

The Whiskeytown Environmental School

Naturalist Guide

By Colin Kessler



Clear Creek at the School

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1. Introduction:

This guidebook is designed to be a manual for the use of the naturalists at the Whiskeytown Environmental School. It focuses on the more ubiquitous members and history of the local biome's ecosystems. The objective is to provide visuals and descriptions for correct identifications and additional information that will help the naturalist put each member within the context of the concepts that are the foundation of the WES curriculum. Happy trails!

Additional notes: All plants and animals within any ecosystem are interdependent because of their rolls in cycles and the food web. Because of this I have used the following abbreviations as reminders: NC=nutrient cycle; CO₂/O₂=carbon dioxide/oxygen cycle (as in respiration and photosynthesis); and WC=water cycle. I have also used PC, indicating that the species being described controls the mentioned populations.

Also, as far as adaptations go, some are true for whole categories. These types of categorical adaptations will be mentioned here, but not for each entry where they apply. *Plants*: Unless otherwise mentioned, all plants use chlorophyll and sunlight to synthesize glucose from water and CO₂, producing oxygen and gaseous water as a result. *Birds*: All birds have feathers and hollow bones, and defecate reflexively when lifting off. *Amphibians*: Most have the ability to absorb some oxygen through their skin. And most must be very near water so as not to dry out. All are predators. *Reptiles*: Cold-blooded, their body temperature fluctuates with the ambient air, ground, or water temperatures. Skin is covered with scales for protection and moisture retention. *Mammals*: All have fur for protection and thermo-regulation. All are warm-blooded and so rely on their fur and various types of shelter in order to stay warm through the winter. *Insects*: All have exoskeletons; this hard layer is a semi-permeable protective and structural adaptation. Many insects have antennae sensory organs and wings for flight.

Final note: This work is not infallible or immutable; it is designed to be modified or added onto in the future. In this spirit, I must disclaim I am not an expert and there probably are some mistakes in my identifying and ecological theorizing. If you find mistakes, please let me know and changes will be made to the master; thank you in advance. (All photos with an asterisk (*) below them were taken by me. All others were downloaded from the internet or scanned from guidebooks.)

A. Plants

Big Leaf Maple (*Acer macrophyllum*) Maple family



*

A large, beautiful deciduous tree growing up to 35 meters tall on our north facing slopes. *Leaves*: Simple, palmately veined, 5 lobed, opposite, large (15-30 cm across), dark green above, paler green below, turning bright yellow in the fall. *Flowers*: Greenish yellow, hanging clusters of small (3mm across) flowers on short stalks. Appear with or before leaves. *Fruits*: Brown, paired, winged seeds, 3-6 cm long, wings spread in a V-shape. *Bark*: Green and smooth when young, dark gray-brown and ridged when older; often covered by mosses. Young saplings have a distinct, regular “mathematical” way of branching; alternating opposites.

Adaptations:

- Grows “canopy roots”; roots sprouting from its trunk high above the ground taking advantage of the “soil” created there by thick layers of mosses (rare).
- Seeds’ wings are an adaptation that takes advantage of wind for greater dispersal.
- Sprouts after being cut or burned; the new sprouts can grow up to 3 meters in a single year.

Interdependence:

- Mosses, ferns, and lichens will grow on the bark of the Big Leaf Maple (comensal).

- The tree depends on a north facing slope or deep (less sunlight, more moisture, cooler temperatures).

Black Locust (*Robinia pseudoacacia*) Legume family



*

Mainly seen growing around the school grounds, this deciduous tree is native to North America, but not endemic to this area. *Leaves:* Pinnately compound, up to 30cm long, 7-19 leaflets, paired except at end, smooth margined leaflets, drooping and folding at night, dark green above. *Flowers:* Small (up to 2cm), pea-like, with 5 unequal white petals, arranged in drooping clusters up to 20cm long, very fragrant, blooming in May. *Fruit:* Pods, narrowly oblong, flat, up to 10cm long, maturing in autumn and remaining on tree through the winter, splitting open to release 3-14 beanlike seeds. *Bark:* Dark brownish gray, thick, deeply furrowed into long forking ridges. Twigs have paired spines. Grows in moist to dry sandy and rocky soils; not a riparian species.

Adaptations:

- Flower fragrance attracts pollinators.
- Defense: Spiny twigs and thick bark.

Interdependence:

- NC. CO₂/O₂. WC.

Other:

Originally from the east and midwest, the Black Locust was naturalized here from Maine. Most larger specimens were originally planted by the early settlers for use as a fast-growing hardwood timber source. There are a few growing near Merlin and a healthy grove living at Chinese Camp. The flowers are edible and delicious, having a honey-nut type flavor. The seeds can be collected and cooked in the same way we cook dry beans.

Black Oak (California) (*Quercus kelloggii*) Beech family



*

A classic of the wooded uplands. Its irregular branches, dark bark, large size, and shiny dark green leaves conspire to make it one of the more beautiful trees in the forest.

Leaves: Simple, deeply lobed with points on ends of lobes, dark green above, light yellow-green and fuzzy below, up to 20cm long and 13cm wide. Leaves turn yellow, red, and/or brown in the fall. *Flowers:* Small and unobtrusive. *Fruit:* Acorns (up to 4cm long), taking two seasons to mature. *Bark:* Dark brown (black), thick, and furrowed. On younger branches, it is smooth and brown.

Adaptations:

- Stores water in its deep roots and tissues in order to survive the dry soils of the long summer.
- Can produce huge acorn crops, which increases the chances of procreation.

Interdependence:

- Deer feed on the leaves and acorns (an important pre-winter protein source).
- The acorn woodpecker also eats the acorns and sometimes will store them in holes it makes in the thick bark of Black Oaks.
- Grows well in sandy, rocky soil (like the endemic decomposed granite), so is important in soil building; it adds organic matter over the years.

Other:

Folks around here say that a large acorn harvest indicates that the winter will be cold and long... These trees are valued locally as premium firewood.

Blue Dicks (*Dichelostemma pulchellum*) Amaryllis family



A very common wildflower throughout the spring in open meadows and in edges; very closely resembling Brodiaeas and Allums. *Leaves*: Long slender and grass-like.

Flowers: Clusters at top of stem of small bluish-purple six-petaled flowers; clusters about 3-4cm across. Growing up to 30cm tall.

Adaptations:

- Its rapid annual growth is an adaptation for a short growing season.

Interdependence:

- NC. CO₂/O₂. WC.

Other:

For as long as I have worked here, we have always avoided calling this flower “Blue Dicks” with the students for obvious reasons. We have used the name Brodiaea instead, which works because this flower is also known as *Brodiaea pulchella*. It must be noted that the Brodiaea genus is large and varied, we have several other species growing around here too.

Blue Oak (*Quercus douglasii*) Beech family



*

This deciduous oak is easy to spot because of its bluish foliage. *Leaves:* Simple, pinnately veined, up to 10cm long, oblong with shallow lobes, pale blue-green, often coarsely toothed. *Fruit:* Acorns, up to 3cm long, with shallow cup. *Bark:* Light gray, whitish, thin and scaly. Grows in the mixed foothill forest, commonly with the Foothill Pine. Is not usually a tall tree, it tends to look scraggly.

Adaptations:

- Stores water and has deep roots for surviving a long dry season.

Interdependence:

- The often abundant acorns are important food for many herbivores, including the deer.
- NC. CO₂/O₂. WC.

Bracken Fern (*Pteridium aquilinum*) Fern family



*

A larger fern, the leaf fronds grow solitary and erect. *Leaves:* Bi/tripinnately compound, bright green, with 10 or more pairs of leaflets. Grows in meadows and burned or disturbed areas like alongside roads and on old logging pads. An edge species, the Bracken Fern can live in dry or moist areas.

Adaptations:

- Its rapid annual growth is an adaptation for a short growing season.

Interdependence:

- Is dependent on soil disturbance and lots of sunlight. Can be considered an edge species participating in the patch-dynamics of a forest (the migration of meadow species within a forest following localized disturbances).
- NC. CO2/O2. WC.

Other:

Leaves were used in ovens, in the storing of foods, and for floor coverings and bedding. Rhizomes were eaten and used to treat diarrhea. The leaves are edible before they have unfurled. Warning: Do not eat until more information is gathered on this; the plant has been implicated in livestock poisoning and stomach cancer.

Buckbrush (*Ceanothus* spp.) Buckthorn family



* C. cuneatus



*C. lemonii



* *C. integrerrimus*

Also known as California Lilacs, these shrubs are an important part of our chaparral. We have several species growing locally including: Common Buckbrush (*C. cuneatus*) which grows upright and has tiny, opposite leaves and whitish flowers; Deer Brush (*C. integrerrimus*) which grows upright, has thin larger alternating leaves and light blue flowers; Lemmon's Ceanothus (*C. lemmonii*) which grows low to the ground and has small toothed alternating leaves and pale blue flowers; and Pine Mat (*C. diversifolius*) which grows low to the ground and has very small toothed alternating leaves and deep blue flowers. All of these species have tiny flowers that grow in terminal clusters that resemble lilac blooms. Ceanothus species are quite widespread and grow almost everywhere except in riparian zones.

Adaptations:

- Seed capsules of the Common Buckbrush (and perhaps the others as well) explosively separate from their bases, spewing seeds.
- Thick, woody and sharp stems a defense adaptation against browsing.

Interdependence:

- The leaves of most Ceanothus species are an important food for Deer as they are high in protein.
- NC. CO₂/O₂. WC.

Other:

Deer Brush has a distinctly Lilac-look to it, though the other species require a bit more imagination to see the resemblance. They bloom at different times; you'll see the white flowers before the blue ones in most cases.

Buckeye (*Aesculus californica*) Horsechestnut family



*

A striking plant, sometimes a bush, sometimes a tree, with unusual leaves, flowers and nuts. *Leaves*: Palmately compound with 5-7 leaflets, leaflets up to 15cm long, bright green, margins toothed. *Flowers*: White, up to 3cm long, with 4-5 petals, arranged in upright inflorescences, fragrant. *Fruit*: Large (up to 8cm long) capsules, light brownish green, maturing in September when the outer covering splits open to let one, large shiny brown nut fall. *Bark*: Smooth grayish white. Grows in the mixed foothill forests in full sun and deep shade.

Adaptations:

- Its leaves bud in late winter/early spring and fall off mid summer, taking advantage of the coolest, wettest part of the season. Its reproductive cycle corresponds; its flowers open, are fertilized, and the nuts start growing within these 4 (or so) months.

Interdependence:

- Squirrels eat the seeds and butterflies are attracted to the flowers, though bees are poisoned by the pollen and nectar.
- NC. CO₂/O₂. WC.

Other:

The seed is poisonous; do not eat it! Local peoples would eat the seeds only after pounding them and leaching them with boiling water. Also, the pounded, untreated seeds were thrown into pools of water to stupefy the fish. I have seen the Pipe Vine Swallowtail butterfly feeding at the flowers.

Buttonbush (Button Willow) (*Cephalanthus occidentalis*) Madder family



*

Common in riparian communities, this shrub stands out due to its flowers. *Leaves:* Simple, pinnately veined, opposite or 3 at a node, up to 15cm long and 7.5cm wide, egg-shaped, smooth margined, bright shiny green. *Flowers:* Tiny white, crowded tightly into perfectly round balls about 4cm in diameter, blooming late spring through summer. *Fruit:* Compact, rough, brown, round balls of many nutlets each containing two seeds, maturing in autumn. *Bark:* Gray or brown, becoming deeply furrowed into scaly ridges.

Adaptations:

- Abundance of seeds assures reproduction.

Interdependence:

- Depends on riparian moisture.
- Is a honey plant; bees use its nectar.
- NC. CO₂/O₂. WC.

Other:

The leaves are poisonous. Is deciduous, but can be evergreen in warmer climates.

California Blackberry (*Rubus ursinus*) Rose family



*

The only native blackberry, this deciduous trailing vine is much less conspicuous than its invasive cousins. *Leaves:* Pinnately compound, usually 3 leaflets (3-7cm long), the terminal leaflet 3-lobed, toothed margins. *Flowers:* White or pink, up to 4cm across, in flat-topped clusters, male and female flowers on separate plants. *Fruit:* Black, to 1cm long, edible and delicious. Grows in disturbed sites, in dry open forest. Grows as a vine, trailing along the ground, with weak needle-like spines along the stems.

Adaptations:

- The spines are a defense adaptation.
- Seeds encased in tasty fruit for dispersal by animals.

Interdependence:

- The berries are eaten by birds who then spread the seeds.
- NC. CO₂/O₂. WC.

Other:

Look for this native blackberry in Horsetail and Mystery Canyons. In addition to eating the fruits, the local peoples would use the leaves as medicine to treat a variety of ailments. The exotic Himalayan Blackberry (*Rubus discolor*) is different in these ways: The compound leaves are palmate with 5 leaflets, the berries are larger and much more numerous, the thorns are curved and tough, and the plant can form thickets up to 2.5 meters high. This plant is much more prevalent, forming dense barrier-like thickets in riparian zones like along the pond, along Clear Creek and along Paige Boulder Creek at Chinese Camp. Also similar, but less invasive, is the Evergreen Blackberry (*Rubus*

laciniatus). It is much like the Himalayan species, but is from Europe originally, and its usually five leaflets are deeply incised and jaggedly toothed.

California Redbud (*Cercis occidentalis*) Legume family



*

Large shrub or small tree, often with multiple trunks and thickly tangled branches.

Leaves: Simple, smooth-margined, nearly round, palmately veined. *Flowers:* Very showy, bright purple, small, pea-like, growing in thick clusters all over the plant before the leaves bud (the earliest flowering shrub around here). *Fruit:* Pods, purplish-brown, 5-9 cm long, hanging in clusters, maturing late summer and splitting open on one edge.

Bark: Smooth and gray. Grows in riparian, oak woodland, and mixed conifer communities.

Adaptations:

- Flowers early so has nearly a monopoly on insect pollinators.
- Seeds have thick waxy cuticle so require passage through digestive systems, heating by fire, or abrasion by water and gravel in order to germinate; such seeds can stay viable for many months, resisting insects and drying until the safe-site conditions are reached.

Interdependence:

- Important source of nectar and pollen for early-hatching insects.
- Seeds rely on rigorous biotic and/or abiotic events in order to germinate.
- A legume, the Red Bud's roots fix nitrogen in the soil; this occurs through a symbiosis the plant's roots have with *Rhizobium* bacteria.
- NC. CO₂/O₂. WC.

Other:

Flowers are delicious (both edible and eat-able). Share them with your students!

California Rose (*Rosa californica*) Rose family



*



* *Rose-hip*

A deciduous shrub, growing in riparian zones, is recognizable as quite similar to garden variety roses. *Leaves*: Pinnately compound, with 3-7 leaflets, leaflets up to 4cm long, toothed margins. *Flowers*: Small, around 2cm across, pink with yellow centers, usually with 5 petals. *Fruit*: Reddish hips.

Adaptations:

- Its thorns are a defense.
- Color and fragrance of flowers attracts pollinators.

Interdependence:

- Needs cooler temperatures and moister soils of riparian zones.
- NC. CO₂/O₂. WC.

Other:

This is an extremely variable genus; see also spp. *gymnocarpa*, *pinetorum*, *spithamea*, and *nutkana*. The hips can be eaten; they are tart yet flavorful, just be careful—eat only the outer flesh, not the seeds and their hair as they are very irritating in the mouth and throat. Rose hips were eaten as a famine food and are high in vitamin C.

Canyon Live Oak (*Quercus chrysolepis*) Beech family



*

A large beautiful evergreen oak with a short trunk and large horizontally spreading branches. *Leaves:* Simple, small (up to 7cm), thick and leathery, shiny green above, yellow and fuzzy below, smooth margined with sharp point at tip. Leaves lower on tree often have toothed margins all the way around. Leaves tend to lose their yellow fuzz; when older, they'll have dull, whitish undersides. *Flowers:* Small hanging clusters. *Fruit:* Acorns (up to 5cm long). *Bark:* Light gray nearly smooth or scaly. Grows in canyons and on sandy, gravelly, or rocky slopes.

Adaptations:

- The small thick leaves can survive the cold of the local winters.
- The spiny teeth on lower and newer leaves defend the tree from browsing herbivores.

Interdependence:

- The acorns are important food for many herbivores like the Mule Deer, Acorn Woodpecker, and Gray Squirrel.
- More common on north-facing slopes; it seems to thrive where it's slightly cooler.
- NC. CO₂/O₂. WC.

Other:

The wood is hard and is valued for making hand tools and firewood. Once used to make wedges to split softer woods like Cedar and Redwood. This species is very similar to the Interior Live Oak. "Big Mama," at the top of the Ridge trail is a Canyon Live Oak, as is "Merlin."

Caraway (Gairdner's Yampah) (*Perideridia gairdneri*) Carrot family



*

A tall (up to 120cm) slender annual, with edible seeds. *Leaves*: Long and slender, grasslike, distributed along the stem, sometimes once or twice pinnately divided into long narrow segments. *Flowers*: Tiny white flowers grouped together in a flat topped umbrella. *Fruit*: Small (up to 3mm long), ribbed seeds, many per plant. Grows along the edges of riparian zones, usually in mostly sunny locations.

Adaptations:

- Abundance of seed assures annual propagation.

Interdependence:

- NC. CO₂/O₂. WC.

Other:

The seeds are edible and have a pleasant flavor, much like that of cultivated caraway (common in rye bread); look for them in the fall especially in lower Horsetail Canyon and share them with your students. The roots were pounded by native peoples to make flour. Note: Be sure to know the carrot family well. We are fortunate that Poison Hemlock doesn't grow locally. If traveling to other parts of California (especially coastal regions), make sure your ID is ironclad before you eat any part of a member of the carrot family; Hemlock WILL kill you.

Cat's Ear (*Calochortus* genus [Star Tulips] *maweanus* or *tolmiei* species)
Lily Family



A favorite, especially of the students, this flower is easy to identify in April. *Leaves:* Thin and grass-like. *Flowers:* About 4cm across, white to pale purple, 3 petals covered on the inside with hairs, 3 pointed sepals alternating and behind the petals, upright. *Fruit:* Capsules, around 4cm long, same color as the stem and leaves, a cross-section of which would look like a 3 pointed star. Grows in the partial shade and humus of brushy or wooded slopes (there are many on Guardian Rock trail).

Adaptations:

- The hairy petals might serve to direct pollinating insects downward toward the pollen...

Interdependence:

- Dependent on the partial shade provided by larger plants.
- NC. CO₂/O₂. WC.

Other:

Also called "Pussy Ears" a name that for obvious reasons, we usually do not use with the students... I am not sure of the exact species found locally, maybe you can decide...

Cattail (*Typha latifolia*) Cat-tail family



*

Growing only in marshes or the shallows of ponds, the Cattail is easy to spot, especially when its seeds are dispersing. *Leaves*: Alternate, flat, long, and narrow (1-2cm wide), somewhat grass-like. *Flowers*: Very tiny, very numerous, packed tightly into a cylindrical terminal spike; this “hot dog” is green until flowers bloom, when it is covered in yellow pollen. Later, after the flowers have gone to seed, it dries up and is velvety-brown, eventually releasing fluff called “Kapok”.

Adaptations:

- This plant takes advantage of wind for propagation in two ways: For pollination and seed dispersal.

Interdependence:

- The masses of Cattails that can choke a pond actually filter water that passes through them.
- Birds eat the seeds and some use the Kapok in their nests.
- NC. CO₂/O₂. WC.

