California Ecology

Foothill College BIOL015, Spring 2022.

Christopher Prendergast
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Introduction

The following maps contain observations made on the field trips for the BIOL015 California ecology class. Here are some brief instructions on how to navigate the content of this StoryMap.

How to Navigate the Field Trip Maps

The yellow lines are our tracks, and the orange dots are individual observations. You can interact with these maps as follows:

- Click on any orange dot to see more details of the observation and view the associated photograph.
- Use the controls to pan and zoom around the maps.
- Hit the home button to return to the original view of a map.
- Scroll down to see the next map.
- The panel to the left of the map describes some highlights from each location.

Photo Gallery

Below the maps there is a gallery with a selection of photographs from each field trip.

Field Trip Maps

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Foothill College Campus - April 8, 2022

Weather Conditions: Temperature: 79°F; Day range 55-83°F; Average: 66.88°F; Max wind speed: 18; Pressure: 30.0

Adaptations in California native plants

California's Mediterranean climate is cold and wet in the winter and hot and dry in the summer. Native plants have evolved specific adaptations to survive this climate. Adaptations are traits and characteristics that help organisms survive and reproduce under the pressure of certain environmental conditions. California native plants have evolved a wide variety of adaptations to survive both fire and hot, dry summers.

Adaptations to Fire

Plant burns to ground, but re-sprouts after fire.

- Chamise (*Adenostoma fasciculatum*)
- Mountain Mahogany (*Cercocarpus betuloides*)
- Canyon Oak (*Quercus chyroslepis*)
- Toyon (*Heteromeles arbutifolia*)

Seeds must either be heated, shocked, or exposed to smoke and ash to germinate.

- *Ceanothus spp*.
- Sugarbush (*Rhus ovata*)
- Coffeeberry (*Rhamnus californica*)

Vaporization of allelopathic chemicals in soil following fire.

- Fire poppy (*Papaver californicum*)

Thick bark Insulates living tissues from heat and fire damage.

- Coast redwood (*Sequoia sempervirens*)

Adaptations to Hot, Dry Summer

Thick cuticles and the thick leaves and more supportive tissue.

- Canyon Oak (*Quercus chrysolepis*)
- Blue Oak (*Quercus douglasii*)
- Manzanitas (*Arctostaphylos spp.*)
- Coffeeberry (*Frangula californica*)
- California Bay Laurel (*Umbellularia californica)*

Deep lobing to reduce surface area of leaves.

- California sagebrush (*Artemisia californica*)
- San Diego sagewort (*Artemisia palmeri*)

Hairy leaves shade and trap moisture close to leaves.

- Island Buckwheat (*Eriogonum arborescens*)
- St. Catherine's Lace (*Eriogonum giganteum*)

Linear or lanceolate leaf shape reduces surface area of leaf.

- Chamise (*Adenostoma fasciculatum*)
- California Buckwheat (*Eriogonum fasciculatum*)

Gray or lighter green coloration reflects more light and heat

away from the leaves reducing heat load.

- White Sage (*Salvia apiana*)
- Purple sage (*Salvia leucophylla*)

Volatile oils in tissues evaporate into stomatal chambers trapping
water and reducing transpiration loss.

- Sages (*Salvia spp.*)

Sunken stomata reduce gradient of humidity that results in water loss.

- *Ceanothus spp.*

Geophytes store food and water underground.

- Soaproot (*Chloragalum parvifolium*)
- Calochortus spp.
- Brodiaea spp.
- Star Lily (Toxicoscordion fremontii)

Drop leaves when it gets too hot and
dry.

- California Buckeye (*Aesculus californica*)
- Purple Sage
  (*Salvia leucophylla*)
- Black Sage (*Salvia mellifera*)
- California sagebrush (*Artemisia californica*)

Vertical leaf orientations offers less surface area exposed to light/heat.

- Manzanitas (Arctostaphylos spp.)

Plant produces different sized
leaves at different times of year.

- Coastal Buckwheat (*Eriogonum cinereum*)
- White sage (*Salvia apiana*)
- Purple sage (*Salvia leucophylla*)
- Black sage (*Salvia mellifera*)
- California brittlebush (*Encelia californica*)
- Sticky Monkeyflower (*Diplacus aurantiacus*)

Shallow surface roots enable access water quickly when it does rain. Deep tap root able to get water from water table or aquifer when it is dry.

- Blue oak (*Quercus douglasii*)
- Black oak (*Quercus kellogii*)
- Valley oak (*Quercus lobata*)
- Chamise
  (*Adenostoma fasciculatum*)
- Desert Ceanothus (*Ceanothus greggii*)
- California Buckwheat (*Eriogonum fasciculatum*)

Swallows nesting at Foothill College

Edgewood County Park - April 15, 2022

Weather Conditions: Temperature: 58°F; Day range 48-62°F; Average: 56.44°F; Max wind speed: 17; Pressure: 30.06

Favorite Species

My favorite organisms that we observed at Edgewood Park were:

- Leather oak (*Quercus durata*)
- California goldfields (*Lastenia californica*).

