ESP/ERS 30 World Ecosystem and Geography

Davis-Bodega Bay

Sacramento Valley - Coastal Ranges & Valleys - Coastline

Introduction

This trip follows a westward transect from Davis across the low coastal mountain ranges to the coast.

A. Plant Communities

1. Central Valley Grassland (now primarily agricultural fields and orchards)

2. Oak Savannas and Oak Woodlands

3. Chaparral and a chaparral variant with Gray Pine

4. A variety of Riparian habitats

5. Mixed Evergreen Forest

6. Redwood Forest

7. North Coastal Scrub and Prairie

8. Coastal Beach, Marsh, and Tidal Communities

B. Environmental Factors

Climatic zones you will encounter include the somewhat "continental" climate of the Sacramento Valley, characterized by cool, wet winters with frequent winter fog (a result of cold air subsidence off the Sierras and entrapment in the Valley by the Coast Ranges), and long, dry, hot summers. Even more continental climates are characteristic of regions much further inland, e.g., Ohio. Really extreme continental climates occur in Central Asia and Siberia. Continental climates are so called because as you move inland away from the ocean, the moderating effect of the ocean on temperature leads to more extremes inland. The Coast Ranges are characterized by somewhat less extreme, but still highly variable, conditions of temperature and precipitation as they are in a zone of transition between the more Continental climate of the Valley and the highly Maritime climate of the Coast. The climate along the Coast is dominated by the cool waters of the Pacific Ocean and the California Current which flows south along this part of our coast. The ocean acts as a buffer and greatly reduces the extremes in temperature characteristic of the Sacramento Valley but also increases the amount of moisture in the air, increasing relative humidity. If you look at the climate zones of the Sunset Garden book (see

excerpt on the ESP 30 web page) or at less sophisticated depictions of climate, you will see that the sharpest gradients in the West are coast versus inland rather than north and south, as is more usual. Summer fog develops frequently along the northern California coast, a result of the warm, moist air masses associated with the warm Central Pacific being chilled as it moves over the frigid California Current roaring down from Alaska, chilled further by upwelling which sucks packets of even colder water up to the surface right next to the beach (see lectures on oceans). As Mark Twain said, "the coldest winter I ever spent was a summer in San Francisco!" In winter, however, the coast remains clear while the Valley often becomes shrouded in chilly fog. MT might have said, "the nicest summer I ever spent was a winter in San Diego!" California as far north as our latitude has these strips of lovely climates just out of the reach of all-day fog in summer but with good cold air drainage in winter. See Sunset Climate Zone 16. The coastal mountain ranges limit the inland spread of the maritime influence; the "marine layer" of weather forecaster jargon is usually a few hundred to a few thousand feet thick and it can only sometimes spill over the successive ridges of the coastal mountains. Notice on the Sunset map how Davis' own Zone 14 designation comes from the ability of even a thin marine layer to spill some marine air into the Valley through the gap in the Coast Range created by the Valley rivers having cut the Carquinez Strait through the mountains.

Soils are of two main types: the alluvial (water-deposited) soils of the Sacramento Valley and smaller valleys of the Coast Range, and the soils developed directly on the rocks of the Coast Ranges. Alluvial soils are relatively fine-grained, deep, and often young and productive and can support intensive agriculture. The residual soils in the hills are often coarse and thin, have little organic content, and are relatively low in productivity. The coastal plains consist of recently (geologically) deposited marine sediments, uplifted so as to be above sea level.

C. Geology

This trip crosses five major geological provinces (see Alt and Hyndman for an excellent review of the geology of northern California). You begin in the Great Valley, once a trough filled with seawater and now with muddy sediments (alluvium) accumulated over millions of years. Beneath Davis, the relative recent alluvium is some 10,000 feet thick. As you proceed into the foothills and on into the Coast Ranges you cross the Great Valley Sequence, Serpentine, rock that should never see the light of day, the Franciscan Formation, ancient sea floor sediments which have been crumpled up against the western flank of the North American Plate and, finally, upon reaching Bodega Bay you encounter the San Andreas Fault, a boundary between slabs of continent riding on two moving segments of the mantle. The Pacific Plate is slowly moving northwestward, sliding past the relatively stationary North American Plate, and causing events like the 1906 San Francisco earthquake in the process. If you call about 35 mm or 1.5 inches per year slow. That is something like 10 feet in a human lifetime, plenty to store up the enormous energy released in earthquakes. The granite at the end of the trip was formed several hundred miles to the south in the Transverse Ranges near Los Angeles.

The coast of California was a subduction zone until fairly recently. In fact, north of Cape Mendocino, it still is. At our latitude, subduction ceased just a few million years ago as the lengthening San Andreas Fault system reached us from the south. As long as the subduction zone existed, the North American Plate's western edgeacted like a bulldozer blade, scraping the lighter marine sediments off the top of the subducting Farallon plate. As sediments, islands and whatever else came rafting in on the eastward moving Farallon plate was jammed against North America, the continent grew westward. The ancient core of North America is far to the east of us. All of Nevada and California are relatively recent add-ons. The Coast Ranges were added over the last 200 million years or so.