Other:

Besides in our pond and in small patches, there are two very large patches growing on either side of Paige Bar Road East right at the mouth of Mystery Canyon. Also, the patch growing in the sediment pond on Paige Bar Road West is part of why that sediment pond actually works; it helps trap the sediment coming down Paige Bar Creek. The core of the rhizomes (roots) can be ground, filtered and dried to make flour. The stems close to the rhizomes can be eaten fresh like celery. The immature flower spike (when green) can be steamed for 10-20 minutes and eaten like corn on the cob. The pollen can be collected and added to flower when baking. The Kapok once was used as floatation in life jackets and insulation in cheap sleeping bags. The leaves, dried and soaked can be woven into useful things like wicker chair seats. The easiest way to share this plant with your students is to cut a stalk off just below water level where it joins the rhizome; clean well (the water is bound to have giardia at least) and slice the lower, more tender end of the stalk, discarding the upper length. Supposedly, the dry dead stalks can be used as a spindle when making friction fire by hand...

Chain Fern (*Woodwardia fimbriata*) Fern family



*



*

The largest of our ferns, it grows only where there is a year-round seep. *Leaves:* Bipinnately compound, large (up to 2 meters), growing in bunches from a common origin at ground level, the backs carry the sori (spore producing bodies about the size and shape of a grain of rice) in double rows parallel with the midrib of the leaflets.

Adaptations:

- Tiny spores for wind dispersal.

Interdependence:

- NC. CO₂/O₂. WC.

Other:

The only examples I know of are at the top of the small rock waterfall in Mystery Canyon and alongside the upper Peltier Valley road where there are a couple of seeps on the way up to “The Cedars”. Parts of this plant were used once in basket making.

Coffeberry (*Rhamnus californica*) Buckthorn family



*

An evergreen shrub, there is a great specimen growing near the volleyball court. *Leaves:* Alternate, simple, pinnately veined, narrowly elliptical, smooth-margined, up to 10cm long, bright green turning to bluish-green later in the season. *Flower:* Clustered, greenish white, small, five petals. *Fruit:* Berry, black, about 10-12mm in diameter. This plant is not a riparian species.

- Adaptations: The berries are eaten and the seeds spread by being passed through the digestive systems of birds and/or animals.

Interdependence:

- NC. CO₂/O₂. WC.

Other:

Highly valued as a medicinal plant first by American Indians and then by early Spanish settlers who gave it the name “Cascara Sagrada” or “Sacred Bark.” Its properties are mainly as a laxative. “No more valuable laxative is known to the medical world today...” --Parsons, 1966

Common Scouring Rush (*Equisetum hyemale*) Horsetail family



*



*

The namesake of the Horsetail Canyon trail, this plant is relatively rare locally; within the reaches of our trails the one place to find it is in the canyon named for it. The Horsetail family only has one genus, indicating that the plants within it are very distinct from any other plants. This could have something to do with the fact that fossils of Horsetails are common and show that the genus has changed little since the Tertiary period. Like ferns, Horsetails reproduce by broadcasting spores from their “cones.” The Common Scouring Rush can grow just over a meter tall, and doesn’t have leaves. The cylindrical stems are impregnated with silicon dioxide, which gives them a very abrasive feel.

Adaptations:

- Spreads underground by jointed root stocks that send out roots at each joint, assuring survival independent of reproduction.
- Tiny spores are easily carried by wind.
- Silicon in cell walls may make this plant difficult to eat and/or digest.

Interdependence:

- Relies on moist ground to grow.
- NC. CO₂/O₂. WC.

Other:

This plant was used by local peoples to polish wooden objects. The miners would use it to clean their dirty cookware. If you scratch your fingernail across the grain of the stem, it will actually be filed.

Dogwood (Pacific) (*Cornus nuttallii*) Dogwood family



*

A very beautiful broad-leaved deciduous tree growing on north-facing slopes and in canyons. *Leaves:* Simple, pinnately veined, opposite, oval, with pointed tip and smooth margins. *Flowers:* Inconspicuous, small (about 5mm across), greenish-white tipped with purple, arranged in tight hemispheric clusters, surrounded by 4-6 large (2-7cm), showy, white to pinkish bracts. The inflorescence appears as one upright flower. Flowers in spring, sometimes before its leaves appear. *Fruit:* Cluster of bright red “berries”, each berry about 1cm long. *Bark:* Smooth and gray, finely ridged on older trees.

Adaptations:

- Its abundance of large leaves and their “mathematical” arrangement are adaptations to take advantage of low light in the understory.

Interdependence:

- Fruits are food for birds (the Band-tailed Pigeon loves them).

- It depends on the topography and canopy trees for correct growing conditions (low light, cooler temperatures, more moisture).
- NC. CO2/O2. WC.

Other:

The fruit is not edible. Everything else about this tree is graceful and beautiful; note the “scalloped” way the branches grow. The wood is hard and has uses thus (bows, tool handles, etc.) Bark was used in preparations as a dark-brown dye and a blood purifier, lung strengthener, and for stomach trouble.

Douglas Fir (*Pseudotsuga menziesii*) Pine family



*

A very large evergreen tree; a favorite, mostly found on our north-facing slopes or higher up. We are luckily on lowest edge of the altitude range of the Douglas Fir. *Leaves:* Single needles, about 3cm long, flattened, rounded at the tip (not sharp), growing like a bottle brush in all directions around the twigs. *Cones:* Up to 9cm long, narrowly egg shaped, light brown, papery scales each with a 3 pointed bract protruding from beneath. *Bark:* Dark, reddish-brown, very thick, deeply furrowed.

Adaptations:

- The thick bark is a defense against fire damage.

- Tiny, abundant seeds assure dispersal by wind.

Interdependence:

- The foliage is eaten by the deer and grouse. Birds and mammals eat the seeds.
- This tree provides deep shade for the many understory plant species.
- NC. CO₂/O₂. WC.

Other:

This tree is one of the most important timber species in the world! (We are lucky to have a few old-growth individuals left; there's one on Captain's Gangplank.) The needles are edible (though not really eat-able) and a good source of vitamin C (reputedly, the needles were used by the miners to combat scurvy). Not a real fir, this species is more closely related to the spruces, all in the Pine family as well.

Everlasting (*Anaphalis margaritacea*) Composite (Sunflower) family



*

A common herbaceous perennial, Everlasting is named thus because the dried up flowers retain their scent for many months. *Leaves:* Alternate, linear, up to 10cm long, light green due to being covered in fine white hairs. *Flowers:* Terminal cluster of oval, papery white flowers, retaining their shape many months after the yellow center dries up in June.

Adaptation:

- Keeps its flowering appearance and smell for months after blooming is finished, maybe attracting seed-dispersal animals and insects.

Interdependence:

- NC. CO₂/O₂. WC.

Other:

To smell the “everlasting” smell, crush a few flowers between your fingers; it smells to me like a cross between maple syrup and curry. Sometimes in late summer and early fall, the fragrance can fill the air around patches of this flower. As a side note, I found an

Everlasting growing in a northern valley of the Himalaya; it looked and smelled the same at our species. Maybe it was the same?

Fawn Lily (*Erythronium giganteum*, *californicum* or *oregonum*) Lily family



A spectacular Lily, blooming in mid-early spring, there are spots where the ground is thick with them. *Leaves*: Only two growing from base, wide linear, fawn-spotted. *Flowers*: 15 to 30cm high, hanging, six petals backward sweeping, white to cream, sometimes 2 or 3 to a stem.

Adaptations:

- Rapid annual growth takes advantage of the short growing season.

Interdependence:

- This Lily depends on a very specific type of site, shady, sloped, with deep humus; it can be seen growing in thick patches where conditions are right and not at all elsewhere.
- NC. CO₂/O₂. WC.

Other:

Look for an extensive patch where the Paige Boulder Creek trail hits the Kanaka Loop (where you turn right to head towards Upper Crossing). Obviously this ID needs narrowing down; see what you find...

Filaree (*Erodium botrys*) Geranium family



A very small, unassuming plant with a fascinating seed adaptation. *Leaves*: Feathery, fern-like, around 10cm long. *Flowers*: Pink, about 1-1½cm across, with 5 petals, 2-10 arranged in a loose cluster, one of the earliest wildflowers to bloom in the spring. *Fruit*: “Storksbills,” up to 10cm long, each with five parts, green when young but drying to brown when mature at which point, they split apart violently sending each seed with its long “tail” flying. A very common weed-like plant, it grows especially well in the richer soil of floodplains; look for it in dense patches by the big sand bar at the beginning of the Guardian Rock trail.

Adaptations:

- The seeds have several fascinating traits: Not only do they launch themselves from the plant, but the tail then dries up into a spiral. This spiral flexes according to changes in the humidity of the air. Because of its shape and the barbs and hairs along its length, the tightening-loosening movement of the spiral serves to screw the barbed seed into the ground. Once the seed is effectively planted, the spiral breaks off, leaving the seed. I have seen a time-lapse film of this; it’s incredible. Additionally, the barbs on the seed and the tail do a fine job of sticking in animal hair and socks for further distribution.

Interdependence:

- An exotic originally from Europe, the Filaree has few population controls, in other words, is not important to many herbivores, parasites, or diseases.
- NC. CO2/O2. WC.

Other:

This is a great plant to know and use to teach about adaptations in plants. The Mountain Mahogany’s seeds behave very similarly.

Firecracker Flower (*Brodiaea coccinea* or *ida-maia*) Lily family
Firecracker Flower (*Dichelostemma ida-maia*) Amaryllis family



One of the more unusual and beautiful wildflowers of this area. *Leaves:* Grasslike.
Flowers: Bright red, firecracker shaped and sized, cylindrical, about 3cm long, with light green tips, drooping in groups from the tip of the single stem.

Adaptation:

- Rapid annual growth takes advantage of short growing season.

Interdependence:

- NC. CO₂/O₂. WC.

Other:

Note that there are different entries above. The pictures in the books were identical, they just gave different classifications... Be sure to look for these just past the rocky gully towards the far end of Martha's Ditch (among other places); they bloom in May.

Foothill or Gray Pine (*Pinus sabiniana*) Pine family



*

Another common pine around here, easily identified by its branching trunk and huge cones. *Leaves:* Needles, 3 in a bundle, dull gray green with many white lines, drooping, up to 30cm long. *Cones:* Huge, up to 25cm long, round, very spiny, very dense and heavy. *Bark:* Dark gray, thick, deeply and irregularly furrowed into scaly ridges; light gray and smooth on branches. Grows on dry slopes with Oaks and other pines.

Adaptations:

- The seeds have a wing which enables them to drift larger distances in the wind.

Interdependence:

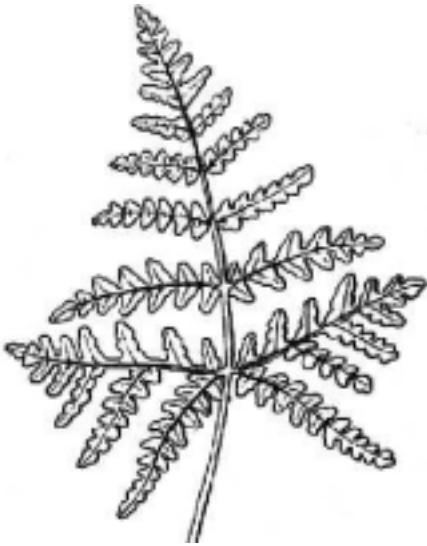
- The seeds are important food for the Gray Squirrel, the remnants of their meals being visible throughout the year.
- NC. CO₂/O₂. WC.

Other:

The large seeds are edible and tasty though a bit difficult to crack open. Watch out for falling cones in a windstorm! This pine has been commonly known as the Digger Pine, though there is an effort underway to change that name. The Wintu and other local tribes are understandably offended by the use of the term “Digger” which was once used to

lump different peoples into a single group and stems from the fact that digging for roots was an important food gathering technique. The Foothill Pine's seeds were a staple food for the Wintu. The white, lightweight, twisted wood is not useful for anything except firewood, and a lot of locals sneer at it even for that.

Goldenback Fern (*Pityrogramma triangularis*) Fern family



Smallish fern, preferring shady dry banks and rocky outcroppings. *Leaves*: Light green, 15-40cm long, bipinnately compound, undersides covered with a yellowish powder. The sporangia follow the course of the veins or completely cover them.

Adaptations:

- Smaller roots are adaptations for dry or little soil.
- The leaves curl up in dry weather, conserving moisture.
- Powder covering leaf backs could help disguise the spores.

Interdependence:

- Because it reproduces by spores like all ferns, it is dependent on moisture for spore germination.
- NC. CO₂/O₂. WC.

Other:

I have heard this fern called a "Tattoo Fern" by a WES naturalist because if the leaf back is pressed onto one's skin, the yellow powder will stick there and stay for quite some time.

Warning: This could lead to wanton picking of the fern which is not very common to begin with.

Gumplant (*Grindelia camporum*) Composite (Sunflower) family.



*

Very common strange and attractive flower. *Leaves*: Short, linear, with sawtooth margins, on erect stems. *Flowers*: Rounded flower heads with hooked bract tips with a distinct white gummy liquid between them, yellow petals surrounding a tight cluster of tiny flowers also very gummy. Grows in dry rocky open spaces, usually where there has been some disturbance.

Adaptations:

- The thick sticky gum exuded by this plant must be a defense and/or a water retention adaptation, thought it might also serve to attract pollinating insects.

Interdependence:

- The toxicity of plants in this genus depends on the soil.
- NC. CO₂/O₂. WC.

Other:

Probably native to the great plains region, this plant has been used for centuries as a source of medicine to treat a wide range of complaints.

Honeysuckle (*Lonicera hispidula*) Honeysuckle family



* *Unripe berries*

A evergreen climbing vine, it has unusual leaves and attractive flowers, but the most striking thing about this plant is its berries. *Leaves:* Opposite, pale green, up to 7cm long, pinnately veined, the upper pairs uniting around the stem. *Flowers:* Pink, up to 2.5cm long, tube-like, emerging in a cluster from the center of the last united leaf pair. *Fruit:* Bright red, translucent, in clusters.

Adaptations:

- A vine, this plant has the ability to use the structures of other plants to reach the light.

Interdependence:

- Relies on other plants (bushes and trees) for structure.
- NC. CO₂/O₂. WC.

Other:

This plant is not necessarily a riparian species, but it can also be found near water. There are some nice examples growing next to the Paige Boulder Creek trail; look for the berries in the fall. The berries are not considered edible, it is not known if this is because they are truly poisonous or just foul-tasting (I do not recommend trying).

Incense Cedar (*Libocedrus decurrens*) Cypress family



*

A large aromatic evergreen tree found only on the higher slopes of our trail system. *Leaves:* Scale like, shiny green, very aromatic when crushed, opposite. *Cones:* Up to

2.5cm long, scaly, reddish-brown, hanging. *Bark*: light or reddish-brown, thick, deeply and irregularly furrowed, shredding.

Adaptations:

- The very thick bark is protection against fires.

Interdependence:

- Almost always exists as part of a mixed conifer woodland suggesting it is somehow dependent on those other conifers...
- NC. CO₂/O₂. WC.

Other:

An important timber species, it is commonly used in making pencils. The wood is used to make chests and furniture and can protect your woolens from moths. Cedar is the wood of choice for the “hearth” in making fire by friction. There is a stand of these trees above Upper Swimming Hole on Paige Boulder Creek past Chinese Camp; “The Cedars”.

Indian’s Dream (Oregon Cliff-Brake) (*Cheilanthes siliquosa* or *Onychium densum*) Lip Fern family



*

A small but very common light-green fern growing in very dry conditions on rocky banks. *Leaves*: Not common larger than 10cm, light green, tripinnate, with shiny brown stalks, many and crowded; feathery. Grows under partial shade, usually not out in the open.

Adaptations:

- In extremely dry and hot conditions, this plant can become dormant; all its leaves will completely dry up in order to conserve moisture.

Interdependence:

- NC. CO₂/O₂. WC.

Other:

Though not very “Fern-looking,” this is an attractive little plant that can be seen all around you if you look closely enough.

Indian Rhubarb or Umbrella Plant (*Peltiphyllum peltatum*) Saxifrage family



*

Probably the most noticeable riparian plant, its flowers and huge leaves growing from tough roots growing between rocks in the streams and along its banks. *Leaves:* Very large (around a ½meter across), each with its own tall (up to a meter) stem, umbrella-like, palmately veined, with 9-14 toothy lobes, changing color in fall. *Flowers:* White to pink, small, showily grouped on the branching end of each stalk, appearing before the leaves in early spring. *Fruit:* Small woody brown oval capsules which split open releasing copious tiny seeds.

Adaptations:

- Though the plant is annual, its seed stalks and leaves washed completely away by rising waters, its roots persist among the rocks even through the most violent of floods.
- Copious seed production assures propagation.

Interdependence:

- The very tough roots seem to hold rocks in place, resisting the eroding force of water within the stream's flow; this would have an effect on the evolution of the stream's channels.
- NC. CO₂/O₂. WC.

Other:

The thick, fleshy leafstalks were peeled and eaten by the Wintu, who considered them to be a delicacy (they are quite refreshing). They can also be cooked like asparagus.

Interior Live Oak (*Quercus wislizeni*) Beech family



*

Evergreen oak tree very similar in appearance to the Canyon Live Oak; short of trunk and with thick spreading branches. *Leaves*: Simple, small (up to 5cm long), thick and leathery, shiny dark green above and shiny light green, with prominent network of veins below, smooth margined with sharp point at tip, lower leaves often have sharp toothed margins all the way around. *Flowers*: Small hanging clusters. *Fruits*: Acorns (up to 4cm long). *Bark*: Gray, becoming furrowed into narrow scaly ridges. Grows in valleys and on foothill slopes, often mixed with other oaks and Gray Pines.

Adaptations:

- The thick, small leaves are good at withstanding the cold of local winters as well as long hot, dry summers.
- Sharp teeth present on many of the leaves serve to protect the tree from browsing.

Interdependence:

- Mule Deer browse on young leaves and acorn drop.
- Acorn Woodpeckers and Gray Squirrels also feed on the acorns.
- Because of its place in mixed forest communities, it is easy to theorize a variety of mutualistic relationships that may exist between the Interior Live Oak and the other plants.
- NC. CO2/O2. WC.

Other:

Another local fuel wood. Sometimes used as an ornamental, though it grows slowly. This species is very similar to the Canyon Live Oak.

Iris (Purdy's) (*Iris purdyi*) Iris family



A well-loved, easy to identify flower blooming mid-May in the forests, especially among the pines. *Leaves*: Long, light green, grass-like. *Flowers*: Cream colored or white with some yellow and faint purple veins; very similar to the domesticated Iris, just smaller and more elegant. Grows alone or in loose patches, one flower per plant.

Adaptations:

- Rapid annual growth takes advantage of short growing season.

Interdependence:

- NC. CO₂/O₂. WC.

Other:

Blooms after the Fawn Lily but in similar locations. There are many types of wild Iris; it is possible that my ID is incorrect, check it out...

Knobcone Pine (*Pinus attenuata*) Pine family



*

This is one of the most common pines of this area, distinguished by its cones. *Leaves:* Needles, gray-green, dull, 3 in a bundle, up to 18cm long. *Cones:* Up to 15cm long, often clustered in whorls on the trunk or branches (having a knob-like appearance), remain closed for many years. *Bark:* Gray and smooth, becoming darker and fissure into large scaly ridges. Grows well in poor rocky soil, usually not on north-facing slopes.

Adaptations:

- The cones will only open and release their seeds after being heated by fire; cones can be up to 30 years old before their seeds are released.