We observed the leather oak near the boundary between the chaparral and serpentine grassland areas. It is endemic to California and can tolerate nutrient poor soils which lack calcium but are high magnesium, nickel, chromium. I believe such soils are formed at the edge of serpentine grasslands.

We observed the California goldfields in the serpentine grassland.

Ecological Communities

The serpentine soil is ecologically unique due to the chemical composition of the serpentine rock which creates the soil. Serpentine generates soil which is nutrient poor and toxic to many plants. These
soils lack available nitrogen which stunts the growth of many plants. The soils also have a relatively low abundance of calcium and high abundance of the metals magnesium, nickel, and chromium. These heavy metals are toxic to many plants. Together these conditions inhibit the growth of non-native invasive European grasses which, in turn, creates space for California many native plants to flourish. There are also California native species that have specific
adaptations to the serpentine soil's composition and become endemic to these soils.

Additional Observations

One observation I made at Edgewood was how the size of the goldfields varies depending on where they are growing. In the serpentine soils poorest in nutrients, where there is hardly any grass, the
California goldfield plants are very small, and their flower are tiny. In other serpentine areas, where there is more grass and

the soil is presumably richer in nutrients, the goldfield plants and flowers are much larger. Because of the large difference in the size of the goldfield's flowers between these two locations, I wonder whether they can be pollinated by the same insect.

A second observation was the height of the common yarrow (*Achillea millefolium*), at Edgewood we saw it growing over 4 feet tall. This was interesting to me because this is the species used in the textbook as an example of ecotypes where the height of this plant diminishes with elevation along a transect through the Sierra Nevada Mountains.

Henry Coe State Park - April 22, 2022

Weather Conditions: Temperature: 59°F; Day range 50-65°F; Average: 55.99°F; Max wind speed: 18; Pressure: 30.17

Favorite Species

The valley oak (*Quercus lobata*) grows in the oak savannah ecosystem at Henry Coe State Park. It is a deciduous oak that has large, deeply lobed leaves. The lobes are round. The bark is light gray and has deep ridges and furrows which form a checkerboard pattern. It gets the water it needs to survive from roots that grow up to 80 feet deep.

The California black oak (*Quercus kelloggii*) grows in the mixed oak woodland ecosystem at Henry Coe State Park. It is a deciduous oak that has large, deeply lobed leaves. The lobes are angular with bristles at the ends of the veins. The bark is dark and sometimes almost black. The new leaves are fuzzy.

Ecological Communities

The grassland community at Henry Coe State Park differs from that at Edgewood Park in several ways. On one hand, the grassland at Henry Coe occurs in the oak savanna ecosystem which is dotted with large valley oaks which offer pools of shade. Often this oak savanna ecosystem occurs on the relatively flat tops of ridges. The grass here tends to be relatively tall and often outcompetes the native flowers. On the other hand, the grassland at Edgewood occurs in the serpentine grassland ecosystem. These areas can be rocky and generally lack large trees and shrubs. Consequently, there is hardly any shade. The grass in these areas tends to be short and bare rock and soil is visible in places. A wide variety of

native flowers to thrive in the serpentine areas. Many of the plants in these areas are stunted.

Ecological Interactions

Larger balls of oak mistletoe (*Phoradendron villosum*) grow on the valley oak. The mistletoe is a hemi-parasitic plant that grows mainly on oaks. The mistletoe attaches to the tree's xylem via a structure called the haustorium. This enables the mistletoe to obtain water, nutrients, and minerals from the host tree. However, the mistletoe also has its own chlorophyll and can produce food through photosynthesis.

Additional Observations

We observed the ponderosa pine trees (*Pinus ponderosa*) growing on Pine Ridge at Henry Coe State Park. The ponderosa pine has long needles in bundles of three. It also has large cones with outwardly curved spines. These pickles can be felt by rolling the cones between your hands. This observation distinguishes the ponderosa pine cones from the cones of the similar Jeffrey pine (*Pinus jeffreyi*). However, the Jeffrey pine does not grow at Henry Coe State Park. In short, the difference can be remembered as, "prickly ponderosa, gentle Jeffrey." In addition, it is said that these species can also be distinguished by smelling their back which sometimes smells of vanilla. However, scratching the bark of a ponderosa pine at Henry Coe State Park, I could not smell anything. The ponderosa pine can be easily distinguished from another pine, the gray pine (*Pinus sabiniana*) which is common at Henry Coe State Park. Like the ponderosa pine, the gray pine also has needles in clusters of three per bundle, but these needles are much longer than those of the ponderosa. The gray pine also has much larger cones compared to the ponderosa pine. The

gray pinecones have large hook-like spines. Moreover, the ponderosa pine casts more shade that the gray pined which appears more open from a distance. The ponderosa pine also tends to have a tall single trunk while the gray pine often has multiple trucks branching lower down the tree often forming a y-shape.

