Knobcone Pine Forest
- ✓ Ponderosa Pine Forest
- ✓ Sand Parkland
- ✓ California Mixed Chaparral
- ✓ Maritime Chaparral
- ✓ Maritime Scrub
- ✓ Coast Live Oak Riparian Forest
- ✓ Willow Riparian Forest
- ✓ Pond
- ✓ Grassland
- ✓ Pasture
- ✓ Eucalyptus Grove



GENERAL VEGETATION

QUAIL HOLLOW RANCH EIR
SANTA CRUZ, CALIFORNIA

LEGEND

PEMA	Palustrine Emergent Wetland
SP	Sand Parkland
MS	Maritime Scrub
DRS	Dwarf Redwood Stand
CMC	California Mixed Chaparral
PP	Ponderosa Pine Forest/Parkland
MEF	Mixed Evergreen Forest
CR	Coast Redwood Forest
MC	Maritime Chaparral
CLOR	Coast Live Oak Riparian Forest
WR	Willow Riparian
KP	Knobcone Pine Forest
NNG	Non-native Grassland
E	Eucalyptus Grove

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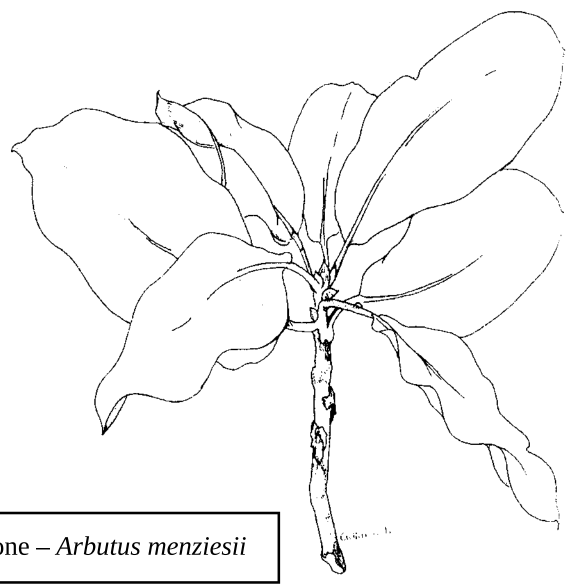
Six of these plant communities are sensitive, meaning that they are threatened or rare. They include the ponderosa pine forest, coast live oak riparian forest, willow riparian forest, maritime chaparral, maritime scrub, and sand parkland. This diversity of communities are one of the things that makes Quail Hollow Ranch so unique.

The Mixed Evergreen Forest

Imagine walking along a trail as it winds in and out, along the base of the ridge, through a mixed evergreen forest. Its shady canopy is made up of coast live oak, madrone, California bay, tan oak, Douglas fir, and other broad-leaf and coniferous trees. Beneath the varied collection of trees is an understory consisting of plants like toyon, California hazel, wild rose, poison oak, and more.

The amount of moisture has an affect on the distribution of many of this forest's trees. The well-drained, sandy soils found here contribute to the abundance of broad-leaf evergreens with their stiff, leathery leaves and waxy coatings. These adaptations help to ward off excessive water loss and ensure survival during the long dry summer. On the other hand, those locations that are more moist will find an increased occurrence of trees like Douglas fir and redwood.

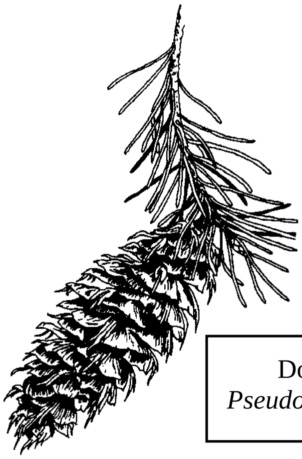


Madrone – *Arbutus menziesii*

One of the more noticeable trees is the **madrone**, or *Arbutus menziesii*, which looks like a tree version of the manzanita. Its large, waxy leaves help it to keep from from drying out, but more striking is its twisted trunk, covered with a smooth, red, papery bark which is quite cool to the touch. Both the madrone and manzanita belong to the heath, or *Ericaceae*, family, hence there is also a similarity in their urn-shaped, white flowers and resulting orange-to-red berries.

Have you ever been walking in the forest and caught a powerful whiff of something, then looked around to find, not a bank of flowers, but a **California bay**, or *Umbellularia californica*? Sometimes called pepperwood, bay laurel, or Oregon myrtle, the California bay is a relative of the Greek laurel whose leaves are sold in stores as a cooking spice. Although this local bay can also be used as a spice, the leaves can be toxic if used in large doses. Native Americans put his plant into a different service by rolling up the lance-shaped leaves and placing it in one nostril to relieve headaches. It also acts as a flea repellant. As you might suspect, the potent oils found in its leaves have an effect on its local environment by chemically altering the soils, discouraging other plants from growing there. This plant chemical warfare is called **allelopathy**.

Tanoak, or *Lithocarpus densiflorus,* is a broad-leaf evergreen that bears little resemblance to other oaks, except for the acorns. Its bark contain large amounts of tannin, which historically was used in the process of tanning animal hides. Because Santa Cruz County had large groves of these trees, they were extensively logged, creating the center of the state's tanning industry during the late 1800s. Fortunately, chemical substitutes have been discovered, allowing these tanoak stands to recover.



Douglas fir –
Pseudotsuga menziesii

Hiking through the forest, occasionally one comes upon an evergreen with a long, papery bract. What you have found is the **Douglas fir**, or *Pseudotsuga menziesii*, a member of the pine family. In the springtime, the bright green, new growth, high in vitamin C, can be made into a tea, good for helping with lung problems and tuberculosis. More commonly, however, this conifer is logged for its wood.