D. Human Uses

As you progress along the route, be aware also of the different human use patterns. As you're no doubt already aware, the Sacramento Valley has been extensively modified by humans and is now primarily an agricultural area, with major areas planted in tomatoes, corn, and rice. The foothills and coast ranges, with their poorly-developed soils, offer little opportunity for farmers and have been used instead for grazing livestock, especially sheep and cattle. Valleys between the ranges, however, rapidly being converted into vineyards, yielding some of the highest quality wine grapes in the world. Indeed vineyardists often plant on poor upland soils because they want low yields. Stressed grapevines make relatively more flavor enhancing compounds relative to sugar. Why are expensive wines expensive? The main reason is that the vineyards that produce the best grapes have the lowest yield! Vineyardists also seek out soils and microclimates that favor grape varieties that produce unusually fine wines under rather special conditions. Hence vineyards march right up into the hills where formerly only cows grazed.

If you go wine tasting, chat up the pourer about soils and microclimate and see how much they know! With luck you might flush out a grape biogeographer that can talk soils and climate in a level of detail that will make your head spin! I find that the best way to learn something fast is to find real experts and very respectfully try to make them explain what they know to you. Even crusty ones often warm to a little flattery, especially if you can sound just a little knowledgeable yourself and are genuinely interested. If they think you can understand, and want to understand, what burns in their bosom, they are often more than happy to try to tell you everything they know. Beware that you need a graceful exit strategy if they wan to tell your more than you need to know!

The Coast Redwood forests persist mainly as "second growth" forests, having already provided lumber for house construction; those tracts still intact have largely been set aside as parks and reserves. Redwoods are formidable stump sprouters and fast growers. In Redwood forests, always look for evidence of former logging. The hills along the coast are intensively grazed but are increasingly the targets of developers, who wish to turn them in to home sites.

As you drive along the route, note the various uses that man has found for this region and think about the characteristics of an area (climatic, geological) which may have predisposed it to its present use.

TRIP GUIDE

Route

This trip takes you west on Highway 128 to Winters and Lake Berryessa, through the Inner Coast ranges to Rutherford in the Napa Valley. Then you go up the Napa Valley on Highway 29 to Calistoga. After Calistoga, you take Petrified Forest Road to Hwy 101 just north of Santa Rosa. Then the route follows Highway 116 along the Russian River to Jenner and Highway 1 south from Jenner to Bodega Bay. The return trip takes a variety of secondary roads to Petaluma and from Petaluma to Napa finally reaching I-80 between Fairfield and Vallejo, then I-80 back to Davis. The return trip has no suggested stops, but it is a good opportunity to observe general patterns at highway speed. Once you know the vegetation dominants well enough to recognize them at speed and at a distance, you can read a lot of vegetation pattern as you drive along.

Study the route ahead of time, and be sure to have a decent highway map. I always carry one of the widely available DeLorme atlases. They provide reasonably large scale maps with topography and lots of interesting features indicated. If you have a team, having a designated navigator riding shotgun is a good idea. The guide below outlines all the turns, but it is still very easy to get lost, in which case you have to navigate back to the route using a map for help. Try to be aware of the cardinal directions. You can use a compass, but in California the topography is a big help. In our area, ridges and valleys run roughly N-S but with to bit of N-W to S-E in the trend. All of this is generated ultimately by the trend of the San Andreas fault system. The direction of the sun combined with the time of day is an important clue (easterly in the morning, south at noon, and headed into the west in the afternoon). Some people have a better intuition for directions than others. Pick a navigator who is good. Also if you are lost, it helps for the navigator to listen to others. If you are (maybe) lost, your navigator is following a shaky hypothesis. Sometimes you have to follow more than one hypothesis before you get back on track. A good navigator has a solid running hypothesis for where s/he is. Bad navigators are often overconfident and follow a false hypothesis too long. BTW, hunter-gather tracking was a social affair, with various hypotheses under discussion as the hunters pursued faint, often ambiguous signs. A good navigator takes no shame for making the wrong guess from time to time or in needing advice from the rest of the crew.

Mileage

0.0 Drive west along Russell Blvd. Set your trip odometer to zero at the Hwy. 113 overpass. Continue west as Russell becomes Highway 128.

Note the various human uses of the Central Valley. The native perennial bunch grasses are now rare in the valley because of grazing or something favoring annual grasses (experts debate the reasons for the invasion of the annuals) and major alterations such as farming and housing. The University/Nature Conservancy Jepson Prairie Reserve south of Dixon has been set aside to preserve a remnant of the original Central Valley

Grassland; it is well worth a visit in spring. It is about 20 miles south of us here on the edge of the Delta.

3.5 Note Glide Ranch Headquarters sign. The slightly rolling topography south of the road has never been mechanically leveled, unlike most of the Great Valley. Formerly, much of the Valley would have looked more like this than the dead-flat fields the land levelers have made. Why are California farmers keen to have such dead-flat fields? The Glide Ranch and some other similar surfaces you may spot on other trips around Davis were spared leveling because they are on old higher terraces with relatively old soils. Farmer have not found it worthwhile to level them.

