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Date: 10 July, 2014

To: Philippe Cohen,
Executive Director, Jasper Ridge Biological Preserve
Nona Chiariello
Research Coordinator, Jasper Ridge Biological Preserve

From: Mark Vande Pol,
Co-Owner, The Wildergarten

Re: Impressions of Jasper Ridge Biological Preserve, 13 June, 2014

Attachments:

Hi Nona & Philipe,

These notes comprise my impressions upon visiting Jasper Ridge as well as attendant suggestions for further research and development. For the purpose of perspective, besides decades of detailed weed management on our property I have also visited many grassland types of the American West as escorted by various local range management experts of long acquaintance. I have visited the 205,000-acre Deseret Land & Livestock Co. Ranch in Woodruff, UT, conducted a grass transect across Nevada along US Highway 50, and composed a photo series of cheat grass invading native vegetation in the Hamilton Range of Nevada later used by a professor of t Utah State University in a lawsuit. I have also studied the diaries of Crespi (2), Fages (2), Costansó, and Font and the voyages of Vila, Drake, and Cabrillo, along with enough archaeological papers (particularly on the Quiroste) and anthropology texts to render those aspects of the site history of Jasper Ridge by Bocek and Reese familiar. I have occasional discussions with the archaeologists of this area, some of whom are pleased to have learned what I have to say about native plant behavior as a way to identify relics of aboriginal agriculture and to characterize successional processes such that we can get a better idea of protohistorical conditions and the consequences of the Spanish ban on aboriginal burning.

What the compiled Spanish record has to say about the area containing Jasper Ridge is particularly interesting, in that it suggests a reason why there were so many settlements along San Francisquito Creek with so few to the northwest along the San Andreas Valley. Once the likely cause is understood, the differences between those two areas in the character of the vegetation at that time become reliably predictable. Needless to say, those differences have a lot to do with how Jasper Ridge and its surroundings appear today and suggest reasons for its response to its policy of site preservation.

Most of the native plant species found at Jasper Ridge are the same as or are closely related to ours (other than the serpentine and riparian areas we do not have). They are however configured very

differently. Jasper's plant communities are each on a far larger scale than ours, primarily because the geology and topography are *very* different from our property. The harder underlying rock render the drainages at Jasper much less incised than are found here with slopes that are also more gradual. Solar exposures at Jasper are therefore much more uniform across the landscape, with each slope and therefore vegetative type covering much larger areas than are found here. This configuration at Jasper is much more conducive to multivariable factorial arrays than here at the Wildergarten simply because there are homogeneous plant communities that cover areas sufficient to allow more room for separation of treatments sufficiently so as to avoid confounding the consequent observations with edge effects. Needless to say, with its affiliation with Stanford, it is the ideal laboratory for scientific study of how that system responds to various treatments of which I saw virtually no evidence.

Because of those lower slopes, precipitation at Jasper has more opportunity to infiltrate and percolate than here. The site is also much farther below the crest of a ridge than ours, therefore fed by more groundwater, multiple creeks, and Searsville Lake. The climate is more subject to marine influences, and the soils have far more clay than does our powdery sandstone. Jasper has adequate trace minerals, where ours were stripped when the place was terraced for an apple orchard, not to mention the resulting topsoil erosion due to the average slopes already present. Summer temperatures at Jasper Ridge are typically about 2-5°C cooler than ours, as our elevations traverse the usual altitude of the marine inversion off Monterey Bay. Jasper being along I-280 gets more anthropogenic nitrogen deposition than we do here over a mile from (much smaller) State Highway 17. Both Jasper and the Wildergarten are upwind of those respective roads during most rain events, which are probably more frequent at Jasper being 30 miles to the north, albeit less intense, due to lower elevation and rain shadowing of the proximate ridges. It is here that I come to the reason why I have been discussing these hydrological differences between the Wildergarten and Jasper Ridge.

Despite these many hydrological advantages at Jasper Ridge, the overwhelming and continuing impression I had was how **dry** so much of it is compared to the Wildergarten. **Everyone** in our family noticed it. The degree of difference surprised me so much that I said nothing about it when you asked what I thought as I had to go home and take a walk around the property to be sure I wasn't letting my recollection over the last few weeks skew my impressions at that moment. There was no mistake: most of our native perennial grasses are quite a bit greener a week after the visit during which temperatures reached over 100°F, while the grasses at Jasper Ridge were clearly already dormant. Two weeks later (6/28) I went out and took some photos to show that difference (attached). I didn't have to go looking either; I just walked out the front door and started shooting. Our grass still shows some green in both sun and shade, and is re-sprouting even where I harvested it three weeks ago. In places, I still have Bromus carinatus still putting out new green seed, which I did not see *anywhere* at Jasper Ridge (with but one important exception that will illustrate a point yet to be made). Our *Mimulus* and *Eriophyllum* bloomed brightly, while the same species at Jasper were drying out. This may be only a difference of a few weeks in terms of the season, but I don't think so. Our brome grasses survived that long dry spell between last April and this February. They were 6-8" tall and bright green on February 2nd when the rains started while everywhere else in the area the grasses were dead and dry (I have photos). So this may really be a systematic difference, but I cannot know for certain of the degree without more extensive observations than the two hours we had at Jasper.