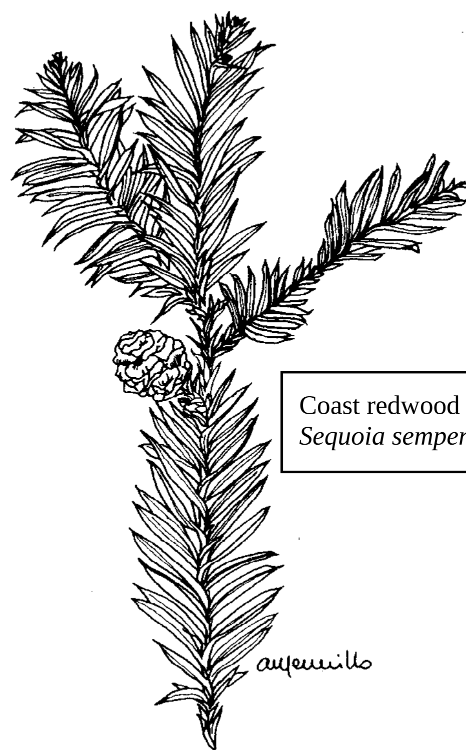
These are just a few dominant plant of the many species found in the mixed evergreen forest. As you familiarize yourself with this community, you will discover others, giving you the opportunity to learn about how they survive, reproduce, and make this habitat their home.

The Redwood Forest

Oh ancient one, you grow so tall
The earth will tremble when you fall,
But when you fall upon the ground
The seedlings of your roots will rise around
And around and around and around we sing
And dance inside your fairy ring,
And from that ring each tree will rise,
Until it reaches beyond our eyes
And ears for years reaching to the sun,
Perhaps to become the ancient one.

- Julie Sidel, Big Basin Redwoods State Park Interpreter

Walking into a cool, moist redwood forest gives one a feeling of walking back in time. The dominant **coast redwood trees**, or *Sequoia sempervirens,* are one of the oldest living things on this planet, some dating back 2,000 years. Under this dark, damp canopy lies a place seemingly devoid of seasonal changes, with the tree tops protecting the forest floor from the sweltering summer sun, maintaining those winter-like conditions throughout the year.



Coast redwood tree
Sequoia sempervirens

Looking up, it is difficult to see the top of these giants. We understand why, when we discover that they are the tallest living things on earth, commonly reaching heights of well over 300 feet, with the tallest redwoods measuring over 360 feet. Think of a football field which runs 300 feet from goal-line to goal-line. Now add the 30-foot end zones on each side, and we have a 360-foot reference. The tallest redwoods would not be contained in that football field!

Walking along the forest floor we become familiar with the redwood's feather-like arrangement of needles, but occasionally discover a sprig of redwood needles broken away from the top of the tree looking very different. These sun-needles are small and spiny adapted to reducing water loss in the hot, dry canopy. Comparing them to the feathery shade needles, we can see how the amount of sunlight and the need to conserve water determines the size and shape of its leaves.

When we look down at the ground, we find a thick mat of duff with a dark, underlying soil. Upper layers of the soil contain a web of redwood roots, extending down six to eight feet and out one to two hundred feet. These trees lack a taproot, opting instead to interlace the roots of surrounding trees in an underground network that provides stability and strength through mutual support. Because the roots are so close to the surface, they are sensitive to trampling and soil compaction. This is why it is important to keep hikers along designated trails, automobile traffic along roadways, and campgrounds out of redwood groves.

Reproduction in the coast redwood is through two avenues: cones and sprouting. The small, one-inch cones are wind pollinated, producing about 50 seeds per cone. The tiny seeds are so small that a pound would contain 125,000 of them. A problem arises, however, when we look at seed germination. Redwood duff contains fungus that kills seedlings, so in order to grow, a seed needs to be in contact with bare mineral soil, which usually lies about six to eight inches below ground. This can occur when a fire has burned off the top duff layer, a flood has deposited sediment, a tree has fallen and upturned the soil, or other disturbance has exposed the lower layers of soil. Yet, even if a seed finds a patch of mineral soil, it still needs enough moisture to soak up its seed coat – about five to eight inches of rain – and temperatures warmer than 58 degrees to sprout. If it can make it through three months, it usually has enough of a root system to survive, however it is estimated that fewer than one percent make it this far.

You may be wondering how these redwoods have been able to survive with such limiting growing conditions for its seeds. The response to this dilemma lies in its ability to sprout. This asexual form of reproduction occurs as a result of dormant buds that remain fairly inactive in healthy trees. Growing redwoods produce a growth regulator which inhibits fast-growing sprouts. However, when a tree has fallen, been burned, or been injured, these regulators are not produced and sprouts quickly take over. These young shoots arise from the already extensive root system and are so persistent that they out-compete the seedlings for resources.

Only a few sprouts will survive and mature into a new generation of redwoods. But because these shoots sprouted around a single parent tree, their placement tends to be in a circle, creating what is referred to as a "**fairy ring**". Often there is nothing left of the parent tree, except its roots and the circle of half a dozen or so sprouts. Because redwoods can reproduce in this manner, a second growth stand of 80 years could be tapped into a root system that is thousands of years old.

Besides the coast redwood, other plants found in this community are ones that are adapted to the challenging conditions found here. The deep shade of the redwood forest requires shade-tolerant species, and the thick, acidic duff make seed germination difficult. Because of these requirements, few plants make this habitat their home, resulting in a lack in diversity. However, there are some species that find these moist, dark conditions to their liking including hazelnut, blackberry, yerba buena and others.

These forests may be lacking diversity, however they contain more biomass than any other California community. Its **biomass**, or net weight of all living things within that community, is about 1500 tons per acre. The main contributor to this amount is the redwood, which is a very rapidly growing plant. A 20 year old tree may average 50 feet in height and 8 inches in diameter, with the average mature tree measuring 225 feet tall and 12 feet in diameter.

Once upon a time, about 100 million years ago, relatives of the redwood could have been found throughout Europe and Asia, as well as North America. Today, those dozen or so species have been reduced to three: the coast redwood, the giant sequoia or *Sequoiadendron giganteum,* and the dawn redwood or *Metasequoia glyptostroboides.* The coast redwood forests are now limited to a narrow coastal strip stretching from the Oregon border, south to Big Sur – a mere 500 miles long and sometimes only 20 to 30 miles wide. This limitation is due to the conditions that these trees require: summer fog, moderate year-round temperatures, and abundant winter rainfall.

Here at Quail Hollow Ranch, there are only **second growth**, or previously logged forests within its boundaries. Yet as we enter their realm, it is like entering a great cathedral being rebuilt. As fairy rings sprout and grow around old stumps, we are reminded of their longevity and greatness, and we can see their ability to rebound when they are given the opportunity. But it is as John Muir said almost a century ago: "God has cared for these trees... but He cannot save them from fools. Only Uncle Sam can do that."

