ESP/ERS 30 World Ecosystem and Geography

Davis-Emigrant Gap Field Trip

Sacramento Valley - Foothills - Sierra Nevada Slopes

Introduction

This trip follows an eastward transect from Davis up to the middle elevations of the Sierras.

A. Communities. The smaller units of ecological pattern within biomes are usually called communities, though if you use Walter you will see much more ornate terms used by our German colleagues. But we don't want complex terminology to get in our way. Too much books, too little nature! Since plants dominate the structure of communities, plants usually define communities.

A word of warning about plant communities. Plants species are actually wildly individualistic in following the physical, chemical, and competitive factors that affect that particular species. Communities are very rough abstractions we use to give us some concepts to use to impose order on chaos. Think of plant communities as integrated multiethnic neighborhoods, not as tightly segregated ones with only some species admitted not others. Or think of them as how plant geography would exist if it were done to make life easy for book writers. Patterns exist, but they are anything but neat. On any given day, they vex, trouble, and thrill the biogeographers. Never a dull field trip anyway.

Plant Communities you will see:

1.Riparian Woodland of the Sacramento River,

2.Central Valley Grassland - now primarily agricultural fields,

3. Oak Savannah and Foothill woodland,

4. Chaparral and mosaics of Chaparral and Foothill Woodland-Yellow Pine transitional communities,

5.Yellow Pine Forest,

6.Montane Chaparral, and

7.Lodgepole-Red Fir forest.

B. Field Guides as an aid to observation.

Our slogan “read nature like a book, not books about nature” slights somewhat the value of good field guides. This literature is ever-expanding and many titles are aimed at people with little formal preparation. And the dirty secret is that professional ecologists use the simple field guides to teach themselves new organisms or new places because nobody is well trained in all the necessary areas.

This guide should help you distinguish these communities, though you will find additional references such as Ornduff or Storer and Usinger to help you recognize characteristics of these communities. Storer and Usinger is a fair general guide for plant (and animal) identification. More specialized field guides such as Niehaus and Ripper for wildflowers and the Pacific Coast Tree Finder for woody things are more satisfactory because many species you will see will be absent from the more general guides. I encourage you to concentrate on the woody trees and shrubs unless you already know this part of the vegetation or have a strong interest in something else. The woody vegetation structures the whole community, there are relatively few species and they are relatively easy to identify. Work the Pacific Coast Tree Finder hard on this trip! Don’t forget to take copious notes and photographs.

As you observe these communities and the changes that occur, use a comparative approach. Why are deciduous trees more common at some elevations than at others? Why can some habitats support tall vegetation while others are restricted to low-growing plants? Recall from class lectures how various environmental factors are supposed to influence plants. Can you see any of these ideas actually manifest out in the real world?

B. Environmental Factors

On a mountain elevation gradient such as the one you'll travel over, the main environmental changes are due to changes in temperature and precipitation, with some influence of soils and soil parent material. Just like biomes on a smaller scale.

Temperature drops with elevation at the approximate rate of 3.5^{o}F per 1000 feet or 6.5^{o}C per 1000 meters. Emigrant Gap, the end of the trip, is about 5,500 ft. Keep track of your elevation as you go along; city limit signs give elevation and there are usually roadside signs at the 1000 foot contours.

The moisture regime is complex. In a semi-arid environment like California, rainfall reaches a peak at middle elevations, ca 6,000 ft. Rainfall is lowest in the Valley floor (e.g. at Davis), and even the lower foothills receive much more rain than we do.

Thus, plant growth ends up being limited by aridity at low elevations and again on the Eastern Slope. At high elevations, growing seasons are sharply circumscribed by temperature due to the long cold season. A complicating factor is soil depth and quality. The deep clay soils of the Valley tend to hold more moisture than the increasingly thinner soils of the upland slopes. As a result of all these interacting factors, the Sierra mountain

gradient is a good place to observe how cold and drought stress interact to shape vegetation. (Of course, particular sites can be quite confusing because of the multiplicity of factors; form hypotheses about what is going on, but do not get too dogmatic too soon!)

C. Geology

Observing geology on road trips is fun and easy. I highly recommend Alt and Hyndman's Roadside Geology of Northern and Central California. (The Roadside Geology series grows year by year. If traveling elsewhere consider picking up the relevant one. You can learn a lot of geology this way.) The geologist's main friend is the road cut. In road cuts the rocks normally covered by vegetation and a mantle of nondescript soil are laid open in all their splendor. The High Sierras are mainly composed of granite batholiths (big blobs of relatively light, originally molten, rock emplaced from 210 to 80 million years ago. Subsequently, the area was lifted out of the sea to form a low mountain range, which was itself, particularly in the northern part, covered with an extensive layer of volcanic deposits beginning about 30 million years ago. In the last 10 to 20 million years the main uplift of the Sierras began. During the last 2 million years, the higher elevations of the chain have been extensively eroded by glaciers.