Interdependence:

- The succession of a forest is affected by the openings left by falling Knobcones as well as by their ability to sprout quickly after fire.
- Because the cones hold their seeds so tightly for so long, they are like caches for seed-eating animals like squirrels.
- Acute dependence on fire for continued existence of the species: Because this tree has shallow and weak roots, they blow over easily when the ground is saturated; individual trees rarely ever live long. However, this species sprouts readily after fire, assuring replacement of downed trees (as long as there are fires).
- NC. CO2/O2. WC.

Leopard Lily (*Lilium pardalinum*) Lily family



Usually (and mistakenly) called a Tiger Lily, the Leopard Lily is a great pleasure to happen upon as it is an extremely striking flower. *Leaves:* 4-8 whorls of lance-like leaves per stem. *Flowers:* Nodding, orange with some red to dark red and many maroon spots, about 5-6cm across, each petal curved from the middle outward (swept back),

sometimes up to 4 blooms per plant. *Fruit*: Elongated capsule with longitudinal ribs. Grows in the rich moist soils of riparian zones, usually in partial shade.

Adaptations:

- Large colorful blooms attract pollinators.

Interdependence:

- NC. CO₂/O₂. WC.

Other:

Unfortunately, this plant blooms right at the end of the spring semester and into the summer. Look for it along the banks of Paige Boulder Creek, especially near Lower Swimming Hole.

Lupine (*Lupinus* spp.) Legume family



We have two forms of Lupine which grow here; one is a very small annual, and the other a larger perennial; both have purplish-blue flowers. *Leaves*: Palmately compound. *Flowers*: Pea-like, in dense spike-like terminal clusters. *Fruit*: Fuzzy pods.

Interdependence:

- A legume, Lupine roots enjoy a symbiosis with Rhyzobium bacteria which fix nitrogen in the soil.

- NC. CO2/O2. WC.

Other:

I have not made the effort to narrow this down past the genus because there are so many Lupines that are difficult to differentiate. The characteristics I have described work for the Lupines I can remember observing here. The seeds of certain species supposedly can be cooked and eaten like domestic peas; CAUTION be sure to know which are edible before attempting this.

Maidenhair Fern (*Adiantum capillus-veneris*) Maidenhair Fern family



*

A very elegant fern growing in dark canyons and on north-facing slopes. *Leaves:* Bipinnately compound, growing in groups from a common origin, usually hanging, with light green very thin leaflets and shiny black stems, the sori (groups of sporangia) are clustered under the tips of the palmately veined leaflets.

Interdependence:

- Depends on canopy trees for dark, cool habitat.
- NC. CO2/O2. WC.

Other:

There are examples growing on the north facing upper reaches of the Ridge Trail and in Mystery and Horsetail canyons.

Manzanita

Heath family

(Green Leaf: *Arctostaphylos patula*)

(White Leaf: *Arctostaphylos viscida*)



* *A. patula*



* *A. viscida*

The ubiquitous evergreen shrub of this area. *Leaves:* Simple, positioned vertically (on edge), bifacial (both sides are exactly the same), round with pointed tip, smooth margined, thick and leathery, up to 5cm long. *Flowers:* Thick clusters, urn shaped, pinkish-white blooming early to mid spring. *Fruit:* Little “apples” in clusters, about 1cm in diameter, green when young, drying to dark reddish brown. *Bark:* Smooth, reddish

brown, cracking and peeling in late spring and summer, green when new but quickly turning red again. Grows in full sun in chaparral zones and in the mixed hardwood communities.

Adaptations:

- Has the ability to partially die, in other words, when parts of a branch die, other parts can continue growing, even if only a narrow strip of living wood remains.
- The vertically positioned leaves capture adequate sunlight while helping the plant to conserve moisture, as does the waxy texture of the leaves.
- The smooth bark enables water to run down to the roots of the plants.
- Opportunists, Manzanitas are one of the first shrubs to colonize disturbed areas. Not a riparian genus.

Interdependence:

- The flowers are heavy nectar producers; an important source for insects and hummingbirds.
- The berries are eaten by many animals and birds, including Black Bear, Grey Fox, and Coyote.
- Manzanitas release a chemical that prevents its own seeds from germinating in its drip zone, a control on intra-species competition.
- NC. CO₂/O₂. WC.

Other:

The White Leaf Manzanita is much more common around the school than the Green Leaf, which seems to prefer higher elevations. The main perceptible difference between the two species is their leaf color. All other characteristics are essentially the same. The flowers of both species are edible; sweet and slightly astringent (share them with your students). The fruit is edible just after changing from green to red (if you wait too long, they become very dry), though it is debatable whether they are very eat-able... I know people who have made tea from the peeling bark. I read that the reddish berries were used to make jam. The beautiful red wood is not useful for anything except as firewood (it's very good for this) because it checks too much. Dense thickets of Manzanita contribute greatly to the susceptibility of an area to catastrophic wildfire.

Miner's Lettuce (*Claytonia perfoliata*) Purslane family



A tasty little plant that can be nice in a “hand salad” with Sheep Sorrel. *Leaves:* Varied, some narrow, some wider and club-shaped, all smooth margined and fleshy, on the main stems some leaf pairs are united to form a single disk-like leaf completely encircling the stem. *Flowers:* Tiny, usually with 5 petals, white to pinkish, in small groups at the end of the stems.

Adaptations:

- Rapid annual growth takes advantage of short growing season.

Interdependence:

- NC. CO₂/O₂. WC.

Other:

Look for this plant in shady moist spots; best picked in early spring. Share it with your students!

Mock Orange (*Philadelphus lewisii*) Saxifrage family



*

A deciduous shrub that commonly goes unnoticed until it blooms in early June. *Leaves:* Simple, opposite, acute, up to 8cm long, gently toothed along margins. *Flowers:* Copious and conspicuous and fragrant, white, about 3cm across; a simple flower with four petals, usually growing in groups. *Fruit:* Small capsules about 5mm long. *Bark:* Brown and checking. Grows in mixed communities, sometimes in broad sunlight and sometimes in partial shade (not a riparian species).

Adaptations:

- The fragrance of its flowers is a strong attractant for pollinating insects.

Interdependence:

- NC. CO₂/O₂. WC.

Other:

Make sure to notice the flowers and their scent in June!

Mountain Mahogany (Birchleaf) (*Cercocarpus betuloides*) Rose family



*

An evergreen shrub found in brushy areas and sometimes in the woodland community (not a riparian species). Noticeable particularly when blooming; its flowers are unusual. *Leaves:* Simple, small, thick. *Flowers:* Notable for the long, feathery, persistent styles, up to 9cm long; in mass these curvy little “tails” give the bush a silvery appearance in mid summer through early fall. These tails remain attached to the seeds once they have formed.

Adaptations:

- The small leathery leaves are a design which retains moisture well—important in the sunny chaparral.
- Can withstand heavy browsing, cutting, drought, and fire.
- The seeds are carried long distances by wind and by being harbored in animal fur.
- After falling to the ground the seed twists itself into the soil, flexing with fluctuations in humidity.

Interdependence:

- Sprouts after fire.

- Important browse food for deer.
- NC. CO2/O2. WC.

Other:

There are a couple of nice specimens on either side, heading up the Paige Boulder Creek trail in the small rocky draw just before “hug a rock”.

Filaree seeds behave very similarly.

Mountain Spray (Creambush) (*Holodiscus discolor*) Rose family



*

An evergreen shrub usually found in the partial shade of woodland communities. *Leaves:* Alternate, simple, lightly hairy, broadly egg-shaped, up to 6cm long, toothed usually only on distal half. *Flowers:* White to cream, small (about 5mm across), arranged in dense lilac-like clusters up to 17cm long, not fragrant, clusters turn brown and remain on the plant through the winter. *Fruit:* Tiny (2mm long), hairy, light-brown.

Adaptations:

- The very showy flowers, though not fragrant, attract large numbers of small insect pollinators.

Interdependence:

- NC. CO2/O2. WC.

Other:

I have listed this plant as evergreen, because that’s how I remember it. This is debatable because in my research, I found that it was listed one place as evergreen and in another as deciduous; if you’re here in the winter time, you will be able to decide... This species has very strong hard wood that was used by the Wintu to make digging sticks, arrow shafts, and bows.

Mountain Violet (*Viola purpurea*) Violet family



A small flower, usually blooming singularly very close to the ground, they are easy to miss, but a treat if seen as they are one of the earliest blooming wildflowers around here.

Leaves: Simple, pinnately veined, dark green, growing flat on the ground, almost triangular shaped with toothed margins. *Flowers:* Yellow, 5 petals, with bilateral symmetry, the lower 3 petals have purple veins.

Adaptations:

- The veins on the lower petals probably help insects locate the flower's opening.
- Growing low to the ground helps the plant conserve moisture and energy for it must produce seeds quickly before the short window of ideal growing conditions ends.

Interdependence:

- Because it is one of the earliest blooming wildflowers, the early hatching pollinators must depend it for pollen and nectar.
- The Violet depends on trees or bushes for overhead shade.
- NC. CO₂/O₂. WC.

Other:

There is a nice little patch that blooms right where you come out of the trees onto the sketchy rocky slope when approaching the Salt Creek Mine.

Mugwort (*Artemisia vulgaris* var. *californica*) Composite family



*

This is a common annual herb in disturbed areas, especially thriving in slightly moist soils. *Leaves:* Simple, growing thickly along the unbranching stems, green above, cottony-woolly below, with long acute lobes. *Stems:* Up to a meter in height. *Flowers:* Tiny, grouped at tip of stem, blooming in late summer, early fall.

Adaptations:

- Its strong scent may warn herbivores not to eat it.
- Rapid annual growth takes advantage of short growing season.

Interdependence:

- NC. CO₂/O₂. WC.

Other: Though it was hard to find any details about this plant in our books, it is notable because of its fragrance. Be sure to share this one with your students; crush or bruise a leaf and the smell is distinct (and I think pleasant). Mugwort is common around here, but there is an especially nice patch growing near the seep on Paige Bar Road East. The Wintu are reputed to have used this herb as a type of deodorant, disguising their body odors when hunting.

Mule Ears (Gray) (*Wyethia mollis*) Composite (Sunflower) family



*

A striking annual due to its unusually large flowers and leaves. *Leaves:* Very large (up to 60cm long), standing erect in groups from a common base, pinnately veined, smooth margined, shaped like a mule's ear, light green, appearing resinous. *Flowers:* Large (about 7cm across), sunflower-like, yellow petals surrounding a composite flower head, can be several per plant. Grows in partial sun in dry sandy soils.

Adaptations:

- Despite their large size, the leaves have several water conserving adaptations; the resin they exude and their erect stature.
- Very rapid annual growth takes advantage of short growing season.

Interdependence:

- NC. CO₂/O₂. WC.

Other:

In winter months, it is possible to find the leaves skeletonized. The seeds were gathered and ground in large quantities to make flour by California Indians. Look for its blooms in April and May, otherwise look for its distinctive leaves; there is a nice specimen on Paige Bar Road West just after crossing Paige Bar Creek.

Mullein (Flannel or Woolly) (*Verbascum thapsus*) Snapdragon (Figwort) family



*

Noticeable due to its tall flower stalk, this plant is also interesting because of the soft texture of its leaves and stalk. *Leaves:* Large, soft, woolly, growing from a common base at the ground and extending up the single stem, pinnately veined, smooth margined. *Flowers:* Yellow, numerous, grouped in a terminal cylindrical spike. Grows in disturbed sites in dry soil and full sun; can reach almost 2 meters tall.

Adaptations:

- The leaves with their dense hairs must be unpalatable to many herbivores animals and insects.

Interdependence:

- NC. CO₂/O₂. WC.

Other:

There is another species, Moth Mullein (*Verbascum blattaria*) which is similar, though it is not fuzzy, has green toothed leaves, a green stem, and yellow flowers not so densely grouped. Native to Europe, the Mulleins don't seem to be invasive. The Flannel Mullein has many historical uses: The dry flower stalk, dipped in tallow, can be used as a torch, and the dry leaves as lamp wicks. I understand that the dry flower stalk can be used as a spindle when making a friction fire by hand.

Oregon Ash (*Fraxinus latifolia*) Olive family



*

A deciduous riparian tree, usually growing along the outer edges of riparian zones. *Leaves:* Pinnately compound, up to 30cm long, with 5 or 7 leaflets paired except at the end, smooth margined, elliptical, nearly stalkless. *Flowers:* About 3mm long male yellowish and female greenish on separate trees, many together in small clusters on twigs, before leaves in early spring. *Fruit:* 3-5cm long, light brown key with broad, rounded wing, many hanging in dense clusters, maturing in early autumn. *Bark:* Dark brown or gray, furrowed into forking scaly ridges.

Adaptations:

- The winged seeds are designed to be distributed by wind.

Interdependence:

- As a riparian species, the Oregon Ash depends on permanent soil moisture.
- Because trees are either male or female, they depend on other individuals being nearby to be pollinated.
- NC. CO₂/O₂. WC.

Other:

We have many of these growing along Clear Creek and Paige Boulder Creek, though the ones I have noticed all seem to be quite crooked, with the exception of a very large one growing very close to a big Black Oak in front of the upper classroom.

Oregon White Oak (*Quercus garryana*) Beech family



*

Can be a tree or stay shrubby. *Leaves*: Medium sized (7-15cm long), simple, pinnately veined, dark shiny green above, lighter below, deeply lobed with bluntly toothed lobes, sometimes turning red in autumn. *Fruit*: Acorns (up to 3cm long). *Bark*: Gray and smooth when young, gray or whitish when older, scaly or furrowed into broad ridges. Grows on slopes and in valleys, in pure stands or mixed with other oaks.

Interdependence:

- Its acorns are important food for a variety of herbivores.
- NC. CO₂/O₂. WC.

Other:

The sweet acorns were eaten by local peoples. Today, this is the most commercially important oak in the west; it is used in shipbuilding, furniture, construction, finishing, and fuel. We have few in tree form, but many in its scrub form; there are some on the Paige Boulder Creek trail. Because oaks hybridize so easily, what we have locally could be a hybrid of the California Scrub Oak (*Quercus dumosa*)...

Pacific Sedum (*Sedum spathulifolium*) Sedum family



*

A tiny perennial succulent, this plant is worth noticing because of its unusual appearance and reproductive strategies. *Leaves:* Spatula-like, arranged in flat rosettes on the ground. *Flowers:* Small, 5 petals, yellow, star-like, arranged in groups along the terminal branches of the stalk. Grows in very shallow soil on rocky outcrops, sometimes between rocks.

Adaptations:

- Its succulent character enables this plant to survive the long dry season in dry soils.

Interdependence:

- NC. CO₂/O₂. WC.

Other:

In addition to sexual reproduction, this species will send out runner-like stems along the ground at the end of which will grow a new rosette of leaves. The appearance of a larger rosette creating smaller ones has led some people to call this plant “Hen and Chicks.” Look for this one on “Hug a Rock” and other rocky outcroppings, blooming in mid Spring.

Paintbrush (*Castilleja* spp.) Snapdragon (Figwort) family



A bright, familiar annual wildflower with a long blooming time through April and May. *Leaves:* Thin and linear, sometimes with wavy margins. *Flowers:* Scarlet, in dense clumps at the tip of the stem (like a paintbrush dipped in paint). Grows in open spots in disturbed ground that gets some shade during the day.

Adaptation:

- Showy flower arrangement attracts pollinators like hummingbirds.
- Many leaves growing close to or within the flower inflorescence are partially bright red, further accenting the flowers' attractiveness.

Interdependence:

- NC. CO2/O2. WC.

Other:

There are some nice specimens visible along the Kanaka Loop trail (above upper crossing) in late spring. I only listed the genus because it is very hard to differentiate the different species, especially when they aren't blooming to look at.

Pennyroyal (*Monardella lanceolata*) Mint family



*

One of the most fragrant herbs growing here, it has an intense, mint-like smell and square stems like most mints. *Leaves:* Small (about 2cm long), opposite, smooth margined, acute, dull green. *Flowers:* Occurring at the end of the stalks (up to 30cm tall), reddish-purple, tight clumps of tiny flowers. Grows in perennial clumps that flower annually in April and May.

Adaptations:

- Strong scent may deter herbivores from eating it.

Interdependence:

- NC. CO₂/O₂. WC.

Other:

Though having a very pleasing smell, it is not known if Pennyroyal is edible. I have heard about it being used medicinally as a type of contraceptive; do more research before you use it this way. Meanwhile, if you are pregnant, do not consume (same goes for Peppermint). There are bunches of Pennyroyal growing next to the trail in partial shade and full sun on the Ridge and the Kanaka Loop trail (past upper crossing).

Pipe Vine (Dutchman's Pipe) (*Aristolochia californica*) Birthwort family



*

A straggly woody vine climbing other plants up to 3 meters. *Leaves:* Simple, heart shaped, up to 15cm long, velvety on both sides. *Flowers:* Resembling a pipe, greenish with browns and purples. *Fruit:* Capsule-like, up to 4cm long, with ribs running length-wise (a cross-section would appear like a 6 pointed star), green when unripe, drying to woody brown at which point it opens to release numerous small seeds.

Adaptations:

- The vine-like growth enables the plant to reach enough light for growth.
- The velvet on the leaves and young stems deters some herbivores.

Interdependence:

- The Pipe-Vine Swallowtail butterfly lays its eggs on the Pipe Vine because the caterpillars feed almost exclusively on it. Wherever you see this butterfly, there must be Pipe-Vine nearby.
- The vine depends on other plants for structure.
- NC. CO₂/O₂. WC.

Other:

Though not particularly colorful, the flowers of the Pipe-Vine are unusually beautiful; look hard and you will be rewarded.

Poison Oak (*Rhus diversiloba* also *Toxicodendron diversiloba*) Sumac family



*



*

If you learn only one plant, let this be the one; and once you know it, practice avoidance as the ensuing rash is VERY unpleasant at best. *Leaves*: Alternate, pinnately compound with 3 leaflets usually lobed and oak-like, but sometimes smooth margined, bright green, deciduous, shiny when new, bright red before falling. *Flowers*: Small, greenish, in clusters. *Fruit*: Whitish berries, also in clusters. *Bark*: Light gray to gray, most easily identified by their distinctive leaf scars, the leafless stems can still cause a reaction. Grows in the mixed forest communities, usually in clay soil; not a riparian plant.

Adaptations:

- The toxic oils that cause us hairless humans to itch and swell must either taste bad or cause reactions in the mouths, esophagi, or digestive tracts of herbivores that are lucky enough to be protected by body hair.

Interdependence:

- NC. CO₂/O₂. WC.

Other: This species is extremely varied and therefore difficult for some to identify; it will grow as a small shrub, a brushy tree, and as a vine climbing the trunks of other trees;

sometimes the leaflets look just like lobed oak leaves, sometimes not; often the leaflets are about 5 cm long but I have seen them up to 3 times that big... You get the picture. Poison Oak is easiest to identify when it has leaves and berries (late spring through early fall), and most difficult to ID when it has neither (winter). Luckily, the bare stems are not as potent as the leaves, but they can still cause a rash. Theories abound about techniques for developing an immunity to this plant, but I haven't known anyone to try them... Some people are fortunate and simply don't have a reaction, hopefully that's you. Finally, Poison Oak is very similar looking (and closely related) to Squaw Bush; learn the difference.

Ponderosa Pine (*Pinus ponderosa*) Pine family



*

The classic pine tree, growing in pure stands or as part of the mixed conifer forests, it is a favorite teaching tool. *Leaves*: Needles in bunches of three (usually), up to 20cm long, dark shiny green. *Cones*: Up to 15cm long, very prickly sharp. *Bark*: Thick and furrowed, comprised of the classic “puzzle piece” design, flaky.