Dwarf Redwood Stand

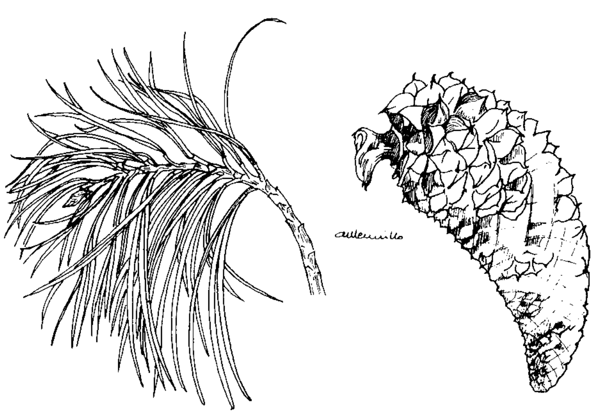
Imagine hiking up the Sunset trail, zig-zaging along the switch-backs, until you finally ascend to the top of the ridge. As you rest on the bench, you begin to look around, enjoying the view and surroundings, until your eyes come to rest on the stand of bean-pole trees behind you. Upon closer inspection, you notice that these trees have the familiar collection of feather-shaped shade needles and spiny sun needles of the coast redwood, but they are lime-green and stunted in height. What you have found is Quail Hollow Ranch's **dwarf redwood stand**, or pygmy redwood forest.

This is what happens when a towering coast redwood is allowed to grow in impoverished, hardpan soils, causing stunted growth and altered color. The shallow root system of the redwoods are an advantage in these superficial soils, however when soils are limited, they result in stunted tree growth.

In your typical pygmy forest, trees can grow centuries old, yet remain a mere ten feet tall. Stunted growth may be caused by extreme ph levels, poor drainage, low oxygen levels, or poor nutrient levels. In our stand, the trees are fairly young, and with time they may acquire a gnarled appearance yet maintain their small stature. Little is known of this dwarf redwood stand, but with time, as the trees mature and more study provides additional information, we will come to discover the hidden secrets of this unique habitat.

The Knobcone Pine Forest

As you make your way to the warm, dry ridge-tops of the park that have impoverished shale or sandy soils, you are bound to come upon a scraggly, sparse pine that appears to be in poor health. This is the **knobcone pine**, or *Pinus attenuata*, a member of the closed-cone pine group.



Knobcone pine – *Pinus attenuata*

Communities dominated by knobcone pines are adapted to frequent fires – about once every 33 to 50 years – with plenty of fog. There is an interesting relationship between the poor soils in which these trees are found, and their need for fire and fog. The crescent-shaped cones will cling like a lump of clay to a main branch, in a closed condition, for many years, waiting for the heat of a fire to open them, releasing the winged seeds. Periodic fires do two things for the knobcone pines: they clear away any competing brush and they prepare the soil for a new seedling with a layer of mineral-rich ash.

These depleted soils also tend to be well-drained, creating a need for an alternative water source. This is where fog becomes an important aspect of this community. Fog condenses on the needles converting unavailable moisture in the atmosphere to available water in the soil, sometimes measuring as much as four inches per month in some parts of the state.

Within the understory of the knobcone pine forest one frequently finds **chamise**, or *Adenostoma fasciculatum.* Its small, spiny leaves reduce water loss and make it well adapted to these sunny habitats. It fairs well with fire in that it is able to sprout, like redwoods, from the highly branched stems. Like the California bay, chamise uses allelopathy, altering the soil as it drops leaves, eliminating competition of other plants.

The knobcone pine's needles are arranged in groups of three, just like the other dominant pine in the park: the ponderosa pine. However, the shorter knobcone pine frequently has multiple trunks compared to the ponderosa pine's typically single trunk. In addition, these two pines have a very different overall appearance: the ponderosa pine has a sturdy, stately look, where the knobcone pine is wispy and tenuous. And yet, despite its unhealthy impression, this tree is able to survive in conditions that only the hardiest chaparral species would persist.

The Ponderosa Pine Forest

You see them here and there throughout the park: large, regal pines with long, graceful needles and a bark that looked like it was pieced together like puzzle-pieces. The **ponderosa pine**, or *Pinus ponderosa*, is the dominant tree found in this community which is usually located at higher elevations. They are uncommon west of the Sierra Nevada mountains and, as a result, make a unique appearance in this part of the state. Because of this occurrence, the habitat is locally listed as a high inventory priority plant community by the California Department of Fish and Game.

Ponderosa pine – *Pinus ponderosa*

Generally speaking, ponderosa pines like climates where the average January temperatures are below 30 degrees Fahrenheit, meaning that they tend to occur above 3,000 feet in elevation and only drop below that limit in the northern latitudes. This is because there is a ratio between photosynthesis and respiration in regards to temperature. As temperatures rise, photosynthesis decreases and respiration increases. At a certain point, the rate of respiration requires more "food" than the rate of photosynthesis can provide. For species sensitive to this, like the ponderosa pine, cooler temperatures, which are generally found at high elevations and latitudes, become the limiting factors of their range.

So why are these trees found at Quail Hollow Ranch, at elevations of a little over 400 feet? The jury is still out on that question, however the answer could have something to do with local conditions like the sandy Soquel complex soils so prevalent in the park. Moisture loving trees like redwoods cannot tolerate the dry conditions of the sandy soils, leaving them open to intrusion by other species, like the ponderosa pine. Also, it has been suggested that these pines are not genetically the same as the mountainous variety, suggesting another reason why they may be located here.

Our pine stands are not dense forests, but patchy, allowing an understory of bracken fern and silver bush lupine, as well as sensitive species like the Santa Cruz wallflower, Ben Lomond spineflower, and silver-leaved manzanita. All of these species are also found in the sand parkland habitat which creates a very fuzzy line between the ponderosa pine and sand parkland communities, occasionally becoming indistinguishable.