On this trip, you will see mostly ancient metamorphic rocks in road cuts, sediments that were partly melted and recrystalized as the batholiths were emplaced. At lower elevations, large areas of the batholiths are covered by a more or less thick layer of these rocks. They are dark brownish and blackish rocks that often preserve the layered appearance of sedimentary rocks. They were originally jammed against the edge of the North American Plate as this plate scraped all sorts of junk off the top of the Farallon Plate as it dived underneath the North American Plate. Until the theory of seafloor spreading became accepted 40 years ago, these rocks confused geologists no end. The disorder of the jumble is quite evident in road cuts. Nearly every cut is a little different from every other, quite unlike the granitic rocks exposed higher up that look very similar for miles in every direction. At the upper elevations of this trip you will see the light-colored granites exposed. On other trips, or if you go on over the summit to Truckee on this trip, you can easily spot the U-shaped valleys and lake basins that result from glacial activity. Frequently, old lava flows and volcanic ash layers can be seen as isolated caps at the highest elevations where erosive forces have spared them. Also on other trips, you may see the relatively young, soft marine sediments of the Great Valley Formation as they lap onto the base of the Sierra.

D. Human Uses

None of the country you will see on this trip is wilderness by any stretch. The Valley floor has been, completely modified for agriculture and human habitation by flood control and irrigation schemes. The lower elevations of the mountains have been heavily grazed and in places destructively mined for almost two centuries. The middle elevations are logged, although logging has declined dramatically in the last two decades, partly because the best stands had already been logged and partly because of species

conservation issues. Above about 5500 feet extractive industries are less common and tourism becomes the main land use. In general, you'll notice that human uses are as patterned as the vegetation in response to the environment.

The road right-of-way is often a very interesting place to observe. On the one hand, it is often badly disturbed, and often shows the effects of creating thin soils on steep slopes. Other places, a more or less intact bit of a community is fenced from grazing. On older rights-of-way a rather substantially modified community is often developing for pretty clear reasons. Pay attention to what is happening in these strips as you go along. Are things from the surrounding forest pioneering along road rights-of-way or are the areas away from the road being colonized by roadside weeds?

TRIP GUIDE

General Route: This trip goes up I-80 to its junction with Highway 20, just past Emigrant Gap. The I-80 part is a fast glimpse of the Sierra gradient. Natural history a 65 mph. Actually, you can see a lot at 65 mph. Concentrate on the general form of the communities and how the various trees differ in height, limb structure and so forth. An experience naturalist can recognize most of the trees and larger shrubs at 65 mph. A few years back a new species of shrub was discovered in up near Mt Shasta when a carload of botanists on a road trip saw something that didn't fit any pattern they knew. The got out and took a good look and found a new genus! That almost never happens anymore. Driving naturalists have to take care not to get too distracted by the vegetation but you can manage a little without excessive danger. The main observations begin at Emigrant Gap, following Hwy 20 to Marysville, Hwy 70 from Marysville to East Nicolaus, the Garden Highway from East Nicolas to Sacramento International Airport, an then home to Davis. Best if someone volunteers to navigate and studies the maps in advance. The mileage guides below are approximate and if you get lost you'll have to map read to get back on track. If you have an auto GPS or can borrow one that helps, but navigation sometimes poses interesting challenges even with all the tools and a good navigator.

Davis to Highway 20

0 trip odometer at Davis I-80 onramp headed to Sacramento

5.3 miles. Note Vic Fazio Wildlife area on your right as you climb onto the Causeway. Before the European invasion, the Central Valley rivers were lined by broad floodplains with wetlands of various kinds, gallery forests, Valley Oak Savannas thick with fish an game. Mexican and American farmers discovered that these areas had deep, youthful, silty loam soils of the highest production potential. The dikes went up to prevent floods, wetlands were drained and filled, land was leveled, and the farmers conquered almost all in a century of pioneering. Even the pioneers were often ambivalent about what they were doing and early conservationists like John Muir were scathing that nothing was being preserved. Now, at places like the Fazio, restorations are trying to recreate some of what was lost.

The raised causeway portion of I-80 on this leg crosses the Yolo Bypass. When the water in the Sacramento River is high, this diked portion of the flood plain serves as an alternate river channel. Several of these are used along the Sacramento. Such a solution to flooding is temporary since the lower velocities of floodwaters in the bypass allow silt to drop out of suspension, gradually filling the bypass up.