On the other hand, being a lifelong resident of the Bay Area used to oats and star thistle, I saw far more perennial grasses at Jasper Ridge than I expected. Some of the denser stands of *Stipa lepida* looked OK, but most did not. I was surprised to see no *Calamagrostis rubescens*, very little *Melica* of any kind, and a distinct lack of sedges as we have large patches of them here. But please, please, please do get rid of the Harding grass and *Ehrharta* before they spread any farther or you *will* regret it!!! You can characterize the progress of those disasters just as easily on Mid-Pen land.

I had been warned prior to my visit to expect the serpentine ridge to be more degraded than it appeared to me, although I am unfamiliar with that geology, having upon only one other occasion visited another serpentine grassland in Redwood Regional Park (as the personal guest of David Amme and Jim Hanson of the California Native Grasslands Association). Certainly Jasper's serpentine ridge did look like it was crying for disturbance, but in terms of species distribution and what little I could observe of soil organic matter, it was far better than I expected (although I didn't recognize the dominant herbaceous groundcover, now gone to seed). The site was severely lacking in diversity compared to native landscapes here. I was also surprised to see so much of that *Elymus* hybrid, given how dry it has been this year, yet because of the heat immediately after the rains, our *Elymus* grasses reached considerable size as well (some of our *E. glaucus* reaching 2m). I was interested to see that the Elymus hybrid had gone dormant before dropping its seed as this is not what I see *Elymus glaucus* do here. There was very little *V. microstachys* as I had expected. I do not allow *V. microstachys* here as it is so allelopathic that it inhibits exotic germination whilst I am trying to cleanse the exotic seed bank. It is also so difficult to distinguish V. microstachys from exotic *Vulpia* species in its vegetative state, that allowing it to spread here is an extreme hazard I will not attempt until I have the time for that.

There was one place on the serpentine ridge which looked like it had significant annual disturbance and in that one spot the grass was green and lush (the exception to which I referred earlier). It was a very soft swale at the head of a seasonal drainage fed by a substantial collection area. So it is reasonable to assume that it remained muddy later in the season than the surroundings, perhaps even functioning as an ephemeral pool. There was evidence of hoof and rodent disturbance everywhere, with indication that they were after the plentiful annual forbs in that spot (although they were so intensely browsed I could not tell what they were). The organic content was high and the grasses bright green in full sun. All good but for the seemingly desperate intensity of the herbivory. I guess they must be hungry. I wish I had seen more such disturbance while we were there.

Woodland

In general, Jasper oak woodlands have much more groundcover under heavy tree cover than the Wildergarten. At first, I wondered about that, attributing to differences in soil, but upon reflection I realized that the likely cause was Jasper's predominantly deciduous *Q. lobata* compared to our much more prevalent evergreen *Q. agrifolia* and *Q. wislizenii* (or *Q. shrevei* depending upon whom one asks). We do have Q. lobata and kellogii here albeit very sparsely. I suspect the distinction between the dominance of evergreen versus deciduous oaks might have an anthropogenic origin as the local tribes did prefer to harvest the deciduous oaks for acorns (including *Q kellogii*). There would seem to be an ancillary benefit to deciduous oaks in they allow both considerably more winter sun and possibly more mulch that certainly decomposes more rapidly, and a somewhat less dense summer canopy allowing

more filtered light to the perennial groundcovers, particularly that luxurious patch of *Eurybia radulina* I saw. Most of the denser native assemblages under the oak canopy also look like they have resisted exotic infestation for reasons I cannot fathom, but usually only under partial shade.

Unlike Jasper, we have oak seedlings virtually everywhere, in places equivalent to 18,000 stems per acre (I have photos) to the point that they were displacing our native groundcovers almost completely. We used to have less of a problem with oak seedlings back when we had more deer in the early 1990s. Hence, part of that difference may be attributable to reduced herbivory due to our now heavy population of coyotes, bobcats, mountain lions, and perhaps the pigs in the next watershed (pigs are known to predate does in labor and their young fawns). As you obviously know well, our problem with overpopulated oak seedlings is in stark contrast to Jasper Ridge. I noted the herbivory experiment to that effect, and might I suggest the experimenter wrap those 6X6 welded-wire fabric (WWF) cages with 2X2 chicken wire, to be more certain to inhibit the persistence of deer and rabbits seeking summer browse, a depressing reality for many a home gardener. Stake them in better too.

