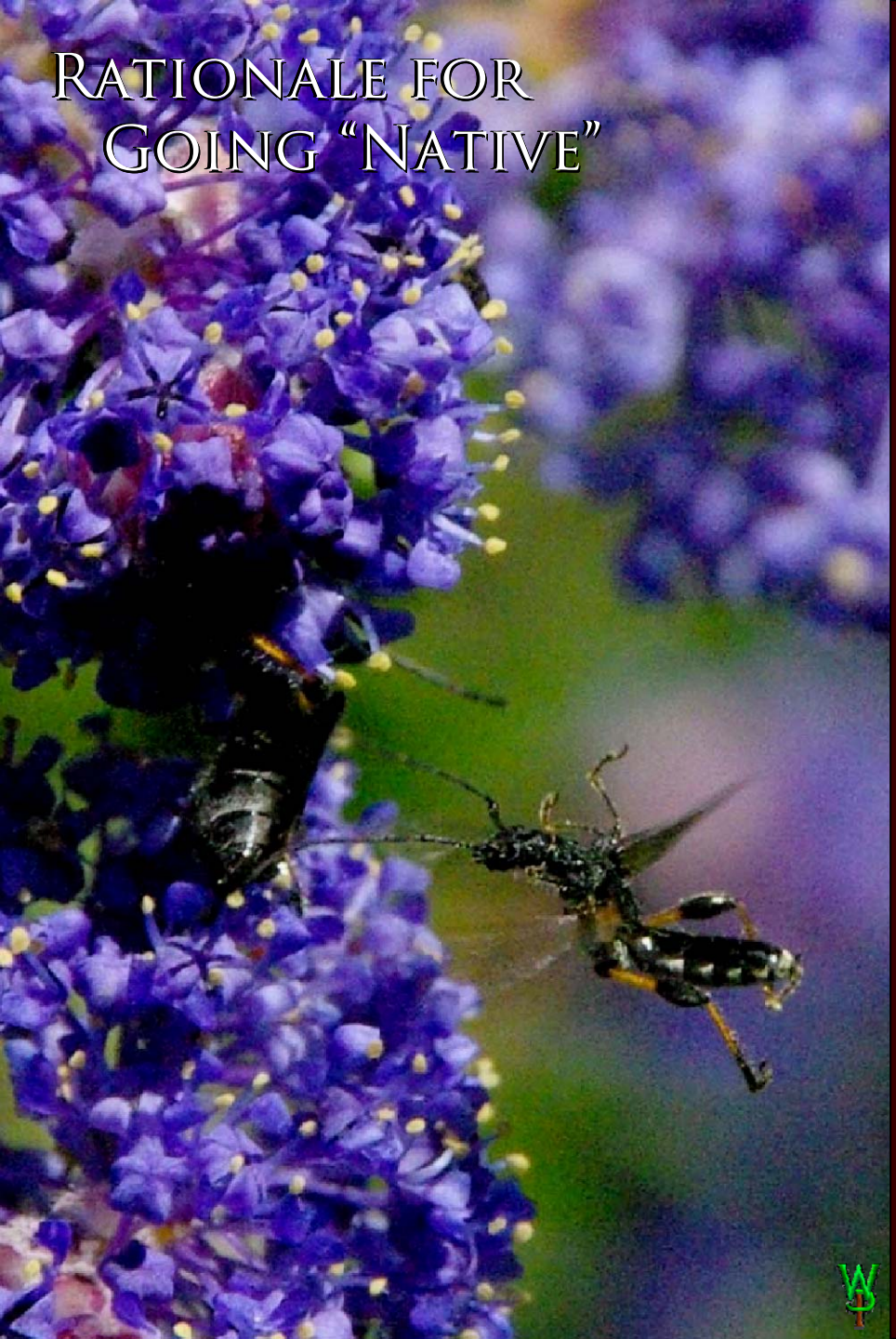
Rationale for Going "Native"



Plants are the most accessible means for people to manipulate the biological world. They can't run away and are relatively easy to propagate into vast numbers. Besides providing the bulk of food and materials for insects, people, and animals, they process nutrients for rivers and lakes that feed the estuaries that breed so much marine life. The ocean in turn processes 80% of the oxygen in the atmosphere, mostly along coastlines. Learn to manipulate plants and one can indeed hold sway over every bird of the air, fish of the water, and herding animal.

Native plants (especially post-disturbance annuals) provide the energy for their fungal and bacterial symbiotes that process minerals and gases into soil organic matter. 70% of agricultural soils are former native grasslands. Annual forbs were once most common in grasslands. Insects and animals need the annual plants to make proteins while 80% of the plants need insects for pollination and larger animals for soil fertility and disturbance.

Migratory birds not only consume insects and seed, but some require plants that produce the fruits for which they are suited. Many relationships among insects and plants are specific: pollination in return for food or for insects and larvae tolerant of the toxins the host plant produces. Without the biomass of appropriate plant hosts, the biomass of insects declines. Soil bacteria and fungi too often have specific relationships with their native plant hosts, and less their exotic counterparts. Hence, if that botanical foundation changes, the insect and microbial bases of the food pyramid changes too, particularly if non-native plants take over after a disturbance such as a flood or fire.

April 2010 – Rove Beetle in Flight *(Callimoxys fuscipennis).* On the right is a male coming in to mate with the female on the left.

This *Ceanothus papillosus* is a fruit-bearing lilac shrub popular with birds. These should be fairly common. When we bought our place, weeds and overcrowded forests had progressed so far that none were left. Thinning the forest and burning the tops in piles induced germination. I transplanted the seedlings to get things going for bugs. Besides, they're pretty and they smell wonderful.

Wildergarten 6.0

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.

Revision History 1.0 2.0 3.0 3.1 3.2 3.3 3.4 3.5 4.0 4.1 4.2 4.3 4.7 5.2 5.4 5.5 5.7 5.8 6.0

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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www.wildergarten.com

March 2019 – Makers and takers? Nitrate fixing *Apahanes occcidentalis* mixes with likely nitrate sequestering *Psilocharphus tennelus*, an undescribed nitrogen cycle at a tiny scale never before observed invading the understory of clovers and lotuses. It's cool.

The *Wildergarten* is amazingly varietal for native plants even for this region, and especially for a parcel this small. It is home to five distinct types of habitat**:** redwood conifer forest, oak and madrone woodland, native meadows of several types, scrub/chaparral, and the unique "Santa Cruz Sand Hill" habitat. It is a wonderful laboratory for observing dynamic behaviors among these plant communities over multiple decades but only as long as management continues.

Even though it lacks a pond or perennial stream (therefore not a place botanists would rationally call a "biological hot spot"), as of 2019, we manage 354 observed plant species (225 natives) on only 14 acres. Despite having been inundated with weeds for 200 years, according to at least seven local botanists and restoration experts (three of whom had been presidents of the local chapter of the California Native Plant Society), the Wildergarten is the purest restoration of native plants to be found anywhere on the Central Coast of California and perhaps in the world. Virtually every park, preserve, or "pristine area" in the region is significantly infested with exotic plants by comparison. Yet this place was once FAR from "pristine." It was a disaster.

Most of this book centers upon how to achieve these results. The previous chapter introduced the challenges we faced due to weeds and succession. This chapter explains why this project represents a prototype laboratory for scientific discovery and restoration process and tool development. The goal here is to learn how native plants behave in order to maintain them. It has never been done on this scale before. What we have learned is that this system is quite different than the usual landscape in California.

These plants exhibit complex interactions with each other and soil that are not described in the literature (left). This is how small the critical battleground gets. Get it clean enough, and processes such as you see at left begin to appear. Yet it can take a decade before getting enough tissue for analytical work simply because we start out with so few. Yet we are learning how to accelerate control processes so that larger areas can be covered fast enough to keep up with the rates of weed appearance and maturation to seeding to allow them to express. We are only beginning.

If all there is are trees, is it really a forest?

The previous chapter showed that “preserving” the landscape, allowing succession to progress to forest unabated, means that native annuals will then fail to germinate, and with them go many insects. Eventually, the annual seed bank slowly dies. Disturb that “preserved” forest with weeds present, and the remaining native annuals will be overwhelmed. Repeat the cycle enough times and the result is mass extinctions of both the annual plants and their animal and microbial associates. We will have then lost much of the base of the biological food pyramid.

This chapter begins with a series of factual observations, and then synthesizes them into the key policy thesis of this project.

1. The botanical foundations of the soil system are now rare. Early successional native plant systems are subtle, complex, and not well understood.
2. Native systems of annual plants are not easy to maintain under current boundary conditions.
3. Systems subjected to exotic invasion are profoundly different on massive scale. Many of these exotics have serious drawbacks.
4. How to restore native post-disturbance annuals is relatively unknown, and can vary radically by site.
5. Seemingly small errors or differences in nativity can have profound consequences for biodiversity.
6. A system of plants missing its associates complicates restoration management choices.
7. A manager must make hard choices quickly re what to propagate and what to cull even among natives.
8. Centralized oversight systems are unsuited for that job.

The needs are so many and so urgent, the challenges are so complex, while so little is known about how to do this, that instead of large scale landscape preservation or hierarchical bureaucracy, what we need is to inculcate a network of SMALL independent projects developing a wide range of processes to increase specifically local knowledge of native annual systems at reduced cost and risk. Now.

Why Native Plants?

Our "Back Yard," June 1997 – The groundcovers were virtually all exotic

When we began in late 1989, the goals were fire-tolerance in healthy forests and getting rid of French broom, most of which had been accomplished by 1997 (above). At the time If anyone had suggested a 100% native landscape, I would have said that was crazy. Not that it wouldn't be desirable, but with the weed history this property had and with as fast as they breed, I thought even controlling a grass impossible (above). The decision to go 100% native came about 4 years later. Little did we know that nobody ever had.

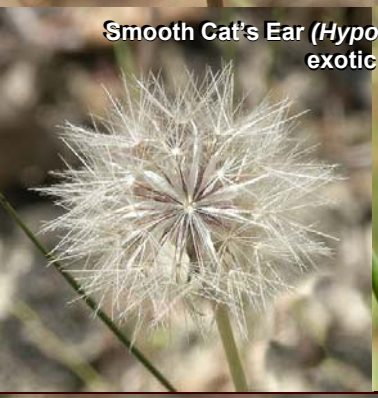
So if it was “crazy,” why embark on such a likely fruitless effort? I had spent four years writing a book proposing a free enterprise approach to environmental management. If it was ever to happen, its seemed that its progenitor had best exemplify what private management could accomplish. The background in this area had been graded 3 years prior in 2016. There are fewer trees and less shade . Other than the vegetable garden, nothing here has been irrigated. Yet despite the disturbance, weed removals, extra sun, and weed burning early this spring, the observation is unmistakable that everything is greener (including above the leach line pipe). Why?

Native plants are the difference. Above are *Verbena lasiostachys*, needle grass *(Stipa pulchra)*, blue wild rye *(Elymus glaucus)*, skunkweed *(Navarretia atractyloides)*, California brome *(Bromus carinatus)*, Spanish lotus *(Acmispon americanus)*, and slender tarweed *(Madia gracilis)*. Weeds removed here were rat tail fescue *(Festuca myuros)*, *Oxalis micrantha*, rip gut brome *(B. diandrus),* scarlet pimpernel *(Lysmacha arvensis)*, wall bedstraw *(Galium parisiense)*, Coast tarweed *(M. sativa)*, and horseweed *(Conyza canadensis)*. The latter two species are considered “native” plants. That choice to cull them will be addressed later in this chapter.

But are *native* plants really necessary? After all, things are so degraded or converted everywhere else, there may be no point to this other than as a matter of curiosity. Well, at that point one must ask: Why are deer numbers down? Deer need enough forbs to eat to survive over-predation. Do you want birds? Birds need bugs, whose numbers are way down. Do you want your food pollinated? Native bees don't make honey, depending upon a series of flowering plants. Other birds eat fruits of shrubs in season. If we allow a non-native shrub (center) that doesn't make edible fruit to take over, their migratory pathways will lack food for the trip.

Annual Agoseris *(A. heterophylla)*
native

Silver Puff Dandelion *(Uropappus lindleyi)*
native



Smooth Cat's Ear *(Hypochoeris glabrosa)*
exotic

Of these dandelions, only cat's ear (on this row) is non-native.