Rivers in flood plains are almost living things. They build up natural levees because as the river spills out of its channel during floods, coarser sediments settle out as velocities drop. The river actually tends to raise itself up above the land on either side as this processes continues flood after flood. A big river's flood plain is usually a little lower than the river itself! This situation is obviously unstable. Every once in awhile the river will abandon such raised beds and form a new channel in the flood plain. The Yellow River in China carries a lot of sediment and is prone to catastrophic reorganizations every few centuries that kill millions. Also, rivers in flood plains have a very strong tendency to meander, cutting new channel on the outsides of bends and depositing sediments on the insides. (To understand why this occurs, reflect on the fact that faster water carries more and coarser sediment than slower. How will water velocity differ on the inside and outside of a bend as the stream makes the turn?). Humans like to make expensive modifications of the flood plain, which requires us to try to defend them from the river's natural tendencies to flood, meander, and find new courses. Some catastrophic event will come along someday to rearrange all this. Sacramento has statistically poorer flood protection in parts than New Orleans did before Hurricane Katrina. Soil science tells us why people end up living along rivers prone to flood, volcanoes that tend to erupt and maintains that tend to shake. These things make good youthful soils, whereas the soils in safe places tend o be old and bad.

Most of the bypass is used to grow rice these days.

8.6 miles. Follow signs to Reno.

11 Miles. Cross Sacramento River.

12 miles. You are in the Natomas Basin. Note the heavy development. Planners allowed this development based on assumptions about the strength of the levees that protect the area that turned out to be suspect. The water might get 20 feet deep in some places here in a serious levee breach. Maybe every house should be required to have a lifeboat slung next to an upstairs window!

34 miles. The beginning of the Oak Savanna/Foothill Woodland belt. Blue Oaks are one of the dominant plants here. They are smaller than the grand Valley Oak, and have leaves of a somewhat bluish cast. Easy to recognize at 65! As you climb out of the Valley and development is less you'll get good views of this community. Another signature species is the Gray Pine. It is generally a large untidy tree with multiple ascending branches. It has a sparse foliage very long gray-green needles. The nuts of this pine are large and delicious and were sought out by the Native Peoples.

44.2 Miles. 1000 ft elevation sign

45 miles. Roadcuts showing the dingy metamorphic rock of the region. Note the variety of rock in the different cuts as you go along.

49 miles. The first Yellow (Ponderosa) Pines. These are often tall trees with reddish bark. They have bundles of bright green needles of medium length. They and their relatives the Jeffrey Pine are widely distributed in the West. An important timber tree. For awhile now the vegetation is a complex mix of shrublands (often dominated by Manzanitas), Gray Pines, Yellow Pines, oaks of several species and many other plants. Black Oak, a deciduous oak with rather large toothed leaves appears. This is a good place to appreciate the chaotic jumble often produced by plant individualism. Notice very red soils in some road cuts. At this elevation conditions are fairly warm and wet and soil erosion rates are not too high. Rather deeply weathered soils often develop on these surfaces. Look for Sugar Pines. They are relatively few but are generally taller than Yellow Pines. They have long limbs held out horizontally and shorter needles that Yellow Pine. Most dramatically, they have huge long cones right at the ends of the branches (smaller in the spring when immature). They remind me of Lord-of-the Rings Ents holding bombs in their hands/limbs to try to kill the lumbermen who sought their high-quality wood so avidly. You can get to spot them at 65 mph.

56.4 miles. 2,000 ft marker.

60 miles. Douglas Fir, another major timber tree appears. It has many thin branches covered by short green needles. They are sometimes mixed with Yellow Pines but tend to grow on north facing slopes and other places that are cooler and wetter than the sites that Yellow Pines favor. Another signature plant of slightly cooler and wetter habitats is Madrone, a small tree with glossy green leaves and a distinctive smooth light red bark. It is a relative of the shrubby Manzanitas, which has a dark red smooth bark. The Manzanitas come in some 30 odd species, most restricted to California. They are one of California's most famous adaptive radiations. Their partner shrub genus is Ceanothus, a wild lilac, which also has 30 or so species in our state and few outside it. You may see it blooming even at 65 mph. It produces masses of finger-sized sprays of tiny, fragrant, blue or white flowers.

69 miles 3,000 ft.