Adaptations:

- The thick bark is protection from fire, and the fact that it self-prunes its lower branches protects the crown from fire.
- The extremely sharp cones are a defense against herbivores.

Interdependence:

- As the most widely distributed North American pine, forming extensive forests in some places, the Ponderosa has myriad relationships with animals and other plants.
- Quail, nutcrackers, and squirrels eat the seeds.
- NC. CO₂/O₂. WC.

Other:

It is the most commercially important western pine; called “Yellow Pine” by foresters because of its yellow wood. The last remains of the logging industry around here still harvest Ponderosas. The Ponderosa growing next to the pond closest to the parking lot has many needle bundles of 4. The “Big Wawona” tree on Roger’s cut-off is a Ponderosa Pine.

Rattlesnake Grass (Big Quakinggrass) (*Briza maxima*) Grass family, subfamily Festucoideae



*

Out of all the grasses growing locally, I chose to include this one because it is distinct and beautiful. It is an annual grass common in rocky soils and drainages, though it can be seen almost anywhere. We know it as Rattlesnake Grass because its seed heads resemble rattlesnake rattles. The seed heads hang and quiver in a breeze, hence the name Quakinggrass.

Adaptations:

- Rapid annual growth takes advantage of short growing season. (Its seed heads are already dry in May.)

Interdependence:

- NC. CO₂/O₂. WC.

Scotch Broom (*Cystisus scoparius*) Legume family



*

An invasive exotic shrub originally from Hawaii, Scotch Broom was originally introduced by a Scotch immigrant to Vancouver Island. *Leaves*: Alternate, deciduous, small, with 3 leaflets when near the base of the branches, simple above. *Flowers*: Bright yellow, pea-like, about 2cm long, single but growing densely on the bush. *Fruit*: Black flattened pods, about 4cm long, the two halves tend to warp in different directions eventually snapping apart audibly and catapulting seeds. *Bark*: Stems are green. Grows in disturbed and open sites.

Adaptations:

- The ejection of its seeds assures widespread propagation.

Interdependence:

- A legume, the Scotch Broom has a symbiotic relationship with Rhyzobium bacteria which fixes nitrogen in the soil, enriching it.
- Because it is exotic, Scotch Broom has been extremely invasive in certain areas, crowding out native plant species; this is because there are no native diseases, parasites, or other population controls adapted to it.
- NC. CO2/O2. WC.

Other:

There is a dense stand of Scotch Broom on Clear Creek south, blooming in late spring. Do not eat any part of this plant; it contains several toxic alkaloids.

Sheep Sorrel (*Rumex acetosella*) Buckwheat family



An edible plant with a pleasant sour taste, but small and takes some looking for. *Leaves:* Dark green, arrow shaped, growing in a clump at the base of the stem (basal leaves).

Flowers: Tiny green or reddish, growing in clusters in narrow elongated spikes branching off the single tall stem (up to 50cm). *Seeds:* Tiny, shiny, brown, three angled nutlets enclosed in a capsule. Grows in disturbed ground, grasslands and fields, usually in acid soils; look for it along the border between the riparian zones and the drier upland soils (its best harvested in spring).

Adaptations:

- Rapid annual growth takes advantage of short growing season.

Interdependence:

- NC. CO2/O2. WC.

Other:

Share this one with the students; make a “hand salad” of Sheep Sorrel and Miner’s Lettuce...

Shooting Star (*Dodecatheon pulchellum*) Primrose family



A wildflower, the shooting star is one of the earliest spring wildflowers, blooming when the ground is still wet. *Leaves*: Oval, growing from base. *Flowers*: Purple with yellow and black, hanging, with 5 backward-swept petals, 1-3 flowers per plant.

Adaptations:

- Stamens and pistils fully exposed for easy pollination.
- Rapid annual growth takes advantage of short growing season.

Interdependence:

- Source of nectar and pollen for early spring insect pollinators.
- Depends on adequate ground saturation in spring to complete its life cycle.
- NC. CO₂/O₂. WC.

Other:

A white form, perhaps a distinct species (*Dodecatheon dentatum*), can be found above upper crossing on the Kanaka Loop trail in early spring; look carefully right next to the trail, left side (if going uphill), 2-5 minutes after upper crossing.

Snowdrop Bush (*Styrax officinalis* var. *californica*) Styrax family



*

One of the most beautiful local deciduous shrubs. *Leaves*: Simple, nearly round, bright green, around 5cm long, smooth margined. *Flowers*: Individual, white, showy, hanging with back-swept petals, blooming in May, fragrant and abundant. *Fruit*: White, hanging, individual berries, maturing to light green at which point it cracks open to let a single, brown nut-like seed fall out. *Bark*: Dark brown and smooth. Note the fluid patterns of the branches. Grows in partial shade as an understory plant in the mixed forest communities (not a riparian species).

Adaptations:

- The roots must be very deep-probing or have water-storage capabilities for the plant to survive the long hot dry summers.
- The smooth, round, lightweight yet tough seeds can travel well, and resist damage, in water and/or from gravity.

Interdependence:

- Dependent on larger trees for a shady environment.
- NC. CO2/O2. WC.

Other:

The fruit is NOT edible, nor are the seeds. However, at the height of their bloom, the Snowdrop Bush is stunning and very fragrant.

Soap Root (*Chlorogalum pomeridianum*) Lily family



A very common annual, growing in the hardest and driest of soils. *Leaves*: Long and grass-like, with wavy edges, up to 60cm long, growing from the base. *Flowers*: Small (up to 4cm wide), white, with 6 narrow petals that curve backward, grouped in a large freely and openly branched cluster on a tall stalk (up to 3 meters) that grows up new each spring (blooming late May).

Adaptations:

- Its bulb is protected by a thick mat of very tough fibers and is extremely difficult to dig up.
- The flowers only open on cool days or in the evening through the night; moisture conservation?

Interdependence:

- Must be important to nocturnal insect pollinating insects... moths?
- NC. CO₂/O₂. WC.

Other:

The bulb can be crushed with water to yield a lather that can be used for cleaning. A past made from the crushed root can be used for some relief from a Poison Oak rash. The crushed roots were also used to stupefy fish. A substance released from the roasted bulbs was used to glue feathers on arrow shafts.

Spice Bush (*Calycanthus occidentalis*) Sweet Shrub family



*

A very beautiful riparian shrub. *Leaves:* Simple, pinnately veined, up to 15cm long, egg shaped, smooth margined, delicate yet having a rough feel. When bruised, the leaves smell spicy and pleasant. *Flowers:* Wine colored, solitary, about 5cm across, Chrysanthemum-looking, blooming early to mid June. *Fruit:* Veined, urn-shaped seed vessels, turning brown, remaining on plant until it blooms again the following year.

Adaptations:

- The fragrance of the leaves and their unpalatable texture may keep herbivores at bay.

Interdependence:

- Needs the full shade and moist soils of canyon riparian zones.
- NC. CO₂/O₂. WC.

Other:

These plants are relatively rare here, but there is one growing in Mystery Canyon near the stacked rocks and others growing along Paige Boulder Creek.

Squaw Bush (*Rhus trilobata*) Sumac family



*

A low dense deciduous shrub growing up to 1½ meters tall; this one is easily confused with Poison Oak. *Leaves*: Pinnately compound with 3 leaflets, smaller than Poison Oak and more regular in shape and size, slightly fuzzy. *Flowers*: Usually yellowish, contain both male and female parts. *Fruit*: Red berries in clusters. *Bark*: Gray, young twigs red. Grows in same places you'd expect to find Poison Oak; in the mixed forest communities.

Adaptations:

- If mimicry is possible in plants, then this must be a case of it; it looks so similar to Poison Oak, that it's probably a good defense.

Interdependence:

- NC. CO2/O2. WC.

Other:

I strongly recommend learning the differences between this plant and its cousin Poison Oak.

Star Thistle (*Centaurea solstitialis*) Composite (Sunflower) family



*

A very hardy exotic weed with painful needle-like seeds, it grows especially well in disturbed places. *Leaves*: Linear and extending down the stem. Leaves and stem cottony-haired. *Flowers*: Small, yellow, thistle-like. *Seeds*: Tiny, at the base of a needle about 2cm long (very sharp).

Adaptations:

- The seeds, which have microscopic barbs, stick in animal fur and hikers' socks and are thus transported.
- The spines act as an effective defense against browsing before they are disseminated.

Interdependence:

- Because it is an exotic, this plant is often extremely invasive; few native herbivores, parasites, or diseases affect it.
- NC. CO2/O2. WC.

Other:

This plant is originally from the Mediterranean and Middle-East.

Sugar Pine (*Pinus lambertiana*) Pine family



*

On of the most beautiful and large pines, we have a few excellent specimens on the Ridge trail and Captain's Gangplank. *Leaves:* Needles, medium in length (to 10cm), 5 in a bundle, blue green, twisted. *Cones:* Large (up to 46cm long), cylindrical, light brown, hanging near ends of upper branches, not particularly dense or heavy. *Bark:* Brown or gray, furrowed but not deeply so.

Adaptations:

- The seeds are equipped with long wings which slow their descent and assure their wide distribution by wind.

Interdependence:

- Because this species does not form pure stands, it must need the other trees in a mixed conifer woodland...
- NC. CO₂/O₂. WC.

Other:

Another important timber species. The tallest recorded Sugar was 73.5 meters (241 feet) tall. Early settlers and miners used the wood for houses, shingles, fences, flumes, sluice boxes, bridges and mine timbers. The large seeds are edible; the local Wintu peoples depended on them. The common name comes from the sweet resin that exudes from cut or burned heartwood; this was also eaten by the Wintu.

Sword Fern (*Polystichum munitum*) Fern family



*

A larger fern, it prefers moist upland, almost exclusively north-facing slopes (in this area). *Leaves:* Pinnately compound, each leaflet looks like a miniature serrated sword and each has a forward-pointing lobe at its base. Sporangia arranged in dots on the backsides of leaflets. Leaf stalks covered with brown, papery scales. On larger plants in wetter spots, the leaves can grow to longer than a meter in length. Leaves grow in bunches from a common base.

Adaptations:

- Large leaves are an adaptation to collect more sunlight.

Interdependence:

- Spores are food for smaller invertebrates.
- Sword Fern depends on the topography of the land and the canopy of the forest for the shade, cooler temperatures and moisture that it needs.
- NC. CO2/O2. WC.

Other:

Coastal peoples used the larger leaves as a protective layer in traditional pit ovens, between food in storage, and on berry-drying racks. Leaves were also used as flooring and bedding. Larger rhizomes (roots) were eaten as a starvation food; first they were roasted or steamed then peeled and eaten. The rhizomes were also used to treat diarrhea.

Toyon (Christmas Berry) (*Herm arbutifolia*) Rose family



*

An evergreen shrub. *Leaves:* Simple, lanceolate, with toothed margins, around 12cm in length, grass green and leathery. *Flowers:* Clusters of tiny white flowers, blooming late May through late June. *Fruit:* Clusters of small berries, green when unripe, bright red when ripe (around winter solstice). *Bark:* Smooth, grayish-brown. Grows in full sun and partial shade; not a riparian species.

Adaptations:

- Fruits designed to be eaten and passed and because they are ripest during winter, they have a “monopoly” on herbivore seed vectors.

Interdependence:

- An important winter survival food for many herbivores, especially birds.
- Sprouts vigorously after fire or cutting; a pioneer plant on eroded soil.
- NC. CO2/O2. WC.

Other:

Fruits are edible, but not very eat-able; they have a sweetness to them, but are also quite astringent. Share them with your students!

Tree of Heaven or *Ailanthus* (*Ailanthus altissima*) Quassia family



*

Another exotic, this deciduous tree is quite beautiful though it loses its appeal when it grows invasively. *Leaves*: Pinnately compound, huge (up to 61cm long), with 13-25 leaflets paired except at end, leaflets toothed near bases, leaf rib bright red, leaflets bright green. *Flowers*: Small (up to 6mm long), with 5 yellowish-green petals, grouped in terminal branched clusters up to 25cm long, male and female usually on separate trees, blooming in late spring. *Fruit*: Flat narrow winged one-seeded key, up to 4cm long, 1-6 coming from each fertilized flower, maturing in late summer and hanging on tree well into the winter. Grows sparsely here at the school, but can be very invasive in waste places like old lots and roadsides.

Adaptations:

- Can spread very rapidly by sending up suckers.
- Winged seeds are well distributed by wind.

Interdependence:

- NC. CO₂/O₂. WC.

Other:

The gigantic leaves are good for illustrating what “compound leaf” means to the students. The leaves when crushed exude a smell that some have likened to peanut butter, however, the plant is poisonous; do not eat. Supposedly, this tree is sacred in China (where it is native?) and was brought here by the Chinese laborers used to build the railroad.

Valley Oak (California White Oak) (*Quercus lobata*) Beech family



*

A large deciduous tree with stout white-ish trunk and thick branches. *Leaves:* Simple, deeply lobed, smooth tipped lobes, darker above, paler below with thin fuzz, up to 10cm long and 6cm wide. *Fruit:* Acorns (up to 6cm long). *Bark:* Thick, deeply furrowed forming plates, light gray. Grows in valleys and slopes in rich soil.

Adaptations:

- Like most of the trees in this area, the Valley Oak has the ability to store water in its tissues to survive the long, hot dry summer.
- Abundant acorn crops increase the chances of procreation.

Interdependence:

- The acorns are important food for a variety of animals and are considered sweet and edible (they were an important part of the diet of the local Wintu people).
- This tree needs rich soil (which may explain why there are relatively few around WES).
- NC. CO₂/O₂. WC.

Other:

There is a beautiful Valley Oak at the mouth of Mystery Canyon, right next to the trail, and several overhanging the upper lawn (though these have dark brown, more finely furrowed bark—perhaps they are hybrids).

Western Azalea (*Rhododendron occidentale*) Heath family



*

One of the most showy and fragrant of our shrubs; a must find. *Leaves:* Deciduous, simple, thin and long (up to 8cm). *Flowers:* Large (up to 5cm long), white to pinkish, blooming in early May, often in bunches, very fragrant. *Fruit:* Capsule-like, green and sticky when immature.

Bark: Light gray and smooth, becoming fissured. Grows locally only in riparian zones.

Adaptations:

- The abundant, very fragrant flowers attract pollinators.

Interdependence:

- Needs the moist soil of riparian communities.
- Both butterflies and hummingbirds feed at these flowers.
- NC. CO₂/O₂. WC.

Other:

There is one growing on Clear Creek South trail, not long after crossing Paige Bar Creek; it'll be on your left as you walk the cobbles going upstream. You'll probably smell it before you see it, if it's blooming. There are some growing right next to Paige Boulder Creek; one I know of requires wading down the creek, it's midway between Lower Crossing and the school.

White Alder (*Alnus rhombifolia*) Birch family



*

A medium-sized to large riparian tree (up to 21 meters tall) with a straight, tall trunk.

Leaves: Simple, pinnately veined, up to 10cm long, egg-shaped, with pointed tip, finely saw-toothed, dull dark green, light yellow-green underneath, with 9-12 parallel veins along each side of central vein. *Flowers:* Tiny, in winter and early spring before the leaves. Male flowers yellowish in drooping cylindrical catkins up to 13cm long; female flowers reddish in narrow cones, about 10mm long. *Seeds:* Tiny flat elliptical nutlets maturing in late summer. *Bark:* Light or dark brown, fissured into flat, scaly ridges.

Adaptations:

- Tiny seeds are well dispersed by wind and water.
- Because each tree has both male and female flowers, a tree can fertilize itself, assuring propagation even when alone.

Interdependence:

- An important riparian tree, growing only where there is perennial water, stabilizing stream banks with its roots and shading the water, the Alder is important to the maintenance of proper salmon spawning habitat in Paige Boulder and Clear Creeks.
- NC. CO₂/O₂. WC.

Wild Grape (*Vitis californica*) Grape family



*

A vine, the wild grape is nearly identical to its cultivated relatives. *Leaves:* Simple, palmately veined, usually lobed, colorful (reds) in October and November before falling. *Flowers:* Fragrant, greenish-yellow, blooming in May and June. *Fruit:* Clusters of dark purple fruits, ripe in September and October. *Bark:* Shredding. Grows most commonly along the edge of the riparian and higher oak woodland communities.

Adaptations:

- Climbs trees to reach light.
- Berries meant to be eaten for seed dispersal.

Interdependence:

- Relies on the structures of trees to reach the light of the upper canopy (comensalism).
- Fruits eaten by birds, coyotes, foxes, and black bears.
- NC. CO₂/O₂. WC.

Other:

Fruits are delicious (both edible and eat-able). Share them with your students!

Wild Onion (Paper Onion) (*Allium amplexans*) Amaryllis family



* (Dried up)

Fresh and best edible in early and mid spring when the ground is still quite moist; this is not a riparian species, but it thrives where water collects in shallow depressions (vernal pools) on gentle slopes. *Leaves*: Thin and grass-like. *Flowers*: An umbel-like group of white, papery flowers, one group per plant growing on the end of the single stalk (about 30cm tall usually).

Adaptations:

- Rapid annual growth takes advantage of short growing season.
- Develops little “plantlets” from fertilized flowers which then drop to the ground to take root.

Interdependence:

- NC. CO₂/O₂. WC.

Other:

Try this one with the students; it’s a classic onion taste, just a bit sharper. Onion is easily confused with white Brodiaea lilies; the easiest way to identify them is to crush a leaf or flower and smell it.

Willow (Pacific) (*Salix lasiandra*) Willow family



*

A deciduous riparian tree that is most commonly a thicket-forming shrub around here. *Leaves:* Simple, narrowly lance-shaped (lanceolate), finely saw-toothed, shiny green above, whitish underneath. *Flowers:* Catkins up to 10cm long, with hairy yellow or brown scales, blooming in spring with the opening of the leaves. *Fruit:* Small (6mm long), light reddish-brown hairless capsule, maturing in early summer.

Adaptations:

- A *Salix*, the willow has the ability to grow back vigorously from its roots or cuttings after being damaged.

Interdependence:

- An important riparian shrub/tree, willows stabilized riverbanks and shade the water, helping to maintain ideal salmon spawning habitat.
- NC. CO₂/O₂. WC.

Other:

The willow family has many members and is extremely widespread and difficult to differentiate; there may be other species of willow present locally... While willows are most often found along streams where there is permanent water, they can also be found where there is a high water table with no visible water. The tissues of the willow contain a compound that enables a cut twig to sprout when placed in water. If you are interested in sprouting cuttings of other species that may not usually sprout from cuttings, place them in a bucket of water that has had willow twigs soaking in it for a time; they will sprout too. Young willow twigs make the best marshmallow roasting sticks.

Yarrow (*Achillea lanulosa*, *millefolium*, or *borealis* var. *californica*)
Sunflower or Composite family



*

A showy white flower, Yarrow is a ubiquitous California flower found in almost all ecosystems at nearly all elevations. *Leaves*: Linear, with numerous, highly-dissected leaflets (they look feathery). *Flowers*: Small, arranged in dense, flat-topped clusters. Stems are covered with fine, white hairs. Can grow 30-60cm high. Around here, they seem to prefer disturbed sites and edge zones.

Interdependence:

- NC. CO₂/O₂. WC.

Other:

This was a highly revered medicinal herb; the leaves steeped in hot water were used to stop bleeding wounds. Look for Yarrow next to the Paige Bar Road West trail just before you cross Paige Bar Creek.

