Native Conquest

November 1994 – Both the straw and the grass seed were exotic Blando brome *(B. hordeadeus)*
The bare surfaces on the right of the slope and the foreground are cut sandstone.

Recall from the previous chapter discussing Weed Management by Species that the project started with denuding large areas of the property because it was almost all broom seedlings and sprouting cut stubs. There were trees, lots of stumps, leaf litter in the draw, and not much else. There was also grading to repair old roads and improve drainage producing areas that were denuded. In order to get the final inspection on the house stamped, I seeded with exotic grasses and straw *(B. hordeaceus)* and exotic legumes *(T. hirtum)*, just like the County wanted, but then, it wasn't as if there was sufficient seed from local native plants available to do that job!

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There is a reason for this. This is a dynamic work that will be updated over time. I have no intention of defending conditions that no longer exist or explanations that have since been relieved of unintentional ambiguity or error.

Please, use a link. Thank you.

Revision History 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.

1.0 2.0 3.0 3.1 3.2 3.3 3.4 3.5 4.0

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

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April 2009 – *Lupinus bicolor*, *Trifolium microdon*, and *Pseudognaphalium stramineum* invade an open niche.

Recall from the introduction that much of the native seed bank here had been exhausted. Given that (to my knowledge), nobody has witnessed this native re-colonization process before, I felt it important to report what happens as native annuals and grasses reestablish without exotic competition. This chapter will touch upon**:** their patterned hierarchies, if they exhibited unexpected behaviors, if there were indications of genetic adaptation when invading a compatible niche, or responses of possibly residual microbial symbiotes (or the lack thereof). If during the process those latter patterns were repeated in the behavior of exotics, such is also noted in this chapter.

April 2006 – Three years after the war on cat's ear began, clovers, cudweed, and other natives began their comeback.

For plants exhibiting seed dormancy, once they have invade and settle into a site, the seed bank and fungal relationships might also be reestablished, thus making the initial conditions unlikely to be repeatable. Hopefully, some of what I have seen will alert whoever attempts this somewhere else for what they might see such that more information can be captured. Given that I had no training as a biologist at the time, these will be fairly gross observations replete with speculation, as they must be at this point.

April 2004 – There are two *Stipa pulchra* and the rest are *S. lepida*.

The hilltop “grassland” and the ridge to the right was occasional bare dirt with remnants of dead broom and weeds running amok. At the time, although I had a few native grasses, a native grassland as such was but a distant wish. I dumped a couple of loads of chips up there to cover most of it up, but they had to rot in a pile for years before being usable as an amendment. It was awful hot and dry up there, pretty grim really; I didn’t take many pictures. Once the broom started to quit and once I started learning native from exotic, the only thing to do with the latter was to kill them. Therewith came significant “collateral damage” but things did start getting better.

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

I have seen some “strange” things up on this sandy hilltop, such as rushes that are supposedly indicative of a wetland. Similarly slender wooly heads *(Psilocarphus tenellus)* aren’t known to inhabit this kind of system but it showed up here first. Low growing perennials like *Verbena lasiostachys* have made their presence known (the latter builds a soil with very high organic content). Then too I have successfully grown grasses here that continue to spread during a drought despite that they are supposedly only found along the coast!

April 2009 – Grasses invade a meadow that was almost exclusively forbs in 2008.

There were two general hierarchical patterns among natives as this process took shape**:** forbs-before-grasses (above) or grasses-before-forbs. From what I can tell, the character each system assumed over a period of about a decade resulted from that "order of addition.' In other words, it is evident that hysteresis and entropy are at work. Were I able to "start over" things might have happened differently.

As one might expect, the pattern of grassland forb establishment is much more varied than with grasses. This flat used to be dominated by exotic dwarf hop clover *(Trifolium dubium)*. As I killed the exotic clover, it shifted to tarweed.

Then, as one would expect given the previous slide, the pattern reversed, with *Trifolium gracilentum* taking up much of this flat.

The lowest group of plants on the successional “totem pole” is a special subset of native colonizers for which there is a separate chapter on sand hill species (next), or this one would have been too long.