70.1 miles. The road passes here at the base of a cliff for a couple of thousand feet. This is the headwall of a hydraulic mine. As the gold rush exhausted the placer deposits in the living streams flowing out of the existing Sierra streams, miners started prospecting for the "Mother Lode," the source of the gold in the low elevation living streams. One such lode was ancient river gravels deposited when the Sierras were much lower and many rivers flowed N-S instead of E-W as the present streams do. Notice that the cliff is a mixture of sand, gravel and rounded, stream rolled cobbles. It is the bed of one of these ancient rivers. The material is only very lightly cemented and mining engineers discovered that they could set up giant nozzles (monitors) to direct high pressure water

against these deposits. Then they ran the resulting muddy muck over a series of corrugations behind which the heavy gold deposited. The lighter material was flushed way into the local rivers. These mines became so extensive that their sediments gummed up irrigation and navigation in the Valley and even in San Francisco Bay. After a famous court fight, hydraulic mining was essentially banned well before 1900. But the scars of it, like this, are scattered all over the gold mining districts.

80 miles. White firs appear. This is one of the species extensively cut as Christmas trees. The bark of young trees is very light colored compared to other similar trees. Twigs are covered with a straight row of short needles on each side. Even at a distance they have a neat appearance unlike the superficially similar, but shaggy, Douglas Fir, which would a good clipping to make a decent Christmas tree.

81 miles 5,000 ft.

84 miles. First road cuts into granite. Granite is the frozen magma chambers that fed a system of volcanoes that once sat over the subducting slab of Farallon Plate. The top of the slab was covered with relatively light material eroded from the continental margin. When it got deep enough and hot enough to melt, this relatively light rock floated upwards. At the top of the blob, mountains like Shasta and Lassen erupted. The portion of the Farallon Plate west of the Sierras was eventually entirely eaten and the source of hot light magma stopped. Now the frozen, never-erupted magma has been uplifted (in the last few million years especially) and the overburden eroded off the granite. The Cascade Range beginning at Lassen and stretching north to the Aleutian Island chain is still an active subduction zone. In the Sierras, geologists can study the plumbing systems of these dangerous systems.

88.5 miles. Turn off onto Highway 20 heading back down the mountain towards Marysville. As you look out to the northeast you are looking at glacially carved terrain. From this elevation on up, the landscape is dominated by lakes, glacially carved valleys and related features. Alas, on this trip we turn away from this awesome landscape in favor of more detailed observations of the elevation gradient we have gone over lightly at 65 mph.

Zero your odometer again as you exit onto Highway 20. Stop at the rise just after the exit. On the right side of the road is an example of Montane Chaparral, consisting of many low shrubs. You may find Snowberry, a tall Manzanita and a dwarf ground hugging one, and Huckleberry Oak, a small shrub in a group dominated by mighty trees. The ratty trees here are Incense Cedar and Jeffery Pine, Yellow Pine's close relative. What distinguishes this community from the foothill chaparral? Why are the trees doing so poorly here that they do not shade out the shrubs?

0.1 mile. Pass under I-80.

3.6 miles. You approach the "Gravity Hill" Aqueduct. Water seems to some observers to run up hill in the big aqueduct. Pull onto the dirt road to the left just before you would

cross the aqueduct. Walk slowly up the road 50 or 100 meters observing as you go. This is an example of Red Fir forest. Red Firs are so called because the mature trees have dark reddish-brown bark, often decorated with yellow-green lichens. Most of the limbs with needles are so high up in the tree that you can't see any detail, but you can usually find a small tree or some bits of branch that have blown out of the canopy. (Why do tall trees have clean trunks? Why don't they grow leafy branches right down to the ground?) It is often the case that you can figure out what a tree is by observing seeds or leaves dropped to the forest floor. In the case of bare deciduous trees, last year's dropped leaves will often do. Red Firs have two rows of needles like their relative White Fir, but the needles of Red Fir are quite fat and curve dramatically upward. Young needles are also conspicuously silvery as you can see from the ground, especially with the aid of binoculars. Young Red Firs are "silvertip fir" in the Christmas tree trade, the premium species. You will find also White Fir, Douglas Fir, Big-Leaf Maple, and Alder in this forest. You will see some small masses of glacial deposits in the road cut. Glaciers transport huge amounts of eroded debris as the grind their way downhill. If they melt and leave their load in place as here, you find angular rocks embedded in a silty matrix of finer material.

4.2 miles. Possible serpentine rock in road cut. Serpentine is the State Rock. It has a distinctive gray-green color and slick, shiny look to it. The term comes from its resemblance to the texture of the skin of serpents. It is formed deep in seafloor spreading zones at the boundary between the crust and the mantle. The heavy rocks of this zone have no business being at the surface of the earth, quite the opposite of granite and related silica rich rocks, which essentially float on top of such dense rocks. Serpentines and allied "ultramafic" rocks (rocks with lots of heavy minerals like iron and magnesium and relatively little light silicon) are almost as paradoxical as a brick of gold floating on a lake.