Turkeys (*Meleagris gallopavo*) at Henry Coe State Park

Monte Bello OSP - April 29, 2022

Weather Conditions: Temperature: 65°F; Day range 45-74°F;

Average: 58.29°F; Max wind speed: 20; Pressure: 30.11

Favorite Species

The two organisms that stood out for me were the scorpion (*Paruroctonus silvestrii*) and the slender salamander (*Batrachoseps attenuates*) which we discovered together under a log. I had never seen either of these species before! I had never seen a scorpion in the Bay Area. Moreover, I had no idea that there were so many species of lungless salamanders and scorpions in California.

Ecological Communities

At Monte Bello, we observed grassland, mixed oak woodland, and riparian plant communities.

We observed the mixed oak woodland along the Stevens's Creek nature trail at Monte Bello OSP. This community is dark, and the understory is shaded by the tree canopy. Some of the plants observed were Fernald's iris (*Iris fernaldii*), Baldhip rose (*Rosa gymnocarpa*), California wildrose (*Rosa califonica*), California bay laurel (*Umbellularia califórnica*), western heart's ease (*Viola ocellata*), Pacific starflower (*Lysimachia latifolia*), pale flax (*Linum bienne*), false Solomon's seal (*Maianthemum racemosum*), miner's lettuce (*Claytonia perfoliate*), ocean spray (*Holodiscus discolor*), and dwarf checkermallow (*Sidalcea malviflora*).

The riparian community occurs around the sag pond on the Canyon trail is more open with more brushy shrubs than trees. This community is composed of a heterogeneous mix of plants which attracts birds. Some of the plant species observed include skunk cabbage (*Lysichiton americanus*),

cattails (*Typha latifolia?*), water cress (*Nasturtium officinale*), redstem dogwood (*Cornus sericea*), California blackberries (*Rubus ursinus*), honeysuckle, (*Lonicera hispidula*), canyon live oak (*Quercus chrysolepis*), horsetails (*Equisetum sp.*) and willows (*Salix spp.*).

McClellan Ranch Preserve and Blackberry Farm - April 29, 2022

Weather Conditions: Temperature: 65°F; Day range 45-75°F; Average: 58.29°F; Max wind speed: 20; Pressure: 30.11

Ecological Succession

Ecological succession is the relatively predictable sequence of changes in an ecological community over time. As the community develops and ages, the composition and abundance of species changes. Often the number of species in the community and the complexity the of relationships between these species will increase over time. In general, early stages of succession are dominated by r-seleted organisms, while later stages are dominated by k-selected species.

We observed an example of ecological succession along the restored section of Stevens Creek in McClellan Ranch Preserve and Blackberry Farm. Oak trees and shrubs including Snowberry (*Symphoricarpos albus*), Pink Honeysuckle (*Lonicera hispidula*), California blackberry (*Rubus ursinus*) are becoming established to create mature riparian and oak woodland communities following the disturbance caused by rerouting a section of the creek. This is not a totally natural succession as this is a managed restoration project. We observed a more natural example of succession at the sag pond in Monte Bello OSP.

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Purisima Creek Redwoods - May 6, 2022

Weather Conditions: Temperature: 66°F; Day range 57-70°F; Average: 61.60°F; Max wind speed: 20; Pressure: 30.09

Favorite Species

My two favorite species were both trees that are foundational species for their respective ecosystems, the coastal redwood (*Sequoia sempervirens*) and the Douglas fir (*Pseudotsuga menziesii*).

At Purisima, the coastal redwood is the foundational species

in the redwood ecosystem in the creek bottoms. The Douglas fir is one of the foundational species in the Douglas fir/tan oak ecosystem on hillsides above the valley bottoms. There are some impressive old growth trees of both species in the open space. I particularly like the way some Douglas firs have low horizontal branches which jut out over the slope, and then turn towards the sky to form an “elbow.”

Ecological Communities

There are similarities and differences between the ecosystems at Henry Coe State Park and Purisma Creek Redwoods Open Space Preserve. Both locations are similar in that they have prominent coniferous trees. However, at Coe, the predominant conifers are the pine trees, Ponderosa pine (*Pinus ponderosa*) and gray pine (*Pinus sabiniana*). Whereas, at Purisima, the prominent conifers are coastal redwood and Douglas fir which are foundational species in their respective ecosystems. The environment at Purisima is much wetter due in part to fog-drip and the tree canopy is denser which creates deeper shade particularly under the redwoods. Unlike the ponderosa pines at Coe, there is hardly any grass growing under the redwoods at Purisima. Some of the same plant species, such as Coast live oak (*Quercus agrifolia*) and Pacific madrone (*Arbutus menziesii*) occur in both locations. But, overall, there seems to be a greater diversity of plant species at Purisima. In comparison to Coe, there are fewer oak trees at Purisima. We heard a wider variety of bird species at Purisima; there were many more warblers.