4.5. Notice Valley Oaks volunteering along the roadside. Eventually you come to a big mother tree whose acorns Scrub Jays have stored for later use, but have forgotten, leading to some volunteers starting several hundred yards from Mama. Any guess why Jays will move seeds so far?

4.6. A fork in the road. You take the right fork to stay on the road to Winters. For the next few miles the road is not straight, but has mysterious turns out on flat ground where roadbuilders usually go for straight lines. The explanation is that the road follows the property line of an old Mexican Land Grant. The straight roads so characteristic of the Valley also follow property lines, in most cases "Section" lines. The Americans surveyed most of the West into square mile blocks called Sections. Hence out on the flats, Yolo County tends to have roads at 1 mile intervals in a N-S and E-W crisscross pattern. You'll see this pattern about as far east as the Mississippi River wherever the land is flat enough to permit it. But the American Surveyors skipped Mexican Lang Grants which had been legally recorded before they arrived.

7.9. You come to a stop and make a left to continue on towards Winters. For the next several miles, the predominant land use is for orchards, especially Walnut orchards, but also including plums for prunes. Recently a prune drier went into operation just a little north of here.

11.9 Winters. Continue straight on Hwy. 128.

14.6 Roadside turnout on right just before the road makes a left bend rather than start climbing into the hills.

Here is the start of the Oak Savannah. In this case the oaks are Blue Oak, a winter deciduous oak. Blue Oak Woodland is one of our state's signature communities. There are also Gray Pine and introduced Chinese Tree of Heaven (Often called by its generic name, Ailanthus, from China) at this stop. The open savannah (rather than closed canopy woodland) character may be due to cattle grazing limiting the establishment of new oak seedlings. Or perhaps competition for water keeps the trees rather widely and evenly spaced as in Tropical Savanna. The experts argue. Blue Oaks are one of the dominant plants here. They are smaller than the grand Valley Oak, and have leaves of a rather bluish cast when mature. They are very drought tolerant and grow on foothills with thin

soils and low annual precipitation. Another signature species here 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. (What are these gray colors all about?)

Once you have a good fix on a species like Valley Oak, Blue Oak, or Gray Pine, practice trying to identify it at a distance and at highway speed (taking care with your driving of course). With a little experience, you'll be able to name most of the dominant trees and shrubs with a fair degree of confidence as much as a mile away and at highway speeds. When you spot something you cannot recognize, time to find a place to pull off and make a new friend! A few years back, a carload of botanists traveling up near Mount Shasta discovered a new genus of shrub just because something about it struck them as odd as they were whizzing by at 65 mph.

16.0 At the Lake Solano-Vacaville turnoff (to the left) continue straight on Hwy. 128. Now you are following the riparian corridor of Putah Creek, here restricted by a low dam that creates Lake Solano and lifts water to put it into a canal headed down to the farms and fields of Solano County.

17.4 Pull off into parking lot to left: Putah Creek Fishing Access. This a largish parking lot with a gate but no buildings. If you miss the first one, just drive along to the next.

"Riparian" (streamside) communities are analogs of temperate deciduous forest. The stream provides year-round water, so the drought adaptations so characteristic of most California plants are absent here. Walk down to and along the creek. Above all, be careful for poison oak. Stinging nettle is also present here.

Common Riparian Woodland plants here are Fremont Cottonwood, Willows, Wild Cucumber (a vine), Wild Grape, and Poison Oak. You can also find Elderberry and California Buckeye here. The introduced Tamarisk. Tamarisk is becoming widespread in this region and has become a problem because it competes for water with native species. You may spot it or spot the remains of plants that have been ripped out in an effort to extirpate what many consider a noxious weed.

What differences do you note between the characteristic leaf morphologies of the riparian species versus those of more drier sites? These garden variety leaves of most of these plants are termed mesophyllic meaning characteristic of fairly moist "mesic" habitats. Have the plant communities on either side of the hills you've been passing through been the same or have they been different? If different, what factor(s) can you suggest as having caused the observed differences? Microclimatic differences due to slope and aspect (orientation to the sun) and soil differences are responsible for most such patterns; which is responsible here?

Take note from the parking lot of the pattern of chaparral and savannah on the hills ahead to the west. What factors may be responsible for producing these patterns?

18.5 Note clumps of weedy Ailanthus trees with large compound leaves similar to walnuts. These trees sucker from their roots forming these aggressive clumps.

21.0 Cross Putah Creek.

21.2 Cold Canyon Natural Reserve is to the south of the road. It belongs to UC and is a great place to hike and pursue natural history. Has a good diversity of spring wildflowers. We will not stop here, but mark the spot on your map for a future trip.

21.4 Monticello Dam and Lake Berryessa. Pull off into the small parking lot at the dam.

Lake Berryessa and Monticello dam flood a small Coast Range Valley in order to store water for agricultural, municipal, and industrial uses. The remnants of the tiny town of Monticello are exposed during extreme droughts. It is a fairly typical medium-size water project of which California has dozens and the arid West as a whole hundreds. Monticello was built in the mid 1950s, near the end of a big post WWII wave of water projects. Why do you suppose that few projects have been built since? Only part of the answer is that environmentalists became well organized to oppose them! The answer is in the geomorphology of the former canyon where you are standing and the size of the drowned valley upstream. Where would cost-conscious engineers look to build dams?