Not surprisingly, many post-disturbance plants familiar to me were found along the footpath because they need the bare soil in order to germinate being otherwise uncompetitive with grasses and shrubs. I certainly noted the abundant *Navarretia heterodoxa* and what looked like *Madia exigua* but the latter certainly did not smell like our *M. exigua* when bruised! Which brings me to an important observation related to our walk with docent, Tom Malloy.

I am sure you understand how "hands on" I must be to have achieved 99.6% native grassland transects (including tiny forbs). After getting rid of at least 12 acres of French broom that had been established for decades and achieving 20 eradications with 45 more pending, my problem was an initial paucity of native plants with which to vegetate. I propagated and planted native shrubs, grasses, and herbs almost all of which were collected locally (*Scuttelaria tuberosa, Deschampsia caespitosa*, and *Festuca californica* (both grasses are recent entrants) this last winter, *Monardella villosa, Danthonia californica* (another recent entrant), and *Wyethia helenioides*, and the two *Castilleja* species found here are in process). Being familiar with the horticulture, I know for a fact that many native shrubs respond well to tipping, or coppicing in a manner similar to animal herbivory or fire. What I did not know was that touching anything at Jasper Ridge is virtually verboten. Tom, on the other hand has been taught that even touching a plant is a forbidden act, this despite the absolute fact that so many are dependent upon disturbance and were found in this area after millennia of ethno-agricultural harvest. Tom is a local resident. I want him and his neighbors to grow this stuff, effectively to enlarge and intensify the value of the plants at Jasper Ridge to wildlife at all levels. So, imagine his consternation when I'm teaching him the value of using those plants as herbs for cooking, plucking the tips of leaves here and there saying, "Here, smell this! This is… it makes a wonderful herb on…" I guess I'd never make a good docent at Jasper Ridge, because I'd be teaching everybody about these wonderful plants in food. And if you haven't had *Artemisia douglasiana* on chicken, you've really missed something.

Ethnobotany is a huge opportunity to construct a truly native California haute cuisine. Indeed, adding native foods to the human diet might do a great deal to reduce this area's rather notable allergy problems (oaks of all types and *A. douglasiana* being very common allergens). Such would put market value into growing native herbs and would therefore get people more interested in learning how to

cultivate them therewith showing obvious benefits to local insect life. You could raise money selling seed the way the arboretum does in Oakland and teach classes in native food preparation online. Of course, there would have to be food safety studies for the FDA and USDA… and now we know why we don't see much in the way of local foods on the market despite a human clinical trial of some 10,000 years! Maybe that's because it's good for the allergy drug business? Yes indeed. Sadly, ALL of the decoctions used for allergy testing in this area come from the east coast (yes, they are testing people experiencing allergies here with allergens from sources not found in this area). Too bad that work isn't done here, isn't it?

Jasper Ridge being in such close proximity to Stanford Medical Center is perfectly situated to do amazing work to help humans adapt immunologically to a local ecosystem. Given how mobile people are on this planet, one would think somebody was working on that in a big way, but no, they're working on selling *treatments* for the immune diseases that mobility likely aggravates! It is a symptom of how badly we have lost contact with that which surrounds us and a philosophy with a long history of tragic consequences.

Consider that "don't touch" philosophy as carried to the extreme. It is as if we decided that the only way for the planet to heal would be if the entire human species should be exterminated. While there certainly are deep ecologists who think that way (such as the Voluntary Human Extinction Movement), the idea that "Nature" can recover from anything only if we stop doing anything is a logical absurdity: It would then not matter at all how destructive we were *before* pulling the plug! Unfortunately, that philosophy underlies policy on a global scale with its foundations in international law. Yet it arises historically from the same misperception that made it so easy for Europeans to discount 10,000 years of aboriginal management of the landscape, hiding what some call racism beneath an intellectual façade about "the New World," or "the empty continent," that wasn't.

This cuts directly to the fundamental question of what it is going to take to fix the mess we have made of the anthropogenic landscape our European forebears confiscated 240 years ago. The system was inarguably habituated to the Indian management regime. Today, the tribes are gone. Nobody, including their few descendants, knows how they managed those plants and animals in detail. We know even less about whether that process was even close to optimal (it certainly wasn't insofar as the 33 large-bodied animal species they extirpated were concerned!). Yet pursuant to what they did, to expect reversibility belies the entire premise of evolutionary adaptation (never mind the second law of thermodynamics). Moreover, nobody intends to replicate the aboriginal diet today or go back to burning whole landscapes annually. This of course means that we will not harvest those plants in a fashion similar to the way they were habituated.