Yerba Santa (*Eriodictyon californicum*) Waterleaf family



*

A common medicinal woody herb growing along roads and in other disturbed, dry soils. *Leaves*: Simple, pinnately veined, up to 10cm long, thick and leathery, toothed margins, shiny sticky and dark green above, lighter and hairy below. *Flowers*: Funnel-shaped, light bluish-purple, up to 2.5cm long, clustered at the tips of new growth. This plant is an evergreen perennial.

Interdependence:

- The older leaves are usually black with a fungal growth that presumably represents a symbiotic relationship as it doesn't seem to kill the leaves or the plant (maybe commensal).

Other:

Native peoples used this plant to treat respiratory tract problems and the Spanish Missionaries came to value it so highly that they gave it its name which means (indirectly) "holy plant." This plant has been used as a substitute for hops in brewing beer, especially porter. This plant can be shared with your students as an edible, but not eat-able, plant; after chewing the leaves and rinsing out your mouth, you are left with a strong, very sweet aftertaste which makes water taste like honey. It's fun to watch their faces as they chew...

B. Birds

Acorn Woodpecker (*Melanerpes formicivorus*) Woodpecker family



A medium sized woodpecker (up to 24cm), it is especially notable for its behavior. Nesting in holes in dead trees, it feeds on insects living in or under tree bark but also eats acorns, fruit, and sap. Unusual in that it lives in communal groups of up to 16 birds, it also nests cooperatively (two or more cooperate in the raising the young from one nest). Also unusual is its hoarding behavior; each community has a “granary tree” at the center of its territory where it stores acorns. Holes are drilled and the acorns tightly hammered in; up to 50,000 acorns can be stored in one tree.

Adaptations:

- Camouflage coloration.
- Beak for drilling holes in dead wood and catching and eating insects; plus a long, retracting tongue for reaching insects at bottom of narrow deep holes.
- Cooperative living and nesting, enabling larger clutches to be raised.
- Hoarding, an insurance of food supply during the shortage of the winter season.

Interdependence:

- Holes for nests and acorn caches hasten the progression of a snag into total decay.
- Symbiosis within each community, especially in the collection, storage, and defense of the granary and in the raising of young.
- NC. CO₂/O₂. WC.

Other:

Only about 3% of the world’s bird species (about 300 species) are cooperative breeders. Another we have locally is the Scrub Jay.

American Crow (*Corvus brachyrhynchos*) Crow family



A very common, widespread bird, it is smaller than a raven (about 45cm) and has a smaller beak and differently shaped tail. It is a true omnivore, opportunistically feeding on everything from fruit to carrion, from insects to lizards. It makes cup-like nests in trees and shrubs, occasionally cooperatively breeding with yearling helpers.

Adaptations:

- Feeding opportunism.
- Multi-purpose beak.
- Has been observed opening mollusk shells by dropping onto rocks from above.

Interdependence:

- In winter roosts communally in trees; there can be tens of thousands of individuals together.
- NC. CO₂/O₂. WC.

Other:

In flight crows have a squared-off tail whereas ravens have a fan-shaped tail. Ravens can be seen locally too.

American Dipper or Water Ouzel (*Cinclus mexicanus*) Dipper family



This small (up to 22cm) dark water bird is not much to look at but is extremely unusual in its foraging strategy; it feeds on aquatic insects that it catches by flying and walking underwater, usually in rapids. It nests on cliffs but can also use bridge abutments.

Adaptations:

- Very soft, dense plumage that is difficult to saturate keeps it warm.
- A white nictitating membrane (third eyelid) can be drawn across the eye to keep it clear of dirt suspended in the water.
- Powerful wings for flying underwater in strong currents and in the air.

Interdependence:

- PC aquatic insects. The diet of the Dipper overlaps with that of Salmon and Trout.
- NC. CO₂/O₂. WC.

Other:

When alighting the Dipper “dips,” bouncing on its legs. The young can climb, dive, and swim upon departing the nest.

American Robin (*Turdus migratorius*) Thrush family



A very common year-round bird (about 25cm), it is easily identified by its coloration and ground-feeding habits. It mainly eats insects and other invertebrates (especially earthworms) that it gleans from the ground and foliage, though will also eat fruit. Monogamous, it nests high in coniferous trees.

Adaptations:

- Multi-purpose, insect-eating beak.
- Sharp eyesight.

Interdependence:

- PC insect and invertebrate.
- Adults defend nest belligerently.
- NC. CO₂/O₂. WC.

Other:

Experimentation has led to the conclusion that Robins locate worms using their eyes, not their ears, though when feeding on lawns, it looks like they are listening. This bird is quite common on our lawn and often shows little fear of people.

Bald Eagle (*Haliaeetus leucocephalus*) Accipiter family



Not a bird you usually see everyday, its huge size (up to 94cm), distinct appearance, and unequalled grandeur make for a very exciting sighting. Monogamous, it makes its large stick-nests in tall trees or on cliff ledges, usually not far from water because it mainly feeds on fish, which it spots from soaring high up and then diving for with its talons. It will also feed on birds and small mammals.

Adaptations:

- Meat tearing beak.
- Powerful, sharp talons for catching and holding live prey.
- Large wings (spanning about 2 meters) for soaring.
- Excellent eyesight for spotting prey from a distance.

Interdependence:

- A top predator.
- Sometimes steals fish from the Osprey which is known to be a more adept fisher.
- NC. CO2/O2. WC.

Other:

There are several nesting pairs around Whiskeytown Lake. This species is endangered in most of the U.S. due to eggshell thinning from biological amplification of DDT; numbers are slowly growing however.

Black Phoebe (*Sayornis nigricans*) Tyrant Flycatcher family



This small (up to 18cm) bird is also identified by its feeding behavior; making short sallies from a perch to catch flying insects over water, it will return repeatedly to the same perch. It is monogamous and nests on cliff faces or walls.

Adaptations:

- Behavioral; insect catching.
- Beak has special tendons that enable it to snap closed very quickly when an insect is caught.

Interdependence:

- Always found near water.
- PC insects.
- NC. CO₂/O₂. WC.

Other:

The pond and amphitheater are good places year-round to catch sight of this little bird.

California Quail (*Callipepla californica*) Pheasant family



A distinctive ground bird (about 25cm), this species is the California state bird and is very common locally. It eats seeds, foliage, acorns, and insects that it gleans from the ground. Monogamous, it nests on the ground in well-concealed shallow scrapes.

Adaptations:

- Strong legs for very rapid running and strong wings for short bursts of quick flight.
- Short, strong beak for eating seeds.

Interdependence:

- Forms coveys of up to 200 individuals in the fall and winter.
- Males act as sentry throughout the year.
- PC insects.
- NC. CO₂/O₂. WC.

Other:

Very recognizable by its body shape, plume of feathers on its head, and voice, often sounding like “chi-ca-go.”

Canada Goose (*Branta canadensis*) Duck family



This large (up to 114cm) water bird is quite common here in the winter and spring, hatching and raising its young. Monogamous, it nests on the ground in shallow scrapes. It mainly feeds on greens though it will eat insects as well. Its feeding behavior includes “dabbling;” floating on the surface and standing on its head to reach food below.

Adaptations:

- Wide bill for browsing and sifting insects from water and mud.
- Large webbed feet for paddling.
- Large powerful wings for long migratory flights.

Interdependence:

- Usually nests near water.
- Returns to ancestral breeding grounds each spring/summer.
- NC. CO2/O2. WC.

Other:

In winter/spring of 2001, we had 4-6 pairs and several gaggles around camp, often feeding on the upper lawn. Adults lose all flight feathers when molting, rendering them flightless for a couple of weeks. Please do not call them “Canadian Geese;” though it is only a matter of common names, it is proper to call them “Canada Geese.”

Common Merganser (*Mergus merganser*) Duck family



(Female)

A type of duck (about 64cm), the male resembles a male Mallard with its shiny dark green head, but their bills are very different as are their diets. It feeds mainly on fish, which it catches by diving and swimming underwater. Monogamous, it nests in cavities in deciduous trees or on the ground.

Adaptations:

- Serrated, thin, slightly hooked beak for catching fish.
- Large, webbed feet for swimming underwater and paddling on the surface.
- Water-resistant feathers for insulation and buoyancy.

Interdependence:

- PC fish and aquatic insects.
- Depends on water for food.
- NC. CO₂/O₂. WC.

Dark-Eyed Junco (*Junco hyemalis*) Finch family



A small bird (up to 16cm) year-round in its range here. A ground-dwelling species, it nests on the ground in protected sites (sometimes in trees). It feeds on seeds, small fruits, and some insects. Also can be found in the tangle of underbrush, in trees, and in shrubs; it is an edge-zone species

Adaptations:

- Camouflage coloration for protection and a short strong beak suited for eating seeds.
- Behavioral; finds protected locations to hide its nest.

Interdependence:

- Probably responsible for the spreading of many plants' seeds through its droppings.
- NC. CO2/O2. WC.

Other:

Also called Oregon Junco, this bird is quite common throughout the year here.

Great Blue Heron (*Ardea herodias*) Heron family



This is one of the largest (up to 132cm) and graceful birds to be seen locally, it always lives near water where it feeds in the shallows mainly on fish which it spears with its long sharp beak. Monogamous, it carefully constructs its nests in tall trees.

Adaptations:

- Long, folding neck which can thrust forward quickly and forcefully, and long sharp beak for hunting.
- Long legs and long toes for walking in water and not sinking in bottom silt.

Interdependence:

- Relies on water for food; PC fish and amphibian.
- NC. CO₂/O₂. WC.

Other:

They often nest in colonies. The sight of one of these birds flying up or down the Clear Creek canyon is fairly common and a treat.

Great Horned Owl (*Bubo virginianus*) Owl family



The largest (up to 64cm) owl living locally, it is mainly nocturnal sometimes crepuscular, and a carnivore. It hunts by swooping: A gliding descent from a perch to catch prey on the ground. It nests in abandoned cavities in trees.

Adaptations:

- Excellent eyesight and hearing for accurate nocturnal hunting.
- Sharp, powerful talons for catching and killing prey; hooked beak for tearing flesh.
- Special, muffled feathers that enable it to fly absolutely silently.
- Ejects pellets; the indigestible remains of prey including bones, teeth, and claws.

Interdependence:

- PC (important) rodents and small mammals.
- NC. CO₂/O₂. WC.

Other:

I have heard the Great Horned Owl called a “Tiger of the forest” because it is such an effective hunter. I have read that it uses its voice to terrify its prey into holding still. Its voice is the archetypal Owl’s voice; low hoots.

Hermit Thrush (*Catharus guttatus*) Thrush family



A little brown bird (up to 20cm), this bird is especially notable because of its beautiful voice, considered by many to be the most beautiful in North America (loud, slow, repetitive phrases spiraling down the scale carry well and echo in the forest). Monogamous, it nests on or just above the ground and feeds on insects, spiders, salamanders, and much fruit (especially in winter).

Adaptations:

- Beak well suited for insect catching and fruit eating.

Interdependence:

- PC insects.
- NC. CO₂/O₂. WC.

Other:

Tends to select nest sites where conditions are relatively moist.

Killdeer (*Charadrius vociferus*) Plover family



Named after its call, a very piercing “kil-dee” or “dee-dee-dee,” this small (27cm) bird is also known for its distraction displays. Eating almost entirely insects, it is a ground feeder. Monogamous, it nests on the ground in camouflaged scrapes.

Adaptations:

- Insect eating beak.
- Behavioral defense; it often will feign injury to draw predators away from nest.

Interdependence:

- PC insects.
- NC. CO₂/O₂. WC.

Other:

Killdeer can be spotted locally in larger meadows, especially the large flat gravel bar downstream of the amphitheater.

Mallard (*Anas platyrhynchos*) Duck family



Male and female

A very distinctive duck about 58cm in size, it is quite common throughout the year. Monogamous, it makes its scrape nests on the ground, often adjacent to bodies of water, and cleverly conceals them. A scavenger, it feeds on seeds, greens, aquatic invertebrates and insects. Its common feeding behavior, involving “standing on its head” while floating on the surface of shallow water, is called “dabbling.”

Adaptations:

- Wide flat beak for browsing and sifting food from water.
- Webbed feet for swimming.
- Water resistant feathers for insulation and buoyancy.

Interdependence:

- Dependent on water for food; a scavenger in aquatic communities, it “cleans up” the ecosystem.
- NC. CO₂/O₂. WC.

Other:

The most wide-spread duck in the Northern Hemisphere, it is the ancestor of the domesticated duck.

Northern Flicker (*Colaptes auratus*) Woodpecker family



A large woodpecker (up to 36cm), this bird is more often heard than seen as its mating rites are quite noisy. This monogamous species nests in holes that it makes in dead trees yet feeds mainly on ants and other ground insects, though it will find insects on tree bark and even will catch insects out of the air in short flights.

Adaptations:

- Beak appropriate for catching and eating insects as well as for excavating nesting holes in dead wood.
- Camouflage coloration (for tree bark especially).

Interdependence:

- PC insects (eats more ants than any other North American bird).
- By making holes in trees, it hastens the dead trees' progression towards total decay.
- The holes it creates are used by many other hole-nesting birds.
- NC. CO₂/O₂. WC.

Other:

The flight of this Flicker is distinct as that of a woodpecker; short bursts of flapping separated by an arc of folded-wing "gliding." You might hear loud staccato bursts of pecking on a hollow tree in spring; this is part of the mating ritual of this species (though it may be for other woodpeckers as well).

Osprey (*Pandion haliaetus*) Osprey family



Another large (up to 64cm) graceful carnivorous bird which is special to see. Monogamous, it makes large nests usually on the tops of broken trees near or over water. It feeds exclusively on fish it catches by hovering, spotting, and diving feet first for.

Adaptations:

- Strong meat eating beak, powerful sharp talons, large (spanning up to 183cm) soaring wings, and excellent eyesight.
- It is the only raptor whose front talons turn backward.

Interdependence:

- PC fish.
- Occasionally will have catch stolen by Bald Eagles.
- Female fed entirely by male from pair formation through egg-laying; courtship feeding may ensure mate fidelity.
- Always lives near water.
- NC. CO2/O2. WC.

Other:

This species is found on every continent. Its population has suffered from DDT poisoning, but has started to increase again.

Red-Tailed Hawk (*Buteo jamaicensis*) Accipiter family



The most common soaring bird after the Turkey Vulture, this hawk can be seen year round locally. A large raptor (about 56cm), it feeds almost entirely on rodents though it will eat birds, reptiles, amphibians, and insects. It feeds by patrolling high in the sky and diving to catch its prey with its talons. Sometimes it swoops down from a perch to catch prey too. Monogamous, it build nests of sticks in tall trees, usually commanding a broad view.

Adaptations:

- Soaring ability, excellent eyesight, and strong talons for catching prey.

Interdependence:

- PC rodents (important).
- Females often return to previous year's nest.
- Scream is often mimicked by the Stellar's Jay.
- NC. CO₂/O₂. WC.

Other:

Habitat loss has been main threat to population though DDT eggshell thinning has also been a problem.

Red-Winged Blackbird (*Agelaius phoeniceus*) Oriole family



This smallish bird (up to 24cm) is often sighted near water where its distinctive voice (a loud, liquid *ok-a-lee!*) and red shoulder patches make it easy to identify. Polygynous (one male mates with two or more females), this species usually nests in reeds, near or over water. It eats insects that it gleans from foliage and the ground, sometimes it will catch flying insects and eat seeds.

Adaptations:

- Insect-eating beak.
- Wing coloration for mating displays.

Interdependence:

- PC insects.
- I think they have complex relationship with the Cattail; not only do they nest in them but I think they take advantage of the Cattail's attractiveness to many insects and may eat its seeds.

Other:

Possibly the most numerous North American land species. It is a territorial species, though males will form flocks in the fall.

Rufous-Sided Towhee (*Pipilo erythrophthalmus*) Finch family



A smallish and colorful bird (up to 22cm), this Towhee is shy but not impossible to see. This monogamous bird forages and nests on the ground, though it sometimes will nest in shrubs. It feeds mainly on insects but will also eat seeds and fruits including acorns and berries.

Adaptations:

- Beak suitable for catching insects while being strong enough to eat seeds as well.

Interdependence:

- PC insects.
- Seed distribution.
- NC. CO₂/O₂. WC.

Other:

Look carefully for this bird in underbrush and shrubbery; it may be hard to spot, but is quite beautiful.

Scrub Jay (*Aphelocoma coerulescens*) Crow family



Aggressive and harsh of voice this bird (29cm) is quite common and easy to identify and hear. Monogamous, it is a cooperative breeder, nesting in trees and shrubs in classic cup-like nests made of twigs etc. Truly omnivorous, it feeds on insects, small invertebrates, small vertebrates, fruits, and seeds which it gleans and catches on the ground.

Adaptations:

- The multi-purpose beak of an omnivore.
- Cooperative breeding (two or more females lay their eggs in the same nest and take turns incubating the eggs and caring for the hatchlings).
- Will cache food.

Interdependence:

- Cooperative breeding.
- Will perch on deer and remove ticks.
- Have been called “uphill planters” because of their tendency to counterbalance acorns rolling and bouncing downhill. Jays bury many more acorns than they find and eat, helping to regenerate oak forests after fire or drought.
- NC. CO2/O2. WC.

Other:

Only 3% of the world’s birds are known to cooperatively breed, another local species is the Acorn Woodpecker. Will scavenge human food and garbage.

Stellar’s Jay (*Cyanocitta stelleri*) Crow family



This blue, crested bird (up to 34cm) is not shy; its voice often announces its presence rather gratingly. Building its nests in coniferous trees, it eats mainly pine seeds and acorns as well as other seeds and fruits, but also eats insects, small vertebrates, eggs, and nestlings.

Adaptations:

- Beak well suited for omnivorous scavenging and insect catching.
- Mimicry: Its scream closely resembles that of a Red-tailed Hawk.

Interdependence:

- Nesting pairs defend their territory, though will congregate with many others at feeding sites.
- Caches food and will steal from Acorn Woodpecker's caches.
- NC. CO2/O2. WC.

Other:

Though quite attractive, this precocious bird's voice can be quite irritating as it is loud and harsh. This is one of the most easily identified local birds and can be seen year-round.

Turkey Vulture (*Cathartes aura*) Vulture family



A huge bird (up to 69cm) this species is very common and usually seen soaring in the air. It feeds on carrion of all sizes that it finds by sight and smell from the air. Monogamous, it nests on cliffs and occasionally snags but doesn't really construct a nest.

Adaptations:

- By spreading its primary wing feathers, this bird lowers the stall speed of its flight and therefore can soar and ride thermals in a wider range of conditions.
- Excellent eyesight and sense of smell.
- Featherless head for cleaner feeding.

Interdependence:

- Cleans the land of dead carcasses.
- Usually roosts communally throughout the year.
- NC. CO2/O2. WC.

Other:

Often miscalled a buzzard, during salmon runs they can be seen roosting in trees by rivers and gorging on the dead fish. Has suffered in the past from eggshell thinning due to DDT.

White-breasted Nuthatch (*Sitta carolinensis*) Nuthatch family



This small (up to 15cm) short-tailed bird is most easily identified by its acrobatic behavior. Monogamous, it nests in cavities in tall conifers. It eats mainly insects that it finds in and on tree bark but will eat acorns and nuts during the winter. It is known to hoard food too, storing it in crevices behind loose tree bark. It is a year-round resident.

Adaptations:

- Insect eating beak.
- Hoarding behavior assuring winter food supply.
- Claws and bracing tail enable it to climb in all directions on tree bark.

Interdependence:

- PC insects.
- Often uses abandoned woodpecker holes for nesting.
- NC. CO2/O2. WC.