At the top of the dam, notice the upturned layered rock. These strata are sedimentary rocks, part of the **Great Valley Sequence**. Sedimentary rocks are typically associated with ancient marine and/or freshwater areas and result from erosion and deposition of weathered fragments of parent material. As such, they are laid down in horizontal layers or strata; what do you suppose was responsible for these once-horizontal strata being upturned in the fashion we now see them? The layering in these rocks is the result of underwater landslides sweeping down the continental slope from the continental shelf. Rivers eroding the mountains built up unstable deposits of rock, sand, silt and clay on the continental shelf. If they did not collapse of their own weight eventually and earthquake would shake them lose. Then, a great cloud of debris would fan out down the continental slope and deposit one of the layers you see. Evidently some were very big and others quite models to judge from the variable thickness of the layers. These rocks were neve buried very deeply or subject to much heat. Most of them are quite weak and erosion rates are high in this landscape. The road cuts for the next several miles have good exposures of the Great Valley Sequence. It also forms the deep floor of the Central Valley and outcrops again in places in the Sierra foothills.

Over the next 5 miles, around Lake Berryessa, are good examples of Chaparral in the Coast Ranges. Choose a turnout after a mile or so and explore from the roadside. Once again be aware of poison oak.

Common chaparral species are Chamise, Coyote Bush, Buck Brush (Wild Lilac, often called by its generic name Ceanothus), Manzanita, Scrub Oak, Toyon (California Holly), California Bay and Poison Oak. In slight drainages, California Buckeye and the Virgin's

Bower (a vine) are also present. Occasionally here and especially later on you may also notice a few scattered Gray Pines. All of these are candidates for you list of plants to recognize at speed. Manazanita (perhaps some 30 species in California, few elsewhere) have smooth dark red bark and scleophylous leaves usually about he size of a quarter. The Ceanothuses, another big genus in California, come with an interesting variety of leaf adaptations but all have in common finger length displays of tiny white or blue flowers, usually with a lovely fragrance. The leaves of Ceanothus often have 3 prominent veins radiating from the base of each leaf. Chamise has only a single species in Northern California, but is notable for large stands of nearly pure Chamise. Look for its bundles of short needle-like leaves, slightly reminiscent of pine needles.

27.6 About here the Old Man's Beard lichen starts appearing on the limbs of Valley and Blue Oaks. It is often pretty thick along the coming stretch. It occurs only here and there in the Coast Range hills. Try to think of an explanation. So far as I know there is no commonly accepted story. Here and elsewhere you may see wildflowers growing along the roadside. Perhaps someone on the trip is using a wildflower guide to try to identify them when you stop. One again, you can often learn to recognize common ones from a distance and at speed, especially the speed of curvy mountain roads. Once more, taking care with your driving, don't stop observing when you're moving on the road. Passengers especially, always keep your eyes peeled for something interesting. This is a good place to try recognizing Blue and Valley Oaks at speed and at a distance. Blue oaks have the color difference once the leaves are mature. Valley Oaks grow considerably larger and grow on flats and bottoms where deep damp soils or ground water are available all summer. Blue Oaks grow on steep slopes with thin soils and very scanty water in midsummer. In severe droughts, Blue Oaks are drought deciduous.

32.0 At the junction with Hwy. 121, continue on Hwy. 128 (to the right) toward Rutherford.

This is the Capell Valley. Have you noticed how quickly the vegetation changes? Do your observations offer any explanation or patterns? Again, recall that climate, microclimate, and soils are the main natural forces affecting vegetation patterns. Human uses may also impose patterns.

33.7 Note that east facing and west facing slopes have different vegetation along here. Why might that be?

34.7 Notice a young vineyard. Wine grape acreage continues to expand, spilling out of the classic wine-growing regions like the Napa and Sonoma valleys. All along this trip you'll see new vineyards. The wine grape industry started with the Franciscan missionaries and boomed in the late 19th and early 20th Century. The American experiment with Prohibition (1920-1933) almost destroyed the wine industry. After WWII a small quality wine industry grew up. As late as the early 1960s quality wine making comprised perhaps a dozen or so major labels, many but not all in the Napa Valley. Since then the growth in quality wines has been phenomenal, perhaps a thousand vintners in the business. The UCD Viticulture and Enology Department played a large

role in its success. Lacking skilled traditional vintners, California relied on reducing winemaking to a science and training vineyardists and winemakers accordingly. Old World winemakers scoffed until California wines started to earn prizes in international blind competitions! Chile, Argentina, South Africa, Australia, and New Zealand have all grown up quality wine industries on the California model and all can compete with the traditionalists from France, Spain and Italy. Just remember that you don't *have* to be wine snob to enjoy wine, it just makes the experience more fun and much more expensive. The French, who are food snobs in general not just about wine, spend about twice as much on food as Americans do, per capita.

36.0 After crossing a small concrete bridge, there is a long road cut of distinctly greenish rock, and then a turnout on the right (be careful for the curb). Mile post "NAP 20.00" may be visible.