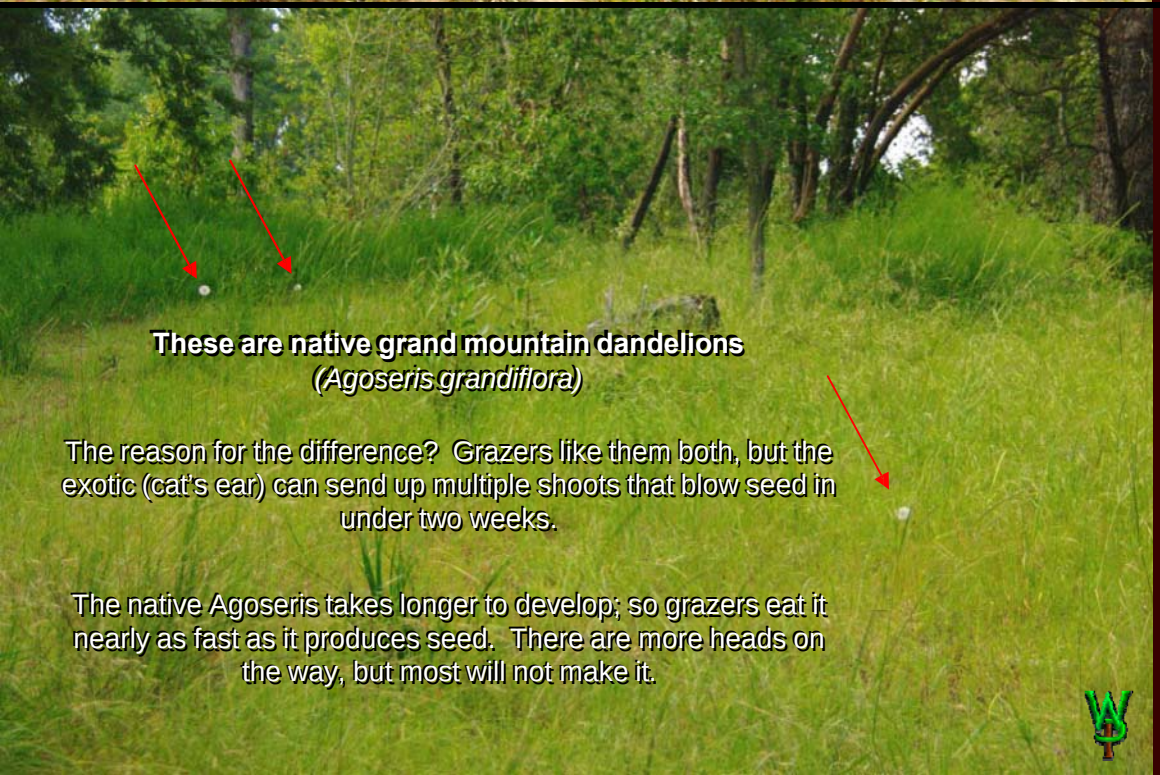
If you think that native v. exotic is a distinction without a difference, please consult the images on the next page

Grand Mountain Dandelion *(Agoseris grandiflora)*
native

People often ask how we know whether or not a plant really is native. In some cases the determinants are easy: Some, (such as redwoods) occur without human propagation in only one region of the world. Other evidences are more subtle but still definitive, such as fossils or pollen layered in mud found in at the bottom of stable water bodies. A few cases are not much more than educated guesses. In fact, there have been errors in the botanical record that have been disastrous for this project and continue to be a costly challenge. Still, I would hazard that the determination of whether a species is native is probably better than 98% accurate overall. Yet the limits as to what constitutes "native" are potentially more subtle than we realize, as examples in this chapter will show.

Beyond nativity, we know *very* little of how pre-colonial native plant systems were arranged or managed beyond explorers' accounts and archaeological analyses. The Spanish records of first encounters are thin, but combined with the knowledge from restoration work, do support valuable inferences discussed in the site history. More detailed information was recorded in Brewer's Diary of the 1860's US Geological Survey of California, but by that time the system had nearly a century to change radically. We ***do*** know which plants we tend to find together now, but that doesn't tell us how they worked as systems because the exotics are so dominant and the native seed bank is so depleted. Upon those and similar bases, how *could* we reconstruct whole systems, much less assess their value, given so many unknowns?

We are addressing that latter question. By ridding so much of the property of introduced plants, we not only get to witness how natives congregate, but how they colonize an open niche and work it out with their old friends. In many cases, the native seed bank had been exhausted for so long that we had to wait for birds and animals to bring something in or find it locally. In most cases, those "somethings" had long been known to be local natives. The associations they form are qutie different from what you see with exotic plants.



Different animals need different kinds of food. For multiple species to reproduce in one spot, no single native can be too dominant. Native plants 'learned how to get along,' but ONLY within the aboriginal envelope within which they were managed. That collective lack of individual dominance may be one factor that leaves them so open to invasion.

Non-native plants by contrast tend toward mono-cultures (top) until they are displaced. Most exotics wreck microbial soil productivity because they lack symbiotic relationships with bacteria and fungi with which to feed plant sugars to the soil system.

How these plant/microflora relationships work remains unknown to science. Without having the genetic raw material, soil nutrients, and a process of disturbance against which to observe system behaviors, we never will. That means somebody has to have a place to do that research with minimal disruption from exotics. Sadly, this is it.

Establishing natives here started with killing everything, making open niches (bare soil), waiting for natives to make an appearance, and then killing weeds around them as they colonized the place. Hence, early on, things were pretty sparse here. Even after some were established, it is uncertain that their microbial soil symbiotes were still present. In some cases, they were clearly not.

The latter consideration is much more serious than many realize, for microbial associations (familiarity with the neighborhood so to speak) may be one of the reasons why native plants can behave either as invaders or partners to a system (as you will see in this chapter). But before we go there, take a quick look at the differences displayed at left in simple dandelions, native and exotic.

Cat’s ear was such a disaster that I wanted you to appreciate this mess. Often confused with the common dandelion, this species is both mildly toxic and allelopathic (it poisons plants that compete with it). 25-50 seeds per head. Imagine acres of it.

Besides, I just like the grand mountain dandelion better.

Verbena lasiostachys

Stachys bullata

Another typical question is if there is anything inherently superior about native plants. To the surprise of many, I would argue that, on an *individual* basis, in most cases the answer is no. However, when one looks at how individuals behave within total *systems*, I would argue natives generally make more productive landscapes. The reasons are subtle and demand some explanation.

There are two ways to obtain the materials to produce the physical products you buy**:** agriculture and mining. The first is in some respects the second, in that whatever soil minerals leave the site as products are also effectively "mined." Seventy percent of the world's farmed products are grown on former grassland soils. So, any process that renews or increases the productivity of grasslands would seem to be a good thing.

Yet functional grasslands are much more than just grasses. Consider the verbena at top left. Although it is a perennial, it has the property of dying back every winter, leaving massive amounts of soil organic matter in the form of decaying roots and vegetation. Every spring, annual forbs germinate in that goo and die, leaving processed nitrogen, then to be covered over by the verbena. During the summer, verbena then becomes a fire-tolerant moisture-retaining blanket while providing an important source of pollen to hordes of bees for months.

Consider hedge nettle *(Stachys bullata)* below. The roots of this genus exude sugars that feed nitrogen-fixing bacteria in the root zone (rhizosphere) similar to nodules on legume roots. These nettles do make beautiful soil and they don't sting. Such relationships may explain why we see so much growth here despite the fact that our sampled nitrate numbers are pitifully low. On the other hand, this book explains why our soils lack trace minerals for nitrogen fixing (diazotrophic) bacteria. It's subtle.

There is a lot of research to do, yet these and similar plants are in trouble. If you now realize that we do not know much about them, more significant is that we know a lot less about how they interact with each other without weeds and especially in soil, where microbial associations are very poorly understood.

Filago californica
(now Logfia flaginoides)

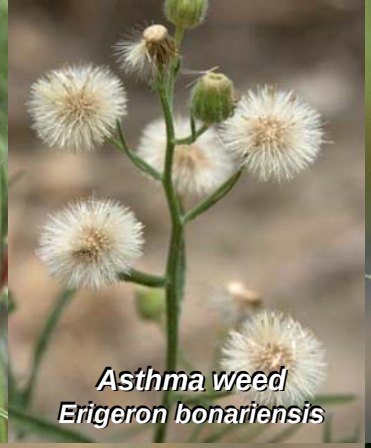
Filago gallica
(now Logfia gallica)

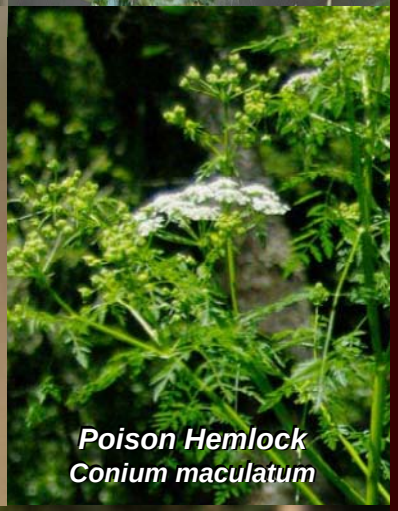
So, do I think non-native plants are always bad? No, not when confined to a farm or ornamental landscape. Yet of the 135 exotic species found on this parcel, only ten (10) are classified as "benign," meaning that they do not displace natives and tend to stay put within the system. Most of these are relict ornamental or agricultural plants**:** an oleander, a mission olive tree, a periwinkle every year or two, a juniper shrub, a patch of “naked ladies” *(Amaryllis belladonna)*… The rest of the exotic plants here all crowd out natives, in part because they can tolerate a broader range of habitat conditions than natives seem willing to inhabit and because they tend to germinate earlier.

A good example is at left. Obviously, *Filago californica* (native, top) and *Filago gallica* (exotic, below) are related. The native lives only in sand hills. The exotic lives anywhere there is full sun and bare soil. The exotic displaces the native, but it also displaces native clovers, lotuses, and *Navarretias* over a considerably larger range. The exotic once outnumbered the native in its *preferred* habitat, 50:1. After ten years of weeding, literally hundreds of thousands of removals, that ratio now tilts native. There is currently no way to separate the two other than by hand. As an annual job, it sucks.

But, don’t we want plants that are widely adaptable?
Well, not necessarily**:**

- If we do not want to displace other native plants in the wild, the answer is no.
- If we want varietal cohort species (such as soil bacteria) with which they are symbiotes, no.
- If we want systems capable of sustaining numerous species of insects and birds, the answer is no.
- If we want the plants to get along with each other such that systems can perform multiple functions in the same spot, no.
- If we want adaptive systems as a whole, probably not.





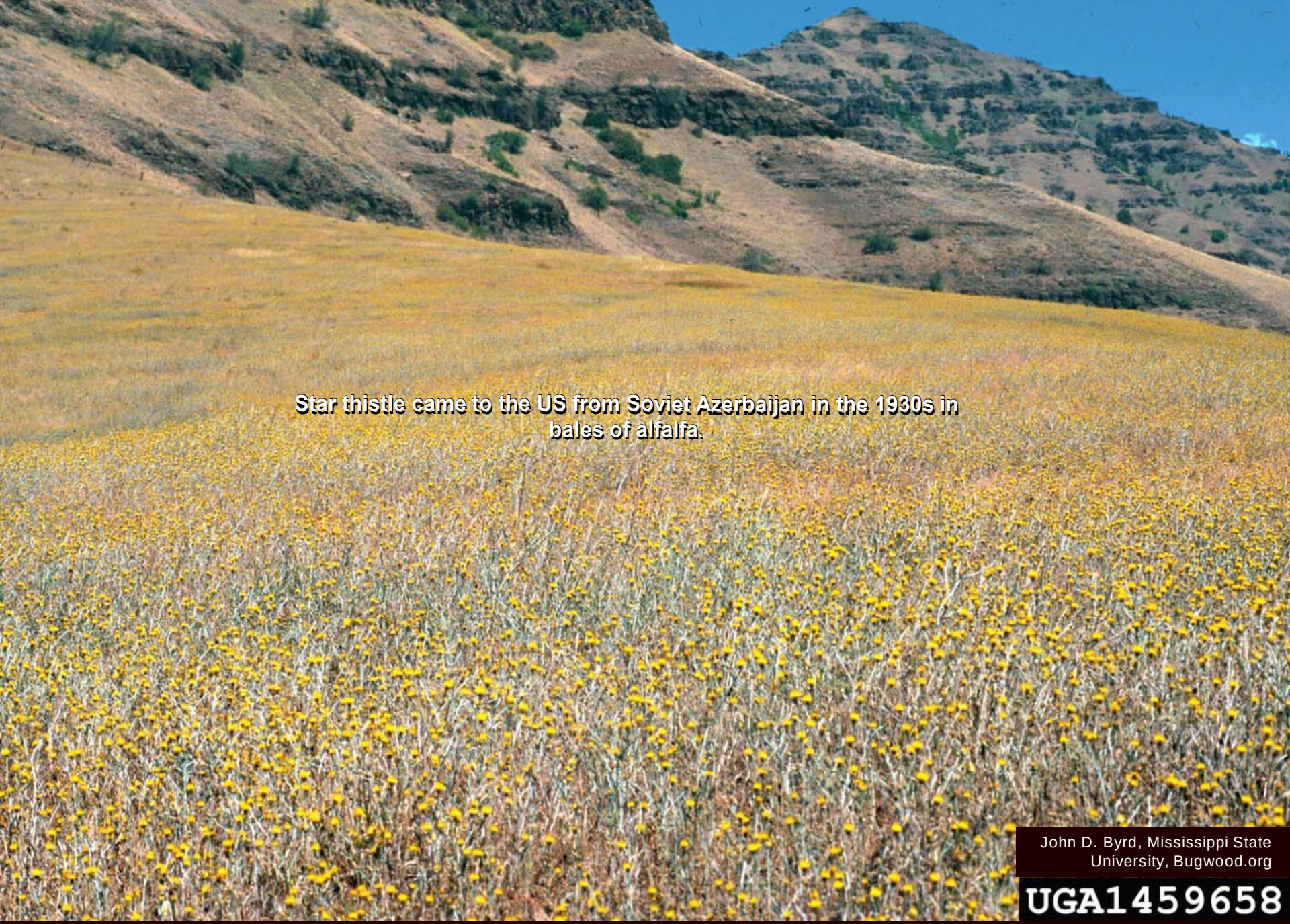
As a final element to this, “Are non-natives always bad?” question, most of the exotic plants we *are* talking about as weeds are plants people have found to be generally undesirable for residential or agricultural use. Most would be considered "bad plants" even where they are native. They are**:**

- Largely inedible to humans, beasts, or insects,
- Most have poor forage value,
- Many are toxic,
- Allergenic irritants,
- They displace forbs that produce protein in forage,
- They are very destructive to native soil fungi and bacteria that complex and distribute nutrients,
- Many cause mechanical injury to animals,
- Many produce irritating burs,
- Most are water hogs,
- They are all virtually uncontrollable, and
- Most are fire hazards (at least they are here).