Other:

Look for this bird on the vertical trunks of trees high up, climbing all around feeding. Its voice is a low-pitched repeated nasal “yank.”

C. Other Animals

Alligator Lizard (*Gerrhonotus multicarinatus multicarinatus coeruleus shastensis*) Anguidae family



The largest lizard of this area, this species is quite common, and is usually seen when startled. It lives in woodlands on the ground, under logs, rocks, or bark. It eats slugs, insects, centipedes, scorpions, and spiders including the venomous Black Widow. Does not run as fast as the Western Fence lizard; it has a distinctive “wriggle.” May climb

trees in search of insects and the eggs and young of birds. Will swim to escape a predator.

Adaptations:

- Camouflage coloration and detaching tail for defense.
- Smooth scales for ease of movement inside rotten logs or beneath forest duff.

Interdependence:

- PC insects.
- Is prey for carnivorous and omnivorous birds and mammals.
- NC. CO₂/O₂. WC.

Other:

My friend Keith has a scar on his finger from the bite of an Alligator Lizard; they have strong jaws though they are not venomous. The Shasta Alligator Lizard (*Gerrhonotus coeruleus shastensis*) lives in this area too but is more secretive (spending less time in the open), is less colorful, and happens to bear live young.

Black Bear (*Ursus americanus*) Bear family



* Cub of local family, July 2001



** Same cub with sibling, July 2001*

Quite common in this area, the Black Bear is an omnivore with poor eyesight, moderate hearing, and excellent sense of smell. It feeds mostly as a scavenger, eating whatever it happens upon; its style of “hunting” is opportunistic. The reputation that this bear has is largely unwarranted; it is generally not aggressive. However, a mother will be quite fierce in the defense of her young and bears that have gotten used to human presence and food can be totally fearless around humans (interpreted as aggression in most cases). A solitary animal, the exception being a mother with its young, this bear will normally flee human contact. Though it doesn’t truly hibernate in this area, it does make a den under fallen logs, in hollow logs, or any place where there is shelter.

Adaptations:

- Strength and sharp claws for reaching insects in dead wood, under loose bark, or underground. Claws also useful for climbing trees (it is very good at this).
- Sharp sense of smell for locating food.

Interdependence:

- Needs lots of space for its home range.
- Because it eats large quantities of berries, it is an important distributor of seeds.
- PC insects.
- NC. CO₂/O₂. WC.

Other:

I have been told that between here and the coast there are more bears per square mile than any place else on the planet; of course these would be exclusively Black Bears. The Black Bear is not always black, often is other colors including reddish, blonde, or brown. In the spring of 2001, there were many sightings of a mother with two cubs; look for them in the future.

Bullfrog (*Rana catesbeiana*) True Frog family



The largest frog of North America, this species was originally native to wetland east of the Rocky Mountains, but has been naturalized across the west. Mainly nocturnal, this species feeds on insects, crayfish, other frogs, and minnows. Larger specimens have been known to catch and swallow small birds and young snakes. An amphibian, it needs to live near water; this species prefers slow moving or still water such as in ponds. Bullfrog tadpoles are large and require about 2 years to completely mature. The low honking rumble that you hear coming from the pond is the voice of the Bullfrog.

Adaptations:

- Camouflage coloration.
- Long powerful rear legs for jumping.
- Long, extending sticky tongue for catching prey.

Interdependence:

- PC insects (important).
- Requires water for reproduction.
- Is food for Herons, snakes, Raccoons, and other carnivores and omnivores.
- NC. CO₂/O₂. WC.

Other:

Ant Annette, once a lead teacher here, told me she witnessed a Bullfrog catch and swallow a duckling.

California Kingsnake (*Lampropeltis getulus californiae*) Kingsnake family



Not seen frequently, this snake is very distinct and attractive. It inhabits a wide variety of habitats, riparian and upland, eating snakes (including Rattlesnakes), lizards, frogs, birds and their eggs, and small mammals. It kills its prey using constriction. Is usually crepuscular, in hot weather can be nocturnal as well. Is terrestrial but sometimes will climb vegetation.

Adaptations:

- Will strike, hiss, and vibrate its tail as a defense.
- Constricting behavior.

Interdependence:

- PC reptiles, amphibians, birds, mammals.
- Is prey for a variety of carnivorous and omnivorous mammals and birds.

Other:

Even more rare is the Mountain Kingsnake (*Lampropeltis zonata*); similar but with black white and red rings.

California Newt (*Taricha torosa*) Newt family



Terrestrial phase

This species is terrestrial most of the time, feeding on insects and other small invertebrates it finds in moist rotting logs and deep in forest litter. In its terrestrial phase, it is rough-skinned. In the late fall, at the onset of the rainy season, individuals migrate to the water where they breed; breeding peaks between February and April. In its breeding phase it is smooth-skinned. Usually, this Newt is only seen during its migration to water when it still has rough skin.

Adaptations:

- Skin has ability to change according to the amount of time its spends in water.
- Flat tail aids in swimming.
- Defensive behavior: Arching its back, it displays its bright underside when disturbed. Bright color equals warning.

Interdependence:

- PC insects.
- Requires water for breeding.
- NC. CO₂/O₂. WC.

Other:

Look for Newts during the first fall rains, sometimes they are prolific. The Rough-Skinned Newt (*Taricha granulosa*) and the Red-Bellied Newt (*Taricha rivularis*) are very similar species.

Coyote (*Canis latrans*) Dog family



Mostly nocturnal, though it is flexible in this, the Coyote is a true scavenger and will eat almost anything including (but not limited to) small rodents and rabbits. Will cache uneaten food and will sometimes hunt in pairs and will follow hunting routes up to 16 km long. Normally dens in the ground, but will use other shelter, not more than 10 km from water. Will cross with domestic dogs. Five to ten pups are born in April or May.

Adaptations:

- Excellent eyesight, hearing, and sense of smell for nocturnal living.
- Claws for running very fast (up to 64 kmph) and digging.
- Multi-purpose teeth; for hunting and chewing.

Interdependence:

- PC rodents (important).
- NC. CO₂/O₂. WC.

Other:

Their howls and yipping are a colorful part of the tapestry of nighttime sounds. Though it has been long killed by ranchers, etc., the coyote has not experienced a general decline in numbers. It is widely known to be quite clever. Many American Indian peoples have revered *Coyote* as a trickster.

Crayfish (*Pacifastacus leniusculus*) Decapoda family



This crustacean lives in our pond and in Clear Creek and is a scavenger, eating vegetation and other detritus. It is closely related to shrimp and molts its exoskeleton as it grows.

Adaptations:

- Front legs are large claws that it uses to hold and tear its food and for defense.
- Paddle tail for rapid swimming (backward) away from harm.

Interdependence:

- A scavenger, it hastens the return of plant and animal tissue to essential nutrients. In “cleaning up” the pond, it obtains its food.
- Is food for Raccoons and Bullfrogs as well as other birds and mammals.
- NC. CO₂/O₂. WC.

Garter Snake Aquatic: (*Thamnophis couchi aquaticus*) Colubrid family
Terrestrial: (*Thamnophis elegans elegans*)



The two species of Garter snake found locally have very similar appearances; they both have black and yellow stripes running the length of their bodies. The terrestrial species is more rare and/or more secretive and inhabits a variety of habitats—grassland, brushland, woodland, and forests—usually not far from water. It eats slugs, leeches, earthworms, fish, salamanders, frogs, toads, tadpoles, lizards, snakes, small mammals, and birds. The aquatic species is quite common and easy to spot during the spring semester, especially in the pond and creeks where it eats fish, fish eggs, frogs, toads, tadpoles, salamanders, earthworms, and leeches. The terrestrial species will retreat to brush on land while the aquatic species will retreat to the water when startled. Both species bear live young.

Adaptations:

- The ability to swim well.
- Jaw can accommodate prey larger than it would appear to be able.

Interdependence:

- PC fish, amphibians, invertebrates.
- NC. CO₂/O₂. WC.

Other:

Like all reptiles, the Garter Snake will molt several times a year, leaving behind its old, too small skin. I once saw an Aquatic Garter Snake eating a Bullfrog tadpole; impressive!

Gopher Snake (*Pituophis melanoleucus*) Colubrid family



A very common local snake which is frequently mistaken for a Rattlesnake because of its markings and behavior (it will mimic Rattlesnakes by vibrating its tail in dry leaves which produces a buzzing sound). It eats rodents, rabbits, birds and their eggs, and

occasionally lizards which it kills by constriction. This snake is usually active during the day and is a good climber and burrower.

Adaptations:

- Mimicry (behavior and physiology) as a defense.
- Camouflage coloration.

Interdependence:

- PC rodents (important).
- NC. CO₂/O₂. WC.

Other:

I was lucky enough to stumble upon a gopher snake raiding a Quail nest; it ate 5 of the 6 eggs therein. Look at the head shape (not triangular and not larger than body diameter), the scales (not rough and large), the markings (not so distinct), and the tail (no buttons) in order to distinguish a Gopher snake from a Rattlesnake.

Gray Fox (*Urocyon cinereoargenteus*) Dog family



Mainly nocturnal and quite secretive, the Gray Fox is not often seen, but its scat is very common around school and on the trails. An omnivore, it mostly eats small mammals,

but will also eat insects, fruits, acorns, birds, and eggs. It makes dens in hollow logs, beneath boulders, or occasionally in the ground. Three to seven pups are born in April or May. Can climb trees to get away from predators.

Adaptations:

- Sharp senses for nocturnal living.
- Multi-purpose teeth of an omnivore; can hunt and chew.
- Tail for balance when climbing.
- Claws for digging and climbing.

Interdependence:

- PC rodents (important).
- NC. CO₂/O₂. WC.

Other:

For some reason, foxes like to defecate on rocks or other prominences. For a long time, I remember noticing a pile on each end of the Clear Creek bridge on the bottom rail. There is a family of Gray Foxes living in the bushes by the Shasta Haus.

Gray Squirrel (*Sciurus griseus*) Tree Squirrel family



*

This attractive squirrel is most often seen in trees, where it spends most of its time, but also is often on the ground. Is most active in the mornings. Feeds mostly on acorns and seeds of conifers. It nests in cavities in trees or in nests that it constructs of twigs and bark usually about 6 meters off the ground.

Adaptations:

- Long tail acts as counterbalance when climbing and jumping.
- Dexterous hands and feet with sharp claws for climbing.

Interdependence:

- Mainly an herbivore, there is some evidence suggesting that they will also eat insects.
- Because it caches acorns to be eaten in winter, more than it later finds, it helps forests regenerate.
- NC. CO2/O2. WC.

Other:

Ant Annette, once a lead teacher here, told me that she once saw a Gray Squirrel hauling a dead cat up a tree... You can make your own conclusions.

Mountain Lion (*Felis concolor*) Cat family





A very secretive large carnivore; its scat and tracks are common, but you probably will never see one. It eats deer almost exclusively but will also kill hares and other large rodents. Mainly nocturnal, it is most comfortable on the ground, though it will climb trees sometimes (like to get away from dogs). Is solitary and territorial; each individual requires several square miles in normal conditions. It is a solitary predator; it lies in wait to ambush individual prey.

Adaptations:

- Sharp senses for hunting and nocturnal living.
- Soft foot pads and retractable claws for silent stalking.
- Sharp claws for running fast and catching prey.
- Carnivore's teeth for killing and eating meat.
- Camouflaged coat for hiding.
- Scent glands for marking the boundary of its home range.

Interdependence:

- PC Mule Deer (important); a single lion may eat between 50 and 75 deer in a normal year.
- As towns grow and more people live in the countryside, lion habitat is fragmented and diminished causing more lions to be forced out of their home ranges. When this happens, more turn to livestock and pets for food.

- The main cause of Mountain Lion death is starvation; when feeding they break up bones which often cut or stab the lion's mouth. These wounds sometimes become infected; if they do not heal in time, the lion will not be able to eat...
- NC. CO2/O2. WC.

Other:

Rogue lions (without a home range and therefore without reliable food source) can be dangerous to humans... Remember, if you see a lion: 1.Do NOT run. 2.Keep your group together. 3.Make lots of noise. Generally speaking, you will not see lions, for they are adept at detecting our presence and avoiding us.

Mule Deer (*Odocoileus hemionus*) Deer family



* Female



* Fawn

A very common local ungulate, it can be seen year-round at school on the lawn. Its common name comes from its large ears which are the root of the activity “deer ears.” It is mainly crepuscular, is mostly a browser, feeding on shrubs, and can be seen singular or in groups. The rutting season is October through December, offspring are born in early summer, and the males lose their antlers in January and February. Some of local population appear to migrate seasonally in altitude; going up in summer and down in winter.

Adaptations:

- Deer have no upper incisors, so lower incisors must be sharp enough to cut off fodder with a jerk of the head.
- Antlers on males for defense and dominance rituals.
- Chewing their cud aids in digestion.
- Large ears and sharp eyesight for defense.

Interdependence:

- Main food source for Mountain Lions. Without lions or hunters, deer populations easily grow so large that individuals start encroaching on human-settled areas.

- The chief host of the Deer Tick.
- Acorns and Ceanothus are important protein-rich foods for the local Mule Deer.
- NC. CO2/O2. WC.

Other:

Try to find someone who will tell you one of the most infamous of wildlife-spotting stories about two deer mating on the volleyball court at 9AM on a Thursday.

Raccoon (*Procyon lotor*) Raccoon and Coati family



Usually found in riparian zones, and mainly nocturnal, this omnivore is one of the most adaptive mammals in North America. Eats fruits, nuts, grains, insects, frogs, crayfish, bird eggs, human food/trash; anything available. Has been observed washing its food before consumption. It will den up in hollow trees (usually) or other sheltered spots during cold spells, but it does not truly hibernate. Two to seven young are born in April or May. Population usually does not get more dense than one individual per acre.

Adaptations:

- Excellent vision, hearing, and sense of smell for nocturnal feeding.
- Claws for digging, climbing, and catching aquatic prey.

Interdependence:

- PC amphibians, reptiles, and invertebrates.
- NC. CO2/O2. WC.

Other:

Its snarl is louder than you might expect; it sounds like a much larger animal.

Racer (*Coluber constrictor mormon*) Colubrid family



A very common snake, but one usually seen for only a few seconds as it is very quick. Diurnal, this species eats lizards, frogs, small mammals, and especially insects. It is chiefly ground-dwelling, and prefers open habitat like meadows, thin brush, open forests, and grassy stream banks.

Adaptations:

- Very rapid movement for catching prey and fleeing predators.

Interdependence:

- PC reptiles, amphibians, mammals, insects.
- NC. CO₂/O₂. WC.

Rattlesnake (*Crotalus viridis oreganus*) Viper family



Our only venomous snake of this area, it is usually quite docile; care is needed when hiking in the warmer months, but it will not attack unless blatantly provoked. Frequenting rock outcrops, talus, rocky stream courses, and ledges, it eats small mammals, birds, lizards, and frogs. A variable species, its general coloration can be cream, yellowish, gray, pink, green, brown, or black. It bears live young.

Adaptations:

- A “pit-viper,” Rattlesnakes have two pit-like hollows on its face which it uses to sense heat. When it strikes, it aims for the strongest heat source.
- Rattlesnakes have hollow, folding fangs with which they inject a venom to kill prey (fangs also used in defense).
- Buttons on tail which buzz loudly to warn away would-be predators.

Interdependence:

- PC; rodents (important).
- Defensive behavior is mimicked by several non-venomous snakes.
- NC. CO2/O2. WC.

Other:

A button is added to the tail, each time a snake molts. For younger snakes which grow more quickly, 3-4 may be added each year; for older snakes, only one or even one per every couple of years. When encountering a Rattlesnake, do not panic! Usually you will hear it before you see it, in either case, just hold still and watch to see where it is going or what it is doing. We have seen quite a few Rattlesnakes on the trails and at school, don't worry, just keep your eyes peeled. I once saw a Rattlesnake swim across the pond to avoid my snake-stick. I've also seen two green Rattlesnakes doing their mating dance. The snake skin in the Naturalist Cabin is from a Rattlesnake that I accidentally killed with my car. A general rule of thumb for snakes is that the venomous ones move more slowly while the “safe” ones move quite quickly. Rattlesnakes reputedly will avoid tangling with Gopher snakes (see the Gopher Snake entry for a list of characteristics to look for in differentiating the two species).

Ringneck Snake (*Diadophis punctatus occidentalis*) Colubrid family



Not very common, but nonetheless quite beautiful. Another rapidly moving snake, you may only get a few seconds to see it. Living in woodland, forest, grasslands, and chaparral, this species prefers moist habitats. Usually found on the ground under bark,

beneath or inside rotting logs, and under stones, it feeds on salamanders, small frogs, lizards, small snakes, insects, and worms.

Adaptations:

- When cornered, this species coils its tail and turns the ventral surface of it uppermost, revealing the bright red color.

Interdependence:

- PC amphibians, reptiles, invertebrates.
- NC. CO₂/O₂. WC.

Ringtail “Cat” (*Bassariscus astutus*) Ringtail family



This shy nocturnal omnivore is usually very rarely seen, though they have been seen many times at school. It eats mainly small mammals, insects, birds, and fruits; will also eat lizards and a variety of invertebrates. May be partly colonial (usually 2 or more are seen together). It makes its den in caves or cliff crevices, in hollow trees, under rock piles, or in unused buildings; usually not far from water. Three to four young born in May or June.

Adaptations:

- Large, sharp eyes, excellent hearing and sense of smell for nocturnal living.
- Claws and balancing tail for climbing.
- The multi-purpose teeth of an omnivore.

Interdependence:

- PC rodents (important).
- NC. CO₂/O₂. WC.

Other:

At the beginning of fall 2000, there was a group of four or five Ringtails living in the rafters of the cafeteria. Have been seen at night eating pears from the trees at school. Incorrectly called a cat; is not related.

Western Fence Lizard (*Sceloporus occidentalis occidentalis*) Spiny Lizard family



* *Performing territorial display*

The most common lizard in this area, this is a highly variable species; it can be black, gray, brown, or tan. Also, females have different coloration than males; usually with dark bars or crescents on back which lacks the blue-green tinting that males have. It spends most of its time on the ground, but will also climb. It eats insects and spiders in a wide variety of habitats. Often observed doing “push-ups” on rocks or logs; this behavior seems to be a territorial display that may have something to do with mating.

Adaptations:

- Excellent camouflage coloration.
- Claws for climbing and running very fast to catch prey or escape predators.

Interdependence:

- PC insects (important).
- NC. CO₂/O₂. WC.

Other:

This lizard is easily captured with a grass noose (I would not show the students how to do this, as they are usually not gentle with captured animals). Commonly called a “Blue-Belly” Lizard.

Western Pond Turtle (*Clemmys marmorata*) Turtle family



*



*

The only turtle seen locally, it is most common in the school observation pond, though it has been spotted in the sediment pond on Paige Bar Road West and in Paige Boulder Creek. An omnivore, it feeds on plants, insects, and carrion.

Adaptations:

- Shell and claws for defense.
- Paddle like feet for swimming with claws for climbing.
- Sharp-edged mouth for browsing on vegetation and catching prey.

Interdependence:

- NC. CO2/O2. WC.

Other:

As you may notice, they are quite shy; when basking, if observers get too close, they will quickly slide back into the water.

Yellow-Legged Frog (Foothill) (*Rana boylei*) True Frog family



A stream or river frog of woodland and forest. Usually found near riffles. When frightened, will dive to the bottom of the water and hide among the rocks. Feeds on insects and invertebrates.