Because the conditions in this forest tend to be dry, one would think that any type of fern would not survive. Not so, at least for the **bracken fern**, or *Pteridium aquilinum,* which can find a home anywhere from dry open slopes to moist, shaded valleys. These ferns are distinguished from others by a highly branched **frond**, or fern leaf. The young leaves, or **fiddle-heads**, are edible, either raw or steamed, and made a good thickener for soups. However, you don't want to eat too much as they inhibit nutrient utilization.

The **silver bush lupine,** or *Lupinus albifrons*, help these sandy soils by nature of their deep root system which stabilize the ground and which also fix nitrogen. **Nitrogen-fixing plants** are ones that have nodules attached to their roots, which convert atmospheric nitrogen into available nitrogen, thus adding to the health of the soil. The typically compound, palmate leaves look much like a many-fingered hand spread wide, however, these leaves have a light, silver color, effectively reflecting light – a useful adaptation in hot, dry habitats.

There is still much that we don't understand about the ponderosa pine stands, especially in finding a home at such low elevations. Yet these noble trees, with their long needles in groups of three; their prickly, four-inch cones; and their bark composed of large, flat plates; have not only found a foothold here, but they have prospered, adding to the overall diversity of the ranch.

The Sand Parkland

Scattered on islands of inland marine sediment lies a collection of "biological islands" called the **sandhills community**, one of the most biologically diverse and unique areas in California. You would think that the sandy, well-drained soils would produce a moon-scape, devoid of life, and from a distance, these communities seem to be just that. However, upon closer inspection, one discovers species of plants and animals found nowhere else in the world.

Within the sandhills is a collection of habitats that can be divided into sub-categories. One of these communities is the silver-leaved manzanita chaparral which is mentioned in the Maritime Chaparral section below. The **sand parkland** is another of these communities, found on white, sandy soils containing widely-spaced ponderosa pine and an understory plant list that looks like it was lifted directly from the pages of a sensitive species directory. The Santa Cruz wallflower, Ben Lomond spineflower, silver-leaved manzanita, Ben Lomond buckwheat, curly-leaved monardella, and Santa Cruz monkeyflower all have listings ranging from endangered to threatened. The following table outlines the specific listings of these sensitive species:

Plant Name	California Native Plant Society Listing	State Listing	Federal Listing
Santa Cruz Wallflower (*Erysimum teretifolium*)	Rare throughout their range	Endangered	Endangered
Ben Lomond Spineflower (*Chorizanthe pungens* var. *hartwegiana)*	Rare throughout their range	None	Endangered
Silver-leaved Manzanita *(Arctostaphylos silvicola)*	Rare throughout their range	None	Threat &/or insufficient data
Ben Lomond Buckwheat *(Eriogonum nudum)*	Rare throughout their range	None	None
Curly-leaved Monardella *(Monardella undulata)*	Under threat, being watched	None	None
Santa Cruz Monkeyflower *(Mimulus rattanii* ssp. *decurtatus)*	Under threat, being watched	None	None

Santa Cruz Wallflower
Erysimum teretifolium

One of the first flowers to bloom in the sand parkland is the brilliant yellow floral display of the **Santa Cruz Wallflower**, or *Erysimum teretifolium*. This state and federal endangered species is a pioneer, preferring to grow in openings devoid of other plants. It is a biennial plant, meaning that it will grow a leafy base of leaves one year and then send out its tall, yellow blossoms the second year.

Like the wallflower, the **Ben Lomond Spineflower**, or *Chorizanthe pungens var. hartwegiana*, is a poor competitor. This federal endangered species is an annual, reproducing entirely from seed each year. As a result, this low growing plant with pink blossoms may have seeds stored in the dry, sandy soil, waiting for competing weeds to be removed before sprouting. Gophers have been known to assist in this matter when soils were cleared for burrow entrances and runways, later erupting with a carpet of spineflowers.

Ben Lomond Spineflower *Chorizanthe pungens var. hartwegiana*

The sandhills communities are only found on the Zayante soil type, composed primarily of coarse sand. It originally covered about 8,000 acres, or about 3 percent, of Santa Cruz County and often contains fossilized sand dollars, shark teeth, and other finds. These beds also contain sand that is valuable for making glass products and high-strength concrete, which is why many of these habitats are quarried.

Our western ridge sand parkland habitat at has been rated at .75, on a biodiversity scale of 0 to 1, with 1 being highly diverse. High quality examples like this, currently occupy less than 35 acres throughout the county. Approximately 60 percent of this sensitive habitat have been lost due to human activities including mining, development, recreation, and agricultural uses, emphasizing a need to protect these dwindling communities. The ecological reserve near Bonny Doon, as well as the Quail Hollow Ranch sand parkland are both owned by the California Department of Fish and Game in an effort to maintain and protect this open space. Guided tours of this unique habitat will aid in educating the public about the plight of these sensitive areas, hopefully leading to a greater awareness of these special biological islands.

The Chaparral Community

By Joyce Nicholas and Alice Watt

Stress, and the problems of dealing with it, seem to be on everyone's mind these days. Were you aware that plants have to deal with stress, too? One plant community that lives in a very stressful environment is chaparral – the name given to the typical brushy vegetation in California. The chaparral's shrubs and low trees – not more that about ten feet high – can form an impenetrable barrier to human travel with their dense network of stiff branches and small, thick evergreen leaves.

Imagine a chaparral shrub on a steep hillside on a hot summer day. The sun beats down on its leaves, heating them and evaporating their water. Its roots are in shallow, unstable, porous soul, with neighboring plants competing for the limited supply of water and nutrients. To survive, chaparral plants must develop methods to discourage insects and mammals from eating it, as well as methods of attracting pollinators.

Typical plants in the chaparral community are the many species of manzanita, and **ceanothus**, some-times called California lilac, with its sprays of blue or white blossoms. **Chamise** is the least typical in appearance with its narrow, needle-like foliage. Often, dense chamise stands often blanket south-facing slopes with a rough, green tapestry.

Chaparral is found only in places with mild winters followed by hot, dry summers. These include California, the Mediterranean regions, Chile, South Africa, and southwest Australia. Although these places are widely separated geographically, their plants have responded in similar ways to the common climatic patterns. As a result, they look amazingly alike, even though the species are different.