Before the theory of seafloor spreading, these rocks really bedeviled geologists. Now there is a story at least. In the trenches subducting slabs of heavy ocean crust are sinking beneath the light continents, with the ultramafic rocks right at the bottom of the slab. But the trenches often get jammed with light debris on top of the ocean crust that resists subduction, such as comprise many of the of the dull metamorphic rocks we've seen in road cut on this trip. Then the subduction zone jumps back 30 or 40 miles. Forces in the new subduction zone then tip a block of crust up against the margin of the continent until it is on its side with light rocks to the east (in our case) and heavy ones to the west. Like a ship thrown upon the beach in a violent storm, what once was vertical is now horizontal. California is like several of these wrecked ships smashed one against another, the superstructure of the younger one crushed against he heavy keel of the older wreck. In some exceptional circumstances the whole ship is preserved almost intact, as in the textbook Josephine complex in far northwestern California. Bands of serpentine running from SE to NW mark the keels of the wrecks. A couple of wrecks comprise the Sierras below the granite, a couple are buried under the Central Valley, and another series comprise most of the Coast Ranges. In addition, serpentine itself also sometimes absorbs so much water that it is quite a bit lighter than the original crust-mantle rocks that were its precursors. Serpentine has been altered by contact with water in hydrothermal systems

along the spreading ridges in the middle of the oceans. Hot, high pressure water drives into the fractured rock of the spreading zone, altering its physical and chemical properties. Wet serpentine can separate itself from the heavy rocks of the unmodified lower crust and upper mantle and move upward something like the hot molten granite and basalt magmas that fuel volcanoes. To confuse matters further, different geologists tell different stories. Even to speak about serpentine and its relatives you really ought to have a PhD in geology with a specialization in ultramafic tectonics. That doesn't mean that we simple naturalists can have some fun trying to figure out what the devil happened to make gold float on water!

4.4 miles. Nondescript metamorphic rock again in road cut. Some superstructure of the younger wreck complementing the serpentine keel at 4.2.

4.9 miles. The road crosses a nice meadow. Often these are former glacial lakes filled with sediment. Look to identify Willow and Red-twig Dogwood.

6.0 miles. Glacial deposits in a road cut. Note again the mixture of coarse angular blocks and finer sediments.

7.8 miles. Here the road ascends onto the Sierra "peneplain." This slope is part of an ancient level-eroded surface called a peneplain of the early Sierra. Subsequent large Sierran uplifts have allowed rivers, such as the Yuba and American, to carve canyons into the peneplain. The present westward flowing rivers have often cut across fossil north-south riverbeds that were active on the old land surface. These are the sediments the hydraulic miners exploited at Gold Run. Also note the large extent of the Yellow Pine Forest merging into Lodgepole-Red Fir Forests at higher elevations and ending at timberline on the Buttes.

14.6 miles. To the left, pull off onto Vista Point turnout with a broad view of the landscape to the north.

In the center of this northern vista are the Sierra Buttes. Note how the landscape to the left of the Buttes is a gently sloping plain interrupted by deep canyons. Look for Ceanothus, Black Oak, Douglas Fir, Manzanita, Canyon Live Oak, and Yellow Pines near the overlook. Ceanothus is interesting in that different species adapt to different conditions by conspicuous changes in leaves and other plant parts. The high elevation examples often live in moist sites and have thin deciduous leaves. Many at lower elevations have thick waxy sclerophyll leaves. The "buckbrushes" are thorny plants with small leaves that are shed if the summer drought is extreme. Many species can be recognized by having three prominent veins on the bottom of the leaf forking off at the leaf base. A fun genus to get to know. As always, look on the ground for fallen plant parts that are too high to reach.

15.9 miles. White Cloud Campground and Picnic Area. Perhaps stop for lunch and prospect the area for interesting natural history. The last of the White Firs are found about at this elevation (5,000 ft).

20 miles. Turn right onto Forestry Camp Road. Take this road through a prime example of the Yellow Pine Forest. Elevation here is about 4000 feet. About 0.6 mile down the road is a short logging road that will allow you to observe a bit of forest logged in 1985 or 1986. Ceanothus and Black Oaks have stump sprouted here, and Yellow Pine and Douglas Fir have been planted. Why do you suppose foresters plant rather than depend on natural reseeding?

