



Primitive plants

1 The ferns you see before you are the descendants of a long lineage of plants...dating back to long before the age of the dinosaurs. Ferns first show up in the fossil record during the Carboniferous geologic era, 360 million years ago, long before flowering plants evolved. Unlike flowering plants (such as pine trees, grasses, roses, forget-me-nots, and so on), ferns do not produce pollen that is deposited on an ovary to produce seed – instead, they produce tiny spores. If you turn over some fern leaves, you can find small dark dots – called sori – that are clusters of spore-containing sporangia. The spores are shed when fully developed, and if they land in the right conditions will grow into a rather blob-like mass which produces sperm and/or eggs. The sperm is mobile, and must swim to find an egg that it can fertilize...which results in the development of a new fern plant.

Raking leaves year round!

2 In California, the unfortunate person who feels the need to rake fallen leaves may go crazy! Unlike most other areas of the continent, where leaf-fall occurs in the autumn, in California you can rake in fall, spring, and summer – what fun! While the black oaks around you are winter deciduous (lose their leaves in the fall), the madrone trees towering above you keep their leaves year-round, but shed older leaves in the late spring and early summer - as is the case for many shrubs like manzanitas, California lilac, and toyon. Buckeye, on the other hand, is

an unusual summer-deciduous plant. Its leaves start to senesce with the onset of hot weather, and are shed in the summer. This makes for a strange sight through the fall, as the fruits continue to grow throughout the summer and hang like Christmas bobbles on the bare branches until they are shed in the early winter.

Evidence of the receding water

3 The small stream you are standing near drains a meadow to the west and flows into Boggs Lake during the rainy season. Now, however, it is completely dry, and Boggs Lake is also drying out as it no longer receives water input. Vernal pools, like Boggs Lake, go through an annual cycle with high water in the winter and often reaching their maximum inundation in spring (hence “vernal”), followed by a slow shrinking of the pool by evapotranspiration as the rains dissipate and the dry season sets in. If you gaze out at the lake (and as you also saw when you followed a side-trail from post #2 that leads to the floating observation platform), you can see evidence of the shrinking pool by taking note of the transition from the green tules nearer the center (still experiencing some soil moisture, if not standing water) to stands of dried-up tules nearer the shore. Although Boggs Lake is such a huge vernal pool that it does not completely dry out each year like most vernal pools, it may do so in extremely dry years. Many of the plants and animals that flourish in the lake and its moist shoreline have adaptations that allow them to survive long dry periods. The cycle comes full circle when the lake begins to fill in response to the next rains, and the species of the lake emerge from senescence and rush through their next annual bout of activity and growth.

These extreme conditions present a unique environment in contrast to the vast expanses of forests and meadows of the surrounding areas. This “island effect” has allowed for the evolution of some unique organisms, like the Boggs Lake hedge-hyssop and the few-flowered navarretia. These plants are restricted to environments with the extreme wet/dry cycles and heavy soils and have developed their unique forms by being regionally isolated to the conditions found at Boggs Lake and a few nearby areas that offer similar conditions.

Lizards instead of mosses

4 While in the winter and spring, mosses cloak the volcanic rocks around you, these mosses dry out and are rather inconspicuous during the dry season (although if you pour some water from your water bottle onto a patch of dried moss, most of these mosses should respond by instantaneously swelling up and becoming green and fluffy again – taking advantage of every possible opportunity to photosynthesize!) In the dry season, these rocky areas belong to the lizards – if you wait quietly, you can watch the most commonly seen Western fence lizard (or “blue-belly”) scampering about or performing push-ups as they posture to nearby lizards or other intruders in their territories. Right now, they are rushing through their own annual cycle of feeding, growth, mating behaviors, and reproduction. During the cool parts of the year, snakes and lizard, which are ectothermic (meaning their body temperature is set by the temperature of their surroundings), remain inactive in their winter refugia. However, during the warm part of the year, higher temperatures allow lizards and other reptiles to become more active and do all the important things in life, before cooler weather sets in again.

Who’s home?