This green, slippery-feeling rock is serpentine, a geological formation of major importance in northern California. 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.. Most of the rocks you'll see in road cuts for the rest of trip are the jumbled junk that was too light to subduct. This messy complex is called the "Franciscan Formation" by geologists. When the trench is well and fairly jammed, 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 and exposed at the surface, as in the textbook Josephine complex in far northwestern California (Alt and Hyndman 97-8). Bands of serpentine running from SE to NW in the Coast Range 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 properties a lot but its chemical properties only slightly. 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. Thus, most of the Franciscan we see at the surface is the superstructure of the wrecks with some serpentine squeezed into it here and there. (See Alt and Hyndman, pages120-122, for a more detailed look at this process.)

To confuse matters, 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!

Plant communities on serpentine are often different than on neighboring areas. Most plants have trouble growing on these soils derived from serpentine because of (1) the very high proportions of magnesium relative to calcium than leads to magnesium toxicity and calcium deficiency, (2) nickel and chromium occur in toxic concentrations, and (3) low concentrations of major as well as trace nutrients. In addition, these soils often waterlog in winter yet are very dry in summer. Professor Singer spoke about the peculiarities of serpentine derived on our Soils Excursion.

Across the road and up the hill from the turnout you can see several dark conifers; these are Sargent cypress, a serpentine endemic. Some of the other plants growing here are serpentine endemics, found growing only on serpentine. Other typically serpentine plants can grow elsewhere but are more abundant on serpentine because of the lack of competition on these poor soils. Leather oak is an example of these latter plants, serpentine tolerators rather than serpentine endemics.

36.9 Spanish Flat turnoff: continue on Hwy. 128 (straight) to Rutherford.

40.0 Pope Valley turnoff: bear left, continuing on Hwy. 128 to Rutherford.

40.4 Nichelini Winery. This is an old-time winery that has been in the same family since the 1890s. It bills itself as a living museum and is worth a visit some other time. Check out their web site. When I was a student, it made cheap red wine vended in gallon jugs, but it followed wine tastes up-market quite effectively. You might get the proprietors to tell colorful stories about the Prohibition Era. A few wineries stayed in business making sacramental wine for Catholic Mass. You can imagine somesidelines.

Over the next 7 miles there are some riparian habitats that include Big Leaf Maple and California Bay Laurel. What are the similarities in the different riparian areas? The differences? How do merely moist canyons differ from valleys with a permanent stream?

41.7 Look here for nice stands of Madrone, one of California's signature plants. The title of the Native Plant Society's journal is Madroño. It is a shortish tree or big shrub with smooth light reddish bark and big evergreen leaves. It has lots of white flowers in the

spring. Also, look for various grungy Franciscan sedimentary rocks in the road cuts along here.

44.3 Lake Hennessey. Water supply reservoir for Napa.

48.1 Reaching Napa Valley, turn right. Soon to follow, take the 1st left to "Rutherford."

How does the land use in the Napa Valley compare to that in the Central Valley? Read the Sunset Garden Climate Zone discussion of Zone 14. It gives a few hints about variations within Zone 14 that are important to grape growing. See also http://en.wikipedia.org/wiki/Climate_regions_of_California for another slightly more technical discussion.

51.0 In Rutherford, turn right at junction of Hwy. 128 with Hwy. 29.

This route takes you right through the most prestigious wine growing region in California. California has imitated the French system of formally defining wine regions. A wine cannot label itself as grown in the Napa Valley unless in was made from grapes grown in the defined Napa region. California now has many such regions, “Appellations” as the French term is. My much older half brother went to high school in Napa in the late 1930s and early 1940s. In his day, prune orchards were more common than vineyards here.

54.7 St. Helena. The main street here preserves much of the charm of the old Napa Valley. One legend is that UCD was started as the University Farm because it was too foggy to grow grapes in Berkeley. A couple of guys were told to take a train inland and find 40 acres to buy for a vineyard. They got on one train and ended up in Davis. If they’d taken a different train, we might be UC St. Helena!

56.2 The imposing stone building on the left is the former Christian Brothers monastery. Until about 1970 they still made and sold wine; it was a significant label in those days. Now a fancy cooking school.

61.7 The tall conifers that you see in the distance are Douglas Firs. This is a hint that although Davis and the Napa Valley map in Sunset Climate Zone 14, the Napa Valley has a bit more marine influence. Douglas First don’t seem to tolerate Davis conditions at all.

63.3 Calistoga. (North of town is "Old Faithful Geyser of California." Up the valley you may see Mt. St. Helena.)

64.3 On Hwy. 128 past Calistoga, turn left on Petrified Forest Road to Santa Rosa. This turn is by a commercial corner with a gas station and other small businesses.

65.9 On a long straight incline, there is a long turnout within this patch of Mixed Evergreen forest. Best to park near the end of the turnout, where the chain link fence ends. Watch out for traffic; this road is often rather busy.