Additional Observations

At Purisima, we observed western tent caterpillars (*Malacosoma californica*) in a blue blossom ceanothus bush

(*Ceanothus thyrsiflorus*). These caterpillars are generalist herbivores. In this relationship, the caterpillar is the predator and the ceanothus is the prey. However, the caterpillars only graze on the ceanothus or another host plant without killing it. We also observed a shaggy mane fungus (*Coprinus comatus*). It is a detritivore that gets its nutrition from decomposing plants and animals. This mushroom grows well on hardwood sawdust and manure enriched soils.

At Purisima, we heard several different species of warblers in one location. The birds were in a mixed flock in shrubs in a wet brushy area within the chaparral ecosystem. The Merlin app identified MacGillivray's (*Geothlypis tolmiei*), Wilson's (Cardellina pusilla), Townsend's (*Setophaga townsendi*), and Hermit (*Setophaga occidentalis*) warblers.

Green Lynx Spider (*Peucetia sp.)* at Purisima

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Baylands: Charleston Slough and Adobe Creek - May 13, 2022

Weather Conditions: Temperature: 71°F; Day range 56-76°F; Average: 61.75°F; Max wind speed: 22; Pressure: 30.23

Ecological Communities

An estuary is a body of brackish water where fresh water from one or more rivers mixes with salt water from the ocean. Thus, an estuary is an ecotone or transition zone between river and maritime environments. This is a very productive natural environment. The San Francisco Bay is an example of

an estuary.

An estuary can be a harsh environment due to the salinity of the water and salt content of the plants that grow there. The salinity level can vary from day to day and season to season. Estuaries are also exposed to sun and wind since there are hardly any trees to provide shade or wind breaks. Estuaries are tidal, some areas become inundated periodically, and this can cause the area of available land to vary. This can pose challenges for terrestrial species. On the other hand, tidal variation poses other problems for aquatic species which may dry out when the tide recedes.

Adaptations

Plants have adaptations that allow them to tolerate to high salinity.
Salt grass absorbs salt through its roots, then excretes the salt out as crystals on its blades.

Pickleweed also absorbs salt. This salt is then transferred to cells at the tips of its leaves. Once these cells are filled with salt, the outer parts of the pickleweed turn red, die, and fall off taking the excess salt with them.

The salt marsh harvest mouse has adaptations to enable it to tolerate high levels of salt in its diet and the water it drinks. It can eat very salty plants such as pickleweed and salt grass. This ability is attributed to elevated kidney function.

Trophic Levels

Examples of organisms at the different trophic levels of the food chain include the following:

Producers

- Pickleweed (*Salicornia virginica*)
- Salt grass (*Distichlis spicata*)

Primary Consumers

- Salt marsh harvest mouse (Reithrodontomys raviventris)

Secondary Consumers

- Peregrine falcon (*Falco peregrinus*)
- Gopher snake (*Pituophis catenifer*)

Gopher snake (*Pituophis catenifer*) at Baylands

Powered by Esri

Baylands/ Duckpond - May 13, 2022

Weather Conditions: Temperature: 71°F; Day range 56-76°F; Average: 61.75°F; Max wind speed: 22; Pressure: 30.23

Invasive Species

The Japanese mud snail (*Batillaria attramentaria*) is an invasive species that outcompetes native sea snails and reduces the biodiversity of mudflats and wetlands. The Japanese mud snail was introduced to the San Francisco Bay in ballast water released by cargo ships which crossed the oceans. A modern technique to prevent the introduction of

invasive species is to treat ballast water with nitrogen before it is released (Graham, 2002).

Graham, S., 2002. *Adding Nitrogen to Ballast Water Can Prevent Corrosion and Alien Invasions*. [online] Scientific American. Available at: <https://www.scientificamerican.com/article/adding-nitrogen-to-ballas/> [Accessed 19 May 2022].

Pillar Point and Mavericks Beach - May 20, 2022

Weather Conditions: Temperature: 71°F; Day range 51-71°F; Average: 59.71°F; Max wind speed: 28; Pressure: 29.85

Favorite Species

The ochre star (*Pisaster ochraceus*) observed in the tidepools is a predator and carnivore that preys on marine invertebrates such as the California mussel (*Mytilus californianus*).

The Pacific peanut worm (*Phascolosoma agassizii*) observed under rocks in the tidepools is a species of sipunculid worm. This group is poorly studied, and I could not find exact details of the Pacific peanut worm's diet. However, most species of Sipuncula are feed on detritus. These worms are deposit feeders which get nutrients from particles of organic matter from decomposing plants and animals.