5 Dead trees, (also called snags), especially snags with plenty of cracks and hollows like the one nearby, are the apartment houses of the forest. Lizards, birds, insects, owls, and bats are among the many different types of animals that spend at least part of their days or nights tucked away in the nooks and crannies of

old snags. During the day, you may be able to glimpse the resident lizards and birds as they pop in and out of their hiding spots, but only with patience (and a flashlight for the trip back to the Reserve’s entrance) will you find out if owls or bats are part of the tree-house community. Snags like these are particularly important to some species of bats, which require the “just right” temperatures provided by tree cracks and hollows (protected from the cool air at night, and from direct sun and heat during the daytime), to raise their babies in the spring and early summer. In some bat species, males and females will roost separately during the time when females are rearing their young. The females need locations where the young are protected from predators, (especially when their mother is foraging at night) and the temperature is steadily warm, allowing the tiny baby bats to stay warm and grow quickly. The bat species in temperate areas like Lake County all eat insects, and most of the foraging occurs during the first few hours of the night, when night-time insect activity is also highest. Although these mammals are warm-blooded (ideal body temperature for maintaining maximum cellular activity is roughly about 104o F, depending on the species), they are heterothermic (meaning “other heat” in Greek) and can allow their body temperature to drop to ambient conditions in order to take advantage of energy savings provided by the resulting slowed-down metabolism. This intentional drop in body temperature (called “torpor”) is regularly used by male bats and non-reproducing females, which can choose cooler roosts to take advantage of the metabolic energy savings that come with torpor. Female bats with babies, however, need to choose roosts that are warm, which allows the body temperature of their pups to remain near or at the ideal temperature necessary for rapid growth. .

Natives Bunch grasses – still green in the summer

6 Down-slope of Boggs Lake and the surrounding forests, the hillsides are now dominated by the blonde-golden cover of annual grasses that have finished their life cycle and are completely dried out. These lower hillside areas are dominated by non-native annual grasses that were intentionally or unintentionally brought to California from Europe and Asia and thus no longer support large populations of native summer wildflowers and native bunch grasses. But in the forest surrounding Boggs Lake, the understory remains relatively untouched by the non-native annual grasses and other plants that have altered so many of California’s ecosystems. The clumpy grasses in front of you are California fescue, a native bunch-grass species, that together with other perennial grass species like slender hairgrass, big squirreltail, California brome, and blue wild rye, are thriving in the forest understory and meadow openings. Unlike the introduced annual grasses, most of the native bunch grasses do not completely die back during the hot season, and therefore provide green tissue that supports insects and other herbivores during the summer and fall months. In turn, these animals serve as a food source for those animals that prey on them. In ecosystems dominated by native species, food webs (or Interaction Webs, as many contemporary scientists consider them) tend to be more complex than those of ecosystems heavily impacted by non-native species. Usually, systems invaded by non-natives have fewer “strands”, and weaker “links”, in the web, which makes them less stable during times of stress. This makes ecosystems with reduced or extirpated populations of native species less resilient to environmental variability and, more likely to lose connections in the web. These broken connections mean there is an increased risk of loss of even more native species in a system.

Opportunities abound after a high-water year

7 A band of dead trees can be seen around the perimeter of the lake. Unusually wet winters in 1982 and 1983 raised the lake so high that it extended into the forest. The forest trees are not adapted to wetland conditions, and with the water lapping about the trunks, the roots couldn’t get enough oxygen and the pine

trees began to die. Bark beetles arrived and laid their eggs, taking advantage of the weakened trees, which are a food source for their larvae. Beetle numbers quickly built up as the trees were unable to defend against them. While healthy trees can direct sticky sap into the beetle tunnels and drown the insects, stressed trees cannot produce enough sap and the beetle attack on the trees escalated. Chemicals released by the trees under attack drifted in the air and attracted other beetles to the dying pines. Although it was hard to notice the increased insect density, the subsequent abundance of woodpeckers was much more evident. For several years, the numbers of downy, hairy, and Nuttall's woodpeckers was higher than normal due to the abundance of beetles. By 1989, as the trees died and insect populations had dropped off, most of the woodpeckers had moved on to other areas where it was easier to find food.

Dead wood – a refuge during the summer

8 Even though the standing or downed dead wood around you looks parched and lifeless, if you were to break open or lift up big logs, you would find all sorts of critters munching away, or taking refuge in remarkably mild and even moist conditions when the rest of the outdoors is parched and hot. But Do Not Disturb these downed logs! If you do, there is a high probability that the exposed critters would not survive – the delicate conditions in the microsites they occupy would most likely be irreversibly altered and become too dry to for these animals to tolerate. The downed wood brings the opportunity for life to many organisms, like beetle larvae and termites that eat dead wood, or newts, salamanders, toads, and frogs that can't survive if their skins dry out. The "dead" parts of a forest are never wasted: they provide life to many things and play a significant role in supporting the vibrant biodiversity of the area.

Acorns and berries

9 Around you, the shrubs and trees are producing fruits that will be welcome food for many animals in the fall and winter. The manzanita are growing their berries, which start out green and hard (and taste like unripened green apples), and become a brown-red when mature. The dry pulp (surrounding large and very hard seeds) is tasty and likely nutritious to many animals, and from summer through fall you can find scat from bear, coyote, and foxes densely packed with partially-digested manzanita berries. By consuming the berries, the animals disperse the seeds to other areas in the forest. Seeds exposed to the acidic conditions in the animals' stomachs are more likely to germinate when the rains begin, compared to seeds that dropped on the ground from the manzanita bush and remained uneaten.