January 2009 – Note the evidence of low soil nitrate and the spreading *Gamochaeta argyrinea*, then thought to be *Gnaphalium purpureum*.

The most common grassland pioneer here has been one of two lotuses, *Acmispon americanus*, or *A. parviflorus*.

Typically the grasses show up singly, most commonly small flowered needle grass *(S. lepida)* and California brome *(B. carinatus)*.

As the grasses take over (here also with blue wild rye *(Elymus glaucus)*) the forbs then recede, in a typical successional pattern.

So I burn brush piles to maintain diversity. The process starts anew with lotus and clover. More on that in a bit.

May 2005 – *Bromus carinatus* seeded on a newly graded road.
I ran the piping to establish it before the winter rains.

In instances of grass-before-forbs, most were revegetation projects in which the area was seeded with grasses.

Yet there are cases where grasses have receded before forbs. Here we return to that “native” clover in Part I *(Trifolium ciliolatum v. ciliolatum)* invading an established grassland. This variant of *T.ciliolatum* has never been seen this far south, here invading grasses when the order has usually been the other way around in this particular meadow.

When *T. ciliolatum v. discolor* first appeared two years prior, it looked to be one of the few clovers capable of competing with our native grasses. *T. ciliolatum v. ciliolatum* was different. In places, it started taking over and holding them from year to year.

In several places, it started making multi-year monoculture patches, most higher-disturbance areas.

On the other hand, it seems to get along fine among this long established needle grass *(S. lepida)* patch.

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

Given how strain specific the relationship between clovers and their rhizobial symbiotes can be, I checked to see if it was forming nodules (yes, inset) and then started confining to the hilltop. I eventually took out this patch as part of that process.

Then I waited and was rewarded with a surprise! Here, the *v. ciliolatum* appears to be forming a near monoculture on the left, 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)* (the clover just disintegrates once it's done). So is a "monoculture" temporal or spatial? Is this the transient behavior of a colonizer? So confine it and watch.

Elsewhere, this is our established local, *T. ciliolatum v. discolor* (the larger variegated leafed clover leaf). This variety has been growing in this spot with California brome *(Bromus carinatus)* and *T. microdon* for about five or six years and gets along fine.

Among the fabaceae, when lotuses and clovers first colonized a "sterilized" area, they were often huge (this *A. brachycarpus (*was *Lotus humistratus)* is well over a foot across). In the second generation, after these pioneers, they seedlings germinate in large numbers but develop as much smaller plants, at most 4” across with a half-dozen flowers or so (inset). I speculate that the seed of pioneer plants have thinner coats with which to establish many scions to control the spot. Once established, the strategy becomes to hold the spot; so the same hormonal signals that make them smaller (Ludlow 2008) would also have them producing seeds more capable of extended dormancy and also either more plastic or genetically variable.

Clovers do the same thing. As this *T. bifidum*, establishes colonies they tends also toward being more erect.

As these clovers colonized the property, they appeared to differentiate. Three of the four photos are notch leaf clover *(T. bifidum)*. The funny thing is that the two that appear to be the most similar are actually different species! The first (1) is at least four times the size of the other two notch leaf clovers here (2 & 4) and is by far the most common. Each subsequent variant has since bred true where first found. It subsequently differentiated or the property was simultaneously colonized by three varieties. The oddball is (3), *T. microdon*.

1

Trifolium bifidum

3

Trifolium microdon

4

5

Clovers (3 & 5) are variants of *T. microdon.* To the casual observer, in may ways (3) resembles the notch leaf variant (4) more than either resemble their respectively more common varieties (1 & 5). Meanwhile, the latter two share several attributes not shared with the smaller flavors of each. So, why does the taxonomy work this way? The traditional distinguishing features are the attributes of the flowers, whether or not there is hair, etc. Interestingly, they are unlikely to be hybrids because apparently clovers do not interbreed. In fact, they are more exclusive of other varieties within their species than without! Still, it would seem that there might either be blocks of genes or conditional branches in the gene algorithm that interact with environmental factors.