Yet we still have a fundamental responsibility to learn how to keep these post disturbance systems going, if only for the life systems in soil that depend upon them; else their dormant seed will eventually lose viability (if it hasn't already) and we will have locally adapted varieties (if not whole species) going extinct all around us sight unseen. This is my most intense concern in what I see of the 'leave it alone' philosophy so common today.

It sounds like a research opportunity to me. For example, we need to learn how to manage herbivory such that we mitigate the need to replicate the effects of historic anthropogenic harvesting, else

successional processes take over in ways that I am certain Native Americans would never have tolerated (I have documented examples). To my mind, the faddish emphasis on large predators we see today is in that regard a huge mistake (but then, I have mountains of evidence suggesting that environmental health and restoration is only peripherally related to the true objectives of that policy anyway, if at all).

As I see it, Jasper Ridge Biological Preserve is governed by the premise that it is possible to "preserve" any such system as isolated from external anthropogenic influences and that however "Nature" adapts must produce the best likely outcomes. The influences will be there no matter what, as you saw with *Dittrichia graveolens*. Some, such as increased carbon dioxide and atmospheric nitrates abetting vegetative growth, are powerful. There is no getting away from them. The point is to learn ***how*** to adapt to changing boundary conditions. Leaving it alone only provides but one experimental field that is being done in various ways almost everywhere there isn't development. Why dedicate the entire preserve to that one experimental field when in reality there is no such thing as a pure experimental control in an outdoor wildland setting? Even if all that is done is to monitor the outcome, Heisenberg's uncertainty principle will surely inflict its inexorable ironies.

The larger is the area of study and the more subtle are the distinctions being examined the more important become the need for precision of sample measurements. Yet with precision comes a much higher cost of measurement, which then constrains the area of study. The larger the area of study, the more obvious it becomes that the magnitude of background variation will exceed the tolerances in the measurements (which argues for bigger scale and more replicates with less analytical precision). Said another way, the more detailed and precise is our study, the less applicable the findings become because everything is subject to external variation. This is why engineers routinely define control boundaries with the understanding that such bears the considerable risk of error in negating a negligible or combinatorial factor of considerable import. This is why in manufacturing we did our factorial arrays with considerable sample sizes but also with very coarse measurement gradients. What is needed is to increase the number of trials and the rate and types of disturbance by which to characterize system responses to discontinuities (in the systems engineering sense). This is not what I usually see in the practice of academic studies in life sciences.

As I see Jasper Ridge, it is uniquely situated to become the laboratory to take the lead in coordinating experiments in isolated locations across the entire region, with the specific goal of developing an array of new measurement technologies. This of course dovetails with Stanford's entrepreneurial culture perfectly. So here I will go into a flight of fancy in listing but a few of the ideas that occurred to me as I walked the Jasper landscape. I know that you are probably legally or politically prohibited from trying many of them (at least for now), but I think you'll find the context illustrative. Having authored a monstrous book about the politics and economics of environmental regulation almost fifteen years ago (and owning a patent that could be cited as prior art to invalidate carbon trading royalty payments to Fannie Mae), I am well aware of how impossible it is to satisfy the range of competing political claims on the use of resources, particularly those that involve mobile commons such as air, water, or anadromous fish. So these ideas are merely to provide my reaction to what I saw from engineering and biological perspectives in light of Jasper's potential as a process and product development laboratory.

Searsville Dam

Dams are a controversial topic worldwide and the calls for their removal are ubiquitous. Conversely, there is a type of dam about which there is little argument regarding its many benefits: beaver dams. The trapping of beaver and resulting loss of beaver dams induced serious hydrological damage to watersheds across the Western US. Beaver dam removal was a primary cause of desertification in the Gila River watershed in Arizona, exacerbating flash flooding and reducing infiltration into the upland substrate which had theretofore functioned as volumetric storage. Yet beaver dams are no friend of development for precisely the same reason, having this nasty way of failing unpredictably with cascading debris flows wrecking havoc downstream.

Searsville Dam would be perfect for studying the hydrology of using beaver dams to induce upland groundwater storage that could then be tapped for the irrigation purposes to which Searsville Lake was historically dedicated (consider how attractive to grants that 3-D exercise in hydraulic modeling might be). Collecting that groundwater for irrigation in a low-cost, low-impact, and low-energy fashion would be a serious engineering challenge. Should the upland beaver dams blow in a storm, Searsville Dam is there to absorb the debris flow. One would therefore need to develop accurate, reliable, and low cost means to manage the capacity of the Lake such that it could absorb transient inputs during high water events. Yes, the lake is silting up, and therein lies another opportunity. A dredge powered by the fall of water over the dam could be designed to emulate the incoming pre-existing bedload. It would be a very tricky engineering challenge to make it as rugged, capable, and simple as possible involving materials to withstand that much abrasive slurry but believe me, that technology would be greatly appreciated, worldwide, every bit as much as better fish conveyances. With beaver dams upstream, the steady state bedload would be lower anyway.