The need to obtain and conserve vital water is the chaparral plant's number one priority. To accomplish this, the leaves can be small and leathery to minimize water loss by transpiration, or waterproofed with a waxy coating, or insulated with fine hairs whose light color reflects the light. In some **manzanitas**, the leaves are on edge, presenting a minimal surface to the direct rays of the sun. Sometimes the leaves curl under to retain moisture. The pores through which water escapes, or stomates, may be recessed, reduced in number, and often are located only on the underside of the leaf.

Chaparral plants are usually evergreen because it is advantageous not to have to produce a whole crop of new leaves at the beginning of the short growing season. Instead, when the rains come, the plant can use its energy for reproduction. Some species are drought deciduous, dropping most of their leaves during prolonged dry periods. Others allow entire branches to die. As the plants age, these dead branches accumulate and result in highly flammable, "decadent" stands of chaparral.

Chaparral branches are rigid, an adaptation which prevents damage due to wilting. The structure of the branches channels the water to the base of the plant, where it is most readily absorbed. The root system, extensive in proportion to plant size, can be shallow and wide-spreading to capture surface water, and deep to capture ground water. Roots of different species penetrate to different depths, thus reducing competition.

Some plants, like **yerba santa**, send out long underground stems, which sprout new plants in neighboring areas where the competition for water would be too great for a seedling to survive. Proof that the young plants are not seedlings has been demonstrated by placing radioactive compounds on the parent plant and monitoring radioactivity soon afterwards in the distant young sprouts.

Some plants engage in chemical warfare, or **allelopathy**. **Chamise** accumulates toxic, water-soluble compounds as a result of normal metabolic processes. Fog drip and rain carry these toxins to the soil, where they inhibit the growth of competing plants. **Sticky monkey flower** produces volatile compounds called terpenes, which discourage consumption by the larvae of the checkerspot butterfly.

California chaparral is one of the most fire-susceptible types of vegetation in the world because the plants are full of oils, waxes, and resins. The dense growth and the dry, dead, interlocked twigs provide for the quick spread of fire. When conditions are right, chaparral fire can be explosive.

Yet fire is used to advantage by the chaparral. The plants have evolved methods of reproduction which depend on recurring fires. Some plants recover quickly after a fire by crown sprouting. Chamise, scrub oak, and many manzanitas have a large burl below the surface which does not burn. It can sprout without rain, drawing on food stored in the extensive root system so the plant can regenerate right away – even in a dry summer. The new growth is especially attractive to deer because of its high nitrogen content.

Non-sprouting species such as ceanothus and some manzanitas reproduce by seeds that need heat to sprout. Fire mechanically damages the seed coat or breaks down its oils, making it more permeable to water and permitting it to sprout. Some seeds require contact with charcoal to germinate, a process not yet understood. Seeds may remain viable for decades between fires. Why they aren't all eaten by small mammals or birds or destroyed by pathogens remains a mystery.

Fire benefits chaparral by clearing an area, allowing light to enter, and nutrients to be returned to the soil. The toxic substances given off by chaparral species to inhibit competition are volatilized. In studies where soil beneath chaparral plants is removed, heated, and then returned to its original location, herbaceous annuals and grasses will grow where previously they were absent. Distinctive "fire followers" make their appearance the first year, sprouting from seeds lying dormant in the soil since the last fire, some 50 years earlier! In each succeeding year, a different group of herbaceous species appears, until the woody chaparral is re-established.

Since chaparral indeed seems to benefit from these stresses, it grows where little else can. So when you walk in the parks, "consider the lily", the splendid oaks, the wooded canyons, and lovely vistas – but also notice the plants of the chaparral and appreciate their marvelous strategies for survival.

Quail Hollow Ranch's Chaparral Communities

If you walk along the Italian and sunset trails, you will pass through three different chaparral-type communities:

- ✓ California mixed chaparral,
- ✓ Maritime chaparral, and
- ✓ Maritime scrub.

At first glance they all seem to look the same, filled with a dense assemblage of manzanita, chamise, and buck brush, with occasional oak or pine towering overhead. And indeed their differences are subtle resulting from changes in soil and/or fire history.

The **California mixed chaparral**, like the mixed evergreen forest, has no dominant species to help define it. It is a collection of several drought-resistant shrubs, adapted to survive in the sandy, well-drained soils so prevalent in the park. When we compare this community with the **maritime chaparral**, we find that the later prefers locations with lots of summer fog. The Monterey bay area averages 135 foggy days per year, providing the prerequisites for this as well as other fog-loving habitats like redwood and knobcone pine communities. Because of the high incidence of the rare silver-leaved manzanita, this community is sometimes grouped within the sandhills community. (See above)

The **maritime scrub** has only a single occurrence within the park, found along the sunset trail. It borders the maritime chaparral community where the boundary line between the two seems to be a subtle change in percentages of manzanita versus buck brush, with manzanita more prevalent in the maritime chaparral and buck brush prevailing in the maritime scrub. A steeper slope emptying into a wash-like area also seem to create the borders for this sensitive scrub community.

Silver-leaved manzanita
Arctostaphylos silvicola

Turning back into the maritime chaparral community, one finds the trail lined with a unique species of manzanita called the **silver-leaved manzanita**, or *Arctostaphylos silvicola*. Its leaves are covered with a silvery fuzz, giving it a lighter color than other manzanitas. This non-burl-forming shrub is endemic, or restricted to Santa Cruz County, and as a result is listed by the California Native Plant Society as rare. The name **manzanita** means little apple in Spanish, and comes from the small, apple-shaped berries which are edible raw, cooked into preserves, or made into a spicy cider or even wine. All manzanitas have a characteristic, red bark that peels off in thin, papery layers, and leaves that are thick and leathery.

The **common buck brush** has the scientific name of *Ceanothus cuneatus*, which puts it in the fragrant lilac family. Its smooth, sturdy leaves grow on spine-like branches which can create formidable barriers nearly impenetrable for the human to cross. The small, white flowers grow in clusters and can be used as a fragrance in soap or tea.