This does not mean that they have no *potential* use, as the examples of various vetches and poison hemlock (to come) demonstrate. One can make honey from star thistle. One can graze rip gut in early season. However, in this region, I really don’t know why anybody would *want* large amounts of them given superior alternatives.

Most people find most exotics undesirable, but seem equally unwilling to do what it takes to bring them under control, which is to… KILL THEM **ALL**, for decades. In general, most people either do not know or care what is native versus exotic or do not possess either the means, the knowledge, or the willingness to make it happen.

There are notable exceptions to the general public indifference to weeds, a special subset of exotics that invade developed areas, excluding all other plants until something worse comes along. These pests are displacing native plants, worldwide. The US Soils Conservation Service introduced kudzu as an erosion control… Well, it certainly worked for that.



… but other invasive exotics came in accidentally, facilitated at an increasing rate by global trade with neither inspections nor treatment.

Some invasions are subtle because we are so accustomed to their presence. "The Golden Hills of California" may be beautiful, but neither are these grasses native nor are they as productive for forage as others could be. Over 25 million acres of annual grasses, particularly slender wild oat *(Avena barbata),* "poverty grass," *(Festuca spp.*), and several exotic bromes such as rip-gut and Spanish brome *(B. diandrus & B. madritensis)* have displaced the perennials that would do as well or better and the forbs that make protein.

Many invasive weeds are outright poisonous by various degrees. So are many natives, but the problem of toxicity in exotic plants is that the monocultures they form increases the total mass of poison. In this “protected ” area, hillsides are covered for miles with poison hemlock *(Conium maculatum)*. Tons of *deadly* poison. There is little food for wildlife here but for some birds (quail can tolerate the seed, but not what eats the quail). Little is done because locals are more afraid of herbicides than the poison, because it is a “Natural” poison. Really. So nobody does anything about it and the plant makes ever more seed. Given the number of native plant species this weed displaces, leaving animals to starve and plants to go extinct, to me, this fear of chemicals seems irrational. Yet there are perils to taking action unless one is dedicated to seeing things through. Get rid of this “top layer” weed and the next can then germinate.

June 2019 – Scarlet pimpernel (orange flowers) makes about 25 seeds per flower capsule.

The exotic seed bank expresses in “layers,” with more aggressive species being the few that form the visible top layer. Consider scarlet pimpernel (*Lysmachia arvensis* – used to be *Anagallis*). Cute isn’t it? This common suburban weed is so poisonous it kills horses, cattle, sheep, goats, birds, and it even kills bugs! These chemical poisons evolved to be as toxic as possible to all animals without the slightest concern about safety, nor has a single herbivore ever developed a tolerance for it. That is one successful poison. But in terms of the weed hierarchy, it’s a wimp that shows up in quantity only when other more dominant plants have been removed. So if there is hemlock, you won’t see much pimpernel. Get rid of hemlock and there’s a good chance pimpernel will be there unless there is something more aggressive present. In fact, I regard this plant as an indicator that there is not much left of the weed bank.

Even if the weeds are non-toxic in themselves, they are usually very damaging to soil microbial relationships with other plants. These two images were taken **¼ mile apart** in the Hamilton Range of Nevada, above "Paradise Valley." When we first got there, I wondered what was "Paradise" about Paradise Valley… the soil was **ALL** hard, brown, cracked, and dry with "cheat grass" *(Bromus tectorum)* everywhere. As darkness fell, we drove up a dirt road into the mountains to stay the night at a campground. As we came back down in the morning, the varietal native cohort (left side) interspersed with wildflowers was fairly typical until we encountered cheat grass (the invasive brown grass on the right). If you have ever weeded invasive bromes then you know how the soil under them stinks.

Paradise Valley, Nevada. It's all cheat grass.

Weeds are poison. And yes, this difference on this scale is enough of a reduction in transpiration to depress precipitation.

When you see Great Basin Wild Rye amid wildflowers *above* Paradise Valley, you start to understand why grizzled ranchers get teary about how things used to be. These grasses make fleshy bunches 2-3 feet tall. The soil organic content under them reaches 15%. With cheat grass, it's 2%. Organic matter is largely decayed roots and fungi, which then can host bacteria to retain and process toxins.

In a Beginning…

March 2016 – A vertical rock wall across the road that was once covered with cat's ear.

A native successional system begins with mosses and bryophytes like on this sandstone wall. These plants dissolve the compounds that cement sand particles into stone. The combined material then sluffs into piles, beginning the process of soil formation. The piles are then populated with annual forbs (such as the clovers in this photograph on a step in the wall). These plants prepare the bacterial, fungal, and mechanical soil conditions for the perennials that succeed them. Unfortunately, these early post-disturbance plants are also the most likely to be displaced by exotics. The little tan blobs on the wall *(Asterella palmeri* - inset*)* are so uncommon today that the University herbarium lacked a specimen until I provided one.

March 2107 – Weeds here are rat tail fescue (*Festuca myuros*) and wall bedstraw (*Galium parisiense*)

Not long after the forbs establish, the byrophytes are virtually gone, but not entirely. We still have mossy patches within a forest only 100m away in which these *Asterella californicum* popped up. Yes, this is a different species of *Asterella* from the one above. We have even less of an idea how this system once worked than we do with the native annual forbs.

The forbs themselves in turn build spectacularly complicated arrays, here of clover, lotus, tarweed, lupine, skunkweed, and cottonrose. This spot is a sandstone road only thirty feet from the cohort you'll see in the next slide.

March 2017 – In this space of about a square foot are 10 species: *Lupinus bicolor, Camissonia micrantha, Calandrinia ciliata, Navarretia atractyloides, Bromus carinatus, Pterostegia drymarioides, Logfia filaginoides, Trifolium microdon, T. gracilentum,* and *Acmispon parviflorus.*

Forbs here form very different cohorts from place to place. This one has deep sand at the foot of a very soft sandstone ridge. These plants express early in the season, drop their seed, and that's it. Ants do the cleanup and gophers turn it.

What we know about early successional plants is that it is hard to keep them without repeated disturbance. Unless I put a big burn pile here, the biodiversity of this sand hill converts to grassland very quickly, although still far beyond what you'll see elsewhere (left). Brush, particularly yerba santa *(Eriodictyon californicum)* and deerweed *(Acmispon glabra)*, also invade this spot very rapidly. Then it's oak trees. In five years, you wouldn't recognize it. We've gone through several cycles of this here over the years. So far, there is no easy way to forestall succession to higher order plants without expensive removals or importing fuel to get it to burn in winter. I cannot burn in summer with million-dollar houses surrounded with crazy fuel loads nearby. Native Americans obviously didn't care about that when they burned. So I must do the extra work of importing tree tops to make a winter fire hot enough to keep this system going.

So why go to all this trouble? What is wrong with a grassland? Nothing intrinsically, but we have those elsewhere. So far, it seems this type of cover occurs rarely elsewhere on the property, yet it is the most varied overall, making this a good spot for study. Interestingly, its composition is different than another sand area on the other side of a tree only 50 feet away! Yet some of these plants are showing up in grasslands elsewhere on the property. Hence, a source of reproducing seed is essential to colonizing the whole, as many plants spread only when they are eaten. Also worthy of note is that each time I have disturbed it, the pattern has changed substantially. In 2010, this road below previous slide had clovers totally dominant (p26). I graded it and now it is *Navarretia* and a small tarweed.

After the burn, this slope above the road that had also been “clover heaven” went to mostly Camissonia, *Logfia*, and *Pterostegia*. Why? I have my speculations, but the point is that there is no point in even asking such questions elsewhere because nobody has a landscape where such behaviors can be observed without significant weed influence. But would there be a practical benefit to such knowledge? It was discovered here that one of these native plants is a fantastic dry land forage, with both high protein and water content. They require no irrigation. One could then run animals for fuel control and they might not need as much added food or water.

If we learn to manage vegetation to feed animals to help manage other vegetation so that cities don't burn down it would then make insurance more affordable. Spinoffs would include enhancing conditions for wildlife that everybody seems to think desirable, boutique cheeses, clean meats, and property value. The technical key is improving forage conditions for the animals that browse tree seedlings. The political key is learning to use actuarial risk management to denominate the economic value of vegetation management.

Small Mistakes

June 2015 – This is *Carex divulsa*. To Stanford's credit, this "green roof" has since been replanted but it still has weed problems.

In some cases, identifying an exotic can be tricky enough that even the professionals get it seriously wrong. In 2004, I was in the throes of learning what was native and not. I was also in too much of a hurry. So I bought 200 *"Carex tumulicola"* (foothill sedge) plants from a local native plant nursery specializing in large (and expensive) habitat restoration projects. Impressed with my efforts, I called in some botanists to witness the progress. One got out of his car, looked up the hill, and said (loudly), "There's that sedge (Name Withheld) is selling as *Carex tumulicola*!" I asked him what it was and he said he didn't know, but that it wasn't as advertised, to which the others agreed. I killed them all (the sedges, not the botanists), packaged some samples, and sent them with some known *C. tumulicola* to the Jepson Herbarium at UC Berkeley. After a year goading them to do the ID work (it is tricky), they punted them up to Dr. Eric Roalson at U. of Washington. By then I had guessed and he confirmed what they were**:** *Carex divulsa*, an exotic European sedge. This plant had been sold all over the State as a native, especially for said very spendy restoration projects such as "green roofs" on government and university buildings (above is atop a parking garage at Stanford University Hospital). The interesting thing is**:** Although the experts in the native plant nursery business had been fooled by appearances, this exotic species did *not* do very well.

This is our *Carex tumulicola.* We already had some. Had I known, I could have done simple divisions for far less trouble. We have lots of it now. In this case, there was no harm because I killed the errant nursery plants before they seeded. We all make mistakes but private research is done individually, necessarily on a much smaller scale. That makes for more reversible mistakes.

April 2015 – Bitter Cress along with hedge parsley on a site recently exposed by forest thinning

But when the university experts get it wrong, the “subtleties” involved can amount to gross negligence on a grand scale. In 2003, when I first keyed this plant (with the brown pods), the flora books took me to *Cardamine oligosperma,* a native. In fact, it is *Cardamine hirsuta*, an exotic weed that costs the nursery business millions every year **nationwide**. Yet *C. hirusta* was not in the flora books for California. To this day, the University of California Jepson herbarium says the exotic is not present in most of the State. Yet our seed bank proves it has been here for over 50 years, with the native (since found elsewhere) every bit as well behaved as the exotic is not. This is indication of CYA covering misplaced institutional priorities in the mundane business of management. There is no excuse.

The native has five pollen anthers. The exotic has four. The flowers are 1-2mm across, too small for field ID when weeding.
I had to develop a vegetative key (the second leaf pair on the end of the rosette). Soon it was obvious that we had only the exotic.