Added environmental benefits of beaver dams would be increased riparian habitat, more food for wildlife, a niche for what may have been a pre-colonial resident of the watershed, and increased disturbance among the stands of trees, shrubs, and forbs immediately surrounding their ponds, thus supplying more food to insects, birds, and animals. There would also be more distributed water available for fighting wildfires albeit extracting it in a rapid fashion would be yet another challenge. You should see what returning beavers did for Deseret Ranch and what their loss due to mismanagement has meant for Yellowstone National Park. I have repeat photographs of the latter too.

The San Francisquito Creek Riparian Area

Of all parts of the Preserve, this was the most alien to me. I was really looking forward to investigating the silt pile along Corte Madera Creek but it was so overgrown as to make such observations from the walking path completely useless. I really liked seeing all the *Ribes menziesii* and what was strange to me is that it more resembled cultivars I have seen from Santa Barbara than it does the variety most local to us which took me some five to seven years to find a living remnant (the distinction being the size and density of the thorns). So that part of the visit was a bust. I'd really like to come back and explore off the path if it would be allowed. I promise: I will clean my shoes both in and definitely on the way out, I'm not looking forward to seeing the damage *Delairea odorata* is likely doing to Jasper at the Wildergarten. Seed in the welts and tongues of modern shoes or in the cleats of muddy boots are a big problem. Better designs and possibly compatible equipment are definitely a major need.

Successional behavior

Most transitions at Jasper Ridge between grasslands and chaparral were stable and hard edged. We saw only one place in which brush was rapidly invading a grassland, unlike what I see most everywhere here. Here, there is a repeated pattern to chaparral invasions here: *Eriodictyon*, *Mimulus* and *Baccharis*, followed by poison oak, blackberry, *Lonicera*, and elderberry, and then quickly oak, madrone, and fir trees. I have seen Stipa meadows here go to brush in three years with the Stipa remaining in the understory. So this appearance of stability at Jasper was unusual to me. On the other hand, when we bought our property our chaparral had long succeeded to impacted oak/madrone woodland, then infested with broom. My guess is that exotic annual grasses play a powerful role in maintaining that edge stability of the chaparral at Jasper Ridge. I did not see a single area in which chaparral was transitional, lush and growing well with a varied understory. Instead it was almost all loaded with dry fuel and bare on the ground with very low biodiversity. Under those circumstances, needless to say, it is an extreme fire hazard. More importantly, we all know that in some respects it needs to burn, but we aren't crazy about the violence of the process or what it will mean to the neighbors, most of whom have a lot to lose.

As was mentioned earlier, the large scale of these stands offers considerable opportunity to play with them. The good news is that whacking *Adenostoma*, *Ribes*, or *Heteromeles* to the ground will usually engender a positive response. Things aren't so predictable with *Arctostaphylos*, *Salvia*, or *Artemisia* although I have done it successfully. *Ceanothus* doesn't like it, but does come back from seed.

There are three tools available to manage this type of vegetation: Animal browsing, mechanical treatment, and fire. Given the fuel load, just lighting it on fire is obviously hazardous while mechanical treatment is both prohibitively expensive and likely to precipitate an insurrection (just imagine the reaction to a D-6 pulling a cultivator through chaparral at Jasper Ridge!!!). That leaves grazing and browsing which I will address briefly here.

In several parts of the Bocek & Reese site history, I noted an antipathy to grazing, particularly in the serpentine grasslands. In every instance, grazing was regarded as a bifurcated choice: grazing or none. This type of metric demonstrates a decision basis that is hopelessly ignorant about grazing (especially because both Crespi (1769) and Fages (1770) did note elk in the San Andreas Valley). Like any tool, grazing can be used well or badly. Sadly, most (but not all) ranchers in this state prefer the latter: They put their cows in a field and wait until they eat everything before taking them off, which is probably what was done at Jasper Ridge. Although *Avena spp*. are nutritious, as just about everybody has noticed this type of grazing has been disastrous to the native perennial grass systems that once dominated this landscape. Fortunately, this is not the most productive way to manage grazing. Proper grazing of perennial grasses emulates the way animals behaved under the conditions in which those grasslands developed facing predatory pressure, and what do you know but the diaries of Crespi, Fages, Costansó, and Font ALL noted that grazers were tightly bunched into herds even during rutting season, thus indicating the expectation of predatory pressure.

In the case of coastal California, predatory pressure on grazers came not only from Indian hunting but grizzlies, mountain lions, and canids. Interestingly, there is not one mention in the diaries of Crespi, Fages, Costansó, and Font of the tribes of this area offering the Spanish *any* meat, this despite the

Indians doing everything they could to entice the Spanish to visit their villages. The latter observation is curious given archaeological indications that aboriginal animal consumption moved to higher ranks in the protohistorical period after Cabrillo but before Portola. Yet *unlike* most of the rest of North America, early explorers to coastal California noted large herds of animals! Why?