The Riparian Forests

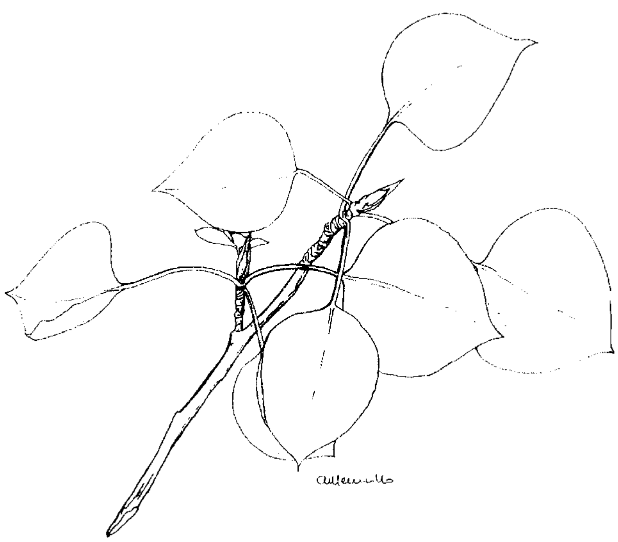
Anyone who has lived in the San Lorenzo valley for any length of time has experienced one of our summer heat waves, in which people flock to the rivers and streams to escape the sweltering temperatures. Those cool, moist conditions that we search out, also attract certain plants which are adapted to live where there is lots of water and not so much sunlight. Within the park boundaries, there are two types of riparian forests, both of which are sensitive habitats:

- ✓ the coast live oak riparian forest, and
- ✓ the willow riparian forest.

The term "**riparian**" comes from the Latin root *riparia*, meaning streamside, and refers to a community that borders a body of water. Plants found within its boundaries are adapted to a high availability of ground water with occasional flooding and deposits of rich mud and silt. At Quail Hollow Ranch, these two habitats are both found associated with moist areas: the coast live oak riparian community running along Quail Hollow creek, and the willow riparian forest surrounding the pond and nearby springs.

The **coast live oak riparian forest** is home to many of the same species as the mixed evergreen forest, but with a significant difference: it is located along the banks of a creek offering an abundance of moisture. As a result, there are many plants found here that require lots of water – trees like the black cottonwood or western sycamore, shrubs like thimbleberry, and a variety of ferns like the western chain fern and western lady fern. However, interspersed throughout this narrow corridor one will find the hardy coast live oak, the dominant plant from which this habitat gets its name.

The rounded helmet of leaves of the **coast live oak**, or *Quercus agrifolia*, are adapted for dry, sunny conditions – hardly what one would expect growing along a stream. However, as the name suggests, this oak prefers the coastal areas for its mild climate with temperate winters and cool, foggy summers. As a result, survival in this dark, moist riparian corridor is possible.



Black cottonwood *Populus trichocarpa*

Another moisture-loving tree found in this habitat is the **black cottonwood**, or *Populus trichocarpa*. These trees can reach a height of 75 feet or more and is identified by its gray, striated bark and spear-shaped leaves. Its flowers hang in long streams called **catkins** and are edible whether raw or boiled.

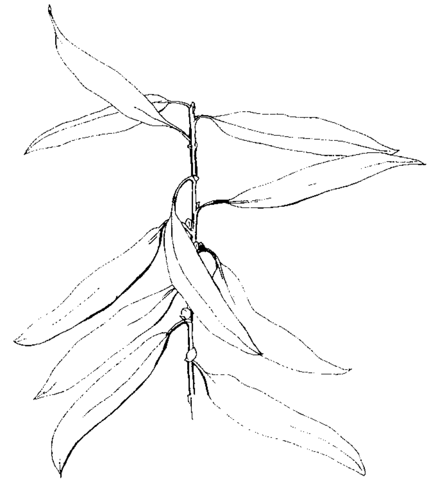
Occasionally, you may spot a tree with smooth, white bark that stands out from the vegetation surrounding it. This is the **western sycamore**, or *Platanus racemosa*, which can grow up to 100 feet in height. Its velvety, light green leaves are deeply lobed in a **palmate**, or "palm-shaped", formation.

The **thimbleberry**, or *Rubus parviflorus*, gets its name from the thimble-shaped, hollow berries which grow from a rose-like flower. These 3-to-4-foot-tall shrubs have large, soft palmate leaves which sometimes give it the children's nick name of "nature's toilet paper". A fun rhyme to help remember this plant is: "*Rubus parviflorus* is the Charmain of the forest." However, early settlers to California had another use for the soft leaves: instead of rouge, they would rub them against their cheeks for facial color.

As we turn our attention away from the moist stream, we find the **willow riparian forest** lining the pond and springs, sometimes spilling over into pasture. This is another moisture-loving habitat, adapted to survive in soggy conditions. Within Quail Hollow Ranch, this community is characterized by a thick stand of willow, underlined by a thick carpet of plants like sedges and rushes.

The dominant **willow**, or *Salix sp*, is a tall wispy tree with simple, elongate leaves, and flowers arranged in a unisexual catkin born on separate plants. This tree produces a toxin called salicin, which is where it gets its Latin name. Salicin is similar to acetylsalicylic acid, or aspirin, and has historically been used as a pain reliever; however, the willow likely evolved this chemical to discourage herbivores from eating them. The Ohlone people had many uses for this plant, apart from a headache remedy, including using branches to thatch roofs, lift cookware, weave baskets, and net fish. The understory of the willow riparian forest consists of a collection of herbaceous plants of which include a couple of general groupings:

- ✓ sedges, or *Cyperus sp.*, and
- ✓ rushes, or *Juncus sp.*



Willow – Salix sp

Sedges are grass-like in appearance, with flat blades located at the base of the plant, however they also have a triangular-shaped stalk that extends from the leaf base. Contrast this with the **rushes**, which are found in clumps here and there throughout the community, and have a round stalk. One way to remember the difference between sedges, rushes, and grasses, is with a commonly quoted rhyme:

> Sedges have edges, rushes are round,
> Grasses have veins going up and down.

The Pond

When people first visit Quail Hollow Ranch, they inevitably spend at least some time at the pond. This scenic, tree-lined aquatic community offers an enjoyable spot for a rest, picnic lunch, or even occasional wedding. However, it is also home to a collection of plants that are able to survive in water-saturated soils, where others would drown. In addition to the sedges and rushes mentioned above, duckweed, cattails, and tule are also found in this habitat which is lower and wetter than the neighboring willow riparian community.