Different species of sipunculid worm have different feeding techniques; some use their tentacles for filter feeding, other species use their tentacles to collect and ingest sediment and prey, and other species use their introvert hooks to scrape organisms off rocks. It is not clear whether the Pacific peanut worm uses any of these other feeding techniques in addition to being a detritivore. So, it might also be a predator.

Ecological Communities

Tidepools differ from fouling communities in several ways. On one hand, tidepools are subjected to rapidly changing conditions, especially water level, temperature, and salinity as the tide goes in and out. On the other hand, fowling communities which occur on the underside of docks and boats enjoy more constant conditions of water level, salinity, and

temperature, as the docks and boats float up and down with the tide.

The tide pool and fowling communities are similar in several ways. Both communities provide suitable locations where free-swimming larva of various marine species can settle, attach, and metamorphose into adults. The species composition varies between the two communities. But mussels can be found in both communities.

Tidepool Challenges

Plants and animals that live in tidepools face several challenges:

- Moisture and evaporation. Organisms can dry out rapidly when the tide is out.
- Variable salinity. Organisms must tolerate a wide range of salinity levels.
- Variable water temperature. The temperature increases rapidly when the small volumes of water in a tidepool is exposed to the sun.
- Variable oxygen levels. The water in tidepools may be poor in oxygen at low tide.
- Predation. Terrestrial animals and birds can reach organisms in tidepools at low tide.
- Limited space and resources in tidepools. Organisms living in tidepools must constantly compete for the scarce resources including space, light, and food.
- Risk of being dislodged by waves and carried out to sea.

Additional Observations

In addition, we observed two other species, sea pork/sea squirt, and the leather star.

I was interested by the sea pork/sea squirts which is a colonial tunicate (*Aplidium californicum*) in the fouling community. These organisms were fascinating to me because I have never observed them before. They have a surprisingly complex lifecycle and evolutionary history. I was interested to learn that their larvae are free-swimming and have a muscular tail which contains a notochord and a nerve cord. Once a larva finds a suitable place to attach itself, it undergoes a metamorphosis in which the tail, notochord, and nerve cord are absorbed and disappear.

The leather star (*Dermasterias imbricata*) is a sea star like the ochre star. This was one of my favorite organisms because of its striking combination of reddish-brown and blueish-gray colors.

Purple Sea Star (*Pisaster ochraceus*)

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Presidio and Thompson Reach - May 27, 2022

Weather Conditions: Temperature: 66°F; Day range 56-69°F; Average: 60.83°F; Max wind speed: 18; Pressure: 30.05

Favorite Species

The serpentine areas in the Presidio are home to several endemic species that are rare and endangered plants.

We observed the Presidio clarkia (*Clarkia franciscana*) which only has two known populations at the Presidio and three

other occurrences in the Oakland hills. The Presidio clarkia appears very similar to the more common ruby chalice clarkia (*Clarkia rubicunda*) except that the petals of the Presidio clarkia are shorter (5–13 mm), and the stigma does not protrude beyond the anthers.

We observed two different species of bumblebees at the Presidio. The yellow-faced bumblebee (*Bombus vosnesenskii*) can be found in both agricultural and urban areas along the west coast. The California bumblebee (*Bombus californicus*) nests in the ground in both wooded areas and urban areas. In addition, we observed several other species of bees.

Ecological Communities

Challenges that wildlife and nature face in urban environments include:

- Urbanization consumes wildlife habitat and takes away space from animal and plant species.
- Air and water pollution can negatively impact the health of plants and animals living in urban areas.
- Higher temperatures which occur in urban areas due to the urban heat island effect can pose a challenge to wildlife.

Benefits of Urban Green Space

Urban nature can be beneficial for humans as follows:

- Regular contact with nature in urban green spaces is beneficial to both human physical health and psychological health.
- Natural green spaces in urban areas can provide vital

ecosystem services valuable to human residents such as flood protection, cleansing urban runoff, purifying polluted air, habitat for pollinators, and moderating excessive urban temperatures through shade and transpiration.

Additional Observations

We observed the San Franciscan Onion (*Allium peninsulare var. franciscanum*) growing in the serpentine areas of the Presidio.

Pescadero Marsh - June 3, 2022

Weather Conditions: Temperature: 68°F; Day range 57-70°F; Average: 61.74°F; Max wind speed: 17; Pressure: 29.92

Favorite Species

At Pescadero Marsh we observed beach suncups (*Camissoniopsis cheiranthifolia*) and the common merganser (*Mergus merganser*).

The beach suncup has grey-green leaves and often forms large mats of plants. It has a yellow flower of with four petals. The beach suncups habitat is coastal strand and coastal scrub. Growing close to the surface of sandy beaches and coastal dunes helps the suncups to survive in the windy conditions and shifting sands found in these areas.