In most of the rest of North America, humans were the unchallenged apex predator. The reason is very simple and equally profound: When and where bears hibernate, they are easy for an Indian to kill, just walk on into the den and stick them, lots. Grizzlies didn't hibernate in coastal California. That made them not easy to kill. This would present an extreme danger to people armed with bows, arrows, and spears, making solitary hunting very dangerous and the use of fire with large hunting parties critical to hunting success. Areas dominated by bears may have created spatial refugia for grazing animals, of which the San Andreas Valley was apparently one. According to multiple Spanish accounts there were "many" large bears in that valley with dense vegetation, uncharacteristic of places Indians burned with frequency.

Locally, the San Andreas Valley does possess unusual properties. The geological configuration of that valley would assure that it had deep soils, moderate temperatures sheltered from salt and wind, and summer water, together ideal for cultivation. In other words, the San Andreas Valley would be ideal for human habitation. Yet note that the map of tribal boundaries (attached) shows the area of the San Andreas Valley between San Francisquito and San Mateo creeks as unclaimed. Map 5 on page 16 of Bocek and Reese (attached) also shows relatively few archaeological sites. Pedro Font's diary described the valley as thick with vegetation, unlike the areas surrounding tribal villages which were burned bare. My guess is that the bottom of the valley was possibly a former lakebed, was probably wet enough to be difficult to burn, with high ridges on both sides leaking water all summer long, thus serving as moist refugia large enough to provide shelter to game from Indian hunting fires.

The damage done by European crowd diseases during the protohistorical period may have resulted in a respite in which both ungulate and bear numbers might have increased, as is surely the case from the beginning of the missionary period into the mid 19th Century. Several Spanish diaries described bear tracks and scat within close distances to the villages all the way down to the Bay, the bears showing evident lack of fear about people unless they were in larger numbers. I am told by the State Parks archaeologist Mark Hylkema that they have found multiple human remains with evidence of grizzly teeth marks thereon. In every instance in which the Spanish killed a bear, the Indians were *very* pleased about it, which might explain why the tribes were so eager to entertain the visitors. The news surely traveled faster than the Spanish did.

Such an uneasy coexistence between bears and people as competing apex predators, each within their own niche, would likely have a profound effect upon the distribution of both animals and vegetation. The Spanish accounts describe areas around the villages as burned clean, while the areas in between villages supported "lush" (moist) vegetation. My guess is that these areas supporting lush vegetation were burned only when the brush could carry a hunting fire, which explains why the fire scar data do not comport with other observations suggesting more frequent burning (the distinction of point and composite fire frequency rarely acknowledged, but that is another problem). Annual burning around the village stimulated post-disturbance forbs the tribes grew for seed and maintained a defensible

perimeter. Yet it also reduced late-season water competition and increased riparian flows, thus possibly multiplying similar marshy refugia.

With this hypothesis, one can read these diaries and predict where the observations of herds and bears will be made as relates to the character of the local hydrology. It is that repeatable and (not surprisingly) bear territory was also where shrubs, trees, and herds were described nearby. The "bunched" herds were obviously under predatory pressure, probably not so much by Indians as by animal predators. This kept the animals moving continuously so that they take but a bite or two out of a grass and move on to be followed by a rest time of up to two years. This fits the classic type of grazing that favors perennial grass development as best managed by a migratory people moving their animals on a seasonal basis as opposed to unregulated predation, as the people of Idaho are currently learning the hard way.

Unfortunately, historic road design has wrecked most prospects of emulating migratory grazing loops in California, albeit CalTrans does have plans for "connecting corridors" (I doubt what they have in mind concurs with my thinking). So until those infrastructure projects are completed, that migratory system must be approximated with pulsed or rotational grazing and browsing, with rest times that I would guess should be between 1-3 years depending upon the vegetative type. Yes, I know how unlikely that is at Jasper Ridge, but given what I have seen of the successes of this type of program, and particularly at Deseret Ranch, it had to be said (and if you haven't seen it you should). The opportunities at Jasper are so many yet are so likely to remain unrealized because of what I regard as a cultural paradigm accepted without recognition of its origins or historic effects.

Annual Grasslands and Post Disturbance Forbs

One of the things we learned here at the Wildergarten was that it had been so long since native post-disturbance forbs and grasses had seeded here that their viability in the seed bank had long been exhausted. Jasper has the opportunity to characterize that problem with little consequence given that so much of its grasslands have been similarly infested with exotics for so long. I believe that we have a lot to learn about how seed dormancy is maintained in what is effectively an array of highly varied and possibly specific bacterial microsystems. For example, I have seen grass seed remain viable in soil here for at least 25 years while that same type of seed goes bad in a storage bag in but two to three. I suspect that there are multiple bacteria species that live within the seed coat that help maintain seed viability and possibly play an important role in the various mechanisms by which dormancy is broken, whether cold stratification, fire, spring temperature gradients, or in processing hormonal signals from adjacent plants. I suspect that relatively little is known about this ecology and that learning more about it may improve the sustainability of viable seed worldwide (to use "The S-word" properly, for once).