Clover (1) is the usual erect form of pinpoint clover *(T. gracilentum).* It entered in 2003 and later appeared as a variegated and prostrate flavor (2) that breeds true and shows a similar albeit slower dispersion pattern to (1). A later entrant (2006) at first I thought was tree clover *(T. ciliolatum)* (3) with monotone lanceolate leaves that later became more elliptical. So, was that *T. ciliolatum* or *T. obtusiflora*? Well, it's not at all glandular, nor was it clear if the calyx was fused or not. Two years later we had a variegated flavor (4) with that was *clearly T. ciliolatum* with wider variegated leaves that, true to its name of "tree clover," is prostrate!

I have also seen clovers that were erect when they first came in but laid down when there was little competition. Then they went erect in grasses, which then produced offspring that grew erect in the open (upper right). I'm wondering if that propensity is a heritable adaptation (epigenetic). I say this because I have had the rare opportunity to witness colonization behavior in several species in completely different plant families behaving according to the same principles.

Not all clovers grow erect in intra-specific competition. This borderline monoculture of *T. microdon* grows prostrate here no matter what.

But *T. microdon* can become decumbent to upright and rangy when growing in other vegetation, especially in a wet year.

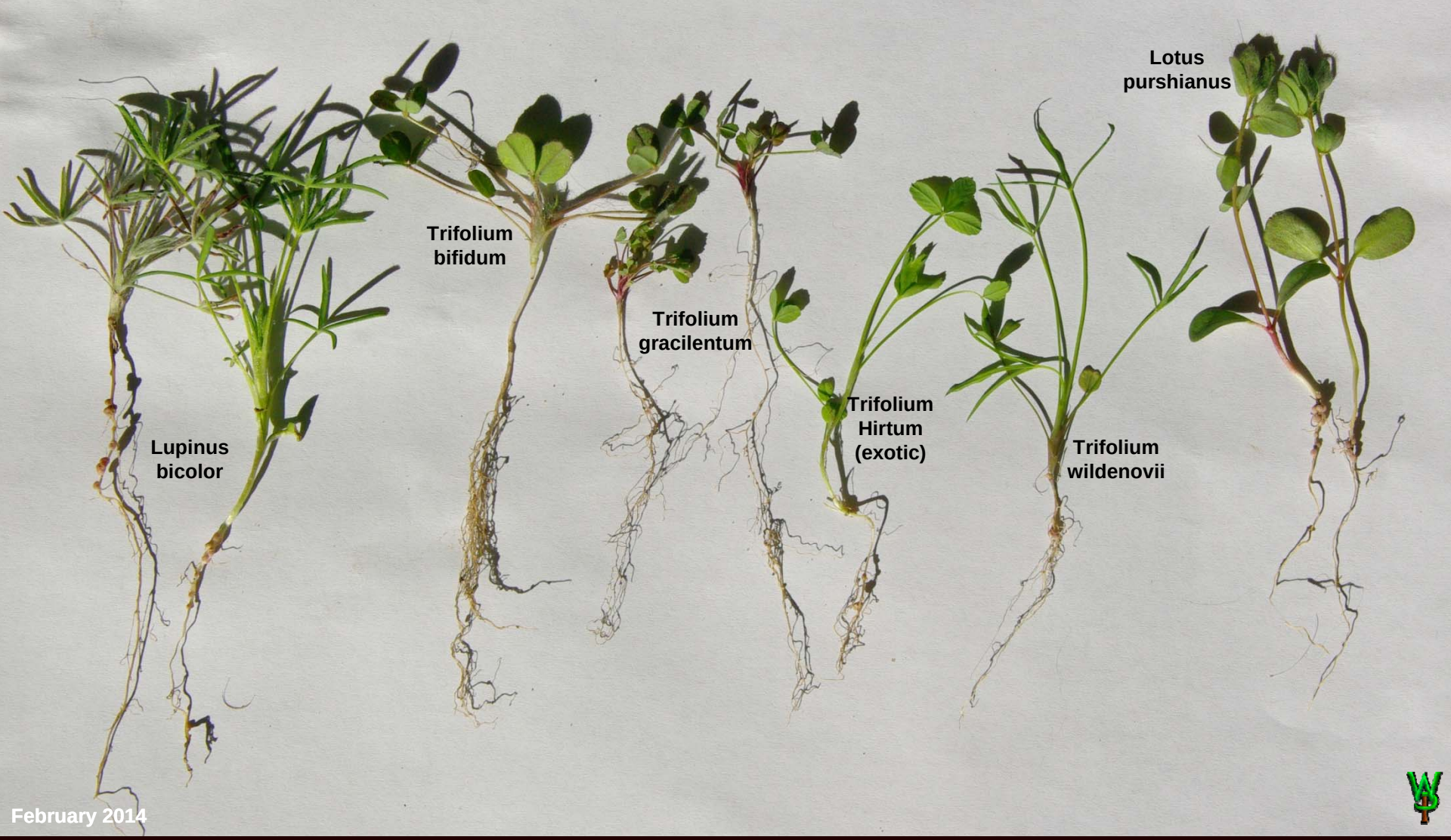
At first, Spanish lotus does the same thing *(Acmispon "americanus"* – go figure) in that it grows completely prostrate and stays that way until it encounters the grass and starts to climb. But then things get interesting.