This mistake of basic taxonomy has been **very** expensive to me. Imagine working for 13 years operating on false information without knowing the growing scope of an unknown problem. Fortunately, I did have my suspicions about this plant for many years and treated it accordingly. Even so, when it was identified, I had gobs of natives I didn't want to kill mixed with this exotic (I should have followed my intuitions and killed it ALL earlier). Unfortunately, at that late date, "starting over" was not an option. So, how much of this weed is in the seed bank? Above is a patch of *C. hirsuta* dominating germination in a spot that had been suppressed under *Ceanothus* for some 75 years. This weed can germinate and release seed in only six weeks, making multiple generations possible within one season. It can put up a pod when the base is but 3-4mm across. Sometimes it is dark purple, nearly the same color as the soil. I have to cover about 7 acres at least twice in that 6 weeks and find them all in order to have any hope of a reduction in the seed bank. It can mature in cool weather, which means the hand weeding must be done in the rain in order to have time to spray during the few hours when it is dry and warm enough. I use chemicals when possible because it is impossible to kill them all fast enough any other way. Who is accountable for such obvious negligence in a system run by universities and agencies that get more funding when they fail?

Nor was it the only such mistake. When I began our grasslands project in 2002, my 1961 *Flora of the Santa Cruz Mountains* keyed this plant to (1) *Oxalis laxa,* an exotic. There was no web page for it at the Jepson Herbarium at UC Berkeley back then, so a local botanist suggested it might be native (2) *O. pilosa,* Until 2012, if you went to the *O. pilosa* page, it said that *O. pilosa* might be (3) *O. albicans*, another native. If you went to the *O. alibcans* page, it said that it might be (4) *O. corniculata*, which is listed as an invasive exotic (and it is). Like *C. hirsuta, O. corniculata* is a very troublesome and expensive pest in the nursery business. So, what did I do*?* I killed it. (Q) Why, when it *might* be native? (A) It was invasive as hell once I started killing weeds (above) and (B) the root was too skinny to be any of 2-4 above. In 2014, I was asked by a local botanist at UC Santa Cruz if it might be exotic (5) *O micrantha,* of which the university didn't have a specimen. Why not? Well, it is so easily dominated by so many other weeds, you don't see it… until you start killing other weeds as I had. Like layers of an onion, when you finally get down to *O. micrantha*, it forms monocultures over natives just like any other invasive exotic (above). I sent them a sample because a neighbor had LOTS of it where I was still working through *his* onion. So, why am I telling you this story? This is how things really are**:** the academic information base is in constant flux. The pests are far more extensive than anyone realizes. The natives are far more depleted than anyone realizes. Virtually nobody is doing anything about it because experts in the field aren't even aware of the scope of the problem. And this is the system managing endangered species!

But Do We Always Know What Is Native?

June 2019 – Wall bedstraw, exotic *(Galium parisiense)*

Consider this example from the *Galium* genus of the madder tribe to illustrate what I mean by “getting along” as an indicator of nativity. Above is the invasive exotic *G. parisiense*, or “wall bedstraw.” Obviously, it makes a lot of seed. It is also enormously destructive to grasslands, but it does invade forests as well. This little pest can make seed when only a quarter-inch tall, or it can make a wad of 2-foot tendrils as above. It definitely displaces native germination. It is invasive as all hell and it was everywhere in the weed bank as soon as broom and exotic grasses started to subside. But we do have other members of this genus here that are no problem at all.

May 2019 – Sweet bedstraw, *Galium triflorum*.

Above is "sweet bedstraw," *(Galium triflorum),* a native perennial mixed in with wild pea, strawberry, honeysuckle, and blackberry. This plant prefers only shady locations such as conifer forest. It too makes a lot of seed. All bedstraw species spread by making sticky burs that adhere to animal coats. Yet this native and the two to follow are not invasive or dominant over the other locals at all.

This is “hairy bedstraw” *(Galium californicum).* This plant was uncommon enough here that I sort of celebrated when it finally showed up. Two ridges to the south. It is well established on a ridge of oak woodland and mixes beautifully with same groundcovers as are in this photo. Hence, “it gets along” with other plants and is not at all exclusive in this niche here. Somewhere else? Don’t know.

Galium porrigens made this mound six feet across, forming important habitat for ground nesting birds. Ever since we got a cat, we have far more quail, not-so-simply because cats eat ground-squirrels that raid nests for eggs (story here). If the cat goes after the birds dual entries allow for a path of escape. The plant stays put, has established relationships with local wildlife, and is not exclusive. We have only 4 such mounds with a few more starting to build. It takes several years.

April 2015 – Bedstraw, aka cleavers, catchweed, stickwilly…

This is catchweed bedstraw, *believed* to be *(Galium aparine).* Although there is proof that there was a native *G. aparine*, this plant behaves like an invasive exotic and I have heard reports of individuals in remote locations that did not behave like this plant does. So, who is doing that DNA work? We are.

This bedstraw (and/or its look-alikes) is a problem on multiple continents. It is *very* destructive to agricultural crops and machinery. It has no problem competing with known exotics (there's a clue). There is one record of it in Glenwood in 1931. Yet despite that it is so invasive and supposedly native, it never appeared here during our first ten years of forestry and grading. The next record is in 1950 at the County dump. Then, suddenly, 25 years later, it was everywhere. It first showed up next to where the garbage is picked up in about 2004 (another clue). I let it go because the experts said it was native. In only two years, it invaded grasslands and woodlands, burying natives and shading them to death. To my knowledge, nothing eats it. It is mildly toxic.

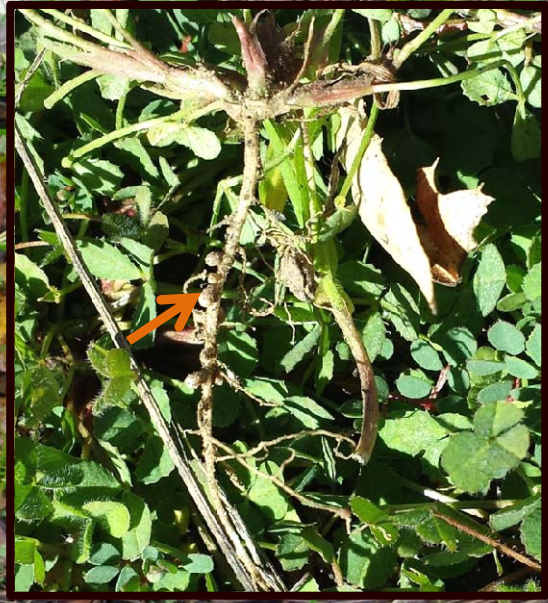
I kill it. *G. aparine* "doesn't know how to get along," meaning that it is immensely destructive to a diverse native habitat. I believe there are 4 possibilities as to what it really is: (1 - and to me most likely) it is actually exotic *G. spurium*, a very similar plant from Eurasia, (2) it is a *G. aparine* hybrid with *Galium spurium*, (3) it could be native but was so well controlled by aboriginal burning that it never expressed itself as the obviously destructive weed it is now (unlikely), and (4 and least likely) it is a new mutant of *G. aparine*. One must allow this as unknown possibilities may also lie at cause. A difference in DNA may not determine why and how a plant suddenly becomes destructive. We have two **identical** forms of an inarguably native clover, one of which is invasive, but it is not in its usual haunts (next section). I restrain the invasive flavor to retain other functional systems with which to play.

Hence, even if **a plant is native, that would not stop me from at least restraining it**. There are several reasons why this has been a necessary adaptation to be illustrated in subsequent discussions of other plant species.

June 2019 – Horseweed *(Eregion canadensis, a.k.a Conyza)* absolutely behaves as a weed. It was not in the early flora for our area at all.

Hence, while the institutional conclusions identifying what is native or not can be legitimately questionable, my guess is that they are probably 99% correct. Yet that means we may have 4 questionable species here alone!! Just one can be a huge problem (above). We have questions of identification in which the data we have is old or cursory (such as *Oxalis pilosa* to *corniculata*). Then there are the mistaken calls with major financial implications the system has obviously avoided (*Cardamine oiligosperma* v. *hirusuta*). Worse, just because a plant is native to North America, doesn't mean that if it is here now, then it must have been here under Indian management (above), especially when we have data indicating otherwise. Yet there are other cases (one to follow) wherein the genetic differences can get so subtle that the analytical technology for identifying the causes of significant behavioral differences does not exist. Such differences may only matter in a purely native setting (very few exist) but are a big deal once you do get there.

Even If We Know They Are Native, We Don't Know the System Components Well Enough To Assume It "Knows" Best WE MUST Make Decisions



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

This next example gets ethically murky! This patch of clover is *Trifolium ciliolatum v. ciliolatum*, inarguably a California native plant. Yet this *variety* of *T. ciliolatum* has never been recorded this far south. So, is it "native" ***here***? It does "get along" with the local soil flora in that it forms profuse nodules of nitrogen-fixing bacteria (inset). It is competitive with the native *Stipa* grasses (unlike most of our local clovers). HOWEVER, it also tends to form monoculture patches wiping out virtually all other native clovers and even the bunch grasses. It is invasive as hell, spreading elsewhere very quickly. So, does this new "native plant" belong here or is it alien? It certainly *behaves* like an alien! This will be discussed at greater length in Part III of this book in the chapter on native colonization behavior.

This is our local *T. ciliolatum v. discolor* (circle) hanging out as it has for years. The local variety has never crowded out other species. I had noticed a potential "problem" with the non-local *T. ciliolatum v. ciliolatum* simply by observing its behavior well before I knew it had never been seen in this area before. Initially, I was hoping it could compete effectively with the grasses which were crowding out clovers because of the lack of fire. Well, it competed all right, to the exclusion of the grasses and was spreading everywhere rapidly! So I had to cull it until I knew more. This business of 'knowing how to get along,' insofar as "native" plants are concerned, is more important than one might suspect. In several instances, my personal and subjective intuition based upon observations of the behavior of questionably native plants in and among indisputably native plants has been shown to be correct. This is despite supposedly authoritative documentation to the contrary, some of which was later *proven* to be wrong (particularly the case of *C. hirsuta*). Nor am I alone among experts in the field in possessing these opinions. Effectively, one wonders if there is something about a complex native system humans may have developed that speaks to human intuition before it can be resolved explicitly. Yet urban people also prefer monoculture lawns and patchy yard landscapes to confusing textures of multiple species. So in that respect did the Indians who grew proto-agricultural 'patches' here! Nor do we have any idea how they maintained an array of monoculture patches far from home in a landscape that was otherwise wildly diverse!!! So the limits of ambiguity are not the only problem with "native."

February 2-17 – *Sanicula crassicaulis,* seeding

Then there are also ecological problems among native species that exist either because of the loss of system components, or because of drastic differences in how they *can* be managed today. We have inarguably native plants here that get "weedy," in that they invade a variety of habitats, in some cases forming situational monocultures. I suspect this is a symptom of fire suppression, but perhaps it is something else too. Above is Pacific Sanicle *(Sanicula crassicaulis)* which has been deemed a pest here. This annoying plant grows about two feet tall covered with burs and seems to show up most anywhere except in redwood. The flowers smell so amazing they could be used as a spice, but I've had zero luck in enticing any chef to experiment in real "California nouvelle" without the blessing of the USDA (this despite a 10,000 year field trial of Indians eating the roots). Its fecundity here may simply be due to the lack of a biocontrol, in this case a moth *(Greya reticulata)*, whose larvae are known to eat much of the seed. However, *Greya* is also known to chew on sweet cicely *(Osmorhiza berteroi),* a nice plant we have here aplenty which gets along fine. Which plant does the bug prefer? How do I get some larvae? How much is enough to start? How would I reverse course if I didn't like the outcome? Does *anybody* do this kind of research? Well, in a way, but mainly on exotics so as to avoid chemical control. Research on management of natives is nearly impossible because (1) there are so few places that have them, and (2) the scientific community sees letting "nature" take its course as conservative despite the obviously disastrous consequences. Hence, we don't learn much about how to manage "nature." Until a reduction is achieved, we cull this one.

Some species believed to be native were found to be destructive exotics. Some were situationally destructive natives (below). Yet that such ambiguity exists after 17 years of work on forbs is indicative of serious problems in our environmental management model, one in which academic science responds to political interests at the expense of acquiring and distributing accurate and timely information to its users, for which, effectively, no one is accountable.