The mid-elevation Yellow Pine Forest is one of the most productive regions in California forests for timber. Can you account for this fact in terms of climate and soils? From this site you can see many logged patches in the distance.

The conspicuous reddish-yellow scars off to the North are the Malakoff Diggings, a large hydraulic mine (and State Park, worth a visit). The remaining sandy flats and steep banks are revegetating very slowly.

Drive on down Forestry Camp Road and pick a likely spot for a little exploration of the forest. At one place or another, get out and take a walk through the Forest. You should be able to identify Yellow Pine (Ponderosa Pine, 3-needled), Incense Cedar (small shingle-like leaves), and Black Oak (lobed deciduous broadleaf).

In some sites Douglas Fir (cones with "mouse tails") and Sugar Pine (with long cones, 5-needled) are also common. White Fir is important at higher elevations. Take a moment to smell the bark of a Ponderosa. Note the lack of a developed understory. You can find some interesting shrubs like tall Dogwoods and thin-leaved Ceanothus.

What biome does this community resemble? What are the similarities and differences in vegetation and climate?

If you have found a quiet spot, you may wish to sit and listen. Often in the forest birds and mammals are more noticeable to the ear than to the eye. Most mammals are nocturnal and hence are hard to observe. Birds are creatures of the day, and are much easier to observe. Hence, bird watching is a common hobby, but mammal watching is mostly for hunters and scientists. Why do birds tend to be diurnal and mammals nocturnal?

23.5 miles. Return to Highway 20.

26.4 miles. Note dark green Broom shrubs along the roadway with yellow flowers and/or peapod fruits. This is an alien invader that is infesting large areas at this elevation.

28 miles. The road goes along a south facing slope here. Not the dominance of drought tolerant evergreen oaks at an elevation where north facing slopes will have conifer forests composed of species that like cooler, wetter conditions. Broken topography creates a mosaic of microclimates that greatly influence the details of plant communities. Siting a house or vineyard in such country also requires an understanding of microclimates.

30 miles to 35 miles. Enter the Nevada City-Grass Valley complex. Navigate carefully, following the signs for Highway 20, avoiding following Highway 49. The historic centers of these towns are fun to visit if you have time.

33.8 Notice first Gray Pines. We are leaving the Yellow Pines of the transition zone. Over the next few miles this foothill vegetation soon becomes dense, forming the Foothill Woodland. Find a convenient place to stop. Identify Blue Oak, Gray Pine, and Interior Live Oak. Shrubs such as Ceanothus, Toyon and Manzanita are also important. Manzanitas can be confused with Madrone, the small tree, with light red bark. Note how the leaf form of the Ceanothus buckbrushes and Mananitas differ; these are both adaptations to drought stress.

The second major mosaic component is chaparral. In the chaparral you should see While-leaf Manzanita and Ceanothus with Toyon and other species. As you continue on Hwy. 20, do your observations of the mosaic suggest any explanations of the patterns?

Look for signs of burns of various vintages. Our summer-dry communities are bound to burn off on cycles ranging from a few decades to a few centuries. Fire protection reduces the frequency of fire, but increases fuel load and eventually makes for a bigger fire. Many shrubs and trees are adapted to fire. For example, Chamise, and many Manzanitas and Ceanothuses, sprout from their stumps after a fire, and some pinecones only open after a fire. Burns older than 10 years can be hard to spot unless some fire-scarred snags remain standing.

37.0 and **37.9 miles**. Serpentine in road cuts. Serpentine has a very low ratio of calcium to magnesium. A few plants are specialists at handling serpentine derived soils. If you see an opportunity, compare adjacent plant communities on and off serpentine sometime.

41.5 miles. A nice small example of Oak Savanna.

43 miles. Turn left off Highway 20, then right on Penn Valley Road and shortly left on Indian Valley Road. This used to be our stop to familiarize you with the mosaic of communities that occupy the Foothill Woodland. Now it is heavily disturbed by ranchette development. Increasingly you have to use scraps of remaining native vegetation and imagination to reconstruct what it used to be like. Away from the immediate influence of the greater Sacramento area these communities are well represented.

Ranchette development has increased the cost of fires. Despite the development, plenty of the former fire-prone landscape remains to threaten many homes in serious fires. Unfortunately for insurance companies and fire departments, ranchettes and ranchetters don't stump sprout!

44.5 miles. Return to Highway 20.