Given that most of the grasslands at the Preserve are so trashed, such experiments can be conducted in those areas with little adverse consequence. As there are oats and star thistle right outside the fence, one could effectively enlarge the preserve, motivating more experimentation within the perimeter out of the realization that there is so much land lying similarly neglected outside the fence (such as on the far side of SLAC, the area around the Dish, or down at the Arastradero Preserve). I don't think one would have any problem accessing those lands to monitor what happens as controls. That way, one could enlarge the acreage available for study of the response to variation without spending a dime.

Decadent Chaparral

One can trim and rejuvenate brush with browsers. Unfortunately, deer are picky eaters compared to the antelope that once shared these mountains with deer and elk (particularly in the seams between tribes and within "bear zones" as I've deemed them). Yet if you were to attempt to use pronghorn to replicate the original patterns of animal browsing at Jasper Ridge, it might be difficult to contain them and there would be big liability problems if they escaped. Fortunately, the diet of goats consisting of brush and forbs is analogous to antelope, goats being much more controllable. Wouldn't it be interesting to learn to use goats to emulate antelope or as a way to test for the efficacy of reintroduction elsewhere? Unfortunately, even Jasper Ridge is probably too small for elk. Yet cattle can be used to emulate elk which actually has been done before (elk would wreck havoc on experimental instrumentation, electric fences or not).

Yet besides the need for enough land to avoid overgrazing and provide adequate rest intervals, the big problem with using grazers at Jasper Ridge (besides the politics) is that it has areas that are relatively free of exotics and others that are thoroughly contaminated. How does one get those animals sufficiently clean that they can move from place to place economically without contaminating the landscape? Well, that is the big problem with animal weed control and it has not been solved. So, who is capable of solving that nasty problem? Think dormancy, seed viability, bacteria, intestinal flora, microbiology… all with the need for containment. Sounds like a technical opportunity to me.

Virtually all herbivores browsing brush need other vegetation to provide carbohydrates to facilitate processing toxins. How much of these various types of *native* vegetation can browsing herbivores stand without injury (one would best stick to wethers under the circumstances)? Further, skilled animal handlers with detailed knowledge of local flora are virtually impossible to find; it takes a botanist's knowledge of what is native, not, rare, toxic, or in need of special management. For example, some species such as *Heteromeles arbitufolia* do just find being cut to the ground while others, such as *Salvia mellifera* can only be tipped off.

How does one keep the animals out of protected areas? Although electric fences are simple and cheap, they must be moved. Who is going to develop a solar-powered walking robotic fence, complete with the technology to deal with obstructions so that it won't short out or get tangled? I have dreamed of building equipment like this to graze freeway medians for over a decade. That is a serious image processing challenge. Who could do that?

One way to process excess biomass such as we have here at the Wildergarten has been to convert it to granulated charcoal. I believe that there is potentially an enormous market for that charcoal. I am hypothesizing that it will capture atmospheric deposition of trace minerals and retain soil ions for exchange with plants, thus replacing clays that we lose to erosion every year. High temperature charcoal is so hydrophilic, that I suspect it would infiltrate liquid water into soil peds without losing it so easily to gas diffusion. I suspect the function is analogous to a check valve for storing soil water, thus remaining attractive to mycorrhizal hyphae by which to extract that stored moisture directly to plants. If that latter hypothesis is true, then if by the addition of charcoal we could reduce agricultural percolation losses in this state by but 5%, it would increase the amount of water available for ecological, industrial, and residential use by 20%. It also stands to reduce salt accumulation rates in agricultural soils, which

would have benefits worldwide. It would also retain agricultural pesticides for microbial decomposition rather than allowing them to sink into groundwater... This is not a small matter.

So far, I have found that simply spreading charcoal on our land without even tilling it in does have benefits to soil. It seems to sequester dew more efficiently than bare soil, to which our grasslands have responded positively. As a result, soils with charcoal are easier to weed without breaking a tap root (consider with all the weeds I pull the number of sample tests behind that observation!). So far, I have made about 25 cubic meters of processed charcoal, with another twenty to come in the next couple of years, although I doubt its economic value purely as a mitigation for anthropogenic atmospheric carbon dioxide water conservation may be another matter entirely.