Adaptations:

- Camouflage coloration.
- Long powerful rear legs for jumping.
- Webbed toes for swimming.

Interdependence:

- PC insects.
- NC. CO₂/O₂. WC.

Other:

This is the most common frog of this area, though the Pacific Tree Frog (*Hyla regilla*) is also fairly common.

D. Insects

Buckeye Butterfly (*Junonia coenia*) Nymphalidae family



This very widespread species has a long flying season and can last well into late fall. Up to 59mm, it's eyespots and aggressive behavior towards other butterflies are its most distinguishable characteristics.

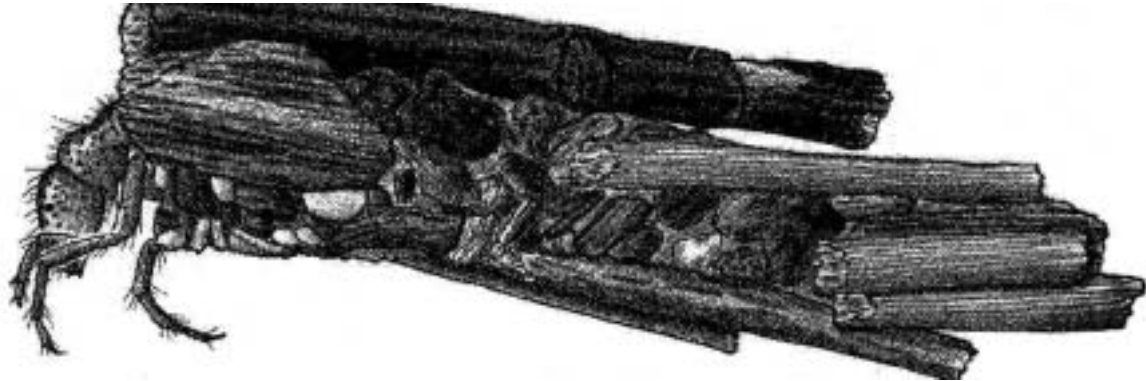
Adaptations:

- Wings have eyespots; a defense adaptation which can scare away potential predators by making the butterfly seem like a different (and larger) type of animal (mimicry).
- Large eyes and wings for flight ability.
- Long proboscis for feeding on nectar.
- Larvae: Branched spines for defense.

Interdependence:

- Larvae feed on Plantain, Monkeyflower, and Snapdragon; species of these groups must be present for this butterfly to live.
- Pollinator.
- NC. CO₂/O₂. WC.

Caddisfly (Order Trichoptera)



(We also have the species that makes their cases out of sand)

A very common aquatic insect with many genera and species. The adults look like moths. The larvae construct protective cases out of leaves, sand, twigs, or bark. Each species makes its case out of different materials and usually can be identified by it (species are identified by larval stage rather than by adult stage). Larvae are omnivores, feeding on both animals and plants.

Adaptation:

- Case-building for protection and camouflage.
- Larval stage has gills for breathing under water.

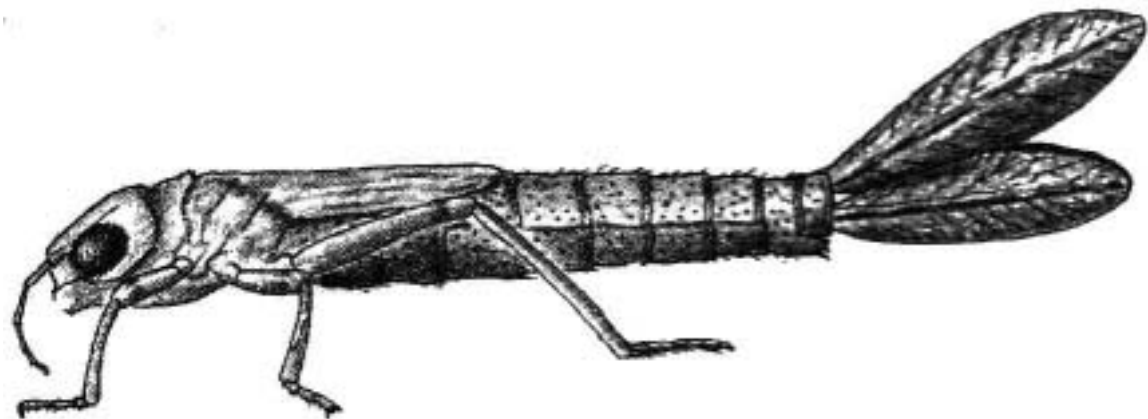
Interdependence:

- Trichoptera are an important food for trout, salmon, and the American Dipper.
- NC. CO₂/O₂. WC.

Other:

There are over 750 different species of Trichoptera in North America. When larva is mature, it attaches its case to some underwater object and seals it. Inside, it pupates. The pupa breaks out of the case and crawls out of the water onto a rock and undergoes its final molt into an adult.

Damselfly (Order Odonata, Sub-Order Zygoptera)



A common riparian insect, very similar to Dragonflies except they hold their wings together when at rest (butterfly-style) and their eyes protrude from the side on short stalks. Often blue in coloration. A weak flyer, it makes short flights, perching on vegetation near water. Usually identified in adult stage, its nymph stage can also be identified by its posterior external gills. Adults eat a variety of small flying insects, catching them on the wing. Nymphs eat a variety of aquatic animals, including tadpoles and small fish.

Adaptations:

- Nymph stage; external gills for breathing underwater and long, jointed lower lip that extends quickly to catch prey.

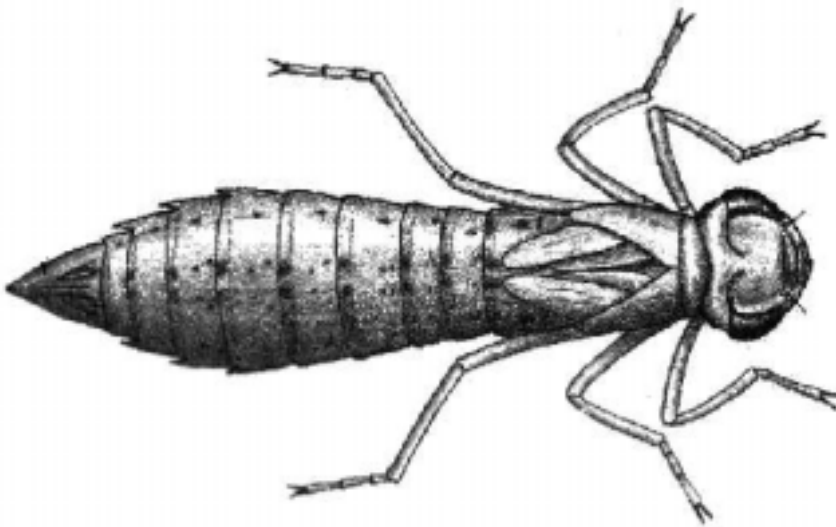
Interdependence:

- PC aquatic invertebrates and vertebrates, flying insects.
- Important food for trout, salmon, and the American Dipper.
- NC. CO₂/O₂. WC.

Other:

When mature, the nymph stage climbs out of the water and dries out. As it dries, its exoskeleton shrinks and cracks open along its dorsal side. The adult then emerges, “inflates” its wings, and flies off. This is an impressive process to witness.

Dragonfly (Order Odonata, Sub-Order Anisoptera)



One of the most easily spotted and identified insects, we have several different species locally. Very similar to Damselflies except they hold their wings flat when at rest and have very large compound eyes. Easily identifiable in adult stage; while nymph stage is very similar to that of the Damselfly, it does not have external gills (its gills are internal). Adults eat small flying insects, which it catches on the wing. Nymphs eat a wide range of aquatic insects and animals.

Adaptations:

- Nymph stage; internal gills for breathing underwater. These gills are located in its rectum; breathing is accomplished by drawing water in through anus and then expelling it. This expelling of water is also a form of rapid locomotion (“jet” propulsion).

- Also has a long, jointed lower lip that extends quickly to catch prey. Adult stage; extremely good eyesight to catch prey and avoid predators. Very powerful wings for flying fast with great maneuverability.

Interdependence:

- PC aquatic invertebrates and vertebrates, flying insects.
- Important food for trout, salmon, and American Dipper.
- NC. CO₂/O₂. WC.

Other:

When mature, the nymph stage climbs out of the water and dries out. As it dries, its exoskeleton shrinks and cracks open along its dorsal side. The adult then emerges, “inflates” its wings, and flies off. This is an impressive process to witness.

Grasshopper (Order Orthoptera, family Acrididae)



A large and diverse family of insects which has many representatives in this area. Most are herbivores, though some will eat detritus. Their nymph stages are smaller, softer bodied, and more brightly colored. Most species are winged and some are strong flyers, though most only make short flights when disturbed. Grasshoppers can be found in almost all terrestrial habitats.

Adaptations:

- Strong hind legs for powerful jumping.
- Wings for flight.
- Chewing mouth parts for feeding on plants.
- Hearing (or tympanic) organs located at the base of the abdomen enable Grasshoppers to hear.
- Coloration of nymphs is advertisement, to potential predators, of their awful taste (defense).

Interdependence:

- A prolific herbivore, this family has a large impact on plants and in turn is important food for birds and other insectivores.

- NC. CO2/O2. WC.

Other:

The Grasshopper that you might hear making a loud “crackling” noise when flying, belongs to the Band-Winged Grasshopper subfamily.

Ladybird Beetle (Ladybug) (*Hippodamia convergens*) Coccinellidae family



* Larva

One of the most common insects in all of California, it is quite common locally as well. The adults and larvae are predatory, feeding on Aphids (a garden-damaging herbivore).

They are easiest to spot when they converge for hibernation; in the fall they can be observed coming together, during the winter, they can be found en masse, and in spring (or warm fall and winter days) they can be seen diverging and flying away to feed. They can fly long distances as they migrate between their hibernation and feeding areas.

Adaptations:

- Adults: Hard wing-covers for protection. Hibernating behavior to survive winter temperatures.
- Larvae: Spines, skin processes, or waxy secretions for defense.

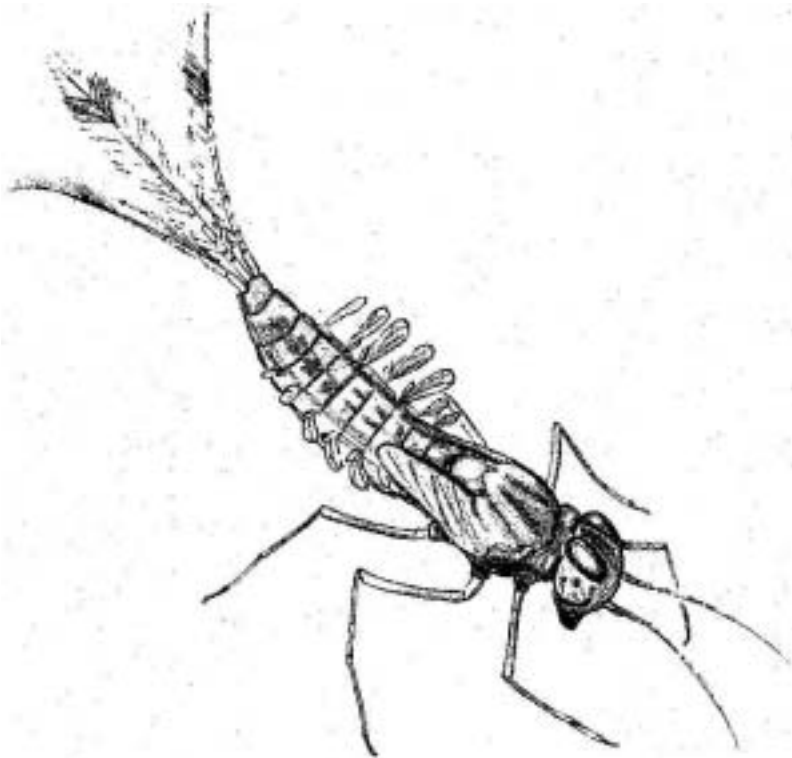
Interdependence:

- Many plant species benefit from Ladybugs eating the Aphids that damage them.
- NC. CO2/O2. WC.

Other:

Though not venomous or aggressive, Ladybugs do bite; it is not particularly painful, but it is sharp enough to be a surprise.

Mayfly (Order Ephemeroptera)



Another common aquatic insect. Adults hold wings together at rest and have 2 or 3 long hair-like tails; they do not feed. Nymphs have 3 hair-like tails, leaf-like gills alongside abdomen, and legs that seem to point forward. Nymphs eat small aquatic organisms and debris. Nymphs molt to the winged form at water surface; the first winged stage is not the adult, it is called the subimago which molts once more into the true adult. (Mayflies are unique among insects in undergoing a molt after the wings have become functional.)

Adaptations:

- Gills for underwater breathing.

Interdependence:

- Important food for trout, salmon, and the American Dipper.
- NC. CO₂/O₂. WC..

Other:

Male adults will engage in swarming flights.

Pale Swallowtail (*Papilio eurymedon*) Papilioninae family



Similar to the Tiger Swallowtail, this large (up to 88mm), striking butterfly is white and black rather than yellow and black. It can be seen at the same time (spring, summer, and fall) and in the same places as the Tiger Swallowtail. The young feed on Coffee-Berry, various species of Ceanothus, and other plants.

Adaptations:

- Adults: Bright coloration for easy mating identification. Large wings and good eyesight for flight. Long proboscis for feeding on nectar.
- Larvae: Green camouflage coloration with small eyespots for defense (mimicry).

Interdependence:

- Pollinator.
- NC. CO₂/O₂. WC.

Pipevine Swallowtail (*Battus philenor*) Papilioninae family



A common, large (up to 100mm) though less-showy Swallowtail; the adults have a long flight season and can be seen throughout the spring, summer, and fall. Larvae are black with orange spots.

Adaptations:

- Adults: Large eyes and wings for flying. Distinct coloration for identification for mating. Long proboscis for feeding on nectar.
- Larvae: Fleshy filaments along its body for defense (mimicry of spines).

Interdependence:

- Though the adults will feed at a variety of flowers, the larvae will only feed on two species of plant; the Pipevine and Wild Ginger.
- Because the population of this species is large locally and the Wild Ginger population is small, it seems that the larvae prefer the Pipevine.
- Pollinator.
- NC. CO₂/O₂. WC.

Sister Butterfly (*Adelpha bredowii californica*) Nymphalidae family



Common, large (up to 75mm), and easy to identify, June through September. The larvae of this species feeds on various species of Oak trees.

Adaptations:

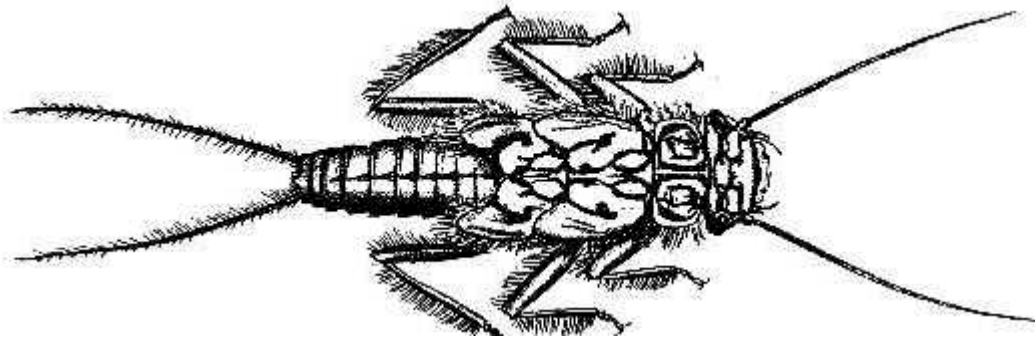
- Adults: Long proboscis for feeding on nectar. Bright colors for easy identification for mating. Large wings and eyes for flying.
- Larvae: Branching spines for protection.

Interdependence:

- This species is only found where there are Oak trees to provide food for the larvae.
- Pollinator.
- NC. CO₂/O₂. WC.

Stonefly (Order Plecoptera)





Usually found in the summer and usually nocturnal, these insects are rather large and have four large wings, though they are weak flyers and are not found far from water. Adults of some species feed on algae and other plant material while others do not feed at all. Nymphs of some species are predaceous while others are herbivorous. All nymphs are aquatic.

Adaptations:

- Some adults do not feed (or cannot); this stage of their life is short enough that they can breed only.
- The nymphs have external gills to breath underwater.

Interdependence:

- Important food for salmon, trout, and the American Dipper.
- NC. CO₂/O₂. WC.

Ticks (Order Acari [Mites], Sub-Order Ixodides)



An arachnid, the tick is not really an insect; it is more closely related to spiders. Ticks are external parasites on mammals, reptiles, and birds; they feed on blood. They wait on vegetation for a host to happen by so they can grab or drop on (they do NOT jump). Each Tick will feed twice in its lifetime; it is after the first blood-meal that Ticks can be dangerous disease carriers. Locally we have several species of Ticks, including the Deer Tick which carries Lyme's Disease; if you are bitten and show early topical symptoms of this disease, get yourself and the Tick tested. Because they spend much of their time in animal fur and sucking blood, Ticks are generally unclean and can cause topical infections (that are not Lyme's Disease) where they bite.

Adaptations:

- Drilling mouth parts.
- Tough, scratch and bite-resistant bodies.
- Grabbing legs for hanging on to animal fur and skin.

Interdependence:

- A parasite, it benefits while its host is harmed.
- Disease vector.
- Weakens some animals so they might be easier prey for predators.
- NC. CO2/O2. WC.

Other:

There are many so-called "right ways" to remove an attached Tick, some quite bizarre or impossible. Truly the best way is to grab the Tick as close as you can to its head and pull straight out (tweezers work nicely). Though Lyme's Disease is a true concern, I am not aware of many cases originating in this immediate area. If bitten, it is recommended that the offender is kept in case testing seems required.

Tiger Swallowtail (Western) (*Papilio rutulus*) Papilioninae family



Large (up to 10cm), showy, and common, this butterfly can be spotted in spring, summer, and fall. The larvae feed locally on Willow, Cottonwood, Alder, Sycamore, and orchard trees such as cherry, apple, and plum.

Adaptations:

- Adults: Long proboscis for feeding on nectar. Large wings and eyes suited for strong flying. Bright colors for easy mating identification.
- Larvae: Green camouflage coloration with eyespots for defense (mimicry).

Interdependence:

- Pollinator.
- NC. CO₂/O₂. WC.

Other:

Watch for the mating flight of this species; it is spectacular and aerobatic. A similar species the Pale Swallowtail is also found locally; instead of yellow and black it is white and black.

Water Strider (*Gerris remigis*) Water Strider family



*

Very common insect present on the surface of all types of freshwater. Predacious, it feeds on insects that fall on the surface of the water, locating them by the vibrations they make by struggling. Will also feed on aquatic insects that come to the surface. Sometimes has wings; winged forms are usually found on annual or temporary water bodies.

Adaptations:

- Ability to feel vibrations in water surface and to use them to home in on prey.
- Predatory mouthparts for catching, demobilizing, and eating insect prey.
- Minute waterproof body hairs help it stay dry and on top of water surface.

Interdependence:

- Uses the water surface like a huge web to catch its prey.
- PC insects.
- NC. CO₂/O₂. WC.

Other:

A question: Why don't fish seem to eat this insect?

Whirligig Beetle (Family Gyrinoidea)



*

A common aquatic insect usually sighted in groups, it is identified by its behavior: Rapid, whirling swimming on the surface of ponds or other slow-moving water. Both the larvae and the adults prey on small aquatic insects and worms which they catch both above and below the water surface.