Acorns of the black oaks also are a welcome food source, and are eaten by acorn woodpeckers, deer, rodents, mountain quail, and jays. Acorns may be a somewhat less reliable food source than manzanita berries: while manzanita flowers bloom for several weeks and are pollinated by animals, oaks are wind pollinated and release their pollen over a relatively short period. If the weather is rainy when the oaks are shedding their pollen in spring, the rain may keep the pollen from dispersing, and therefore the oak tree's ovules can't be fertilized, and no acorns will develop. Also, unlike the blue and valley oaks, black oak acorns take two years to mature...so rainy spring weather in one year affects the food availability of many animals in the fall of the following year. The acorns and manzanita berries were also popular with the Native Americans, who also looked forward to the fall bounty. The black oak's acorns were favored over those of some of the other oak species for making acorn mush.

Forest and short-lived meadows

10 As you walk this loop trail, you move from forest to meadow, and back again. While you probably embrace the lovely forest shade that makes it comfortable to take a summer or fall walk through the forest at Boggs Lake Reserve, the shade is less welcome to some forest residents, who need direct sunlight for a significant portion of the day in order to grow and reproduce. Tree falls create gaps in the forest canopy, and allow sunshine to reach the forest floor. The openings in the forest can become meadows, even if only for a few years or decades, before new trees establish and grow, and a thick tree canopy dominates again. A new meadow eventually becomes dominated by colorful sun-loving wildflowers in the spring, but even in the summer the warm sun is welcome to some species of native bunch grasses and some hardy summer-flowering species, many of which are in the sunflower family. So as you quickly dash across the sunny areas to the next patch of shade, don't forget to pause for a moment to notice the plants that prefer the sun over the shade.

Non-conformist woodpeckers and acorn banks

11 When acorn woodpeckers drill holes in trees, you shouldn't assume they are searching for hidden insect larvae like their relatives. These unusual birds drill holes to store food – that is, acorns! When the holes are just right, they hammer acorns into the new space in the wood, caching the acorns which are a source of dietary carbohydrates for the woodpeckers. As the acorns dry out and shrink, the woodpeckers move them to smaller cavities such as cracks in trees. Other animals, such as white-breasted nuthatches and western grey squirrels, will try to pull the acorns out of the cavity...but they usually fail if the acorn is tightly fit into the hole. Unlike other woodpecker species, acornwoodpeckers are communal; helping one another to feed the offspring and protect the storage trees. Acorn-larder trees such as the ones at the Boggs Lake Reserve are truly impressive... but even more impressive can be the accidental filling with seemingly countless acorns of hollow spaces from which the acorns can't be retrieved, such as a hollow tree or, much to our dismay, a hollow wall or a storage shed!

A meadow that stands on its own

12 The meadow in front of you is not the result of tree-fall like are the many small openings you passed by on your loop-hike through the forest. This meadow is kept open by processes that prevent trees from successfully establishing. In the summer and fall, the soils of the meadow are very dry, and if the soils are rich in clay, cracks can develop which go deep into the ground. In the fall or early winter, with the onset of the rains, the soils drink up the moisture and begin to swell. Eventually, once saturated, it becomes a wet- meadow, and supports unique annual plants such as the many-flowered navarettia that thrive in these conditions. These may be the life-supporting conditions for the species that thrive in the meadow, but the high degree of moisture in the winter and spring, and the extreme drying out during the summer and fall, cannot be tolerated by the trees and shrubs that occur in the surrounding forest. Abrupt changes in soil and moisture generate the heterogeneity in growing conditions across the landscape that supports such a high degree of biodiversity at the Boggs Lake Reserve, and in this part of California in general.

BOGGS LAKE

SELF GUIDED NATURE TRAIL

SUMMER/FALL GUIDE

by

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Descriptions in this trail guide correspond to a series of twelve numbered signposts. The approximately ¾ mile long route proceeds through the forest, and provides excellent views of the lake and other natural communities before it loops back to the parking lot. Hiking it will give you a little exercise in a beautiful environment. This guide, you will help you to learn some of the natural history of this exciting Reserve.

We ask that you stay on the marked trails and keep all dogs on a leash. Thank you

Boggs Lake Preserve has been owned and managed by The Nature Conservancy since 1972 and has been co-managed by the Lake County Land Trust since 2011.

For donations and further information about the Lake County Land Trust please call: (707) 262 0707 or email: lclt@lakecountylandtrust.org