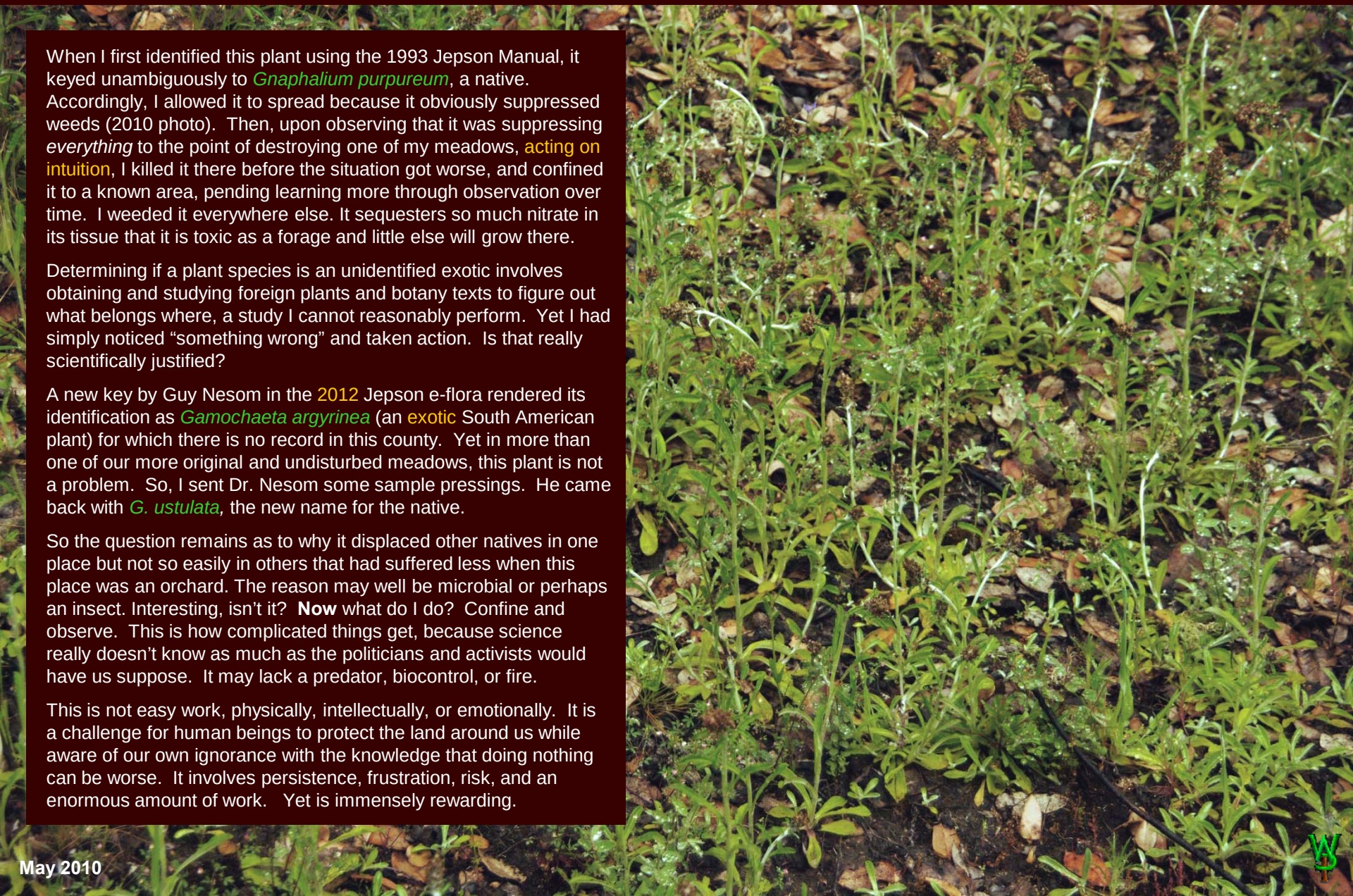
When I first identified this plant using the 1993 Jepson Manual, it keyed unambiguously to *Gnaphalium purpureum*, a native. Accordingly, I allowed it to spread because it obviously suppressed weeds (2010 photo). Then, upon observing that it was suppressing *everything* to the point of destroying one of my meadows, acting on intuition, I killed it there before the situation got worse, and confined it to a known area, pending learning more through observation over time. I weeded it everywhere else. It sequesters so much nitrate in its tissue that it is toxic as a forage and little else will grow there.

Determining if a plant species is an unidentified exotic involves obtaining and studying foreign plants and botany texts to figure out what belongs where, a study I cannot reasonably perform. Yet I had simply noticed "something wrong" and taken action. Is that really scientifically justified?

A new key by Guy Nesom in the 2012 Jepson e-flora rendered its identification as *Gamochaeta argyrinea* (an exotic South American plant) for which there is no record in this county. Yet in more than one of our more original and undisturbed meadows, this plant is not a problem. So, I sent Dr. Nesom some sample pressings. He came back with *G. ustulata*, the new name for the native.

So the question remains as to why it displaced other natives in one place but not so easily in others that had suffered less when this place was an orchard. The reason may well be microbial or perhaps an insect. Interesting, isn't it? **Now** what do I do? Confine and observe. This is how complicated things get, because science really doesn't know as much as the politicians and activists would have us suppose. It may lack a predator, biocontrol, or fire.

This is not easy work, physically, intellectually, or emotionally. It is a challenge for human beings to protect the land around us while aware of our own ignorance with the knowledge that doing nothing can be worse. It involves persistence, frustration, risk, and an enormous amount of work. Yet is immensely rewarding.



May 2010

And here is our “professional cudweed muncher” *Vanessa viginiensis*, of which the numbers are increasing rapidly! As a butterfly she is also known as The Painted Lady (and she is beautiful)! In this case we want and are getting more, but with Sanicle we are not. How much more is necessary and under which circumstances? This is not simply an aesthetic question (although it can be).

May 2018

So when you first identify something like this *Hyles lineata* larva you nerd-out and get all excited! It's a white-lined sphinx moth, another pollinator, and the adults are as impressive (2-3 inch wingspan) as they are beautiful (inset). But…

The larvae eat Clarkia, which is probably why it is here and I like Clarkia too! What to do? I guess I get to watch, and after seeing what they do I may have to grow more Clarkia before I can tolerate more sphinx moths. The two patches we have took 13 years to develop before *Hyles* showed up.

There are also practical limits as to goals in restoring native plants. According to the "authoritative" Jepson Manual, Chilean (aka "Coast") Tarweed *(Madia sativa)* is native. Upon observing its behavior, I have my doubts, as it readily builds monocultures here. The problem with *M. sativa* is that, after weeding in it, one literally feels as if coated in contact cement. It is such a pain of a plant that I have seen papers from both North and South America each accusing the other of being the source! So, even if it is native (I *still* have my doubts), I kill it for the simple reason that **making the guy who weeds this place miserable is bad for this place** and everything this plant did for soil fungi in this system is accomplished just as well by *Madia gracilis,* which is nowhere near as obnoxious to the weeder.

June 2011 – *Madia gracilis* mixed in with Navarretia atractyloides, Lotus purshianus, and various native grasses
Tarweeds are a preferred forage for wildlife here.

With the exception of the bedstraw (which is killed without mercy), every one of the plants treated as “native weeds” is still confined to marginal numbers and locations. Each has a superior (to me) alternative in the same niche. They are in no danger of extinction.

June 2003 – This has been a very persistent weed here

Then there is horseweed *(Erigeron canadensis)*. This plant is of a family of weeds that go by the common names “sneeze weed,” “asthma weed,” and “fleabane.” Each plant can produce up to 200,000 seeds that fly on the wind. With bare sandy soils, it makes a forest of stems 4-6 feet high in only a few years. Most scientists hold this to be “native.” Yet its pollen was not found in marine mud strata in the Santa Barbara channel, at Zaca Lake, or in a nearby pond at Laguna de las Trancas. It is not a palatable forage, so there is no way it would have been suppressed by grazing such that the pollen signature would be insignificant. There is no description with its resemblance in the Spanish diaries and there are no records of it in this County before 1909, despite ample survey work done in Glenwood back in the 1890s where there was plenty of disturbed sand for it to inhabit. In fact, there are no records of it in Glenwood at all! Accordingly, I have my doubts about its nativity here. I kill it, but if you have a real need you can now find it all over the world.

February 2018 – Year two of our latest entrant, *Gilia achilleifolia* as it spreads into a grassland of needle grass, clarkia, and various lotus and clovers. It is invading, as I had hoped for, but it doesn't seem invasive. We'll see.

There are a host of things we cannot or will not do, despite that forsaking them makes it impossible to manage this place identically to Native Americans. We don't eat tons of acorns. We don't harvest bulbs for starch. We don't eat grass seed. We don't collect tiny pods and grind the seeds to make gruel. We can't legally hunt for food. We can't broadcast burn in the summer with or without the fire department. We don't beat tarweed for seed. Nor is the full compliment of insects present, nor large numbers of antelope, bears, or elk without redistributing the weeds. Therefore, under the constraints of what we *can* do with what is here, it is entirely likely that some native plants **will** run amok and thence require a process to sustain the complex biodiversity we now have in so many different arrangements. Moreover, every time a native reappears for the first time, the relationships reset as it invades the property. So much for "Natural." If we can keep the bad actors under control it may allow us to learn how they work things out over the long run.

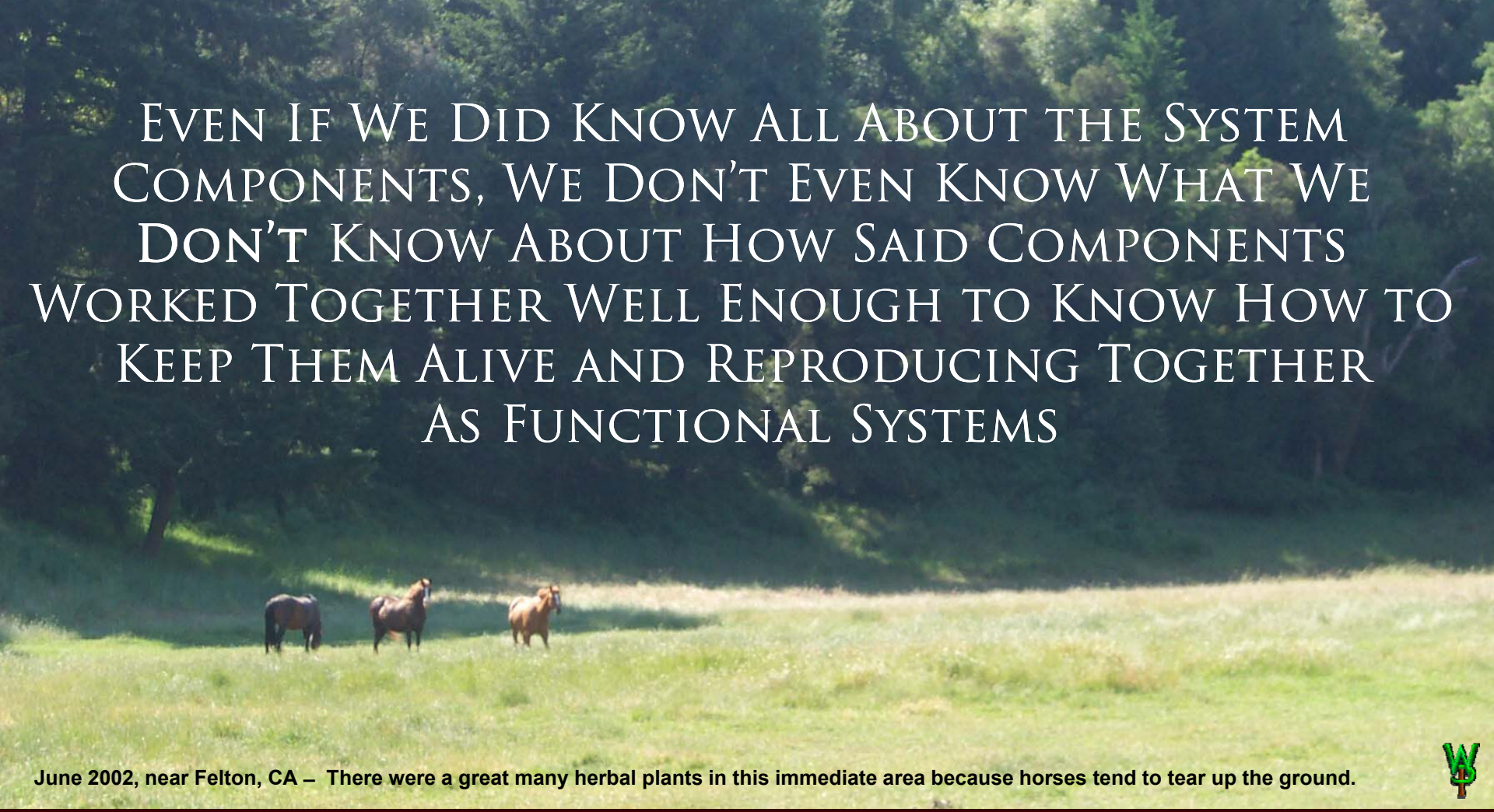
August 2017 – There were a great many herbal plants in this immediate area

If you are getting the sense that “Native” may be more complicated than commonly thought, so it appears, unless biodiversity doesn’t matter. If you read the site history, it said that aboriginal Indians “introduced” plants, with the specific qualification that they could not be invasive no matter how valuable they might be. This was not empty speculation. Our property has two species that exhibit such evidence for the same two reasons**:** spatial distribution and linguistic history. The first is yarrow *(Achillea milleflorum)*. Above you see a patch (white flowers) on Lookout Mountain in central Oregon. There is no other area we saw where there was any yarrow, either on our way there and or in walking around (it stays put). Nor did we see the other herbs in that spot anywhere else either. This location is a good site for a tribe forcing game into a kill zone with a fire. Yarrow was prized by “native” Americans (actually native to Asia) as a digestive medication. Its Chinese name is *“I-chi-kao.”* Yes, it could have been introduced *that* long ago, and from that far away.