Plants seen here include Douglas Fir and a few California Bay Laurel, the deciduous Black Oak, and Madrone. Tanbark Oak is commonly also important in Mixed Evergreen forests). In the understory are Big Leaf Maple, Poison Oak, and California Buckeye. Coast Live Oak and Toyon are present.

68.1 Petrified Forest.

This is an alternate stop for Mixed Evergreen Forest. You can walk along the road opposite the entrance and see a good many plants from this community. You can also do the Petrified Forest tour. The charge for adults is $6.00. You might try asking for a student rate but I did not see one posted. The petrified trees are Redwoods blown down by a volcanic explosion about 3.4 million years ago (note that Redwoods no longer grow here). If you are a neophyte at plant identification, many common plants are labeled here. The community in the Petrified Forest itself is an ecotone with Oak Woodland and Mixed Evergreen species distributed in a mosaic. Look for Coast Live Oak Mountain Mahogany, and Manzanita in addition to Mixed Evergreen species.

68.8 Junction: turn right on to Porter Creek Rd. to US 101.

About 5 miles down this road is a common riparian community of the more coastal Coast Ranges, Redwood Canyon Bottoms. Here with the coast redwoods are Alder, Big-Leaf Maple, California Bay Laurel and species characteristic of the Mixed Evergreen forest. The Coast Redwood community is far more developed in the broader canyon bottoms and river plains closer to the coast, as in the next major stop.

78.5 Santa Rosa Valley. Continue west (straight) to Guerneville-Fulton, crossing over US 101.

Young vines again.

87.6 Redwoods begin again here, mixed with Douglas Fir. These trees are hard to differentiate at distance and at speed. Redwood branches tend to be straighter out from the trunk, whereas Doug Firs have more curvature. Long drooping branchlets trail from the bottom of Doug Fir branches oft-times. The bark is quite different: Doug Firs have a gray bark, and Redwoods a distinctive fibrous reddish bark.

89.4 The Russian River. You now follow the Russian River to the coast at Jenner

95.0 Guerneville. Turn right at the second traffic light to Armstrong Redwoods State Park.

97.1 Armstrong Redwoods. You can park outside the entrance in the Visitor Center parking lot and walk into the park for free. The Visitor Center has a map for $0.50. Walk a few hundred yards up the road or trails into the park. If you want to make a two-day trip of this field trip, it is possible to camp here.

In the Redwood Forest the Coast Redwood is strongly cominant. Why? A few Tanbark Oak and Alders are found occasionally. The shrub story is very reduced, mostly Huckleberry, Tanbark Oak seedlings, and some Poison Oak (as vines clambering some distance up redwood trunks). Ground cover includes Redwood Sorrel, Trillium, Sword Ferns, and Bracken. Also look for California Wild Rose, California Bay, and Big Leaf Maple. On the Redwoods look for burn scars and caverns (illustrating fire resistance), the limited root structure of the fallen trees, and rings of more recent trees around old logged stumps.

99.2 Return to Guerneville.

99.4 Guerneville. Turn right on Hwy. 116 to Jenner/Monte Rio.

101 Note yellow-flowered broom (shrub) here. An invasive weedy species from the Mediterranean.

103.1 Monte Rio. Bear right, staying on Hwy. 116.

109.5 Old-fashioned farm, wind sculpted trees.

111.3 Junction with Hwy. 1, "Shoreline Highway." Turn left over the Russian River.

The coastal bluffs here are a mosaic of North Coastal Scrub and Coastal Prairie. Coastal Scrub, also called Soft Chaparral, is dominated by Coyote Bush. Coastal Eriogonum, Seaside Daisy, Cow Parsnip, Ambrosia, and, of course, Poison Oak. The prairie is naturally bunch grasses but its composition (and the mosaic with the scrub) is highly influenced by grazing. Native bunchgrasses are often present but seldom dominant. Douglas iris and wild strawberries can be found in the prairie.

112.2 Goat Rock State Beach: turn off to the right. Drive along as far as you like before finding a place to stop (about mile 112.7) and take in the view and terrain: this stop is worth it for the view alone!

Notice that the coastline here is predominantly cliffs, illustrating the recent emergent nature of the California coast. In the hills to the east are old sea eroded terraces (not necessarily observable from here) produced at a time when the land was much lower relative to the sea. The Coast Ranges are rising Mountains as the Pacific Plate is Pushing hard against the North American. Not hard enough to initiate subduction, but hard enough to push up the Coast Range Mountains. These terraces are much more pronounced in Mendocino County. You may wish to continue down to Goat Rock Beach

to explore the beach communities there. What kinds of characteristics must organisms living here possess in order to cope with wave shock, shifting sands, etc.?

Alternatively, the isolated jumble of house-sized rocks about 400 meters out in the middle of the terrace to the left of the road at 112.7 has enigmatic polish that is argued to be the result of rubbing by Pleistocene big game that disappeared about 10,000 years ago, perhaps due to over-hunting by the first Californians. Go down and see what you think! One of the turnouts here as a well-beaten path through the costal scrub. Can you imagine that the polish is in positions where big animals would find it convenient to scratch themselves? Any other explanations for the polish seem seem plausible? On the way, watch out for the abundant Wild Iris and Wild Geraniums.

