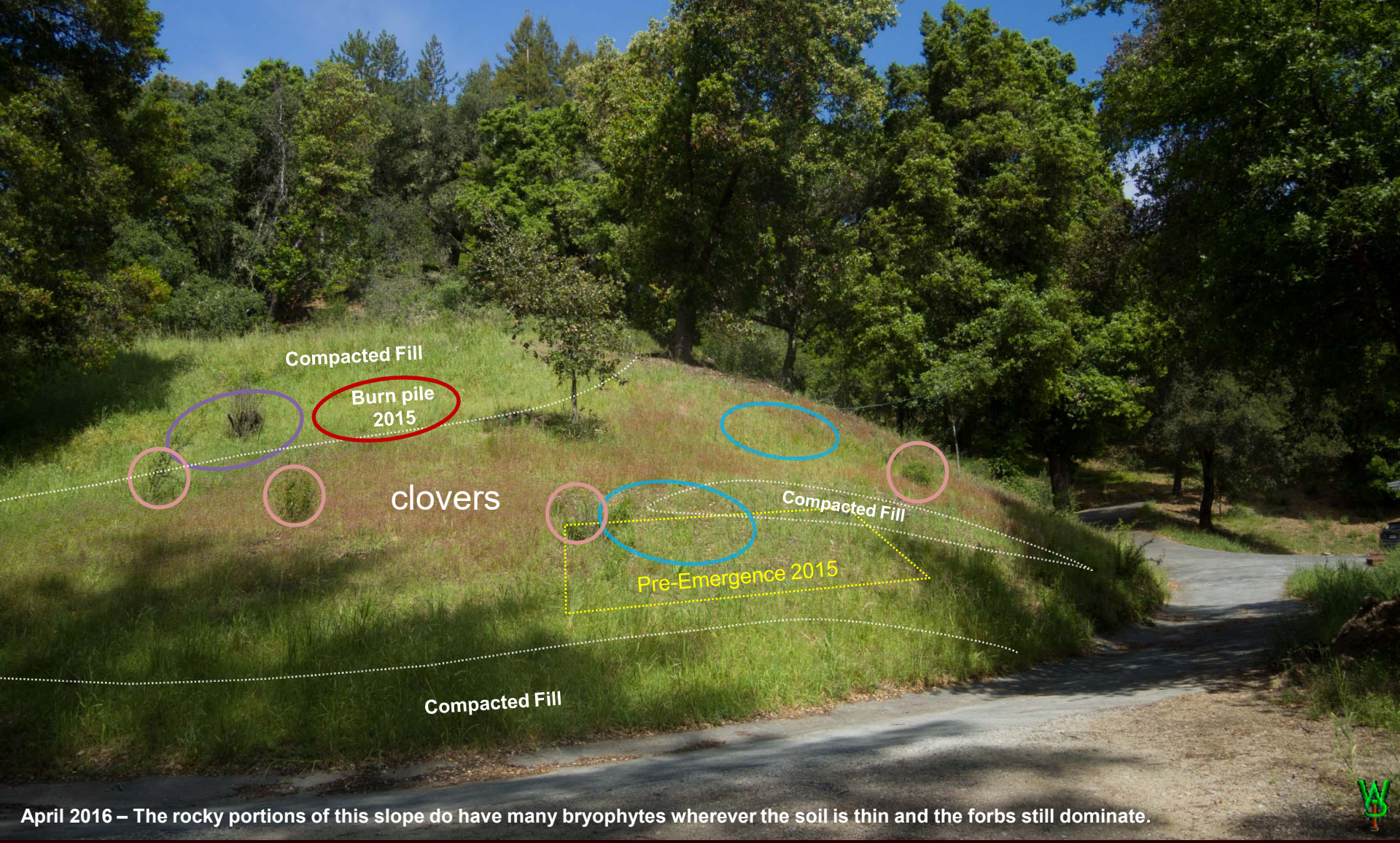
November 1994 – Both the straw and the grass seed over fill dirt were exotic "Blando Brome" *(B. hordeadeus)*. Observe the pattern of bare sandstone in the foreground and on the right slope in the next slide.

Recall from the introductory chapters that the project started with thinning forest and killing broom. There were trees, lots of stumps, weeds, leaf litter in the draws, and not much else. For the most part, the native seed bank was exhausted (or in the case above, scraped away). Seven years later, the goal became a pure native plant landscape. Having observed the lack of native response (and at the time still deluded with the idea of 'natural equilibrium'), I felt it important to document 'the return of the natives,' as I suspected that it might yield information useful to recognizing how native plants worked things out without the usual dominance of exotics.



April 2016 – The rocky portions of this slope do have many bryophytes wherever the soil is thin and the forbs still dominate.

Where there was bare rock in 1994, clovers *(T. wildenovii* and *T. oliganthum)* became dominant (but for an area they usually occupy where pre-emergence herbicide was used in winter 2015 to treat bitter cress *(Cardamine hirsuta)*). I added some fill at the base of the slope in 2003 because I wasn't happy with a notch at the bottom. California brome grass dominates both the top and bottom fill slopes with needle grass slowly moving in. Two *Ceanothus papillosus* were transplanted here, grew old, and were removed as new entrants are replacing them. I wanted to clean out the remaining weed seed bank underneath where they'd been (particularly *Trifolium dubium*). A coyote bush is gone for the same reason. The beautiful oak prominent in the original design didn't survive an incompetent tree feller (me). A young replacement is in its place and is finally starting to develop in what was solid rock.

Wildergarten 6.4

This book was originally produced under the name *The Responsible Party* for which there were two revisions, 1.0 & 2.0. Major revisions are for complete rewrites. Decimal revisions are for revised chapters or navigational changes and are not archived. Back revs are viewable by the numbered links below.

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Vande Pol, Mark Edward, 1954 –

Other writings by Mark Edward Vande Pol:

Natural Process: That Environmental Laws May Serve the Laws of Nature, ©Wildergarten Press, 2001, 454pp, ISBN: 0-9711793-0-1, LOC Control #2001092201.

Shemitta: For the Land is Mine: ©Wildergarten Press, 2009. Contains**:** 217pp text, 980pp overall, 14 picture books, 2 tables, 963 photographs, 9 maps, 2 drawings, 2 charts, 145 footnotes, 358 citations, and 216 other source references, not including external Internet links. ISBN 978-0-9711793-1-8

Articles at Wildergarten Press**:** collected writings on Constitutional history and regulatory racketeering by tax-exempt “charitable” foundations

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This chapter had a rocky start. I say that without apology, as the plant behaviors it documents were not widely known when I started this project (if at all). Early on in the project, when some natives were making their first reappearances, I was too busy killing weeds to think about much of anything beyond how better to kill weeds. As I did that, what I didn't get was natives. After 200 years of invasive dominance, there was either little to nothing native left in the seed bank OR soil conditions had to change before native seed could break dormancy and germinate. It sometimes took several years of loose observations for behavioral patterns among them to register, after which I didn't have all the photos I wanted to demonstrate the intervening stages of the process (it is hard to document something photographically one doesn't know to observe). So to put this chapter together took poring through thousands of old photographs not intended to show what I had finally recognized.

Over time, these 'repeating patterns' of developmental changes in plant behavior were confounded with the cascaded effects of different year-to-year weather patterns. Yet one particular factor remains that will be very hard to repeat**:** starting with a near-total lack of a native seed bank. I have one now. I'm going to kill it on the scale necessary to see if something repeats. So one reason I am writing this is to inform you prior to beginning your project (please) so that you can see if these plant behaviors do repeat, then to subject those hypotheses that are then confirmed at least anecdotally to lab work testing for the underlying biochemistry, then to be confirmed in the field. It's a long learning process we have before us to understand invasion biology, if ever anybody figures out whether native plants really are important and if (by then) we still have the genetic raw material with which to experiment.

Important too is an element mentioned in the site history chapter**: Many native plants tend *not* to colonize aggressively.** Why? Native Americans didn't want that behavior in much of what they grew. They had a survival interest in diverse landscapes with all of their important resources within walking distance. Their proto-agricultural patches had to stay put and in some cases NOT mix (such as food plants mixing with poisons they were growing, whether for fishing or predator control). They certainly did not want one patch crowding out another needed resource plant. Some species they planted cannot reproduce here at all (such as *Toxicoscordion fremontii*). We do know that such patches were regarded as property, passing down from mother to daughter over literally hundreds of generations (Euro-Americans have been in this area for only 10). So it is hard for us to comprehend the depth of knowledge likely wrapped in mysticism that could have produced this kind of species richness. It is a good thing for us to try. Nothing else will connect you to your land like understanding what it might do and then witnessing the adaptive process of recovery in action. At this point, I have little doubt that aboriginal people understood how to prepare a landscape for a particular array of plantings, even with more dramatic climatic variation than we see today. Some of that knowledge was surely wrapped in stories, an element of this work I have yet to learn much about. Mayhap someone reading this one day might choose to enlighten me.

Yet as mentioned in this book's chapter on plant nativity, as our project progressed, some natives here behaved as pests, which takes years to recognize and then years more to retrench. It's made me gun-shy about even new natives making a debut here. But one is still remanded to spreading them around to see what they prefer, seeing how they "get along," and then making hard decisions based upon what one thinks one is seeing amid all those random interjections from weather or irresponsible neighbors. Ultimately, what will help native plants most is if we find uses for them. Some of the later parts of this chapter address that question directly with some surprises suggested by their behavior and locations over time. Having been habituated to what I didn't want, it was a challenge to see these plants again in terms of what we might need from them.