Then there is mugwort *(Artemisia douglasiana)*. We do know that Clovis people originated in Asia, 'but that was 15,000 years ago.' Correct. And? Mugwort's Chinese name is *"lou hao"…* Could it be? Aboriginal tribes also considered mugwort a medicinal herb (its pollen is known to be an allergen). It would be fascinating to see if there was more genetic variability in these plants in Asia than there is here in North America. Such a difference would suggest a deliberate introduction. We REALLY like it on broiled chicken!

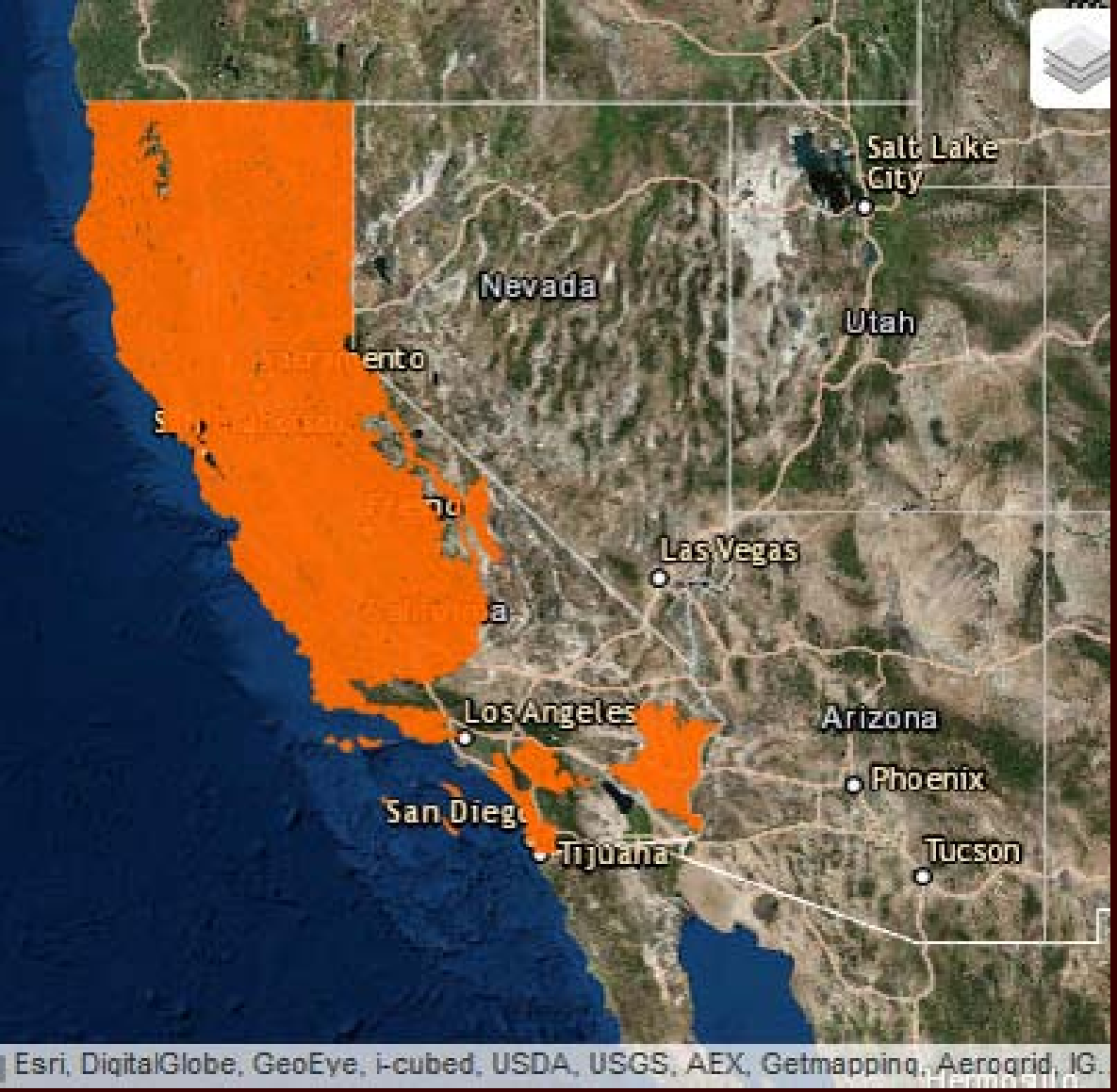
June 2019 – Here I am culling supposedly native horseweed *(Conyza canadensis)*, with less than 25cc of a mixed clopyralid formulation from a special hand squirt bottle discussed in the chapter on tools. The combination of selective chemistry and precise delivery assures there will be no detectable harm to any other plant you see here.

So what does all this ambiguity imply? Someone must make decisions how much risk to tolerate in managing an ambiguously identified or troublesome native against the sum of such risks as added to the existing commitment to cull known exotics. Each species is an individual case, with behavior that varies by location even on as small a parcel as ours. These commitments vary seasonally and must be reassessed with changing weather. This means that weed management decisions can be hourly because so many control processes are sensitive to temperature, soil moisture (which varies by the foot), target plant maturity, proximity to natives… all of which vary by the seasonal history of solar exposure and precipitation. Go ahead, try to get that kind of data to (and responsiveness from) an unaccountable bureaucracy at what cost v. benefit? The raw data collection alone is impossible and the transmission rates would be overwhelming, even to an AI system enforcing the latest in academic groupthink. Please, we may never know enough to go there.



June 2002, near Felton, CA – There were a great many herbal plants in this immediate area because horses tend to tear up the ground.

That must sound pretty radical. It's true, because we know so little about how the system worked in tandem with the people who survived by working with said components. Worse, we have a lot of academics hustling grants with the premise that what is "Natural" is how it works *without* people at all, as if there had been no selection or genetic adaptation to 10,000 years of aboriginal management. Native Americans absolutely depended upon biodiversity for survival**:** All of the resource plants they needed had to be grown within walking distance. They could not afford species that would dominate the area; hence, they had to be very careful about introductions. Yet we do know from the historical record of an introduced species in which this concern was forsaken**:** horses, which Indians traded over huge distances with Spanish brands appearing as far away as the Dakotas. Yet unlike plains Indians, Zenas Leonard noted in 1833 that California Indians saw horses more as 'meals on wheels' than useful as transportation, a beast of burden, or in warfare. This is likely because their diet had so long been lacking meat (despite ample game within the State) AND because the land yielded sufficient resources near their villages that trading for materials from elsewhere was less important than safely obtaining plentiful meat.



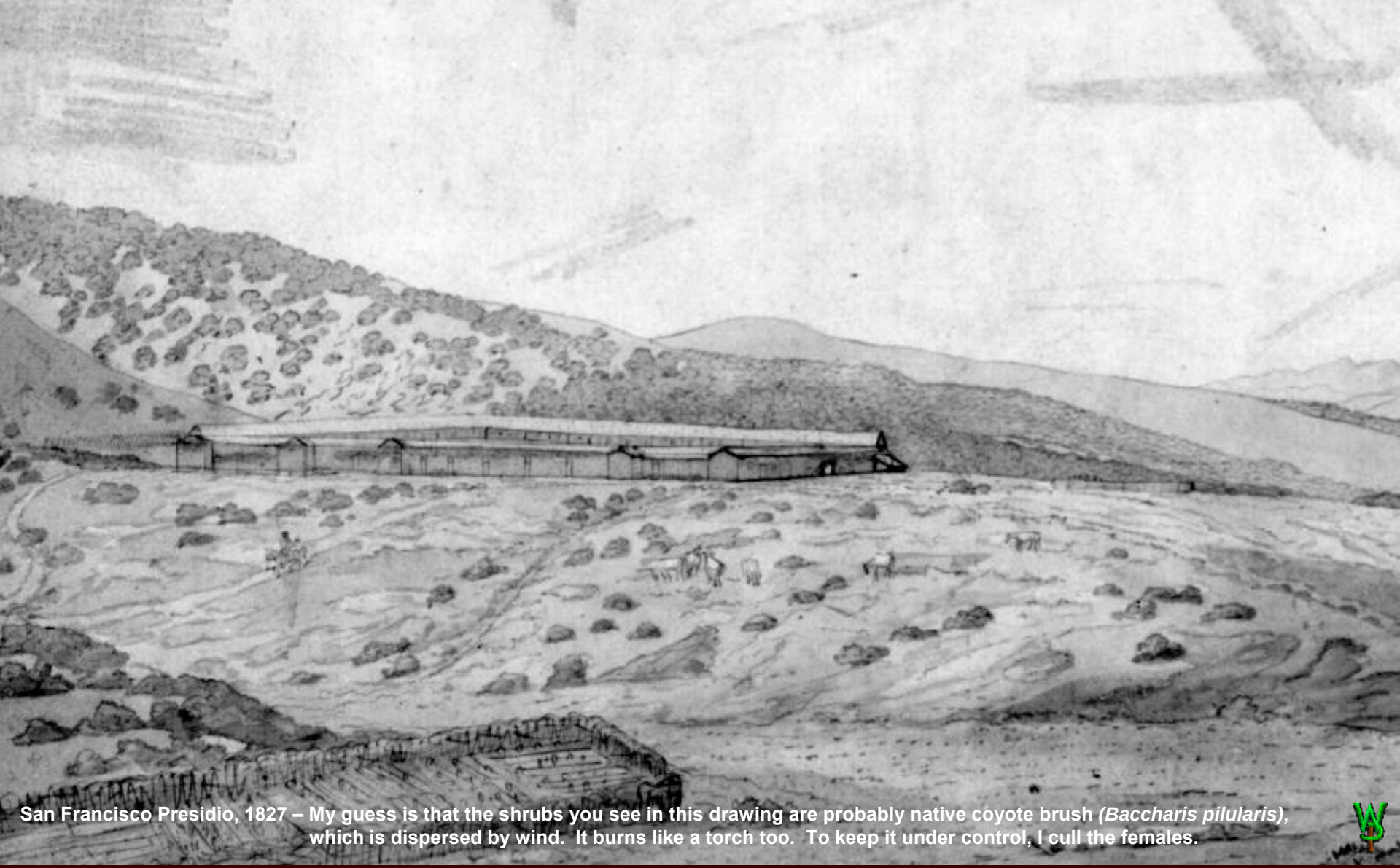
The map at left by the USDA supposedly depicts exotic grass coverage in California. In terms of actual area, it is a gross exaggeration, in that urban, crop, forest, and desert scrub lands within these areas are dominated by higher successional -order vegetation, not grasses. Yet what the map *does* mean is that, wherever there are open grasslands within these areas, exotics ARE dominant. In most of this area, one is hard pressed to find native perennial grasses, never mind annual forbs.

Not a lot more needs to be said about the damage weeds have done to the foundations of the wildlife food and soil systems, and we are WAY behind those two curves.

Collectivist solutions have never worked, because a popular collective won't be held accountable for anything, while those in power will serve chiefly the interests of those who buy the debt, giving only lip service to the public about how much they "care." Please don't go there.

Remedial proposals will be mentioned at the end of this book. Detailing those answers started with *Natural Process*, but taking those to the next level will take yet another book or perhaps even a computer game. There is yet another book to complete first, besides maintaining this one.

As to whether Indians imported Spanish annual oat grasses to their home areas, there may have been good reason**:** Few if any native grasses are especially desirable for grinding into flour as the seed is small and chaffy. The Spanish introduced two *Avena* annual oat species that came in with hay on ships. These North African grasses make huge amounts of high-protein forage horses would eat and spread. The herds grew so large the Spanish had to run them off cliffs to keep range available for their chief cash export of cattle hides. Weeds spread with the horses. By 1841, Fremont reported the Livermore Valley covered with exotic bur clover. Together with horses, the Spanish ban on Indian burning, and the loss of whole tribes due to diseases, the landscape in this area had to have changed radically and rapidly for nearly a hundred years before botanists in the 1890s finally started to assess what was native and where.



San Francisco Presidio, 1827 – My guess is that the shrubs you see in this drawing are probably native coyote brush *(Baccharis pilularis)*, which is dispersed by wind. It burns like a torch too. To keep it under control, I cull the females.