The common merganser is a duck which is smaller than a Canada Goose and slightly larger than a Mallard. Its body is 23 to 28.5 inches long with a wingspan of 0.5 to 38 inch. Immature and female mergansers have a red bill, cinnamon head with a crest of longer head feathers, white chest, and gray body. Males are slightly larger than females. Non-breeding males appear similar to the females. Males in breeding plumage have an iridescent dark green head, white body, and black back.

At the Año Nuevo State Reserve, we observed the northern elephant seal (*Mirounga angustirostris*) and the San Francisco garter snake (*Thamnophis sirtalis tetrataenia*).

Northern elephant seals come ashore on the beaches at the Año Nuevo Reserve in spring and summer to molt. Females and juveniles molt between May and June. Older

males molt between July and August. We observed mainly juveniles and females with a few large older males on the beaches. These are huge animals. Male elephant seals have a large proboscis, which they use to make loud roaring noises. The
males typically measure 13 to 16 feet long and weigh 3,300 to 5,100 pounds. Females are much smaller and typically weigh 880 to 1,980 pounds. The elephant seals
spend most of their time in the ocean. When they come ashore, they lie on the sandy beach and sometimes drag themselves up into the low sand dunes. This habitat
is exposed to the sun and the elephant seal cool themselves by flipping sand over their bodies.

The endangered San Francisco garter snake can grow to between 18 and 55 inches in length. It has a red head and blue green scales along its back bordered by stripes of black, red, and blue green. Garter snakes do not have fangs, but their saliva is mildly toxic. Bites only cause a mild irritation for humans. Habitat for the garter snakes is densely vegetated ponds near open hillsides. The snakes also inhabit temporary ponds and seasonal freshwater bodies. The garter snake prefer areas with bankside vegetation for cover. They like to bask in the sun in the zone between water and grasslands.

Ecological Communities

The influence of the salt water/freshwater gradient at Pescadero marsh is quite noticeable.
The higher salinity areas of the tidal marsh have lower growing vegetation dominated by pickleweed, salt grass, and other species which can tolerate highly saline water. The lower salinity areas have taller brushy vegetation and trees

including willow species (*Salix sp.*) , box elder (*Acer negundo*), and blue gum eucalyptus (*Eucalyptus globulus*).

Overall, there appears to be a greater diversity of plants in the areas where
freshwater permeates the ground.

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Año Nuevo State Park - June 3, 2022

Weather Conditions: Temperature: 68°F; Day range 57-70°F; Average: 61.74°F; Max wind speed: 17; Pressure: 29.92

Favorite Species

We observed norther elephant seals on the beach at Año Nuevo State Reserve.

Ecological Communities

The plant communities at Año Nuevo and Pescadero marsh are similar in several ways. Both locations have similar plants belonging to the coastal strand community on their sandy beaches and dunes. In addition, the riparian areas on the banks of freshwater creeks at both locations have similar plant communities dominated by willow species.

On the other hand, the dominant tree species at Pescadero marsh and Año Neuvo differ. The ground surrounding the tidal marsh at Pescadero is much wetter than the cliff tops at Año Nuevo. This difference in moisture leads to different plant communities. Whereas, at Pescadero marsh the dominant trees are large exotic eucalyptus species (*Eucalyptus globulus*?) and smaller willows (*Salix sp.*), at Año Nuevo the largest trees along the cliffs are Monterey pines (*Pinus radiata*).

A second difference between the two locataions is that the beach at Año Neuvo has a large colony of norther elephant seal while no elephant seals were observed on the beach near Pescadero marsh.

Additional Observations

On this field trip we also observed a peregrine falcon (*Falco peregrinus*) sitting close to a nest in an alcove in the rocky cliffs. The

peregrine falcon
is a bird of prey about the size of a crow. Its body is between 13 and 23
inches in length. It has a black head, a blue-grey back, and white underparts with bars. It has thin, tapered wings, with a wingspan of 29 to 47 inches. Male and female have similar markings and plumage. However, female measuring up to 30% larger than the males. It is known as the fastest bird in the world.

Russian Ridge Restoration - June 10, 2022

Weather Conditions: Temperature: 76°F; Day range 61-90°F;

Average: 70.75°F; Max wind speed: 36; Pressure: 29.98

Restoration Project

At Russian Ridge Open Space Preserve we took part in a restoration project. The project involved removing the alien and invasive yellow star thistle (*Centaurea solstitialis*) which is very abundant in the project area and dominates native plant. We pulled this weed by hand.

Invasive Species

In the past, the introduction of alien species may have been inadvertent, but it was often the result of human “tinkering” as part of misguided attempts to “improve” nature. Negligence also causes invasions. Modern transportation has dramatically accelerated and increased the scope of alien invasions. One example of this is the dumping of millions of gallons of ballast water by cargo ships. However, the text argues convincingly that, today, spreading invasive species can no longer be called inadvertent. Alien species now form a significant component of global biodiversity. Invaders tend to belong to a relatively small number of species. This leads to biotic harmonization globally which makes disparate ecosystem become more like each other. Characteristics of invasive species include high physiological tolerance, adaptability to a wide variety of food sources, high dispersal rates which speed reproduction and spread, ability to outcompete other species, and survival in area disturbed by human activities.