As I removed broom and dealt with that seed bank, the first thing to "colonize" here was weeds**:** cat's ear *(Hypochoeris glabrosa),* and Roundup became the order of the day from 2002-2008. In this spot, other weeds from the seed bank were Spanish brome grass *(B. madritensis)*, and then rat tail fescue *(Festuca myuros)* but they were minor here. The persitent broadleaf weeds were scarlet pimpernel *(Lysmachia arvensis)* and catchfly *(Silene gallica)* for another 4-6 years, at which point most of what was here was sand. *Filago gallica (*now *Logfia galiica)* still requires hand removal by the thousands because it is competing with a spreading native of the same genus *(L. flaginoides).* The underlying 'empty' pile of sand here is where my education in native colonization began.

Three years after the war on cat's ear and the grasses began, a few clovers, cudweed, and other natives started to appear requiring careful spot spraying to establish. I felt it important to report what happened as native annuals and grasses established with diminishing exotic competition. This chapter will touch upon their patterned hierarchies, unexpected behaviors, indications of genetic adaptation when invading various niches, or if there were notable involvements with microbial symbiotes or native insects (and/or the lack thereof).

April 2009 – *Lupinus bicolor, Trifolium microdon, T. microcephalum* and *Pseudognaphalium stramineum* invade the open niche.
This area eventually hosted 45 plant species, most of them native annuals.

As native plants invaded these sites, many changed in form and behavior over succeeding years. Some repeated these behaviors with repeated disturbance, others not; instead taking their successional behaviors. Given that the latter had settled into the site and the seed bank then reestablished, their initial behaviors are unlikely to repeat. Hopefully, some these observations will alert whoever attempts this somewhere else, such that more information can be captured before and during the process. I have few analytical capabilities, so these will be fairly gross visual observations, but it would be very cool to figure out why these changes progressed.

With the warm and wet late-spring of 2010, natives (mostly clover) had finished forming a complete annual groundcover, a conversion process that had taken eight years here. After repeating the process elsewhere after thinning more forest and dealing with the weed response with more knowledge, I have had many opportunities to witness the colonization process over larger and more varied areas.

Of the 24 species of native legumes now found here, I estimate that only five were still viable and broadly distributed in the seed bank. The rest either migrated here by means probably involving animals or had so few remaining viable seeds that their behavior still resembled colonization of an open niche. Typically, they first spread into the immediate areas in which they appeared. Yet it only took a year or two to see scions in satellite locations, sometimes at distances of over 100m. Usually these scion populations were in similar niches, but when otherwise (such as a clover appearing in a forest) they often took on somewhat different forms.

What's the "Big" Deal?

May 2010

When lotuses and clovers first colonized open bare soil, they were often huge. This *Acmispon brachycarpus (*was *Lotus humistratus)* is well over a foot across. In the second generation, the seedlings thereabout germinated in large numbers but developed as much smaller plants, at most 4" across with a half-dozen flowers or less (inset). I speculate that the seed of pioneer plants have thinner coats with which to germinate many scions to control the spot. They are also more genetically plastic or variable. Once established, the goal becomes to hold the spot; so the same hormonal signals that make them smaller would have them producing seeds with thicker coats more capable of extended dormancy by reducing the leaching rate of abscisic acid.

Weeds can do the sane thing. Miss one and it will make so many seeds, you're going backwards.

Clovers do the same thing. This lone *T. wildenovii*, is well over two feet across where usually they grow erect as a single stem 6-8” tall.

This 24” *Trifolium ciliolatum bv. ciliolatum* was on a road that serves as a boundary within which I confine it. Hence, the road was almost bare of it. This is the “tree” clover that grows flat on the ground (more on that later). If July seems late to you for a clover to be flowering, we had a few *T. hirtum* still doing it in August(!!!) thus, is a consequence of a long wet winter and cool spring with substantial rains in May.

The Flip Side, or Different Dirt?

April 2023

Camissoniopsis spp. did the opposite, at least so it seems. When they first showed up in our “sand hill” area they were small, with a rosette perhaps 2-4” across (inset), and continued to be so for well over a decade. They can make such a tangle (especially mixed in with lotuses as above) as to be almost impossible to photograph explicitly but are easier to distinguish early in the season.

Now the average *Camissoniopsis* about 100 feet below in the back yard is between 18-24 inches and I've seen it nearly as large on relatively bare rock walls growing amid *Stipa lepida* bunch-grasses, again growing 'oversized,' nearly erect, and without much of a rosette.

Symphony or Cacophony?

September 2021 - A big *Epilobium brachycarpum* is very hard to photograph

In early 2021, we had a huge gopher irruption on this slope. Up came a couple dozen or so *Epilobium brachycarpum*. According to thesis, they were huge, almost all over six feet tall. Most (not all) *Epilobium* is in general a really painful plant to photograph. It mixes in with other plants. The flowers are tiny. The foliage is so sparse and small it is hard to make out on photo of a bigger plant. About the only distinguishing feature is that it is green when just about everything else annual that is growing with it is dead for the season (except for *Erigeron spp.* begging me to kill it). But with all that dead stuff around it, it almost disappears.

So getting a picture of *Epilobium* takes finesse on the part of one's hyperactive dog, but I had also mowed the dead stuff and this came up from the stub.

So one must ask: Why grow *Epilobium*? At this point my guess is that it has a marked effect on other plants even in terribly poor soil, particularly the Camissoniopsis, which is such an outstanding high-protein forage that to increase that is a very positive outcome. So I'll be watching this relationship in the future, particularly as both continue to spread on the property. Nevertheless, it is big enough to get in the way of weeding, it is relatively aggressive, produces a lot of woody waste every year, and by itself doesn't seem to have much in the way of direct redeeming value. I have not had it analyzed as a forage and could find no data on it at all, but, because of its milky juice, I suspect it to be relatively unpalatable or mildly toxic, which means I should probably have it analyzed.

Starting in 2021, we have got a lot of *Epilobium* within the fenced back yard. Yeah, I know, that's a clue, but it was a gopher invasion that triggered it, and they were gnoshing *Camissoniopsis*. I am hoping to turn that area into a septic leach field someday, as the way it would drain might help a small row of fruit trees down slope. Gophers tearing up the rock would improve the soil bio-activity and drainage functions in that use. At which point, I would happily kill every last one of them. The damage they do to soil stability in this area is not to be discounted. So, in the mean time, *Epilobium*, lots of it, and it was big…

True to thesis, in 2022 they were half that six-foot height, but intermixed with big ***Camissoniopsis*** and grasses. Both forbs were everywhere in the “back yard” and patio bricks, but the *Epilobium* was much smaller than before, while the *Camissoniopsis* was not.

You can see the dead material from the big plants we had the previous year. The problem with it is that it makes it VERY difficult to find smaller groundcover weeds, particularly *Lysmachia arvensis* and *Polycarpon tetraphyllum*. I can't see the Sayante tribe appreciating all that dead material, but it does not burn well. Hence, I am guessing they burned it in the fall. Grass intrusion has been minimal along the bottom of this slope. So at this late date, I flamed it off the dead stuff from the top, hoping not to kill it.

In 2023, everything happened a month late, because the rains had been so persistent and temperatures so cool. March had brought us the biggest snow storm we had seen in 34 years while April was nearly entirely dry. In any case, the *Epilobium* germination was poor and the plants small. It had no noticeable effect on the *Camissoniopsis*. Spanish Lotus *(A. americanus)* went crazy.

April 2015 – Growing on the roadside just after a minor slide

This blue *Gilia achilleifolia* (above) represents only the second time I had seen any in the area for 20 years. Gilia, rare now, was once a dominant annual on Bay Area hillsides. Altogether from various sources, I have counted 16 local annuals in our immediate area that have not been recorded here since 1953. Most are probably locally extinct. Yet the real situation is much worse than that. Why they germinated here and nowhere else along the road is a complete mystery to me.

I collected some of that Gilia seed and sowed it in various places to see where it would grow best and with what. One should not have high expectations because, (for reasons mentioned in the site history) native plants can be hard to propagate. But this spot demonstrated why I do "science" this way in general**:** The practice of measurement dictates that some variables go neglected. Yet in wildland biology, we don't really know all the variables that apply (much less how to measure them even if it was affordable). As an example, note how the left part of this image is charred. There was a 10' wide X 6' high X 20' long burn pile of chopped oak tree cuttings atop some of that seed (the end of the pile was to the right). I seeded before dumping the pile here to see if heat might scarify the seed and facilitate germination. How much heat, what temperature ranges and for how long…? Big matted piles burn from the top down. So as the fire progressed downward and to avoid cooking the soil over a big area, I lifted the burning "mat" underlying the fire with a shovel and folded it over along its length with soil temperatures rising as the mass concentrated. Bunch grasses popped up along the edges. Just beyond one edge of the hot section, up came the Gilia in a nice row of plants. Nowhere else. Caged some of it to protect it until it seeded and found out that (probably) deer must really like it. So now you know **another** reason why we don't have much Gilia**:** no fire, succession, weeds, and herbivores eating what little comes up before it can breed or make as much seed.