Floating like a green carpet on the surface of the pond is **duckweed**, or *Lemna sp*, which appear like minute, leaf-like structures, dangling roots that are often covered with nitrogen-fixing bacteria. Closer to shore, one will find **tule**, or *Scirpus sp*, growing out of the water as much as six feet, topped by a tuft of flowers born on leafless stems. These are relatives of sedges, many having triangular stems. **Cattails**, or *Typha sp*, have the least tolerance to water and therefore are found in the outer fringes of the pond. Sometimes standing 10 feet in height, these plants have long blade-like leaves and air-born flowers that look like brown, fuzzy sausages.

Our pond was built by the Lane family in 1952 and, therefore, is not a naturally occurring body of water. It was built by damming Quail Hollow Creek in order to provide irrigation water for the ranching operations. With time, this pond will undergo successional changes, slowly filling in, until it becomes a meadow. As long as there is water flowing into a pond or lake, there will be an accumulation of material leading to an inevitable end – a process called **eutrophication**.

The term "**trophic**" means to nourish, so a **eutrophic** pond or lake is one that is nutrient-rich and fairly old. The opposite of this is a **oligotrophic** lake, which has few nutrients. Think of a high mountain lake with clear, blue waters and little sediment on its bottom, and you have a good idea of an oligotrophic lake. The following chart gives a comparison of these two classifications:

Characteristic	Oligotrophic	Eutrophic
Age	Young	Old
Nutrient state	Poor	Rich

Clarity	Clear	Cloudy
Color	Blue	Green to brown
Depth	Deep	Shallow
Temperature	Cold	Warm
Dissolved oxygen	High, well distributed	Low, only near surface
Total dissolved solids	Low	High
Sediment	Sparse, coarse	Deep, muddy
Locality	Mountains	Valleys
Fish	Trout	Catfish

*taken from *A Natural History of California*, Schoenherr, 1992.

Euotrophic ponds, like ours, can also demonstrate seasonal changes, depending on the amount of dissolved nutrients that are present. These nutrients produce microscopic organisms like phytoplankton. During the **spring bloom**, when temperatures are rising, phytoplankton become numerous, the color of the water turns green, and aquatic animals take advantage of the abundant food to reproduce. Once the plankton uses up available nutrients, they die and settle to the bottom of the pond, leading to what is called the **summer exhaustion**. At this time decomposers in the sediment convert these dead organisms to available nutrients again.

When autumn approaches, dropping temperatures cool the surface of the pond first. When the surface temperatures become colder than the deeper bottom, they sink in a process called **autumn turnover**. The deeper, nutrient-rich waters from the bottom rise to the surface but will not cause much of an algal bloom until the temperatures begin to rise in the spring and the process starts anew.

Grassland and Pasture

It is difficult to imagine what the California landscape would have looked like prior to human influences. The Ohlone people, who lived here for at least 10,000 years, regularly burned grasslands in order to keep them from succeeding into other dense, difficult-to-traverse communities. After the missions were established, the burning stopped, but grazing maintained the open grasslands and pastures.

In more recent years, these open grasslands were described by early authors like John Muir. In his book *East of Eden*, John Steinbeck described the Salinas Valley:

"The spring flowers in a wet year were unbelievable. The whole valley floor, and the foothills too, would be carpeted with lupins and poppies. Once a woman told me that colored flowers would seem more bright if you added a few white flowers to give the colors definition. Every petal of blue lupin is edged with white, so that a field of lupins is more blue than you can imagine. And mixed with these were splashes of California poppies. These too are of a burning color – not orange, not gold, but if pure gold were liquid and could raise a cream, that golden cream might be like the color of the poppies..."

Here, at Quail Hollow Ranch, the grassland vegetation, with its splashes of seasonal color, have historically been cultivated. They may look natural and undisturbed, however most species that inhabit them are **exotics**, brought over from Europe and Asia. These colonizing plants have traits that are very effective in seed dispersal. Try walking through a meadow with exposed socks, and you will find how proficient some of these plants are, as they hitch-hike a ride to wherever you are going.

California's "golden" hills are such because many of the grasses that inhabit them are **annuals**, or plants that produce seeds and die in one year. This adaptation helps them to survive the hot, dry summer as a seed, waiting until fall to give birth to a new generation, when rains bring more favorable growing conditions. Other grasses are **perennial**, meaning that they will grow more than one year, establishing a more elaborate root system. They survive the hot, dry summers by going dormant.

Within the park, there are pockets of non-native grassland, with the open space around the ranch buildings maintained by grazing and mowing. Where, in the past, Ohlone burning was replaced by the Spanish grazing, today grazing is being replaced by mowing. This practice not only maintains the open space, but decreases any fire danger.

In areas that are not regularly mowed, the beginning stages of succession are seen with the outcropping of **coyote brush**, or *Baccharis pilularis*. This native shrub with small, sturdy leaves is a member of the sunflower or dandelion family. One of the characteristics of this family are its feathery, white, wind-dispersed seeds that cover this plant with tufts of hairs that look as if a coyote brushed against the plant as it was shedding – hence the name coyote brush. It is persistent in its introduction to an area, sprouting after being cut down, mowed, or disced.

Where the coyote brush is not encroaching, natives like western rye grass, blue-eyed grass, and shooting stars as well as exotics like meadow fescue, slender wild oats, and ripgut brome make their home. These open fields give the ranch its park-like quality, sometimes golden brown, sometimes bright green with seasonal splashes of flowering color. The most dramatic changes in season are seen here, as the 1920s Big Sur poet, Robinson Jeffers, said, "vibrat(ing) from bronze to green, bronze to green, year after year... in the racing seasons."

The Eucalyptus Groves

Most people imagine weeds to be low-growing, herbaceous plants that attempt to take over their gardens. However, weeds can take on another form: tall trees growing as high as 130 feet and with diameters up to 15 feet. These are the eucalyptus trees that have found a transplanted home throughout California, becoming one of the most successful and controversial non-native plants around.