In this *Stipa pulchra* grass (and each other), these lotuses nearly all grow completely vertical, forming an moisture-retaining understory blanket almost a foot thick! This condition appears to augment the growth of the Stipa as well, here reaching five feet tall.

Yet here, only four days earlier and with similar lighting and plenty of room, they tend to grow completely erect. In the past, I have seen them do this all by themselves where all the rest of their cohorts were prostrate. It has the appearance of a programmatic adaptation.

These two lotuses are 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 in soil as an epigenetic response to shade.

It is hard to be certain, but it is my guess that clovers suppress germination among each other from year to year 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.



Another question re colonization behavior is whether these returning plants find the correct strains of diazotrophic bacteria they require for successful nodulation. I had been told by academics, 'the bugs are there,' despite their hosts being displaced by exotics over a hundred years. So with these newly returning alleles, I had to take a look. The results for that hypothesis were mixed. The lupines did fine as did all of our small Lotus species, all of which I had long suspected had survived in our seed bank. The exotic *Trifolium hirtum* I introduced without inoculum did not nodulate, yet the exotic *T. dubium* nodulated quite well, this despite being on the poorest soils on the property. I suspect the reason is that the *T. dubium* was here as a weed when the land was still grazed and the local *Rhizobium trifolii* adapted to it by genetic transformation, either in the animal rumen or by shearing in trampled mud. Still, the nodules were white, indicating a lack of leghemoglobin and therefore no nitrogenase produced, which agrees with our low soil molybdenum values.

Another group of native annuals that takes over the grasses is among the everlasting tribe. In particular pink cudweed *(Pseudognaphalium ramossissimum)*, can grow to five feet tall simply exerting physical dominance but so also can some of the tarweeds *(Madia spp.)*. From what I have seen cudweeds compete by sequestering nitrate in their tissues. This one is an annual, so it eventually puts that nutrient back into the soil.

April 2004

Close to our hilltop where I first started with grassland rehab another and more diminutive everlasting species made its first impression: slender wooly heads *(Psilocarphus tennellus)*. This tiny plant makes a small reflective mat on the surface. What was interesting in this case was that the pattern in which it spread (probably by mud on animal feet) was very similar to that which I witnessed in some of the clovers, with the first subsequent appearance also on a ridge some 300 yards away.

And here they are, spreading without competition, slowly working their way uphill. This plant was uncompetitive against weedy mouse eared chickweed *(Cerastium glomeratum)* and annual grasses because it does not germinate until late February to early March. 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. It comes up late enough in the season that it is unlikely to suppress germination of legumes. That it is an annual member of the everlasting tribe suggests that it might possibly recycle nitrates from deeper in the soil back to the surface.

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