Yet the next year, more Gilia came up OUTSIDE the cage than inside but, for over four years, it was still not germinating well. Now, why is that? This (2019) being a great year for germination, Gilia was found in several locations, some of which were never sown with seed. It is clearly colonizing the property, but how are those small hard seeds moving? Birds? Mice? Deer? This is where we really are. Yes, this is real science. You try things, because it doesn't come back on its own and there are so many unknowns. I ran a factorial array of different burn processes on that hilltop in 2023, so we may find out more thereafter. There are lots of barriers to recovery. We don't even know how to list them all. We never will learn as long as we "leave it alone."

Stand Up Lay-Abouts…

April 2016 – Note the *Galium parisiense* among the lotus (both *Acmispon parvula* and *A americanus*).
Hopefully, this too shall pass, but until then , weeding is my life…

Among legume species in newly invaded soil there appears to be a characteristic that they generally start out with a prostrate form and then go erect in later generations (as above). This behavior, while clearly phenotypical at first, appears to be a heritable tendency. These lotuses when occupying an open space with no apparent reason to climb now grow erect from first emergence.

April 2009 – Note how tight and flat to the ground this mix of clovers and lotuses grows! They don't want to be eaten.

They didn't always do that. In the photo above, these grasses are invading a meadow that was almost exclusively forbs in 2008. There were two general hierarchical patterns among "prostrate first" natives as this process took shape: forbs-before-grasses (above) or grasses-before-forbs. From what I can tell, the character each pattern assumed over a decade resulted from that "order of addition" in which the weather in the first year after a disturbance figures prominently. In other words, it suggests that entropy applies, as opposed to equilibrium. Indeed, there may be no such thing as "equilibrium" in systems subject to rapid succession when not perturbed by regular disturbance. Were I able to "start over" by burning it, things might have happened differently with more grasses and fewer forbs.

As the grasses spread, much of this Spanish lotus *(Acmispon "americanus"* – go figure) persisted in growing completely prostrate and stayed that way until it encountered this *(Stipa pulchra)* purple needle grass and (understandably) started to climb.

The Other Way Around

May 2005 – The temporary piping was to germinate and establish the grass before winter rains.

In the case of grass-before-forbs, most instances here were fairly standard revegetation projects to stabilize newly graded soil. Here, California brome *(Bromus carinatus)* was seeded on a newly graded road.

May 2005 – *Deschampsia elongata* after a rain presents a captivating swirl

Sometimes seeding projects worked great, but only for a year or two. Although at 22,000 seeds per pound, this *Deschampsia elongata* was inexpensive and established beautifully, it did not reseed efficiently and looked so much like exotic 'rat tail fescue' *(Vulpia myuros)* that it was overwhelmed by the exotic within two years. One of those 'things you learn' along the way.

Here I had installed plugs, mulching the rest of the hilltop which I regarded as too contaminated to bother with revegetation until the weeds were under more control (more on this type of work is in the chapter Plugging Along). In short, 'grasses before forbs' was counterproductive where I forced it, simply because I still had to remove weeds between and sometimes within grass bunches for years until the native forbs could move in. I won eventually, but events proved that this was a slow and costly way to win. Yet even then, if and when the grass bunch dies, guess what happens? I get to remove the entire onion of weeds where that grass bunch had long suppressed them. In short, it was better to clean out the weed bank, allow the forbs to colonize, and then think about grasses.

Typical of this ‘forbs-before-grasses’ scenario in places where I either used plugs or did not seed, the grasses showed up singly, here most commonly small flowered needle grass *(S. lepida)* and/or California brome *(B. carinatus)*. Note also that the lotuses *(Acmispon americanus)* climb into the grasses and start to grow erect, one presumes for light and in response to shading.
So far, this would seem hardly remarkable.

Surprisingly (given what we have seen since), the clovers and lotuses invaded this pre-existing grassland and assumed a prostrate form they no longer exhibit.

This was the usual appearance of our grasslands for a few years. In fact, I came to expect it. Frankly, it was preferable in a way because it was easier to detect and remove weeds from among prostrate forbs. But as the grasses became denser, the forbs began to stand.

As the grasses continued to intensify, they forced out the forbs and started going senescent (getting old and crappy). Mowing helped remove thatch, but it was not enough. Competition was doing them in. As is discussed later on, the greener area at the top of the hill inside the flags is due to blood meal added the prior year as part of an experiment . As part of the same experiment I had burned a stripe of it (just over the crest of this photo) to see if things would improve. The burn thinned the grasses and things took off. Four years later, it still looks better than most of this, but realize that the hilltop had once been flat for an evacuation landing spot for a helicopter . I humped the soil again to make it drain properly. The result is that the center of the hilltop has deeper soil.

I suspect the drought of the prior two years took its toll on the grasses when faced with stiffer competition from both the clovers and the *Verbena* in the foreground (a perennial sub-shrub that tends to succeed the grasses). Verbena may play an important role in sustaining multiple stages of succession on a site in addition to soil formation. It dies back with freezing in winter, leaving lots of organic root mass to make beautiful soil for forbs. In spring, the forbs start while the Verbena bolts out to cover them as they die off for the year. I keep the verbena numbers down because they hide weeds underneath, yet are so full of bees that they make weeding a challenge for a person with an allergy to stings! We do have a lot to learn.

As time has passed, I have seen similar behaviors occasionally in other mixed clovers and lotuses to suspect that what I am seeing in this possible case of dynamic variation may be characteristic of low groundcovers: initially staying low to the ground as a defense against being eaten. Frequent fire would suppress the grasses and force this adaptation in a region that once supported large numbers of elk, antelope, and deer. Grow tall and get chomped. But once that niche is filled, get chomped and seed gets pooped somewhere else?

The lotuses in the same patch were still prostrate, even between denser arrangements of grass clumps. Well, it didn't stay that way.

Only one year later in this same patch of needle grass, these lotuses nearly all grow completely vertical! Eventually, they formed a moisture-retaining blanket up to 18 inches thick!!! This condition augmented the growth of needle grass, here sometimes 5' tall.

And just down the slope from the above grass patch, all of the lotuses grow erect out in the open, with minimal influence from grasses!

These two lotuses were less than 12” apart. The pattern of this behavior looks to me like more than a phenotypical adaptation. Yet it could just as easily be a response to communication of fungally-transmitted hormonal signals relaying an epigenetic response to shade.

With the lotuses, burn it, and the process restarts. When I burned (this is the edge of a burn at right), the forbs went prostrate again, remaining so even between the grasses on the left. Yet in succeeding years, they'll grow erect in places where they would otherwise grow prostrate. Fungal signal? Heat or leachates from the burn resdue does something to the seed? Epigenetic adaptation? It would be interesting to gather seed from these various forms and conditions to examine the seed coats for thickness and assay them for abscisic acid concentrations, thus indicating differential propensities for sustaining extended dormancy between the erect and prostrate forms or simply germinate them elsewhere in some other soil to see what they do.

These clovers exhibited the same behavior after this burn pile.

In each instance of disturbance, because of the site history and the loss of a native seed bank, one notices the rate of species returning on a spatial basis over time as augmented by disturbance. This burn spot to the right had *T. microcephalum* working its way down the hill from the flat above toward a large patch of *T. wildenovii* on the slope below. After the burn, the *T. microcephalum* came up prostrate at the edges while the *T. wildenovii* appeared in the middle of where the burn pile had been hotter. The latter is almost always erect.

Within a few feet a month later, this borderline monoculture is also *T. microcephalum*.
So while this “weedy” behavior in clovers may not be as unique as I had thought, it isn’t universal.

The upright behavior manifests elsewhere even more bigly. In our fenced yard about 100m from the above series), we have *Acmispon americanus (*Spanish lotus), *Epilobium brachycarpum*, and *Uropappus lindleyi* germinating together. There is *Madia gracilis* here too getting ready to bolt, but it is still in the rosette stage in the understory of the lotus. As you can see, the lotus is fairly upstanding.

Panning tp the left of the previous slide is a dense patch of *Camissoniopsis contorta* with bolting *Madia gracilis* on the upper right and right foreground with a touch of the *Epilobium brachyarpum* in between. Watch what happens!

Two months later, the big deal is a mix of *Madia gracilis* in *Acmispon americanus* with a bit of *Epilobium brachyarpum* is over 3' tall where the latter had been twice that in years prior. *Verbena lasiostachys* is in the right foreground with browned *Camissoniopsis contorta* on the left. *Pseudognaphalium ramossissimum* and *Diplacus aurantiacus* (monkey flower) are in the background.

After the *Madia* had bred and died, we still have free standing lotuses over 2' tall, 4' across, and still in flower. It is simply astonishing to me the forage density represented here. Yet it is clear that it only tends to do this when prompted by other plants, here being the *Madia*. Note the flat at the upper left with the weed heap and blue curls *(Trichostema lanceolatum)*.

These lotuses *(A. americanus)* are growing around our weed composting heap. Most are about 4' across and prostrate, again fitting the forbs before grass scenario. I burned here last year and shot glyphosate earlier this year. There has been no irrigation. Here are also are *Trichostemma lanceolatum,* dried out *Camissoniopsis contorta,* and a *Navarretia atractyloides* (a truly unpleasant plant). So these are late germinations with no water and minimal-to-no competition. The annual and sometimes semiannual "disturbance" of killing everything that comes up around the heap not only produces large individuals at the fringes of that treatment, but grow prostrate here unless prompted by other plants. Note that even the slightest presence of a competing plant induces some degree of erect behavior in the lotus. In 1 there is *Madia gracilis*, whle 2, 3 & 4 are clean. #5 on the other hand grows more erect with only a smallish Navarretia in its midst.