Impact of Invasive Species

The introduction of alien invasive species has many diverse impacts. These impacts include:

- Economic damage—disruption to human water supply, fisheries, and crops. These impacts impose large additional costs for their control.
- Economic benefits despite ecological damage.
- Sometimes societies may perceive alien organisms as beneficial, for example crops.
- Long-term, broad-scale consequences and large-scale negative impacts on native plants and animals.
- Natural ecosystems become much harder to manage.

Many invasions are caused by human actions. Subsequent human attempts to solve these problems frequently create additional problems. This occurs because disturbed ecosystems often feature many complex interdependent relationships which cause changes to cascade in unpredictable ways. This is an example of the law of unintended consequences.

Restoration Ecology

I wonder whether a “natural ecosystem” that must be managed by humans can still be called natural. I find it challenging to logically justify attempts to manage ecosystems across the board, especially when the goal is to return them to a more pristine state. It seems that each invasion must be treated on a case-by-case basis because each has unique costs and benefits. Change in ecosystems is part of nature, although humans have massively accelerated the rate of change. However, the loss of relatively undisturbed natural ecosystems makes me sad. I believe there is something worth preserving that has more than economic value. The text claims that “biotic harmonization makes the planet’s diverse

ecosystems less interesting, as natural systems lose their distinctiveness.” I feel more strongly, but I find it hard to articulate a reason for preservation except my love of nature and admiration of its beauty. What criteria should be used to decide whether human intervention in an altered ecosystem is beneficial?

Elkhorn Sough - June 17, 2022

Weather Conditions: Temperature: 64°F; Day range 56-68°F; Average: 60.19°F; Max wind speed: 14; Pressure: 29.73

Favorite Species

I was interested to observer the orange sponge (*Hymeniacidon sinapium*) for the first time. I was surprised to learn that this is an invasive species at Elkhorn Slough. It is though that the sponge was introduced with the commercial cultivation of oysters. I was
interested to learn that sponges are classified as animals. In fact, sponges
were the first to branch off the evolutionary from the last common ancestor of all animals.

I was also interested to identify
the galls on California wild rose (*Rosa californica*). These galls are
created by the shiny leaved gall wasp (*Diplolepis polita*).

Ecological Communities

Elkhorn Slough and the San Francisco Bay estuaries are similar in several ways. Both estuaries are surrounded by tidal salt marshes. These marshes have similar salt-tolerant vegetation such as pickleweed. Both areas are subject to tidal action and have extensive mud flats which are exposed at low tide.

We observed similar bird species at both locations. For example, we observed great egrets (*Ardea alba*)
and great blue herons (*Ardea herodius*) at both locations.

However, there are also differences between these two estuaries. Historically, Elkhorn Slough was a
freshwater marsh. In 1945 humans opened the slough to the ocean. This rapidly converted to slough to salt water surrounded by tidal salt marsh. Because the inflows of

freshwater to the slough are very limited in summer the salinity can become very high, approaching 9%. Whereas the San Francisco Bay is surrounded by urban development, Elkhorn Slough is surrounded by agricultural land. Much of the
land around the slough is now being managed to conserve the wildlife and ecosystem of the slough. Compared to the San Francisco Bay, Elkhorn Slough appears to support more abundant and diverse wildlife.

Human Impact

The ecosystem of Elkhorn Slough has been impacted by human activity in several ways. The largest impact came in 1945 when humans opened the slough to the ocean. This action exposed the slough to tidal action and salt water which radically altered the ecosystem from a freshwater marsh to a tidal salt marsh. Another major impact came from human land use changes. Large areas of the original freshwater marsh were drained and converted to dairy pasture. In addition, a railroad embankment was
constructed through the marsh. The raised tracks cut off areas of the marsh from the flow of water. Today, the ecosystem of the slough is threatened by agricultural runoff. In addition, the sea otters (*Enhydra lutris nereis*) are threatened by toxoplasmosis caused by the parasite *Toxoplasma gondii*. Domestic cats release oocysts of the parasite in their feces, which are then carried in runoff to the ocean where otters can also ingest them through feeding
and grooming.