The site history showed that high-disturbance aboriginal management had ceased nearly a century before botanists had arrived here. The previous chapter demonstrated the magnitude of species loss due to weeds and succession since then. It also showed that the situation will continue to get worse with successive disturbances because the weeds are so dominant. In sum, this once-aboriginal system has been so altered for so long, weeds and succession had taken over so completely and over such a huge area, there is no possibility we ***could*** have a detailed understanding of how it used to work virtually anywhere, much less how it should work today. How then do we learn how to keep a remnant annual system reproducing? By covering it up and calling it “restoration”?

June 2015 – This is a suppression strategy in action: a diverse mix of almost entirely perennial native cover only one year after thinning trees. It has already precluded most native annuals (there are a few tarweeds and sanicle). It will soon be overwhelmed by the native blackberry, then shrubs, then trees…

Repeatedly, I see "restoration" projects comprised exclusively of perennials "installed" with such intense density as one would NEVER see in the wild, with the sole purpose of crowding out weeds. Even if they were successful, just because a place has is all native plants does not mean that the native *system* is restored. There is nothing intrinsically wrong with this "suppression" strategy (see above) if it is used only temporarily to contain weed expression, yet without native annual plants (our focus for 15 years), the successional system will lose a critical source of food for wildlife, breeding habitat for its insect associates, and sugars for its microbial foundations in soil.

June 2019 – This minor slide on our place was 100% native cover (mostly poison oak). Geologically it was a perched fill atop a cliff just below the horseweed (very unstable). Originally the cover was a fuel bomb of acacia and fir trees. I cut the trees and planted buckeye and sedge, but they were too small and sparse by the time the bigger stumps rotted.

Eventually, a suppression strategy *will* fail, because there ***will*** be a disturbance (fire, flood, landslide, or fallen tree) such that the niche will open and the weeds can then express, which means that after each successive disturbance they will extend their dominion over native annuals. Nor does this suppression strategy even begin seriously to address soils, bugs, and species loss.

March 2005 – From here, it took six more years to get to the point that I could keep this area clean by hand-weeding alone.

No matter what, somebody MUST grow native annuals or the system dies. That means that somebody MUST purge the exotic weed bank while somehow recovering what is left from the native seed bank. The only problem with that idea for me was that no one had ever done it before. I didn't know any better and just dove in, *knowing* what would happen if I did not. The plan was to kill weeds.

The challenge of a large scale attack on annual weeds is the simple arithmetic of seed production: They make so many that one must get ALL of the weeds while also preventing reinvasion; else, one is making no progress against that “onion” of weed layers. It’s hard to go fast enough to cover a lot of ground while being thorough enough that one is actually making year to year progress. This is physically impossible to do by hand alone. I mowed, sprayed, weeded, tilled, you name it. It was do it or the system dies.

Any tool, from a screwdriver to a gun, can be used well or badly. In wildland restoration, pesticides can be a godsend for native habitat depending upon how they are used. The trick is to protect the few natives that enter or remain viable in the seed bank then to colonize the place and to cull rigorously individual weeds that survive. To gain control, I once used herbicides broadly; now I need only a few quarts per year. This is about hard choices and competing risks, or the system dies while people dither.

The *Wildergarten* has buffers consisting of various land stases selected and managed according to the transmission mechanics of the weeds in those areas coupled to exotic control processes selected specific to the types of weeds invading from those directions: shaded hardwood forest, a County road with a rock embankment, exotic monoculture forest, a vineyard, heavy brush, a high, bare, and windy ridge, and a redwood monoculture. Most useful is that most of the landscapes beyond these “battlements” is dominated by dense forest, which limits inundation with seed from exotic annuals.

McClellan Ranch Preserve, Cupertino CA - Image from Google Earth

This property has excellent prospects for native annual restoration. It is not too big. It is isolated by concrete from weed introduction. They have staff interested in accomplishing a restoration. They have horticultural facilities. The tax base can afford it. There are kids who want to work and learn. It would be easier if they carve it into pieces with vegetative barriers.

Interestingly, a city full of concrete and carefully landscaped yards makes an excellent isolation barrier. There is nothing that intrinsically limits this kind of work exclusively to a remote rural setting. In that respect, for plant restoration, “fragmentation” is our friend.

June 2019 – About 15 years ago, a l Agrostis hallii ocal botanist chided my lack of deerweed *(Acmispon glabra)* as a needed pollinator. I told him it made weeding a pain. I should have listened to my own instincts.

Meanwhile animals carry in more seed and also the wind. Even with buffers, no matter what, over the long run, the keys to real long-term solutions are an almost insane level of persistence and site-specific knowledge over a very long period of time. As natives colonize the property one must then detect the weeds in an increasingly complex and intense visual arrangement. Weeding requires such intimate focus for so long, so repetitively, that it simply cannot be done at large scale with existing technology. Yet the breadth of species loss we are facing, the slow death of dormant seed in the soil (previous chapter) under layers of weeds and higher order perennials, suggests we may not have the time left to wait for genetically specific weed control technologies.

Even if a development lab (such as ours) can be functionally isolated and fully native, we still don't know what the goals "*should*" be in the dynamic sense given the differences in management between aboriginal peoples and an agro-urban industrial economy. We have no intention of subsisting on acorns and blue dicks. There are no grizzlies tilling the soil. There are no elk grazing at will. Nor is any of that a good idea here. I would be delighted if I could burn in June, but in a community of million-dollar homes surrounded with fuel that's not going to happen. But… **We still have the obligation to keep at least remnants of these systems alive and reproducing.**

June 2019 – The last time this Hall's bent grass *(Agrostis hallii)* seeded was nine years ago when we also had ample May rains.

More complicating is that native colonization, and particularly of perennials, is NOT immediate. Sometimes native plant germination is dependent upon unusual weather, which can delay and extend greatly the amount of time it takes for it to reestablish and find its place in the composition. We don't always wait for that. A lot is also learned with horticultural experimentation here. Getting a few natives established really does get others going too. One learns a lot that way about what belongs where, or not. It does take patience.

Turning the Corner

March 2009 – Forest floor, Phase 1 thinning.

Once I got control of grasslands, it was back to forests before I became too old to do it anymore. Above is what I call a “Phase 1” thinning, where dead material and fuels are reduced, but there is not enough light on the forest floor to grow anything. Effectively, this is the state of suspended animation in which I held the forest while I was dealing with grasslands.

The problem became that the trees just kept getting taller and skinnier. It was time to thin again.

June 2019 – This is one of the last photos I got of Dax, still happy doing her job, about a week before she died at 14½ of complications due to osteosarcoma.

As one thins a forest like that, one is left with the legacy of overcrowding. In a sense, for the trees to have decent structure, one must then start over with young trees. Hence, the land beneath approaches a savannah, where grasslands invade forests and forests invade grasslands while the young trees grow at greater distances. Although this allows existing trees room to broaden and improve their structure as well as for their scions room to grow into decent trees, grass invasion also increases visual complexity rapidly which then risks weed invasion while extra light stimulates what is left of the weed bank within those forests.

Then, as succession of higher order plants commences, they too spread, they too make gobs of seed and they too possess a “weed” bank account. They also can hide exotics. One must then deal with how much one will tolerate and where. This is where the real art of managing natives begins. There are only so many hours in a day. “Fast” doesn’t stop. And neither can I.
If I did, this place would be wrecked in just a few years.

June 2019 – This is what I mean by "visual complexity," an annual cover of small flowered lotus *(Acmispon parviflorus)*, cupcake clover *(Trifolium microdon)* is invading the forest floor.

Hence, composition matters when it comes to the labor input that keeps all this going. While these necessary evils do present an enormous challenge, the resulting beauty is undeniable. The question remains though, ***can*** it be done? Is it at all possible for one person to do all this? In the end, this is a question of tools, labor, and scale and the wisdom to make tough choices all guided by one thing that seems to be missing from virtually any other project**:** intimate knowledge and a life or death stake in successful management, both acquired over a period of decades.

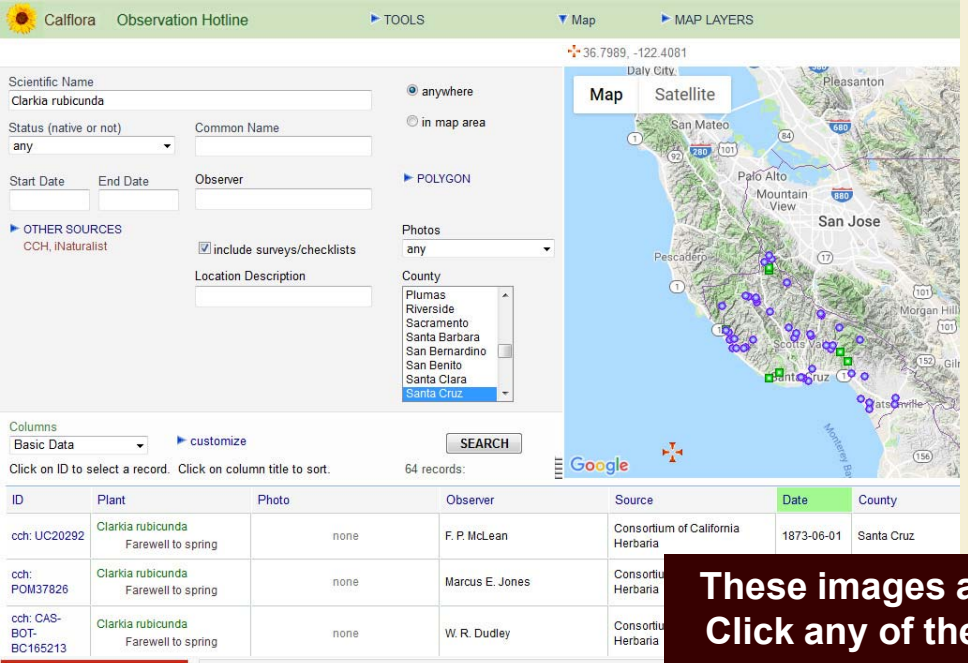
Heading for Home

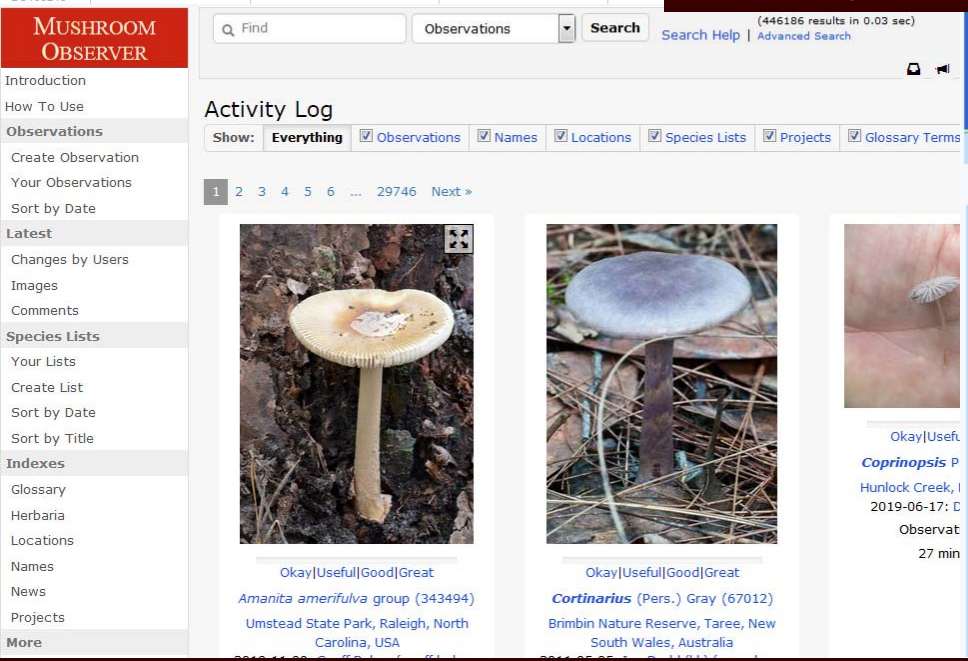
February 2015 – Trifolium microdon and bifidum in Dichelostemma capitatum along with Sanicula crassicaulis.
At this point in the season, one must check the germination to see what is coming up and what the weed challenges will be.