49 miles. Nice Oak Savanna. The floor of the Central Valley once had extensive savanna like this. (The best remaining Valley Oak Savanna I know of is on Fort Hunter-Liggett between King City and the Big Sur Coast. If it was not so far away, the Naciamento-Ferguson Road from Jolon to Highway 1 would be one of our self-guided trips. You'd also climb to the top of Cone Peak (5,000 ft). Full of biogeographic interest and drop-dead gorgeous in high spring!)

52.9 miles. Look for clumps of the aggressive, weedy Chinese Tree of Heaven. The shortish trees with big pinnately compound leaves (like walnut leaves) sucker from their roots forming clumps up to an acre in size. Imported by Chinese laborers to plant at their temples.

54.3 miles. Yuba River Bridge. Just before the bridge is a road on the right leading down to the river. A possible stopping point to identify Foothill Woodland trees and shrubs. Has many shade-loving wildflowers in season. The Yuba River was heavily mined using dredge techniques just downstream from here. Unfortunately the weird landscape created by dredging is on the other side of the river. Many of you may have noticed the remnants along Highway 50 as you leave Sacramento going east.

57.5 miles. Pull off at the historical monument. This site is in the Blue Oak Savanna you saw from the last stop. The ground cover in this habitat is often similar to the valley grassland, dominated by grasses with annual and bulb wildflowers. In other parts of California other oaks and trees (e.g. Interior Live Oak, California Buckeye) may form the tree layer.

Many annuals in lowland California are weeds from the Mediterranean region, including most of the annual grasses, Filaree, and various Mustards. On the other hand, most of the showy annual wildflowers are natives. The formerly dominant perennial native bunchgrasses are now completely absent from large areas. It is a bit puzzling why these patterns occur. Any ideas?

61.5 miles. Find a convenient place to stop. Facing west gives a good view of the northern Central Valley and the Sutter Buttes. The Buttes are the eroded stumps of some relatively young volcanoes. They are sometimes described as the world's smallest mountain range. If you have any sound idea about why they exist, I know some geologists who would love to talk to you! On a clear day the Coastal Ranges and the Trinity Alps can be seen from here as well. Apart from the riparian and marsh areas, the Central Valley was originally vegetated with perennial bunch grasses. (A remnant of this grassland is preserved in the University's Jepson Prairie Reserve south of Dixon; it is worth a visit in the spring.) These native Valley Grasslands are now rare because of cultivation and grazing (favoring annual grasses) and major alterations such as farming and urban development. Now restricted to a few reserves, Tule Elk and Pronghorn Antelope were once abundant grazers in the grasslands.

Looking east you can observe the transition from Valley Grasslands to Oak Savannah and to Foothill Oak Woodland. The oaks are Blue Oaks, a winter deciduous oak. Blue Oaks live in the toughest environment for tree recruitment. Typically a few acorns per square meter prout in the string and by October 100% are dead. The tree line between savannah and grassland, and the savannah rather than woodland character may be due to cattle grazing limiting establishment of new oak seedlings. We don't quite understand how the Blue Oak woodland maintained itself in the past or if it can maintain itself in the future. We do know that some forest species in California only survive because seedlings survive the summer drought only in rare years with summer rainfall. What other factors may influence this transition and its future prospects?

Study the vegetation near where you've stopped. Can you observe any seasonal succession in grassland plants (dried up vs. mature vs. sprouting species)? Again note the terra rosa (`red earth') soils. If you have come early enough in the season, these grasslands may have a good flower display. You can identify Lupines, Brodiaeas, California Poppies, Mariposa Lilies, Buttercups, and many others.

Unfortunately in this area ranchette development is rapidly encroaching on the grasslands.

63.1 miles. Note fields set up for rice cultivation. These are older terrace soils with reddish topsoil and a cemented hardpan horizon a foot or so down. They are nearly useless for anything but rice cultivation, but the "tight" subsoil limits the downward percolation of expensive water, helping the rice farmer. If the price of rice is low, they are often not planted with anything.

66.3 miles. Notice the gallery forest along the stream a hundred meters or so left of the road. Farmers often crowd this vegetation to a narrow fringe along streams, canals, and sloughs. What wild plants and animals exist on the Valley floor use these strips for habitat. The flat farm field with a distant gallery forest is a signature Valley scene captured by artists who specialize in Valley landscapes. Try to imagine the situation when the Valley was a rich mosaic of grassland, savanna, wetlands, and wide gallery forests and teeming with game. Native peoples found this a lavish environment and population densities were very high by the standards of hunting and gathering economies. Curiously, agriculture was never adopted in Mediterranean California even though corn farming peoples were as close as the lower Colorado River on the California-Arizona border. Any idea why corn faming didn't spread to California until the arrival of the Spanish/Mexican colonists?