Panning to the right, even *Verbena lasiostachys* has got into the ‘standing up’ act. Up until now, this has been the definitively prostrate plant here . Yet here, starting in base-rock among oversized *Camisoniopsis* reaching up into *Madia gracilis* it is pushing 24” tall, coiling, and getting gangly. The lotus in the background is learning how to climb. The sprinkle of Navarretia just adds to the joy of weeding out the occasional *Gamochaeta calviceps*. Those spines are nasty. Once things get wet enough, I would like to burn it.

Trifolium ciliolatum ***bv. discolor*** is one of our later "returning" clovers, here with the larger **striped** (variegated) leaf.
This variety has been growing in this spot for over a decade, getting along just fine with *T.* microdon and a host of other native plants.

Contrary to our ‘forbs before grasses’ scenario, “tree clover” (*T ciliolatum bv. discolor*) at first grew semi-erect. As it invades grasses (here California brome *(B. carinatus)*) it grows taller, even when not in direct contact with the grasses. *“T. microdon”* is still here, but relatively sparse (noted with quotes because we have multiple flavors (with and without hair) that suggest there may be other species).

Unlike the endemic *T. ciliolatum v. discolor* you just saw, this “tree” clover, *Trifolium ciliolatum* ***bv. ciliolatum*** (above) grows absolutely flat (prostrate) in the open, and so tightly that it slowly purges the area of existing *Stipa* bunch grasses. Unlike the lotuses just discussed, it returns to a prostrate growth habit even after encountering grasses. Although this *species* is inarguably native to California, this variety had never been seen this far south. Several botanists (and I) are concerned it may be destructively invasive. There is reason for this concern**:** Today, the prevalence of exotics is so ubiquitous that even botanists roaming the area had not seen this ‘weedy’ behavior before in a native clover. We wonder if it is therefore effectively an exotic here. Will it learn how to get along, or will it stay aggressive?

Originally when it first appeared, I had hopes that *T. ciliolatum v. ciliolatum* would finally stand up to and not be excluded by bunch grasses to the degree that other native clovers had suffered. True to the “forbs before grasses” observation, *v. ciliolatum* climbs into pre-existing grasses with leaves as much as three times the size as other clovers here. Yet it grew so large it ended up killing off the grasses. Then it went back prostrate as a temporal monoculture. I’d never seen that before in a native plant.

For 6-7 years, I have expended the labor to “confine” *T.c. v. ciliolatum* (monotone and prostrate) to an area of about 5,000sft on the lower half of a slope to the east of a dirt road to the hilltop. I kill it everywhere else. As a “reward” I got LOTS of gopher activity there which brought up more exotic seed demanding hand weeding to retain the integrity of the experiment.

Nevertheless, the control process where *T.c. v. ciliolatum* had “invaded” outside its confinement area has been costly to native annual forbs in some places. The labor demand was so significant that broadcast methods became necessary. Thereafter, spot application of a pre-emergence herbicide, torch burning, and squirt bottles were used. Astoundingly, and again as a result of ‘getting rid of everything,’ up came a a widespread irruption of blue dicks *(Dichelostemma capitatum)* across the entire meadow. If one includes the total area within the usual soap lily boundary (which can be found on two sides) the total area in blue dicks would total perhaps a quarter acre.

Fortunately, in *T.c. v. ciliolatum* tending to be invasive, pre-emergence herbicides were relatively effective against it, allowing hand control or a squirt of triclopyr from a spray bottle after the first year. The process was helpful in that I was in the midst of getting control of the aggressive exotic, *Cardamine hirsuta.* The response to the late 2014 conclusion that for over 50 years the University of California had mistakenly identified this virulent exotic as native *C. oligosperma* initiated a multi-year war against that virulent pest (more on that in the chapter on pestilence). The herbicide chosen was isoxaben, which is selective against broadleaf germination. Unfortunately, that meant that I purged a substantial fraction of the native seed bank of clovers and lotuses in those areas which had taken many years to develop. A predominance of drought years between 2014 and 2022 also inhibited recovery native seed production of other Diazotrophic forbs, which tend to take advantage of wet years to distribute seed (2017 and 2023, image at right).

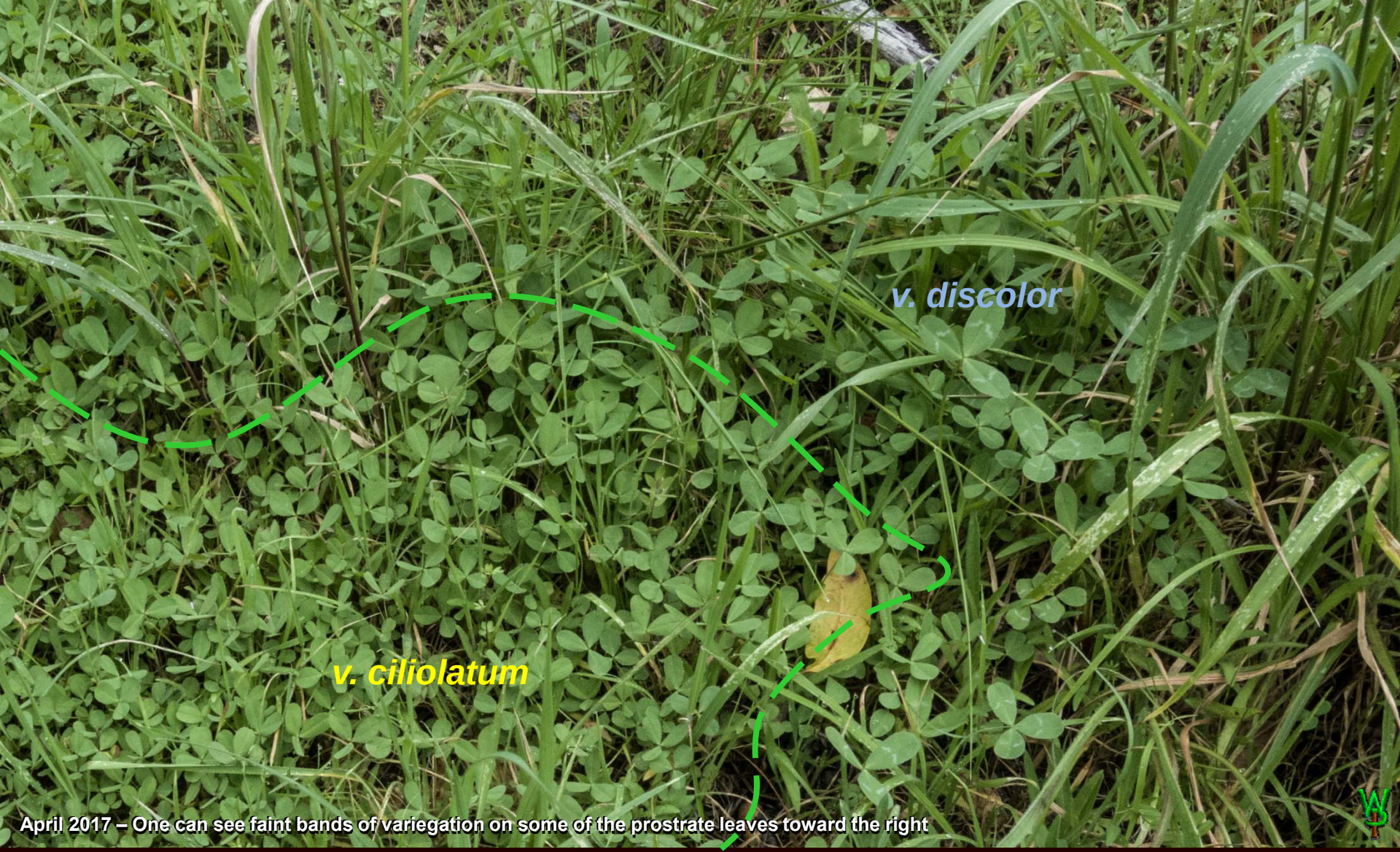
Unfortunately, the blue dicks brought an invasion of gophers. That brought up more exotic seed, particularly *Polycarpon tetraphyllum, Erodium spp.*, *Galium parisiense*, and *Gastridium phleoides*. The control process also admitted invasion by the native perennial purple cudweed *Gamochaeta ustulata*, which has (in places) shown itself to be quite destructive to Diazotrophic forbs. More on that in the grasslands chapter discussing trace minerals in soil.

If you are getting the impression that these decisions bring complicated outcomes with more complicated decisions over long periods of time, welcome to my party.

April 2023 – After the damage removing C. hirsuta and T. ciliolatum bv. ciliolatum, this is resembling recovery, with blue dicks to boot (the big arching "grasslike" blades); elsewhere in this meadow it isn't so pretty.