114.0 Goat Rock Beach.

115.7 Goat Rock State Beach entrance and Hwy. 1: continue south on Hwy. 1.

Have you noticed the pattern of cliffs (headlands) and beaches? On which side of the headlands are the beaches found? Is the pattern consistent, or does it change between sites? How might ocean currents and the transport of sand (longshore transport) be involved in producing the patterns you see?

121.9 Salmon Creek and beach.

Use the gravel pullout just past the paved parking lot on the west side of the road. Look for Sonoma 12.95 milemarker. Notice the accumulation of sand; what is the origin of the sand? What allows the sand to accumulate here while in other areas it forms such tiny beaches?

This is a good place to look for bathing birds, especially gulls and ducks. Why do you suppose that they choose this particular site for bathing, rather than, for instance, the open coast? Almost always the birds bathe in groups; why should this be the case?

123.6 Bodega Bay: turn right on East Shore Road (following directions for sign pointing to Bodega Head/Westside Park/Marinas).

124.0 turn right on to Bay Flat Road. Bodega Harbor.

This is Bodega Harbor, a protected area offering safe haven for boats and birds; in fact, this is one of the premier birding spots in northern California. Stop somewhere where you have a good view of the bay. Use your binoculars (or, better yet, a spotting scope) to scan the birds bobbing about, being especially alert for loons, grebes, and various waterfowl. If you have roped a good birder into coming on the trip, you may pass a lot of time here. Otherwise get a feel for the diversity of shorebirds and waterfowl and let it go at that. It would be best to stop and look from 2 or 3 different vantage points as position of the sun, reflections, etc. can greatly affect bird identification. At low tide, extensive mud flats are exposed here. Mud flats are very productive communities. Some production is local, for

example from algae that grow on the surface of the mud. More is extracted from the sea on each tidal cycle. The water offshore here is very productive because of upwelling bringing nutrients to the surface. The mud flat is filled with clams and worms that draw plankton rich water into some sort of filtering apparatus to extract their food from the water. Every tide brings in a new volume of plankton rich water. The organisms are buried in the mud for protection from predators. The abundance of birds feeding on the flats is testimony to the predation pressure out there. You may see clammers out on the flat with shovels trying to get at some of the big succulent clams buried in the mud.

Look for coastal salt marshes on the right side of the road. Coastal salt marshes are found in areas protected from strong wave action, such as in bays and estuaries, and are generally periodically flooded by higher than average high tides. The plants here are, of necessity, halophytes and most have notably succulent leaves: Pickleweed (Jaumea, in the sunflower family), and Sea Blite. An abundant species here is Salt Grass. Do you notice any zonation in the marsh? What might zonation result from?

Below the marsh are tidal mud flats, more frequently or continuously inundated by the tide. Essentially unvegetated (but for occasional surface films of diatoms and other algae), the flats are inhabited by a myriad of organisms including bent-nose clam, sea pen, moon snail, mudflat crab, and the fat innkeeper. Also, you will probably notice a large number of shorebirds feeding near the water's edge. The most abundant of these is the marbled godwit (garbled nitwit in birder's parlance) but several smaller species, especially western sandpiper, are also found here. What differences do you see in the lengths and shapes of the birds' bills? What might this suggest to you about the depth at which the various species take their prey and, hence, overlap in diet?

126.3 You will pass the UCD Bodega Marine Lab. Unfortunately, it is not possible to visit the lab without advance notice and a lot of hassle. They have too many sensitive experiments going on, and hate to have casual visitors tramping around. They have a great program of Spring and Summer courses if you’re interested in marine ecology.

127.0 Bay Flat Road now climbs up to the top of Bodega Head.

127.6 Take the fork to the left and follow it to a large parking lot looking back to the east.

Welcome to the Pacific Plate. Bodega Head is made of granite formed in southern California and moved a few hundred miles north on the west side of the San Andreas Fault. Across the bay is the North American Plate. The rocks are mostly uplifted marine sediments.

Recently (geologically) Bodega Head was an island. Two sand spits formed north and south to connect the island to the coast and create Bodega Harbor. The San Andreas Fault runs north-south right through Bodega Harbor.

Below the parking lot to the north is the abandoned excavation site for a once proposed PG&E nuclear reactor site. This is the overgrown area with a small pond at the bottom. In the 1960's conservation groups such as the Sierra Club were instrumental in preventing the construction of this reactor so close to the San Andreas Fault. It has taken only 50 years for plants to have almost completely reclaim what was once a raw construction site (but obscuring a nice exposure of the granite that makes up the Head).

Backtracking to the road you may want to take the other fork to the west. This ends in a small parking lot with a view west out over the Pacific. This is an excellent place from which to view California gray whales from November through March.

This is the end of the Main guided portion of your trip. On your return continue to observe what's around you and try to suggest factors causing the patterns in the communities you pass through.

Easiest Return Route

0.0 Re-zero your trip odometer as you return to Hwy 1 and turn south.

2.6 The communities here are coastal chaparral, often called soft chaparral. The plants are sages and other plants quite different from those in interior hard chaparral. Notice also the open grassland communities that are common along this route home. Aside from farmed valley bottoms, you will see a mosaic of Oak Woodland and open grassy communities during much of this return journey. Look for signs in the patterns you see that might give clues to what regulates this ecotone.