Adaptations:

- Rear legs are flattened for fast swimming.
- It has two eyes, each divided into two parts, one for seeing above the surface and the other for seeing below. When swimming on the surface, they can see above and below simultaneously.
- Larvae have external gills for breathing under water.
- May secrete a smelly substance when disturbed as a defense (some adults when handled give off an odor similar to Pineapple).

Interdependence:

- PC insects, invertebrates.
- NC. CO₂/O₂. WC.

Other:

Question: Why don't fish seem to eat this insect either?

E. Other

Lichen



* 3 species of Lichen on a rock

Not really a plant, not really a fungus, Lichen is both, representing a very common and often quite colorful symbiosis. A mold-like fungus captures and entraps microscopic green algae and forms a plant-body that resembles neither the fungus nor the algae. This plant body (a thallus) is completely self-sufficient. The algae use chlorophyll to produce food which the fungus is sustained by. The algae seem to benefit from the protection of the fungus within the thallus. Lichens obtain mineral nutrients from dustfall, dew, fog, rainwater, and the surface where it grows (rocks and tree bark). When dry, Lichen enters a dormant stage and can endure long periods of drought and extreme temperatures. When moistened, they resume growth immediately. Because they grow very slowly and can remain dormant for such long periods of time, Lichens are among the oldest living organisms; some arctic species are estimated to be 5,000 to 9,000 years old! Also, they can be found in almost all terrestrial habitats of the Earth.

Lichen can be found in a true rainbow of colors from bright orange to black, from chartreuse to white, and can be found growing in a wide variety of forms, from a scabrous mat to a long trailing “beard,” from tiny cupped-stalks to lettuce-like “leaves.” If you look closely enough, Lichen can be seen all around you; one time I counted six different Lichens living on a single dead branch less than a meter long!

All Lichens are edible (though maybe not particularly eat-able) and non-poisonous except one: “Wolf Moss (*Letharia* spp.), the yellow-green or chartreuse Lichen found on coniferous trees in the montane forests of California. This species is not common locally. Many Lichen species have antiseptic qualities that were widely used by American Indians. Additionally, they were often used to make dyes.

Lichens are an important food source for snails, slugs, mites, springtails, and other invertebrates. Some ungulates are sustained through severe winters by eating ground Lichens. Lichens do not hurt the trees they live on; their utilization of the bark nutrients is much slower than the replacement rate of the growing tree. Lichens facilitate erosion, very slowly eating away at rock with their rhizines (attachment organ) and by secreting an acid.

Because the thallus accumulates pollution without having a way to excrete it, Lichens are extremely sensitive to air pollution; many studies have been done which measure the extent and impact of industrial air pollution using Lichens.

The Story of Frieda Fungus and Andy Algae

Compliments of Heide Hatcher

Frieda Fungus was a building contractor. She built beautiful homes all over the place. But she had a problem; she was hungry. She was a terrible cook (couldn't even open a can of soup) and suffered because of it. She ended up spending a lot of money eating out for almost every meal.

Meanwhile, Andy Algae was a chef who cooked delicious delicacies at a fancy hotel (the French Gulch Hotel). He was not hungry, but he did have a problem too; he was tired of living in trailers and cheap rented apartments. He wanted a home of his own.

One day, Frieda decided to have her dinner at the French Gulch Hotel because she had heard about its great food. She was so impressed with the meal she had, that she called the chef out to pay him her compliments.

"The food you cooked was excellent!" She exclaimed. "And this hotel is very beautiful too," she said, explaining that she knew a thing or two about buildings.

Andy thanked her and said, "I only wish I had a home of my own as nice as this hotel."

Well, one thing led to another (it was fate), and Frieda and Andy ended up likin' [get it?] each other a lot and eventually began living together. It worked out very well for them both: Frieda was no longer hungry because Andy provided food for her, and Andy had a beautiful home that Frieda had built.

2. Extinction

There are some animals and plants which once occurred locally that are now extinct from our region. Most notable are the Grizzly Bear (*Ursus arctos horribilis*) and the Gray Wolf (*Canis lupus*). Once prevalent throughout California, these top predators were an important component of almost all terrestrial ecosystems. It is an interesting exercise to theorize about the impact these extinctions have had. It is logical to start with their natural prey; other mammals, fish, etc. It is natural to suppose that their absence has led to increases in the Salmon and Deer populations, for example. However, with logging and damming of rivers and creeks, the Salmon population has seen a serious decline as well (it's nearly extinct in Clear Creek up this high). And the Deer population is being controlled by habitat destruction and hunting. The point is, it's very difficult to assess the impacts that losing these species has had. Any ideas?

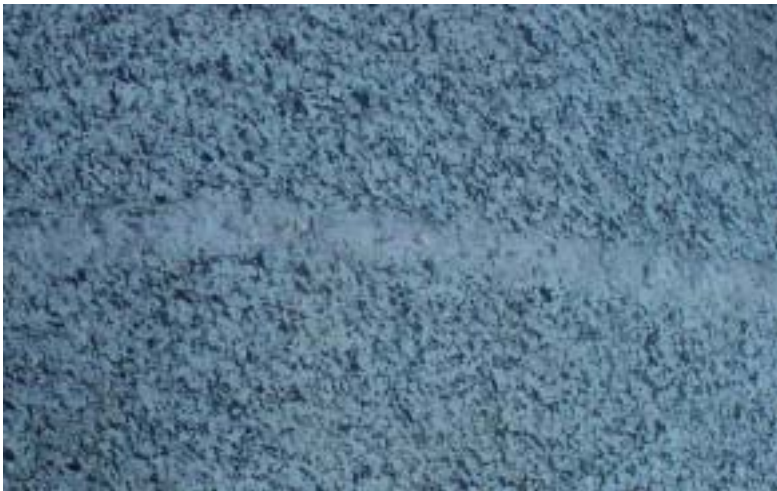
There are also some species that are not necessarily extinct, but haven't been seen for many years. The American Coot (*Fulica americana*) and the Common Goldeneye (*Bucephala clangula*) for example used to be common on Clear Creek when there were still remnants of the beaver pond just upstream of the bridge. In 1996, the huge flood that washed out the bridge also removed any last vestiges of the beaver's work. Now the creek runs swiftly and in well-developed channels where once it slowed and spread out

widely. Since this change, these two birds have not been seen on this section of the creek.

Finally, with the introduction of many invasive plant species, from African grasses to the Himalayan Blackberry, the local ecosystems have been permanently altered. Changes may include extinctions of endemic wildlife and plants. This is particularly possible in riparian zones that are choked with Blackberry thickets; what lived there before?

3. Geology

This area is characterized by uplift and volcanic activity. As the Pacific plate subducts beneath the North American plate the land is uplifted and fractured while rocks are being deformed and melted beneath. Molten igneous rock forced its way to the surface all along the west coast of the continent. At one point the Klamath Mountains (of which this area is part) were the northern end of what is now the Sierra Nevada Mountains (eastern California). Probably about 140million years ago, they were separated; moving about 60 miles apart on a NW-SE diagonal. The Klamaths and Sierras are characterized by long belts of metamorphosed sea floor which were more recently intruded by enormous masses of granite that rose up through them.



** Granite with quartz vein*



* *Metamorphic greenstone*

Basically, we have two main forms of rock locally: Granite and Greenstone.

Granite is an igneous rock which cooled slowly underground and was exposed by erosion. It cooled so slowly that its main minerals (quartz, feldspar, mica and/or hornblende) crystallized. As the granite solidified, it shrank and cracked, any remaining molten rock (usually with lower melting temperatures) would then flow into these cracks; this explains the prevalence of **veins** or dikes within granite rock. Incidentally, quartz and gold have very similar, low melting temperatures which is why the veins in granite are often quartz and why gold is often found in those veins.

Greenstone is a metamorphic rock that was probably volcanic before being subjected to tremendous heat and pressure within the Earth's crust. It is common locally; it has a chalky light green appearance and is relatively soft (makes a good pale green face paint).

Other geological features include the Hoadley fault and the fossil spring. Traditionally, we have always pointed out the ditch alongside Paige Bar Road East as a section of the **Hoadley fault**. This is probably not accurate, though the fault does run across or through the vicinity of the Orofino Creek watershed. The fractured granite exposed in the ditch (which undoubtedly was made when the road was built) indicates movement, so it's as good a place as any to talk about the fault. The fact is the fault runs along the eastern edge of the Shasta Bally Granite Batholith between it and a large area of generally metamorphosed volcanic rock. In the fall of 2000, during our training week, we were in the Salt Creek Mine with Brian Rasmussen (NPS Geologist) when there were two very minor earthquakes. We did not feel them, rather we heard them as very low frequency rumbling. I suppose this is proof that the mine is quite stable...



** Hoadley Fault area*



** Fossil spring*

The **fossil spring** is alongside Paige Bar Road East as well, just across from the beginning of the Mystery Canyon trail. Little is known about this spring, but the water that seeps from the ground here throughout the year was probably “fossilized” millions of years ago in some kind of sealed pocket in the Earth’s crust. So, for a long time the water

was isolated there and became imbued with minerals and gasses. Perhaps due to the geological activity of this area, the water finally found its way to the surface. You will notice that nothing is growing in the immediate area of the seep (unusual for a spring), that the water has a distinctly “mineral” look to it, and that there is a stench of rotten eggs in the vicinity. You are smelling hydrogen sulfide which is escaping with the water from the same place. This is a fascinating and noticeable spot to share with your students with links to using senses other than sight to observe nature and to interdependence. I have noticed that Band-Tailed Pigeons and Mourning Doves seem to be attracted to the spring, perhaps for the minerals.



* *Quartz*

4. Hydrology



* *Clear Creek*

We have several forms of water locally both perennial and annual. All creeks flowing in the vicinity of the school are within the Clear Creek watershed, which is part of the Sacramento River watershed which joins the ocean at the San Francisco Bay. Because Seltzer Dam (a small irrigation dam) was removed in the fall of 2000, migrating salmon are now unobstructed all the way to the base of the Whiskeytown Lake dam.

Only one other local creek is perennial: Paige Boulder Creek. Young trout spend the summer growing larger in the pools of this creek, waiting for the fall and winter rains to wash them into the larger Clear Creek. Also, there is no reason that a run of salmon couldn't go up this creek too. The pond was created from a diversion from Paige Boulder Creek though the inlet is poorly maintained nowadays.

Paige Bar Creek, Orofino Creek, and Salt Creek are all annual; they dry up completely in May. You may notice water flowing in these dry creeks in the fall as the weather cools but before any rain has fallen; this is due to trees releasing moisture through their roots in anticipation of the rainy season. You will also notice that all the creeks will run a dark brown, tea-like color during the first rains of the season. This color is caused by tannins from leaf litter and humus on the forest floor; basically it is forest-tea. This clears up within a few days. Of course during the heaviest winter rains, the creeks will all run muddy with the sediments erosion carries to them. Much of the subsoil locally is decomposed granite (DG) which is highly erosion-prone. The restoration efforts in the Paige Bar Creek watershed (along Logging Camp Road) including the sediment pond on Paige Bar Road West and the water testing probe installed on the bridge by the cabin, are being made to slow the erosion of DG into Clear Creek. Sedimentation clogs the pores between larger gravel, enabling salmon eggs to be

washed away and preventing those that remain from getting adequate water flow (nutrients and oxygen).

The Sacramento River drainage which includes all our creeks has always been one of the most important river systems in the world for migrating salmon species. Because of damming, fisheries, and erosion caused by development and logging, the native anadromous salmon runs have been severely impacted. However, due to hatcheries and restoration efforts, including dam removal, salmon populations are expected to increase. Local creeks probably will see spring, fall, and/or winter runs of **Chinook (or King) Salmon** (*Oncorhynchus tshawytscha*). It is possible that we could also see **Coho (Silver) Salmon** (*Oncorhynchus kisutch*), **Pink Salmon** (*Oncorhynchus gorbuscha*), **Chum Salmon** (*Oncorhynchus keta*), and **Sockeye Salmon** (*Oncorhynchus nerka*). Though these four species are relatively rare in the entire Sacramento system, so the chances of them running up this far in Clear Creek are quite small.

The advantages of living anadromously are relative safety for eggs and fry (in freshwater) and abundance of food in the ocean.

To spawn successfully salmon require cold water temperatures (45-55 degrees F) and pea-sized gravel on the stream bed. This particular gravel size has spaces between each piece that hold the fertilized eggs in place and affords them adequate water flow for up to 70 days. Once the eggs have hatched, the fry start feeding and growing. Chum, Pink, and Sockeye Salmon migrate to the ocean immediately, whereas Chinook, and Coho Salmon spend 4 to 18 months living in streams. Freshwater aquatic insects are very important food for the juvenile salmon.

As the juvenile salmon migrate to the sea (usually with spring floods), they go through smoltification, losing spots and becoming more silvery. This change also enable them to make the change to living in salt water, where they must osmo-regulate (counteract the natural process of osmosis which would draw most of the water out of their tissues otherwise).

Once they smolts have reached the San Francisco Bay, they spend some time in the estuaries there where they adjust to salt water and feed on the abundant life there. The larger they are before entering the ocean, the better their chances of survival. In the ocean, salmon feed on zooplankton (like krill), fish, squid, and shrimp. Iodine in their food source causes their flesh to become pink. Eventually, the adult salmon leave the ocean and swim up stream to the tributary where they hatched; it is there that they spawn and die.



O. tshawytscha

“The three most crucial refugia of Pacific salmon on Earth... are the Sacramento, Yukon and Columbia/Snake river systems... The entire population of the upper Columbia portion of that system—the salmon of eastern British Columbia, a third of Washington state, and northern Idaho—were destroyed in a day, by the Grand Coulee Dam, half a century ago. This is too easy to say; it is crucial to imagine it: Hundreds of crucial salmon strains, ancient as gods, doomed to annihilation in a day. Tens of thousands of people thrown out of sustainable outdoor work and forced to rote factory jobs. Scores of indigenous tribes impoverished if they were lucky, destroyed and dispersed if they weren’t.”

David James Duncan; *My Story as Told by Water*

5. History

The Wintu (or Wintun) Indians were the original inhabitants of this area. There is some indication that the confluence of Paige Boulder Creek with Clear Creek was used as a settlement, at least seasonally. The NPS has designated the flat area between the hill, Clear Creek, and Paige Boulder Creek where the naturalist cabin is as an archeological site. Occasionally pieces of obsidian turn up there. Salmon, Acorns, and Deer were important to the way of the Wintu.

In 1848 Pierson B. Redding made the second discovery of gold in California on Clear Creek (seven miles downstream from WES) which marked the beginning of the influx of miners to the area. In 1849, the great California Gold Rush began. Eventually, Charles and Harry Paige (brothers) mined in this area (it is for them that the bar, creeks, and road are named). Later, the WES upper lawn was a farm operated by Nate Dickey. At this spot, wagons could ford Clear Creek and so the spot was called Dickey’s Ford. It was during this time that a suspension bridge was strung across Clear Creek for foot traffic. The steps across from the amphitheater are remnants of this bridge. The ancient apple, pear, and fig trees located around the school were planted by Mr. Dickey. Locusts were also planted for their strong, hard wood. It was during this era that hydraulic and hardrock mining were used in addition to the panning that started it all off. In 1884 hydraulic mining was banned by the state because of the damage it caused. However, in the 1930’s, it was revived here for a short time.



** The suspension bridge steps*



** Rocks stacked by placer miners to access gravel*

Higher on Paige Boulder Creek there are ruins of a mining operation probably operated by Chinese miners in the 1860's. Across Clear Creek from the school (to the east) are the remains of the Clear Creek Ditch of 1855, which was once over 41 miles long and was constructed to provide water for hydraulic mining.

Eventually, the site was owned by a wealthy Bay Area family and then by the North Valley Baptist church of Redding. The church converted the site into a camp, building the cabins and dining hall. Sometime between 1954 and 1962, the camp was purchased by the National Park Service as part of the creation of the Whiskeytown National Recreation Area. In 1970, the camp was turned into the Whiskeytown National Environmental Education (NEED) camp through a partnership between the NPS and the Shasta County Office of Education.

Because it is one of the last still operating NEED camps (the first public environmental education schools developed), WES is probably one of the oldest continuously operated environmental education schools in the country. Finally, because most other countries are only now starting environmental education schools, if at all, WES may be one of the oldest in the world.

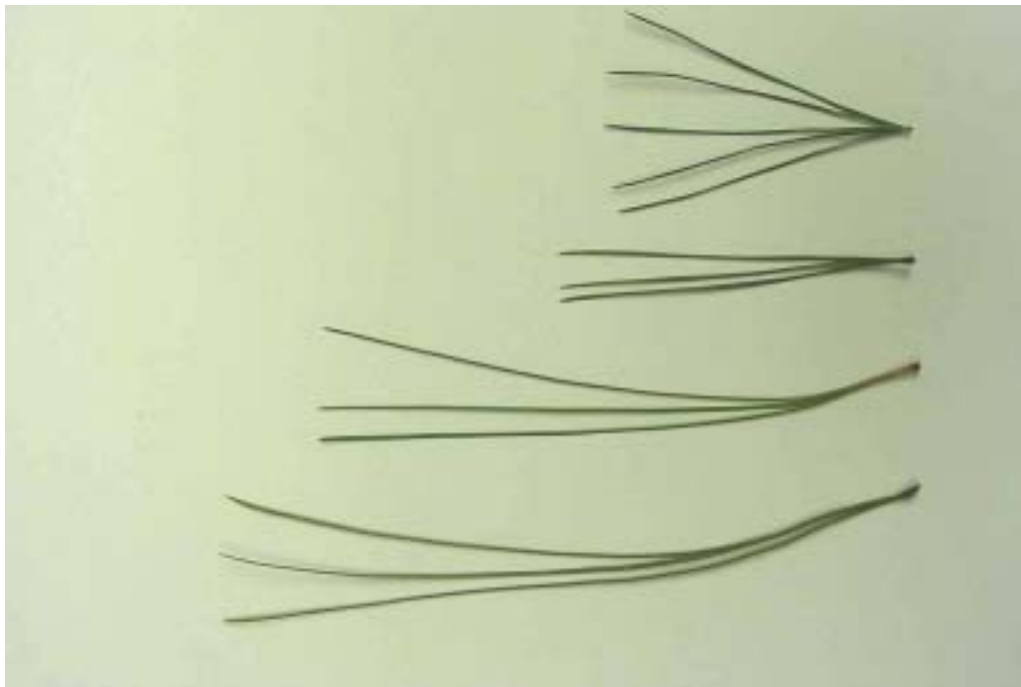
Note: Look for "archeological plants" around the school and on its trails. These are plants that are only found because they were once planted in their present location by people who probably lived nearby. Examples include: Pear, Apple, Locust, Fig, Black Walnut, Lilac, Periwinkle, Iris, and Rose. These plants were planted as domesticated plants or imports from other areas to serve nutritional or aesthetic purposes. Himalayan and Evergreen blackberries and other such invasive exotics are not so revealing because they tend to occupy areas on their own. Look for archeological plants around school, in Merlin's vicinity, at Chinese Camp, in the Peltier Campground, and near the cemetery.

Appendix:

Comparison photographs for easier identification



** Left to right: Black Oak, Valley Oak, Oregon White Oak, Blue Oak*



** Top to bottom: Sugar Pine, Knobcone Pine, Ponderosa Pine, Foothill Pine*



* Clockwise from left: Sugar, Ponderosa, Foothill, Knobcone

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Special thanks to Heide Hatcher, Carol Jandrall, Vanessa Look, Teresa Longworth, and Judge Eaton.

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