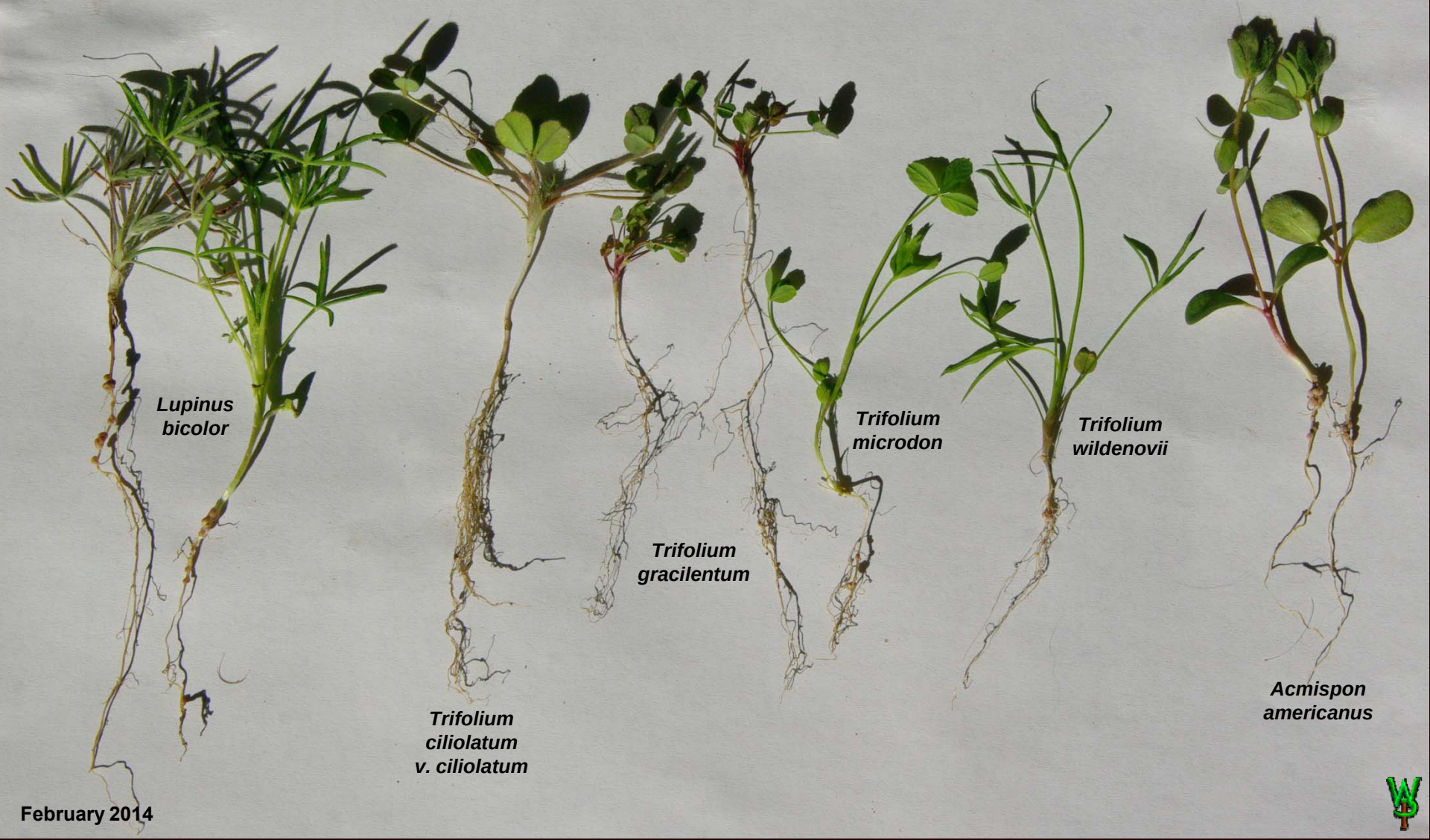
Interestingly, within that “confinement” area for *T. ciliolatum v. ciliolatum* both *T. microcephalum* and *T. bifidum* sustained matted colonies, but intermixing was minimal, which is not what I see among clovers elsewhere on this property. Would that mean the prostrate *T. ciliolatum v. ciliolatum* is actually acting normally? Then why doesn’t *T. ciliolatum v. discolor* do that elsewhere? What’s normal? Nobody knows. There is no other place in all of Western North America where clovers can invade an open niche without weeds to be observed in detail as they colonize the property and compete… or not. This is new territory.

So given the confusion about *v. ciliolatum* versus *v. discolor*, here I waited and was rewarded with a surprise. *T. ciliolatum v. ciliolatum* appeared to be forming a near monoculture on the left (what otherwise might be regarded as "weedy" behavior), but the right half of the split image is the same spot only seven weeks later, now fully occupied by a native annual lotus *(Acmispon americanus)*. Apparently, the clover just disintegrates once it's done. So is this temporary "monoculture" actually temporal biodiversity?

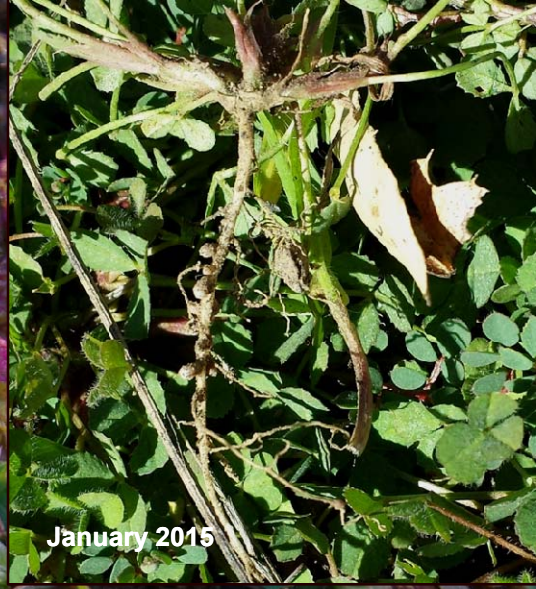


April 2017 – One can see faint bands of variegation on some of the prostrate leaves toward the right

Well, things got more interesting**:** PCR genetic sequencing of these two "varieties," *v. discolor* (variegated and erect) versus *v. ciliolatum* (monotone and prostrate) have genetically **identical** DNA!!! True to form, here in this photo, one can see graduation between the two with fading signs of variegation as the plants grew more prostrate. Yet the *v. ciliolatum* elsewhere NEVER showed variegation when it grew up into grasses. So… is the "invasive" prostrate *v. ciliolatum* here simply a deviant of my pre-existing "benign" *v. discolor* or did it enter from outside? As the prostrate variety appears to be so aggressive, should I tolerate it if it excludes other natives? Yet given that the difference **IS** heritable, what is the substance of that difference? Is it epigenetic? How does that manifest biochemically? More importantly, could the subtlety of this distinction teach us something about what makes a plant invasive?



After reading about how strain-specific the *Trifolium-Rhizobium* symbiosis can be, I had wondered whether returning Fabaceae would find their bacterial symbiotes still alive and well distributed in the soil here. The survey I did produced mixed results. The lupines did fine as did our small lotus species, all of which I had long suspected had survived in our seed bank (lotuses *(Acmispon spp.)* are not picky about the *Bradyrhizobium* they require for nodulation). New exotic clovers showed no bacterial nodules on the roots. Long established exotics did, even though they were introduced before people learned about the importance for each particular clover! Not all returning native clovers formed nodules well. We know that *R. trifolii* is capable of genetic transformation, modifying itself by incorporating loose DNA. My guess is that it adapts by horizontal gene transfer abetted by repeated shearing and incubation in ungulate rumen and is distributed by trampling in mud. How long? In 2023 I noticed nodules for the first time on “rose clover” *(T. hirtum)* I had introduced in 1991. So, 30 years?



February 2015 – *T. ciliolatum v. ciliolatum* displacing *Acmispon parviflorus* and *Trifolium microdon*

As to the questionable *T. ciliolatum*, I checked to see if it was forming nodules (inset), which it does profusely, yet another indication of being an adaptation of genetically identical "*v. discolor*." To learn more about where this might end, one should look at how it begins.

April 2023 – It was more erect, but a certain homeowner had smushed it a bit while weeding

In 2023, we got 71” of rain, with the season beginning in early September and continuing through May but with a very dry December in which many clovers elsewhere had dried and died. What do you know but that I found a few *T.c. v. ciliolatum* growing definitely erect and all by themselves on the margins of where I had confined them. Now what??? I will continue to confine any monotone *T.c. v. ciliolatum* and allow the new erect form of *T.c. v. ciliolatum* to propagate and see if it has learned how to “get along with the other children.”

Flat Tire

I had this flat graded in 1994. It used to be dominated by exotic dwarf hop clover *(Trifolium dubium)*. As I killed the exotic clover, the cover shifted predominantly to a small tarweed *(Madia exigua)*. The next slide is part of the same area four years later.

As one might expect given the previous clover dominance, native *Trifolium gracilentum* (purple flowers) started taking up much of this flat from that tarweed. But note that the *T. gracilentum* assumes an erect form here, as it always has on this property. If a prostrate form was strictly phenotypical to open spaces, if growing erect was a response to shading or taller competition, these would be prostrate and crowded. If an erect form was a response to population density, then those tight prostrate patches we saw would have stood up.

This variant of *T. gracilentum* about 50 feet from the flat took a form that was almost completely prostrate when it first colonized in 2005, yet it grows both erect and prostrate in this same location ten years later.