69 miles. Orchards and row crops are usually planted on deep, youthful alluvial soils on lower terraces. As you drive across the valley floor pay attention to what is planted where, and the color of the soils.

70.9 miles. Navigate carefully to follow Highway 20's twists and turns through Marysville.

71.4 Follow the signs for Highway 70 towards Sacramento.

72.2 miles. Cross the Yuba River.

72.9 miles. Notice the extensive Eucalyptus planting along the roadside. From the late 19th Century until the last 20 years or so, most people scorned the natives for exotics like these. Now the pendulum has swung heavily in favor of natives and these exotics are considered weeds. The plant lovers like me are often at least ambivalent. Both natives and exotics hold a lot of interest and value. Everyone agrees that controlling noxious weeds is a serious problem, but most exotics are not aggressive spreaders. The Davis Arboretum has plant sales. About 25% of the purchases are natives and the rest exotics. Whatever that means!

79 miles. An area with little cropping evident. Probably older terrace soils here with poor clays, perhaps a hard pan.

82.2 miles. The Valley's most important crop these days—subdivisions!

84.5 miles. Bear River. On the south side of the river are extensive orchards, on the recent flood plain of the river. Good, young alluvial soils. Once again, for the next few miles, note how we seem to alternate between good and poor soils.

88.8 miles. Turn right on Nicolaus Avenue heading for the Garden Highway.

90.3 miles. Pass some McMansions and climb onto the levee top following Garden Highway headed south toward Sacramento. The river here is the Feather. For the next 21 miles we follow the Feather River, and then the Sacramento River traveling along the rivers' Riparian Forest. Though parts are becoming more developed with large residences, you can find a good places to pull off and explore this community. Try to find a thicker bit of the forest to get some of the effect of what the much more extensive forests of the past were like. Fisherfolk beat rough paths thru the tangle. Take care if you are susceptible Poison Oak! Scouting we found a good spot between the addresses Garden Highway 6836 and 6862.

Identify Fremont Cottonwood, Oregon Ash, Valley Oak, Buttonwillow and California Sycamore here. Other common riparian include Box Elder, Black Walnut, Alders, Willows, Blackberry, Elderberry, California Wild Rose, and California Grape (and other vines). Many stands of Horsetails (Scouring Rush), a primitive land plant, grow along the levee. If you find it you'll notice why in acquired its second common name. In season, you will see some Lupine and other wildflowers. Why is this community important to organisms that also utilize the adjacent farm fields?

Note the isolated tall Valley Oaks out in the flood plain. The Valley once had extensive stands of these trees mixed with the grasses wherever deep soils or ground water provided sufficient summer moisture. A few old trees were spared by farmers over the

years. Note the kinds of locations where these trees are now recruiting (reproducing successfully, as evidenced by trees a few years old).

The structure and adaptations of the riparian woodland community in California resembles that of the Temperate Deciduous Forest, with which it shares some genera, such as Ash, Sycamore, and Grape. Given the mild winters of California, one might expect this forest to be dominated by moisture-loving evergreens, such as Magnolia. Any ideas why it is not? Similarly, California lowlands have a mixture of deciduous and evergreen Oaks. Note the characteristically different communities in which they occur. Feel free to guess about reasons for these differences. Historical factors play a big role many botanists think.

Notice the backwater sloughs on the land side of the levee. They are very common in the river land topography of the Central Valley. In such sloughs and associated Freshwater Marshes you may find an abundance of bird life. These areas are also important fish habitats. Before the floodplains were developed for agriculture, the smaller tributaries to the Sacramento fed extensive seasonal and year-round wetlands. They could only flow into the Sacramento at high water when they could flow over the natural levee built by the river. The small sloughs are just scraps of what once was. Marsh vegetation generally consists of cattails, tules (bulrushes) and sedges.

At Verona, the Sacramento joins the Feather from the west.

111.5 miles. You'll see Sacramento International Airport on your left and I-5 in front of you. Take the frontage road along I-5 (Crossfield Road) toward the Airport. When you get to Airport Blvd. turn right and find almost immediately the onramp to I-5 in the direction of Redding (north). Cross over the Elkhorn Bridge, and follow I-5 until you reach County Road 102 at 119 miles. Turn south (left) down Rd 102 (Pole Line Road). After about 10 miles you reach the corner of Pole Line Road and Covell Blvd and you are home in Davis.

Hope the trip was fun and educational! If not, give me heck for whatever was not right.

Please report any errors or changes you find in the guide to me.

References (* = most basic supplements to Tree Finder. The others are good additions to your natural history library if you want to become knowledgeable on the particular subject.)

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