2.9 Look for wind damaged and wind sculpted trees about here. Aside from sheer wind strength damaging trees, the storm winds near the coast have a lot of salt in them from the spray thrown up by the surf. Trees and shrubs near the coast may suffer from salt damage as well as wind damage.

4.7 The spiny shrub with the yellow pea flowers here is European Gorse. If you find a safe place, pull over and smell the flowers. It looks like it is quite invasive here, but it is not naturalized over large areas as far as I know.

8.4 Stay on Hwy 1 at Valley Ford

10.1 Go straight as on Valley Ford Road as Hwy 1 turns right

14.0 The dairying industry is prominent in this country and has been for a long time. Note the Eucalyptus groves scattered in the grassland with no native trees. The Eucalyptus were planted many years ago when unscrupulous nurserymen touted their non-existent commercial value. They even make poorish firewood and it is not even worth anyone’s while to cut them for that. I wonder why they do so well here but the native oaks are absent.

18.2 Here and for the next few miles look for long low wooden buildings in various states of decay. These were chicken houses; the Petaluma area used to supply the San Francisco region with chicken and eggs from mom-and-pop chicken farms. Year by year these relicts collapse and disappear. After WWII this industry consolidated into huge factory operations. You'll see a modern operation at mile **18.5.** Look for a much larger low steel barn.

18.4 bear left

Go straight through Petaluma first on Bodega Ave, which turns into Washington Avenue as you bend slightly to the left in the middle of town.

29.9 Washington Ts on Old Adobe Road in the eastern outskirts of Petaluma. Turn right.

31.3 The Old Adobe, a state historical park. Worth a visit if you have time.

31.7 Another T junction. Turn left, following Old Adobe Road.

33.9 Notice Oak Woodland on the ridges to the left. What might keep them from moving down into the grassland?

35.0 Bear left, joining Hwy 116 (Petaluma Rd.) headed toward Sonoma.

35.6 Interesting that trees are growing in the gulches ahead while the tops of the hills are grassy. Pieces of the puzzle here about what regulates the grassland-oak ecotone.

38.1 Follow Hwy 116 right at this junction, away from Sonoma. (Sonoma is worth a visit but probably not today!)

39.9 Turn left onto Carneros Highway (Hwy 121). This road takes you through the Carneros wine appellation. This district gets just enough extra marine influence to grow the best Chardonnay and Pinot Noir grapes, varieties that like cooler temperatures than most wine grapes.

40.9 Pass up another opportunity to go to Sonoma here and keep heading east.

44.0 Straight thru this intersection. **You are now on Hwy 12 and 121**

44.2 Look for old dry stone walling in this area. Much informal stone walling was used for fences in the Napa area in the 19th Century. Said to have been made by gangs of Chinese workers.

49.2 Turn right on Hwy 12 east, passing up a change to go to Napa.

53.1 Turn left on Jameson Canyon Road.

58.8 Cross over I-80 following signs to Sacramento onramp.

If you are making a two-day trip of this one, you can take Rt. 1 all the way down to Pt. Reyes National Seashore, where you'll be able to find an impressive variety of estuaries, lagoons, and, of course, the world-famous lighthouse; the fastest return would be via Sir Francis Drake Blvd., which you pick up in Olema and take all the way to San Rafael, where you pick up U.S. 101 north, then to Rt. 37 in Novato and on to I-80 in Vallejo.

Alternatively, if the road trip bug bites you really good you can go north up Hwy 1 past Jenner and take any number of interesting back roads home. Our own Russell Blvd (Highway 128) eventually comes out to the coast at the Navarro River 80 miles or so up Hwy 1 from Bodega, just south of the charming if a bit too charming, tourist town of Mendocino. Look for Orr Springs Road up that way. It passes through Montgomery Redwoods State Park. The tallest extant Redwood lives in the forgotten little park (the top broke out of the former record holder in a famous park up the Redwood Highway). Orr Spring Resort is itself a trip. Any one of a dozen routes home you can pick out on the map through this country is full of natural history interest. I've never had a dull ride!

Notice how you are crossing the grain of the country on your way home on any of these routes. These roads wind up to the top of a ridge then drop into a valley and repeat the same. The major roads in this region like Hwy 101 follow the grain, sticking to the long straight valleys NW-SE trending valleys and going over mountains only when necessary to find another long valley. Even so a four lane divided highway is expensive to build and maintain in this rapidly eroding terrain, build of soft rocks and being sheared to pieces by the San Andreas fault and all the lesser faults that parallel it. (Movement on the main San Andreas transform fault is dragging blocks of rock in the Coast Range with it, so that many faults approximately parallel to the San Andreas slice the country up so that NW-SE is with the grain and travel at right angles to the trend of the valleys and ridges is across the grain.) Roads across the grain are really hard to build and maintain, and even fairly major destinations like Lake County are only served by 2 lane roads. This leaves NW California full of forgotten villages and nearly unpopulated country. Naturalists love the cross-grain roads!

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