On year two just below that flat, the *T. microcephalum* became more erect as it collided with grasses and *T. wildenovii*. There is very little mixing of the two species so far, unlike what I see elsewhere.

"Cupcake clover" *(T. microdon)* grows prostrate in open spaces, but I have never seen it form an exclusive mat.

The “cupcake” effect goes flat as the flowers mature. *T. microdon* can go decumbent to rangy when growing in grasses, especially in a wet year. Yet it is never exclusive to grasses, nor is *T. gracilentum, T. oliganthum,* or *T. wildenovii,* all of which are usually erect.

Here again, we have two forms of *T. microdon*, this one being far less common, so far, found only on a slope just to the north of and below said flat. Unlike its cousin, there is almost no hair on the stems.

The crux of the achievements on the flat was 100m to the south on a neighbor's property. In 2003, the former owner was on his deathbed. I went in there to take down a patch of French Broom. I kept after it. Being on an exposed ridge it collected cat's ear (Hypochoeris spp.) which suppressed somewhat the seed bank of scarlet pimpernel *(Lysmachia arvensis)*. There was also a small patch of sweet vernal grass (Anthoxanthum odoratum) that had been brought in by a dirty drill for a new power pole to supply an adjacent well. I kept after those areas and the rate at which I was being bombed by weeds dropped precipitously. The clover patch you saw was only possible after a decade of open, notorious, and continuous use of that strip of land as a weed buffer. But the real benefit was that natives started expressing there, particularly needle grass (Stipa lepida) and bird's beak *(Cordylanthus rigidus)*.

It's all gone now. A new "neighbor" moved in and willfully destroyed my buffer easement on a ridge, supposedly to grow an orchard that wouldn't do well there. His property has since been producing prodigious amounts of cat's ear *(Hypochoeris glabrosa).* That weed being allelopathic, germinates profusely on this former flat of clover. Even though I spend weeks worth of time every year weeding it and get it ALL, it has precluded almost all clover germination. End of experiments. Should I sue?

If you are getting the sense that people MUST **do something** in order to sustain local biodiversity, keeping plant species from overwhelming each other, your intuitions are fully functional. Indians did it by burning whole landscapes, frequently, perhaps more than once a year (no, I'm not kidding and yes, it's possible and one can infer productive reasons for doing so).

Frequent burns of entire landscapes on a large scale is a very hard sell to an urban public long sold on the benefits of "clean" air (don't get me started; I've qualified industrial processes for air quality permits in the Bay Area). Note that the sale is made on the *appearance* of clean and that such is presumed to be optimal for human health, with good reason for it not to be so from an immunological perspective alone. For example, nor have they ever considered (much less quantified) as a competing risk the lack of burning having increased production of spores from rotting vegetation as an allergen. But I digress.

Disturbance today comes in many forms, only a few of which make smoke. One can burn it in various ways, till (as bears did on an amazing scale), mow or moo (graze), trample, remove tree and shrub cover, kill plants chemically, amend soil, etc… all of which produce their own consequences depending upon how they are performed, when, and what preparations were undertaken. The "best" combination of these technologies depends entirely on what the goals are and the unique combinations of circumstances particular to a site, as coupled with unpredictable and chaotic atmospheric conditions.

But without disturbance is to issue the botanical system and the insects and wildlife that depend upon it a death sentence.

As of now, humans possess neither the knowledge nor the physical capability to deliver pure native reproduction and germination reliably on a landscape scale. That includes me. Witness how I once thought it was reasonably normal to wish to return a landscape to native plants! Goodness knows how many ideas I've posited and rejected over the years. I've long regarded the latter as key to finding productive answers.

In other words, "best" is unknowable, while "better" is reasonably doable.

Contrary to all of that, technical hubris is so ubiquitous these days that such humility in goal selection as might yield useful information is actually difficult to incorporate. We simply don't know how little we know. Even worse is that the specificity of academic education renders "experts" relatively incapable of developing extra-disciplinary syntheses, much less interdisciplinary communication and cooperation. Perhaps this is most impactful in how education inflects how we see what is before our eyes. Said "education" comes in many forms beyond formal education, from parents, to advertising, to game playing, to group enforcement… Modern education was never intended primarily for imparting learning and capability; from its beginnings in the 1890s the primary purpose of public education has been to prompt a conditioned response set, as if we were animals to be trained. It's worked too.

Yet unless we share what we *think* we see, nobody learns anything from what we did!

So if what you are hearing here is an appeal, a pleading to get outside the box, try something, and share what you found, you've again got it right. It is the feedbacks from reality and communications that truly teach. That means getting things wrong, a lot, but at least in terms of biodiversity, rarely are they worse than doing nothing. Keeping the scope of mistakes smaller reduces overall risk.

If what you just inferred is a private property model instead of government by groupthink, you again have got it right.

Burial at See

May 2016

One wonders if *'make a blanket and smother'* is a common strategy among trailing legumes. Here we see this behavior in American vetch *(Vicia americana)*, growing just across our property line under some Eucalyptus. It's here as long as I keep the bedstraw out of it.

Here is hillside wild pea *(Lathyrus vestitus)* smothering this fully grown hazelnut bush. In this area, it's made a blanket about two feet thick. Given the way other legumes seem to go prostrate after a fire, perhaps this behavior would be suppressed by regular burning?

Grasses and sedges play the same bury-the-competition game, but only for so long. *Calamagrostis rubescens* does not seed efficiently, but instead spreads underground. It possess the capability of depressing exotics and brush while presenting relatively low fuel value and low mass against slopes. Monocots also permit the use of selective herbicides designed for broadleaf plants, which I would need to do to these blackberries if there was more sun. But the big gains are made with fire, in that one can consume exotics before they seed while the monocots recover in only weeks under summer conditions adverse to recovery of exotic annuals.

Illegal Natives

May 2012

In 2012, we had a new entrant to the property, *Deschampsia caespitosa,* or “tufted hairgrass.” This is considered to be a coastal species, supposedly requiring fog and marine temperatures. All the experts told me it would not survive here. I wasn’t so sure. So, what did I do?

I grew out some plugs and planted them in late the next February in the midst of a drought year in the most hostile place we have**:** the middle of a burn patch on that hot, dry, sandy hilltop. There was black charcoal all around them absorbing heat. There was no mulch. The only rain they got to get them established was 3.1 inches over the next two months. Then came the drought of 2013-14. Between May 1 to November 1, 2013, they received 0.6" of rain. Yet by May 2014, it was quite clear they had survived (above).

July 2015 – The dormant bunch grass is *Deschampsia caespitosa*

By the next year, they had bred scions successfully. It continues to spread and does seem to get along well with other native plants.

Note how much bigger the tufted hairgrass became where the forbs established around them than where they are less so (circles). Given the paltry evidence of leghemoglobin in legume nodules here, I doubt the difference is due to nitrates. I suspect the forbs retain soil moisture and keep the surface cooler on a warm day. One must slide one's hand beneath them to appreciate the effect.

Now fully established, this “coastal” *Deschampsia* is doing great. Yet this is not the only instance in which we have plants supposedly growing ‘out of place.’ The point is that this system was so destroyed, and the fungal communities in the soil were so wrecked, we don’t know what “belongs” where. This grass might have been displaced by oats by the early 19th Century.

Small Time Operations

May 2010

This is “dew cup,” *(Aphanes occidentalis)*. I first found the first of this little plant here in 2006 after hosing the hilltop with Roundup for years. At that phase of the project, there wasn’t a lot to show for it in the gross sense, but things were showing up singly for the first time at an amazing rate. With so much work going into this, and with so little reward at the time, when one finds something just about everybody else would not notice, it is tempting to make a big deal of it. For a good many years, this definitely wasn’t.

One thing is likely about a plant like this is that it was probably once ubiquitous, because otherwise it wouldn't survive as a species. It doesn't make a lot to eat except for bugs. So it's small enough to stay beneath the ungulate radar of antelope, deer, and elk. As to *how* it spreads, who knows? What we do know is that it is a member of the rose family. That makes it a nitrogen fixer, and yes, it does produce nodules of *Frankia* actinomycetes. So, where does it like to hang out and with what? How does it interact with other plants? Here it is in a clover and lotus understory. But it turns out that the picture gets a bit more complicated.

April 2004

Another plant breaking the botanical rules is this diminutive member of the everlasting family, “slender wooly heads” *(Psilocarphus tenellus)*. The experts will tell you that this plant is characteristic of mud puddles and vernal pools. Yet where it first appeared here was atop that same hot, dry, sandy, ridge. We see it here on solid rock in full sun. It does like moss though.

Instead of a vernal pool, here are slender wooly heads, spreading without competition, slowly working their way up another ridge some 300 yards away (the same slope as the first slide in this chapter) and almost bare rock. The reason it is not seen in places like this elsewhere is that it is uncompetitive against weeds because it does not germinate until late February to early March. This area had been treated with a pre-emergence herbicide that killed off its exotic competition. More on that in a later chapter.

This tiny plant makes a small reflective mat on the surface. One wonders if the difference in infrared emissivity between dry *Psilocarphus* and bare soil helps reduce oxidation rate of soil organic matter and retain moisture for the brome grasses it is currently invading elsewhere. It comes up late enough in the season that it is unlikely to suppress germination of legumes.

April 2015 – Yes, those are bryophytes in the understory on this rocky slope with very thin soil.