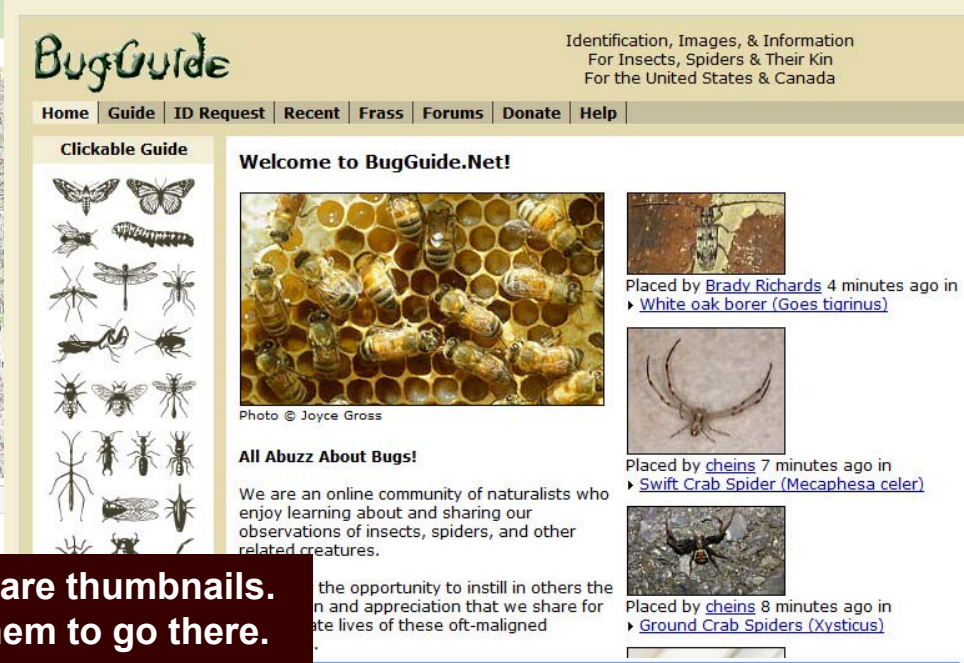
Perhaps we should start with the humility to realize that the aboriginal approach to land management here always was exercised at smaller scale. Maybe that should be a clue: Private plots sized to the conditions, dedicated to rescuing the vestiges of each local system, and running experiments to develop processes to manage them in detail efficiently would be more successful at reproducing the knowledge we need than has been a global policy of "preserving" disastrous conditions on a landscape scale.

June 2019 – This Pacific Reed Grass *(Calamagrostis nutkaensis)* came up from a pile of dirt excavated from beneath the County road. This is a rare grass, and is supposedly only coastal. The pile sat there for years until we had an exceptionally wet and cool rainy season, when grasses, native and exotic, came up all over the property in places I had never seen them before.

The hard thing for people to realize is that the kinds of problems encountered here at the *Wildergarten*: 200 years of weed introductions, topsoil stripped by bulldozers, and 50 years of abandonment to succession… can take DECADES for a family of average means to produce technically significant results toward a set of goals involving so many unknowns. This is particularly because it can take many years before one has the kind of soil conditions and weather they need to germinate.







These images are thumbnails.
Click any of them to go there.

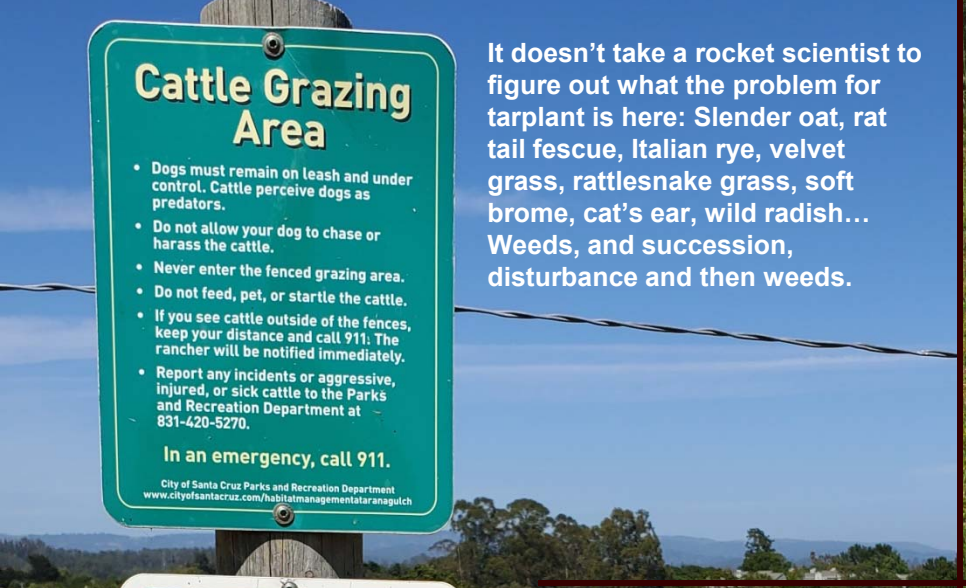
Both element and process knowledge can be more easily shared than ever before. Some of the challenge and risk we faced has since been mitigated in that online resources are now vastly more useful than the were in 1990. Knowing what I know now and with the resources now available (including this book), we could probably have cut our 30-year timeline at least by half.

June 2019 – This is how it looks when weeding hedge parsley *(Torilis arvensis)*. Finding lighting conditions for this photo took a very long time. Most of the time they are not so easy to see. Each cluster of burs has 16-50 seeds. Find them all or one is going backwards.

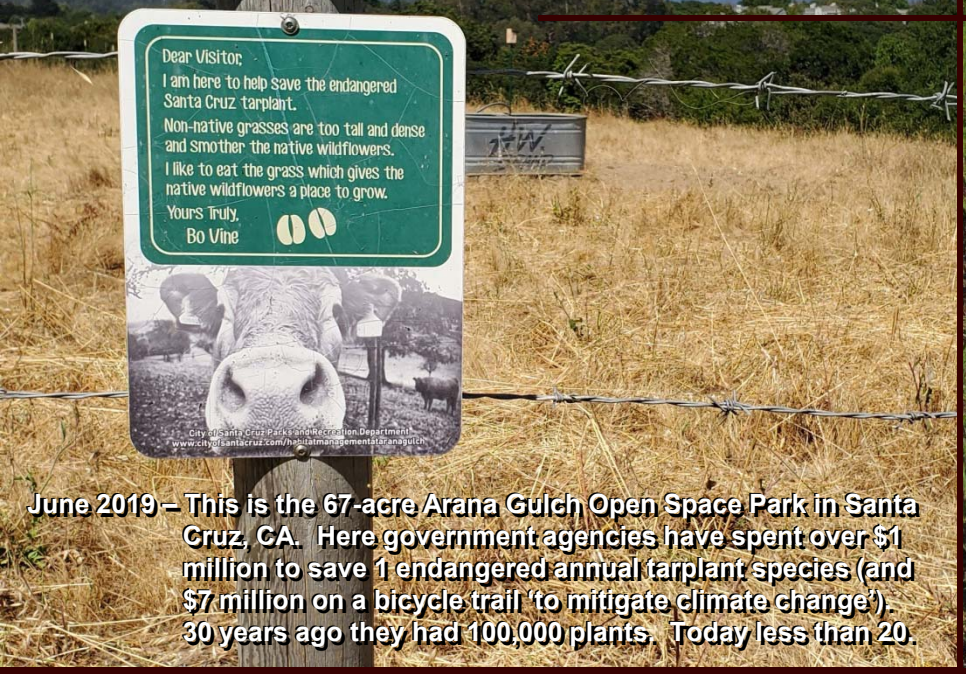
None of those benefits will change the fact that truly restoring native annuals is extremely expensive. Were someone to pay for what I do, the cost would exceed $150,000 per year just in labor. In perpetuity. And that is just expenses, goodness knows how much we paid in capital. Detailed stewardship is labor capital cannot replace for a long time to come. At least this is not about landscapes but a network of laboratories developing high value functional remnants. Take it from somebody who has succeeded where others have failed: Somebody has to do this or the native seed bank will slowly die. The keys to succeeding financially and technically are to confine that work to minimum scale and allow the freedom to try something different. Please, help keep the system alive and breeding.

June 2014 – Katherine Vande Pol, Valedictorian, College of Agriculture and Animal Science, Utah State University, at barely the age of 20.

But how is all of this to be paid for? Well, we did this 14 acres on a nurse's salary while paying for a Bay Area house, raising two kids, and putting them through college into STEM PhD programs graduating with no debt. Nevertheless, restoration and functionality do both raise property value and reduce risk to fixed assets. Both can be funded against actuarially measured risks over time. Remember too, that as robotics and AI displace traditional jobs, those with money still value contact with reality (consider the size of the tourism and outdoor recreation industries). The key is to get the public to understand that "Nature" can't care for itself because nature doesn't "care." What is needed is to cherish the people who do. This isn't about me, this is about motivating young people into doing something beyond playing with their smart phones. Wouldn't we rather that they were smart instead? "Smart" about life.

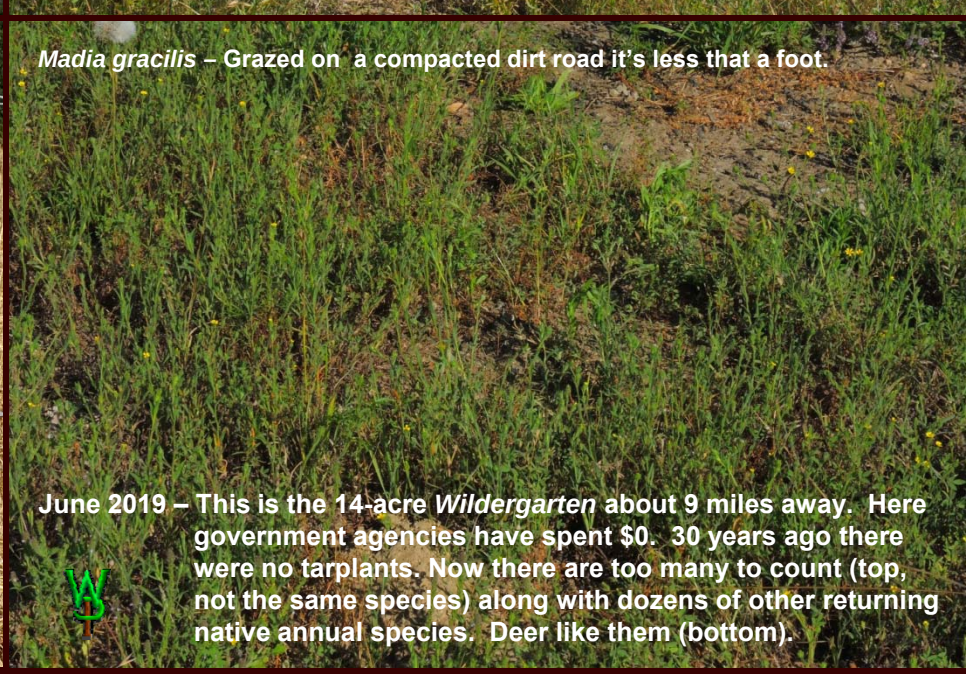


It doesn't take a rocket scientist to figure out what the problem for tarplant is here: Slender oat, rat tail fescue, Italian rye, velvet grass, rattlesnake grass, soft brome, cat's ear, wild radish… Weeds, and succession, disturbance and then weeds.



June 2019 – This is the 67-acre Arana Gulch Open Space Park in Santa Cruz, CA. Here government agencies have spent over $1 million to save 1 endangered annual tarplant species (and $7 million on a bicycle trail 'to mitigate climate change'). 30 years ago they had 100,000 plants. Today less than 20.

Madia gracilis – Ungrazed in uncompacted fill it is four feet tall and bushy



Madia gracilis – Grazed on a compacted dirt road it's less that a foot.

June 2019 – This is the 14-acre *Wildergarten* about 9 miles away. Here government agencies have spent $0. 30 years ago there were no tarplants. Now there are too many to count (top, not the same species) along with dozens of other returning native annual species. Deer like them (bottom).

This is about results. The $24 billion in 6 years Californians paid to preserve nature did little more than fatten the development industry and banking system with an artificial scarcity of developable land. And that by no means is all that is spent for environmental projects having very disappointing outcomes, also producing a lobby to for contractors in bed with an unaccountable bureaucracy. It certainly hasn't improved the condition of habitat very much. Meanwhile, many native habitats are in deep trouble, while all we could reasonably afford is to focus on much smaller and extended projects with much more rigorous goals. We need to rethink this management system.

Perennial Challenges
Annual Labor

June 2019 – Just this year, and for the first time, I noticed that most of the globe lilies *(Calochortus albus)* on this property are on north facing slopes. This important aboriginal root crop is just over the crest of a ridge with a large patch of returning blue dicks *(Dichelostemma capitatum)*, also an important aboriginal source of dietary starch. Learning these plant preferences can take decades of both patient and brutal work. They don't happen by themselves.

This chapter demonstrated how little is known about how all of the components of these systems work over time and with differences in management. More importantly, the biggest barrier to saving them may be the usual worldview about "Nature." How to achieve that minimal goal of keeping what is left reproducing and do it economically at large scale is therefore also unknown. This book is about how I went about acquiring some of that knowledge at smaller scale. The next chapter presents the macro-level changes wrought here with repeat photos, followed with proof of what is being accomplished documenting native annual germination.

Other Books by Mark Edward Vande Pol

Quick Read Picture Books

Range Management

Zion National Park

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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