There are a number of technologies needed to make conversion of biomass to charcoal more feasible, cleaner, and less hazardous, from better chippers or splitters to portable pyrolizers and dust free charcoal grinders and spreaders. Charcoal being both abrasive, dusty, and prone to packing, none of these machines is a trivial thing to develop. Yet the needs vary from simple tools to massive systems, too many to describe here. One would start with simple to justify financing the massive.

Most important however, is that the more remote becomes the place requiring restoration and maintenance, the greater become the many needs for portable habitation for the people doing the animal management, equipment service, data gathering, site analysis, and material processing and research, not to mention, WEEDING. This high-tech infrastructure for such 21st century nomadic communities does not exist, whereas automation worldwide is increasing an available labor pool in search of work. Restoration is a type of work to which this engineer says automation is terribly unsuited. Energy generation and distribution, water recycling, waste processing, growing containerized food, predator deterrence… all of it would have to be portable, low impact, and capable of transiting and surviving rugged terrain 24-7, self-sustaining for months at a time (imagine a building mounted on a "snail" with shredded tires in the bag). Such are non-trivial technologies to develop, perhaps requiring decades to refine.

Isn't that cool!

The Chase

Native habitat is more productive for wildlife (especially insects), has greater biodiversity, and provides important materials and chemistries to offset or mitigate the impacts of sedentary civilization worldwide. Restoring distributed samples of the native plant systems with which to retain the genetics to remain capable of restoring their surroundings is a goal worthy of any educational institution committed to the long term health of the planet, especially an 'out of the box' place like Stanford. Yet paradoxically, no, **tragically,** the principle-thing that stands in the way is the ideological box within which Stanford has imprisoned itself. The resources, talent, and desire to do research to bring about those results do exist, indeed; they are innate, but as yet they go relatively unused. Why?

This idea of "Nature," defined as self-optimizing and best kept separate from people, forms the walls of that box. It is a modern, urban, and self-imposed adaptation of an obviously dysfunctional and destructive 18th Century mythos, generated and maintained by a cadre of wealthy philosophers, men who never lived in the wild, didn't depend upon it with their own labors to survive, and didn't want to.

That same elitist mythos ignored the "savages" who shaped this amazing landscape Europeans "discovered" and developed, with little thought to the consequences. That ignorance resulted in the wholesale destruction of plant, animal, and microbial systems built by hundreds of generations of families, men who burned and hunted, women who gardened and harvested, children who were born, reared, taught, worked, and died shaping these lands. What they did may not have been optimal, but given the habituation of these systems to 10,000 years of their work, their methods should not discounted whimsically, as did our forebears, as we effectively do today by mandated neglect with exotic species continuing to spread with very few doing anything about it and others tying their hands.

As I saw it, Jasper Ridge is slowly dying by varying degrees before our eyes, with no one allowed to act in its defense, because of a belief rooted in that very same urbane mythos. With each eventual disturbance, the exotics will gain and the natives will lose. It is an ethic that forced the Bay Checkerspot to leave for the lack of a decent place to reproduce. Imagine if Dr. Ehrlich had instead grown scads of plaintain and owl's clover. They aren't that hard to grow. How much more about the relationships between these plants, their hosts, insects, soils, and microflora would we know if we studied what it took to grow them among their native cohorts? What is it that that makes Castilleja and Plantain similarly attractive? We would certainly know more than if we just sat there and watched the plants upon which that butterfly depended be displaced, which is just as easy to do ***outside*** the Jasper Ridge Biological Preserve as within. So, if for legal reasons one cannot grow those plants on the Preserve itself, why not on the private ground around it? This is where involving the community could increase the number of experimental trials and samples at lower cost bringing science into the community around the Preserve. It might even induce a few more donations. What I'm not into is self-fulfilling prophecy marketed as science.

All living things die. Our responsibility in fostering reproduction and rearing, food and nesting, is to be positive about life, in the spirit of Stanford. Yet I don't see that emphasis or positive spirit in the condition of the hardly "Natural" landscapes anywhere on that campus or at Jasper Ridge, despite the fact that the mandate for active stewardship is central to the ideals expressed in the written conditions of Stanford's founding benefactors. Yes, we (and I include myself here) are inflected with those very same 18th Century ideas to this day. They remain perhaps every bit as destructive, owing to the global scale upon which they are now too often presumptively imposed. Oh we know a lot about bacteria that change the flavor of *Mimulus* nectar, but that doesn't qualify anyone when it comes to the multidisciplinary big picture. As any Indian would know, the *Mimulus* I saw at Jasper in early June was so dry it looked like no self-respecting hummer *could* give it a try. Maybe it's a good thing that they can survive on the feeders hung from back porches until we can teach their owners how to manage more *Mimulus* without incinerating their homes (the stuff does burn like diesel).

A cascade of monkey flower is an awesome spectacle most any home gardener with a sunny slope could grow and enjoy (see attached). After all, people do love hummingbirds.

Mark