The point of discussing these “rule breakers” is to show how ignorant we are of how this system works. That slender wooly heads are an annual member of the everlasting tribe suggests that they might possibly recycle nitrates from deeper in the soil back to the surface, but I gathered enough to test it and it did not. So aside from *Pseudognaphalium ramossissimum*, these are not part of that surface nitrogen cycle. With these slender wooly heads is *Sanicula crassicaulis* (Pacific sanicle), which turns out to be somewhat invasive on this property. And what do you know but it does not show up in any of the early Glenwood surveys, again.

Now, back to dew cup *(Aphanes occidentialis)*. Here it is, growing with slender wooly heads but with featherweed *(Gamochaeta ustulata)* nearby. So, we have a nitrogen fixer (dew cup) hanging out with a nitrate hog (perennial cudweed)! And we still don't know diddly about how all this works. It just takes a very long time to get rid of enough exotics to have a place for a native to breed to make enough seed to spread far enough that it finds the places it likes, and then breeds in sufficient quantity with enough of its cohorts to posit any pattern out of the behavior, much less offer opportunity to collect representative analytical data.

As a nitrate hog, “featherweed” (long known as “purple cudweed”) has made a mess of some of our grasslands. It is very hard to determine how far to let things go in such a case, and I have seen a real downside to it, which is that the bare soil it creates by starving other natives of nitrate is then more open to aerial weeds such as cat’s ear. I have kept it out of the sand hills. With the amount of nitrate it scavenges into its tissue, it is considered somewhat toxic to herbivores. “Painted lady” butterflies do lay eggs in it. Yet within that missive about featherweed lies an opportunity that has only occurred to me whilst writing this revision, and it’s pretty cool!

The Road Paved With Good Intentions

September 2023 – Don't wait for the spines to harden before weeding

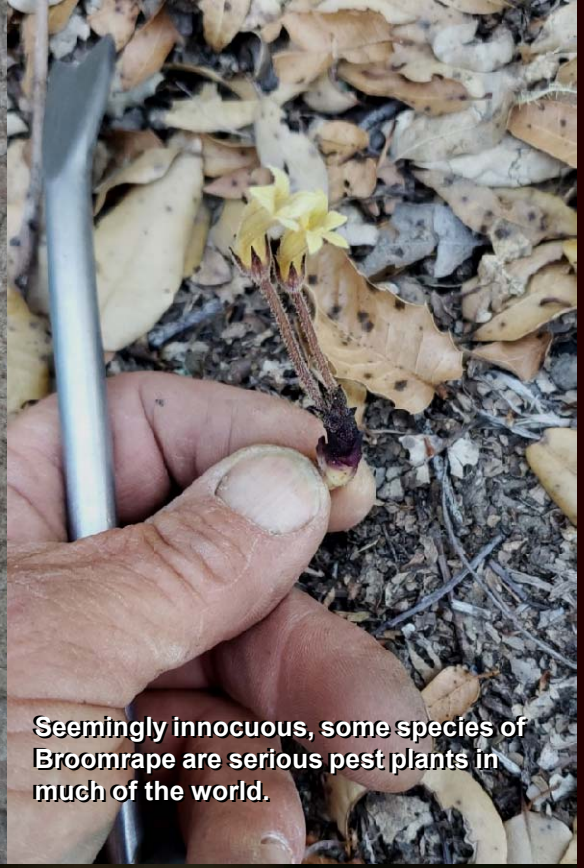
In this area, *Navarretia spp.* (aka "skunk weed") has the distinction in being among the native first forbs to dominate exposed soil after a disturbance. It gives way fairly willingly to just about anything but can be a pest in a bare spot. Hence, I kill it around the house. Weeding in those dry barbed spines is awful, unless burned, which brings up a point of well-founded speculation about plant adaptation to aboriginal management and vice versa.

We know that California has an unusual native flora compared to the rest of North America, having so many plants that are toxic and/or with mechanical defenses against herbivory. As you (hopefully) read in the site history, my conclusion is that this is due to animal adaptation to a landscape bifurcated by climate and topography into those areas dominated by bears (heavily populated with elk, antelope, and deer), as contrasted with areas in which people managed plants intensively near settlements. In between were areas subject to seasonal harvesting and fire.

Either of these ecotypes would be forced to adapt to aboriginal burning, but "bear zones" usually were wet enough to offer refugia for animals during a fire. Swamps, ponds, lakes, and estuaries had these attributes, but the latter were a critical source of protein for people in the form of clams, snails, and fish, some of which bears also consumed (it was a very good thing for people that grizzlies never developed social predation).

But here, along the drier Sayante trail, with less frequent human use and only occasional bears, annual plants would likely be adapted to resisting herbivory. *Navarretia* is known to have been common here and so was Scotts Valley spine-flower (*Chorizanthe pungens*, now endangered and locally extinct).

So, what would the tribe do if they wanted to maintain a trail through this noxious plant habitat? The spines on both of these plants are very sharp. They hurt, and sometimes I must dig them out using a microscope. NOBODY would want to walk through them barefoot unless it was either early in the season before the spines hardened, or after a burn. So, what would you do to keep these nasty plants from wrecking your trail? Would you burn it?



Seemingly innocuous, some species of Broomrape are serious pest plants in much of the world.

Burn skunkweed and you'll get more. So, remembering that our property in which skunkweed is so aggressive adjoined a tribal trail, we know for sure that said 'trail' was NOT 'paved' with spine flower and skunk weed! Therefore it is clear the tribe would need a way to exclude those spiny plants by growing something else there. Grasses would help, but skunkweed invades the gaps between bunch grasses too. One therefore wonders what they might have grown, to which I have these observations to offer…

It is reasonable therefore to conclude that growing perennial featherweed as a pavement for that trail would reduce the physical pain of walking through spines or maintain a campsite for a place to bed down. But you don't want featherweed taking over the whole area, do you? It would destroy forage value for wildlife, particularly elk.

Across from the south end of our place there is a high ridge where I once managed my neighbors' property to prevent weeds from blowing downhill onto our place. There is a cliff on the far side of the ridge forcing the old Sayante trail to skirt the end of the ridge around a rock "nose" just as the Spanish road did and the County road does today. I was told by a former owner of that property it has an archaeo-logical site atop it I am guessing was a campsite. With cliffs around three sides, it was quite defensible. One wouldn't want to bed down on spine flower and skunk weed but one must inhibit the featherweed!

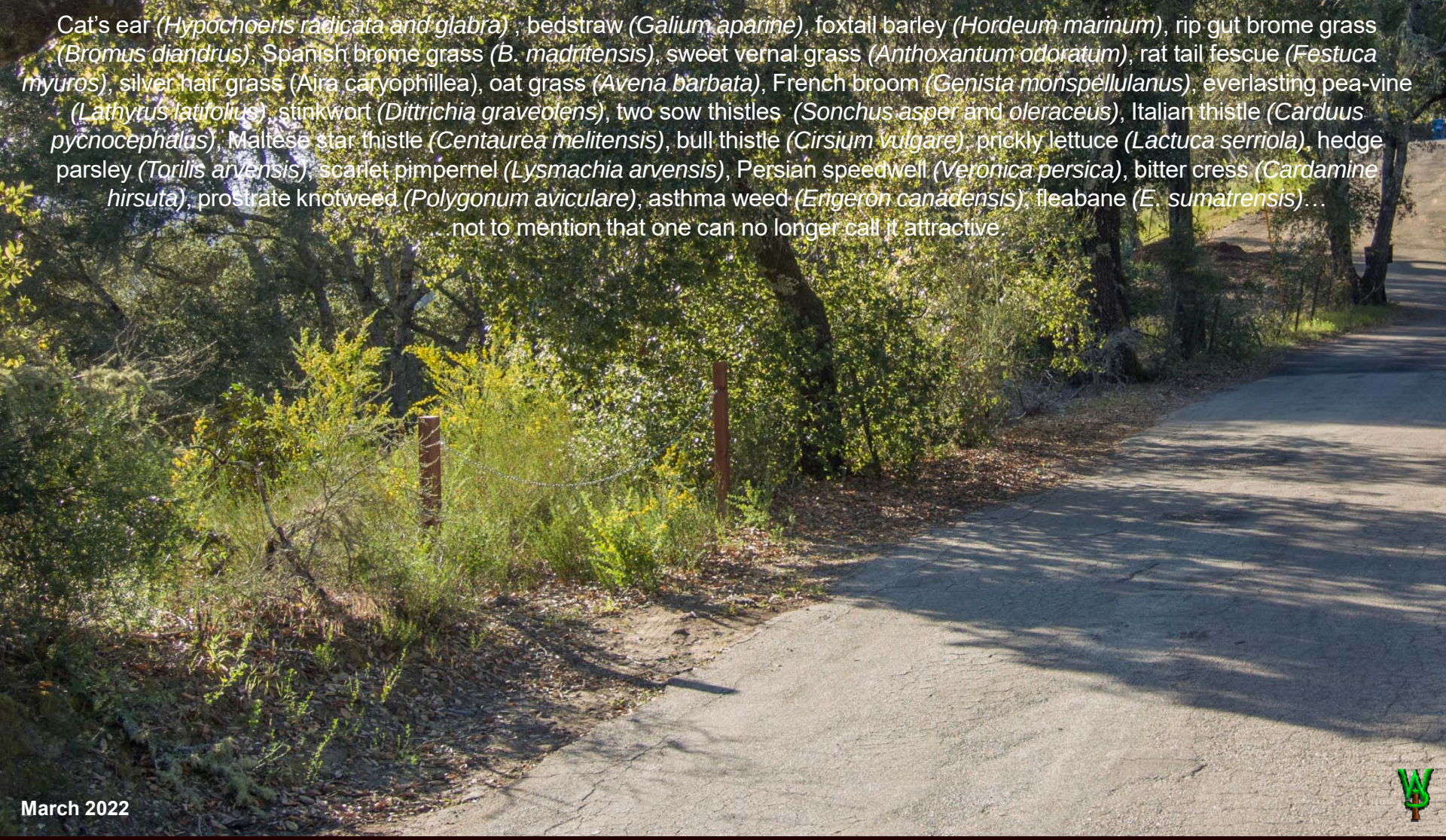
There are indications that the Sayante had taken those appropriate control measures. There are (were) high percentages of parasitic plants along that trail and especially on that rock nose surrounding that "campsite"**:** two species of paintbrush *(Castilleja affinis* and *foliosa)* in two colors (red and bright yellow!!), *(Cordylanthus rigidus (*bird's beak*),* and Naked Broomrape *(Aphyllon franciscanum).* Featherweed being a nitrate hog, might be especially attractive to parasitic plants.