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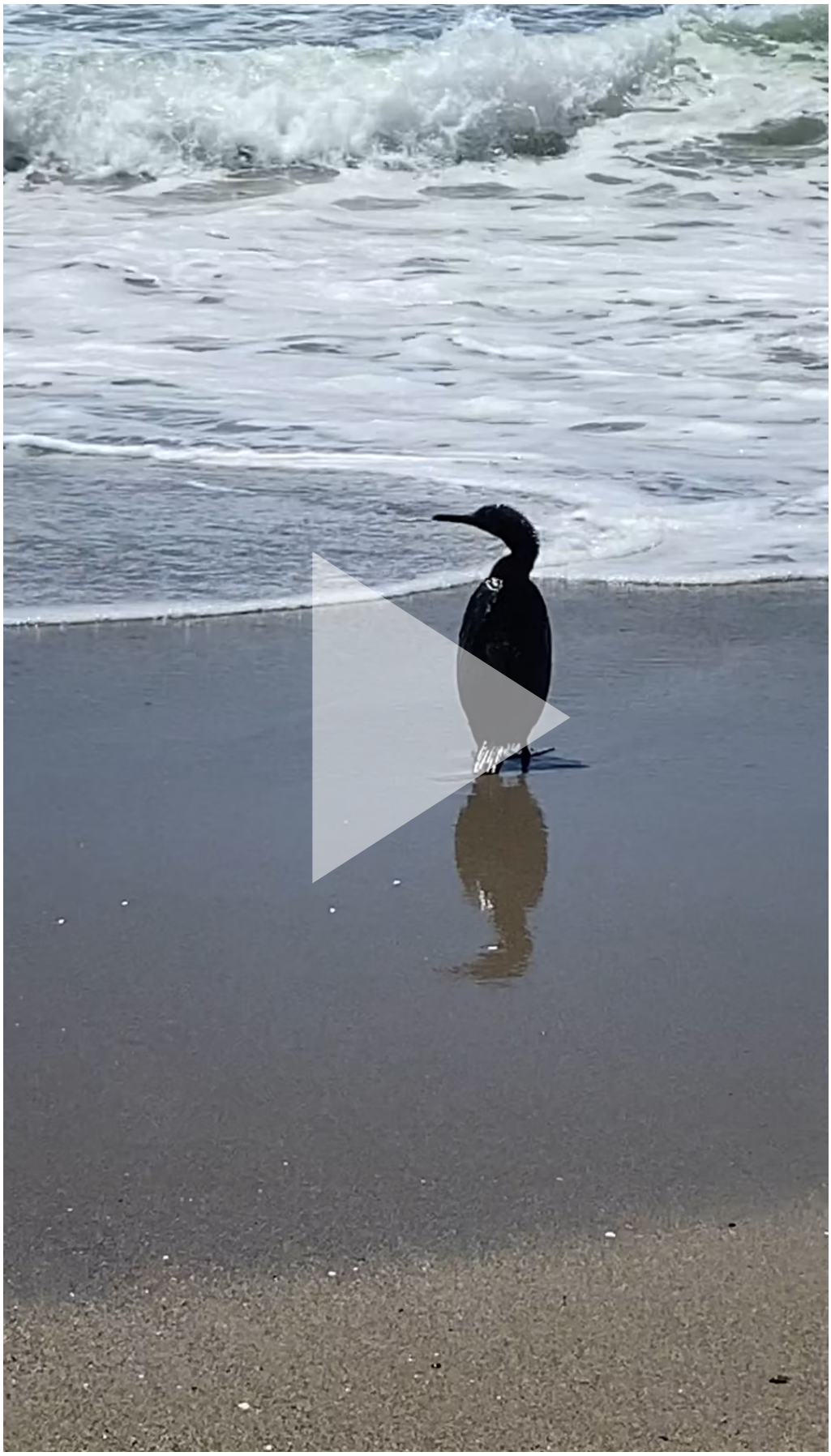
Moss Landing State Beach - June 17, 2022

Weather Conditions: Temperature: 64°F; Day range 56-68°F; Average: 60.19°F; Max wind speed: 14; Pressure: 29.73

Favorite Species

My favorite part of the
field trip was the time we spent observing the sea otter (*Enhydra lutris nereis*) feeding on shellfish in
the main channel. I never get tiered of watching sea otters because they are so cute.



Pelagic Cormorant (*Urile pelagicus*)

Pelagic Cormorant (*Urile pelagicus*)
at Moss Landing State Beach.

Photo Gallery

Foothill College Campus - April 8, 2022

Edgewood County Park - April 15, 2022

Henry Coe State Park - April 22, 2022

Monte Bello Open Space Preserve - April 29, 2022

McClellan Ranch Preserve and
Blackberry Farm - April 29, 2022

Purisima Creek Redwoods Open Space Preserve - May 6, 2022

Adobe Creek and Charleston Slough - May 13, 2022

Baylands Duck Pond - May 13, 2022

Mavericks Beach - May 20, 2022

Pilar Point Harbor, Fouling Community - May 20, 2022

Presidio of San Francisco - May 27, 2022

Pescadero Beach - June 3, 2022

Pescadero Marsh - June 3, 2022

Año Nuevo State Park - June 3, 2022

Russian Ridge - June 10, 2022

Elkhorn Slough - June 17, 2022

Moss Landing State Beach - June 17, 2022