This Australian native made its way to California in the mid-1800s for a variety of reasons: as lumber, windbreaks, fuel, oil, medicinal products, tannin, pulp, honey bee nectar, and insecticides. By the 1870s large-scale planting operations had begun, in order to "convert the barren horizons into both beauty and profit..." More than 150 species of eucalyptus were planted, with one exaggerated timber promotion claiming that "it is only logical to conclude that eucalyptus, with its rapidity of growth and superior qualities, is destined to form a most important factor in the hardwood timber industry of the United States."

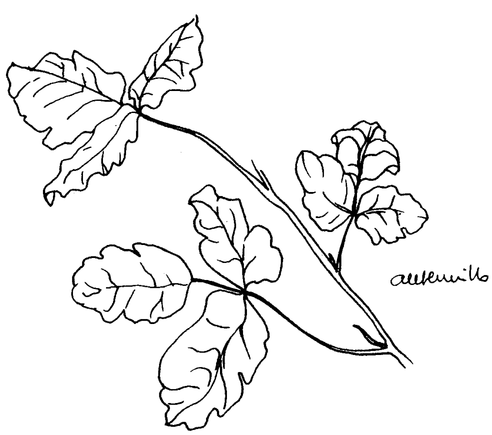
Today, only two species have become naturalized, the **blue-gum**, or *Eucalyptus globulus*, and the **red-gum**, or *Eucalyptus camaldulensis*. The difference between the two can be seen in the arrangement of their flowers – in clusters for the blue-gum, versus three in a single umbel for red-gum. Here at Quail Hollow Ranch, the blue-gum eucalyptus are the most commonly found, with their thin, crescent-shaped leaves attached to reddish branches. These broad-leaved, evergreen leaves grow rapidly – up to 15 feet per year, with trees attaining 70 to 90 percent of their height within 15 years of planting.

At Quail Hollow, these trees are often found in groves with little undergrowth, pointing to their allelopathic tendencies. Its litter deposition and composition effectively hinder any other species from growing in these altered conditions. Just like the weeds that like to overrun your garden, these trees can expand and take over other communities, and as a result require management plans to contain them.

A Note About Poison Oak

There are some of us that are lucky – they have never experienced those swollen, red rashes that irritate and itch, day and night, for two weeks before finally healing. But for those of us who have suffered through an attack of **poison oak**, there grows a great incentive to learn all about this plant.

The scientific name of poison oak is *Toxicodendron diversilobum*, which hints at some of its qualities. The toxic nature is apparent to about 80 percent of the population, who is allergic to its oil, urushiol. When urushiol comes in contact with the skin, it converts this oil into a reactive chemical called quinone, which binds white blood cells and begins an immune reaction leading to a rash. Humans are the only species that is affected in this way by poison oak. Deer browse on the leaves, birds eat their berries, and many others make this plant their home. Even the Ohlone people, who were immune to its poisonous nature, used the stems for thread, warp, and basket foundations, and used the juice as a black die, a cure for warts and ringworm, and an antidote for rattlesnake venom.



The species name, *diversilobum*, describes the diverse forms that it can take. It can grow low as a ground cover, in the form of a bush, and as a vine climbing up the sides of trees 40 feet or more. Its leaves, which grow in groups of three, begin the season green and shiny, but in the fall they will turn red before dropping, leaving the equally-toxic branches behind.

Some of the distinguishing characteristics of poison oak are its lobed, compound leaves in groups of three, as well as its straight and smooth stems colored brown with a tint of rose. Occasionally, poison oak is confused with **blackberry**, or *Rubus ursinus*, as both of them have leaves in groups of three, will turn red in the fall, and are found in many of the same locations. However, blackberry has spines along its stems and serrated leaf edges, where poison oak's stems are smooth and its leaves are lobed. One way to remember the difference is through the children's poem:

Leaves of three, let it be,
But if its hairy, it's a berry.

Learning the characteristics of this toxic plant and avoiding contact, is the main prevention for its nasty rash, as are wearing clothing to protect the skin. However, if you accidently comes into contact with it, there are some measures that can be taken. Wash the affected area as soon as possible with soap and cold water – the soap helping to remove the urushiol oils, and the cold water keeping pores closed to prevent deeper layers of skin from becoming infected. Also, wash clothing and shoes at the end of a hike to further prevent exposure.

Experiencing that uncomfortable rash, forces one to learn how to identify poison oak. Yet, at the same time, familiarity with this plant, can breed an appreciation for its diversity, beauty, and valuable role in the many communities where it lives.

Conclusion

If you were to fly over Quail Hollow Ranch, you would look down upon a green and gold landscape of trees, shrubs, and grasses. From a high enough altitude the plant communities would appear as an irregular patchwork, carpeting the hills – the green representing some of the similarities that they have in common: all requiring food, mainly accomplished through the process of photosynthesis.

Rutherford Platt, in *The Great American Forest,* said of this process:

> "Food in the human menu is hardly recognized as packaged sunlight, but that is exactly what it is. The art of packaging sunlight was originally discovered by plants in the sea, and seaweeds carried the formula for photosynthesis to the water's edge. There they delivered it to ferns and mosses, which in turn bequeathed it to trees. Growing in the sunlight, trees could make full use of photosynthesis; in fact, their energy factory worked so well that packaged sunlight was not only incorporated into food but into wood, as we have seen. Then wood, in turn, increased the production of packaged sunlight by lifting green needles and leaves high off the ground into more winds, bringing more oxygen and giving more exposure to sunlight. These towering arrangements led to the grand climax of forests."

The tallest redwood, as well as the smallest blade of grass, has evolved over time into what they are today. Learning the stories of who lives in which habitat, and why, becomes one of the important components of successfully interpreting the world of plants. There is a temptation, however, to focus on the names, marching down the trail, pointing and labeling, missing the real lessons to be learned.

Sally Carrighar addressed this issue in her book, *Home to the Wilderness*, when she challenged the reader to go beyond the name and into the mystery:

> "I held a blue flower in my hand, probably a wild aster, wondering what its name was, and then thought that human names for natural things are superfluous. Nature herself does not name them. The important thing is to know this flower, look at its color until the blueness becomes as real as a keynote of music. Look at the exquisite yellow floweretts in the center, become very small with them. *Be* the flower, be the trees, the blowing grasses. Fly with the birds, jump with the squirrel!"

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