After a hard day heading back to the village lumping a load of Franciscan Chert to make arrow points, one would definitely need a place to bed down along the way. Another plant here I have found near the trail in dry locations along ridges and without skunkweed present is Turkey Mullein *(Croton setiger)*. This plant would make a relatively nice bedding material, as it does grow flat on the ground with a soft fuzz on the entire top surface (as compared to skunkweed or spineflower). Turkey mullein is toxic to animals and was used for fishing. Turkeys and doves are known to like the seed, which may have added the prospect of dinner at the campsite or nearby!

No photo yet. To this point in 2023, I've resisted its spread sufficiently that it does not express what I wish to show here.

September 2023

Featherweed has other desirable properties for defensive use. Typical of the plants already discussed, as it populates a spot, it gets much smaller and denser, thus possibly making an even better "pavement." Being a perennial, it pops back up after a fire cool enough not to cook the soil, but this plant is so fleshy, small, and exclusive, I doubt seriously it would carry a fire at all. That would make featherweed a good prospect for a safe "pavement" tribal trail on which one could travel confident that an enemy couldn't set fire to trap you! It might even make an effective "fire line" with which to time fires in patches for harvesting purposes. If this experiment proves out, the presence of groups of parasitic plants might be a useful indicator of prior aboriginal use, and therefore a potential archaeological site. With the parasitic plants already established on my neighbor's ridge, it is the only place anywhere around our property where I could have run those experiments without need to establish the parasitics or get rid of the weed seed bank.



But alas, my new neighbor has destroyed the usefulness of my legal easement on that ridge-line, despite that it was so attractive that the real estate agent who sold it to them cut stairs to the top to put a pair of lawn chairs up there so that she could pitch its commanding view of the sunset to buyer and wife… He could have kept it that way and enjoyed the finest land management available, put in his orchard or built the gazebo of his dreams, but instead he got greedy and willfully ruined my easement for a weed buffer to keep me from maintaining it, which would have cost him nothing. Instead, he is now growing hundreds of pounds of proven biochemical poisons out of bogus fears of industrial chemicals that have been tested to no end. Now it provides him nothing, covered with weeds that bomb large portions of OUR property with airborne weeds, with animals and runoff from his driveway also carrying them in. It costs me months of time every year and could eventually destroy my project of 34 years' arduous labor. Would you sue him?

As a much less desirable alternative and almost far enough away from the weed onslaught from the ridge, in front of the house I have a "road" used occasionally that could work for an experiment. On one side it is bounded by a patch of white root sedge *(Carex barbarae)* that gets burned every two years. I can easily populate the road with *Navarretia* and cudweed and watch them duke it out. I have a couple of other annoying weeds there that I'd prefer not to manage so the cudweed might actually help. On the house side there is California brome I can afford to sacrifice but the site lacks any sign of parasitic plants and propagating them is no small feat without a greenhouse. Rroomrape could also be effective as a control plant, so I have confirmed with some 2,500 people they haven't seen it in a veggie garden. Either way, I'll be starting broomrape with cudweed in pots to confirm the establishment of parasitism safely.

Reduce, Reuse, Recycle

Agricultural nitrate pollution of watersheds is a problem worldwide, particularly with sandy soils (as they are here). Pink cudweed *(Pseudognaphalium ramossissimum)* is another native annual member of the everlasting clan that pulls nitrate into its tissues (as probably collected by fungi). Unlike perennial featherweed, this annual cudweed grows to five feet over summer, and puts that nitrate back on top of the soil when it dies. It is visibly evident that it augments germination and development of other plants in its patch of rapidly decomposing mulch. It should be easy to compare nitrate levels in and around one of these plants through a multi-year cycle.

Pink cudweed does not do well against established higher order plants. But as a post disturbance plant, it can be invasive to the point of being perhaps “weedy.” This spot was first exposed to additional sunlight by a tree removal to the left the prior year. Its presence here is not a case of long-term viable dormancy as there had been a population just down the slope. How far does that seed travel? Just up the slope is our “sand hill” area in which I maintain scads of tiny plants to see what they do. Pink cudweed would likely make a mess of it. We will see if the monkey flower *(Diplacus aurantiacus)* can restrain it at the expense of being a fire hazard.

Monkey flower IS invasive here, but some grasses (such as this *Calamagrostis rubescens*) suppress it considerably. One reason for its aggressive behavior is that it is clearly inedible to just about anything. It responds slowly to having been mowed.

There are places where I remove monkey flower for fire control or successional reasons as it becomes decadent quickly and burns like diesel. I wouldn't have any "sand hill" area if I didn't pull its seedlings and it also invades our needle grass *(Stipa lepida)* stands successfully. Monkey flower also abets tree invasion (above). Yet if one is wishing to establish an oak, monkey flower helps that process by forcing the tree to grow a straight stem to acquire light while protecting it from herbivory. Its flammability has me seeing it as a temporary thing, but it is pretty when young and fresh. If I could burn without fear or restriction, I'd do it about every 3-4 years.

Came and Went?

July 2008 – I haven't seen it again

New plants just keep showing up over time, but some never showed up again. This is *Lupinus latifolius*, which made appearances here in 2008 and 2010. Being a Fabaceae, the seed is obviously still around. The book was for scale.

This *Lupinus bicolor (v. microphyllus?)* is either a new entrant for 2015 or something weird happened when it came up in the mud where I drilled a hole for a fence post… That would make it a **real** "post-disturbance" plant! (Sorry, well, no I'm not). We have gobs of the usual herbaceous *L. bicolor* here, but this critter is a small woody shrub over two feet across. Interestingly, while I normally tend toward being a "lumper" simply because too many biologists get all hot and bothered about differences in physical attributes as denoting separate species, our new colonizer may *function* here as a separate species from the more common flavor simply because our usual *L. bicolor* is done flowering in April while this one clearly did not flower until early July. They cannot cross breed successfully here, a difference I have also seen between *Torilis arvensis* and *T. arvensis v. purpurea*. This idea (that what separates one species from another varies on a spatial basis because of differences in habitat) may have global implications, where they might cross breed successfully in one place but not another, placing yet another point of contention in deciding what constitutes a "species."

Negative Impressions

It is hard to be certain, but sometimes it appears that clovers suppress germination among themselves from year to year I suspect due to residual auxins left in the soil, thus possibly allowing other species in the cohort to express themselves in turn (which would explain a lot). I have seen patterns of germination that almost looked like a photographic negative from the prior year, both in instances of disturbance (because I had killed a patch with a burn pile) and without. Unfortunately, planning to document that photographically is very difficult because it is unusual to have two good successive years for clover germination. Maybe some day. At least now I know what to look for.

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Canyonlands National Park

Deseret Ranch

Fuels Management, Succession Run Amok

The Cone Fire (the benefits of active forestry)

The Warm Fire (what happens without it)

Fire Aftermath: Mesa Verde National Park (weeds)

The Croy and Summit Fires (the wildland urban interface)

Socio-Ecological Paradigms

Environmental Consequences

Meadow Encroachment in Yosemite Valley

Why we can't accept how the original forest as it once was got that way

Living Sheepishly

Why we need a culture of animal husbandry

Sustained Development

Cities are becoming prisons

Katrina: What Did You Expect?

Environmental bureaucracy can be deadly

Natural Process: That Environmental Laws May Serve the Laws of Nature, ©Wildergarten Press, 2001, 454pp, ISBN: 0-9711793-0-1, LOC Control #2001092201. http://www.naturalprocess.net

Shemitta: For the Land is Mine: ©Wildergarten Press, 2009. Contains: 217pp text, 980pp overall, 14 picture books, 2 tables, 963 photographs, 9 maps, 2 drawings, 2 charts, 145 footnotes, 358 citations, and 216 other source references, not including external Internet links. ISBN 978-0-9711793-1-8. http://www.shemitta.com

Articles at Wildergarten Press: collected writings on Constitutional history and regulatory racketeering by tax-exempt "charitable" foundations. http://www.wildergarten.com/wp_pages/articles.html

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