Making Meadows

April 2010

In these mountains, fire-suppression has allowed forests to become overgrown. Meadows end up as very occasional openings, usually made by a bulldozer and maintained by machinery or domestic grazing animals. Meadows with large quantities of native forbs are virtually non-existent. Here at the Wildergarten they are maintained by hand and are by far more demanding than any other type of habitat. Larger plants hide tiny weeds, requiring time-consuming inspection and removal at least five times per year (they crop up after rain; in 2010, this one got 14 visits). The soils are tangled with roots, making effective removal more difficult.

This meadow is a mix of small-flowered lotus, Spanish lotus, pinpoint clover *(T. gracilentum)* tree clover *(T. ciliolatum),* thimble clover *(T. microdon),* small-flowered needle-grass *(Stipa lepida),* blue wild-rye *(Elymus glaucus),* California brome *(B. carinatus),* hedge nettle *(Stachys ajugoides;* they don't sting), and about 20 others. Interestingly, this meadow is succeeding to grasses, while the one on p6 is going the other way. Note the three native shrubs, yerba santa (*Eriodictyon californica* - the leafy thing in the mid-ground), monkey-flower *(Mimulus aranticus,* at the tip of the shadow on the right), and deer weed (*Lotus scoparius,* behind my trusty dog). If I don't remove them too, this meadow would succeed to chaparral in about five years. Now, that isn't a bad thing in terms of native plants, but it is a bad thing in terms of management if the goal is to maintain grasslands learn about how each one of these systems works.

Although this site is cleaner than some other locations on our property, disturbance still brings up non-native Dwarf Wood Sorrel *(Oxalis laxa),* nit grass *(Gastridium ventricosum),* bur clover *(Medicago polymorpha vulgaris),* and French Broom, even though they have all been under control here for over 10 years.

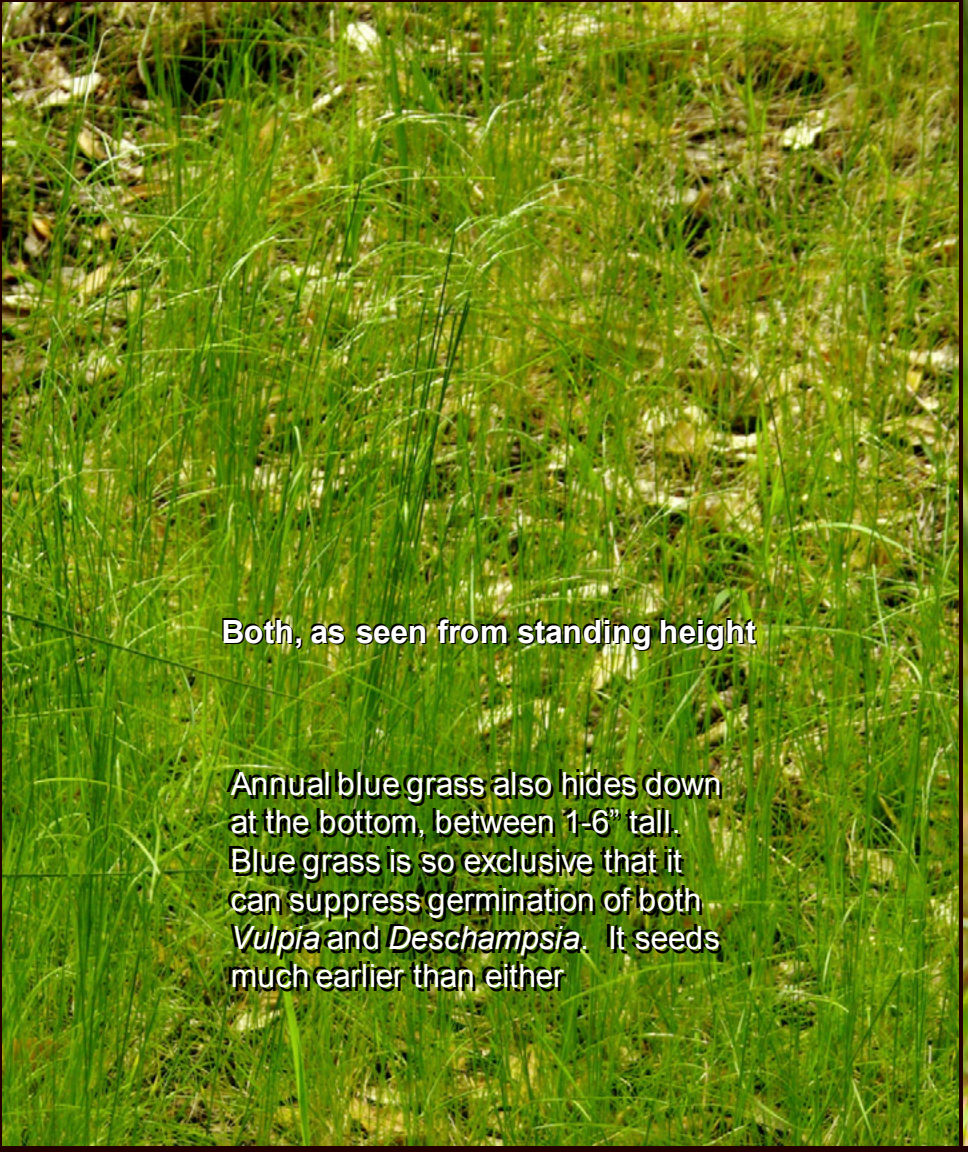
Native meadows are varied too. Their management requires adapting to each individual system. This one is a mix of California brome *(B. carninatus),* purple needle grass *(N. pulcra),* blue wild rye *(Elymus glaucus),* Western fescue *(F. occidentalis),* coastal tufted hair grass (Deschampsia *caespitosa v. holciformis)* Santa Barbara sedge *(Carex barbarae),* and the usual lotuses.

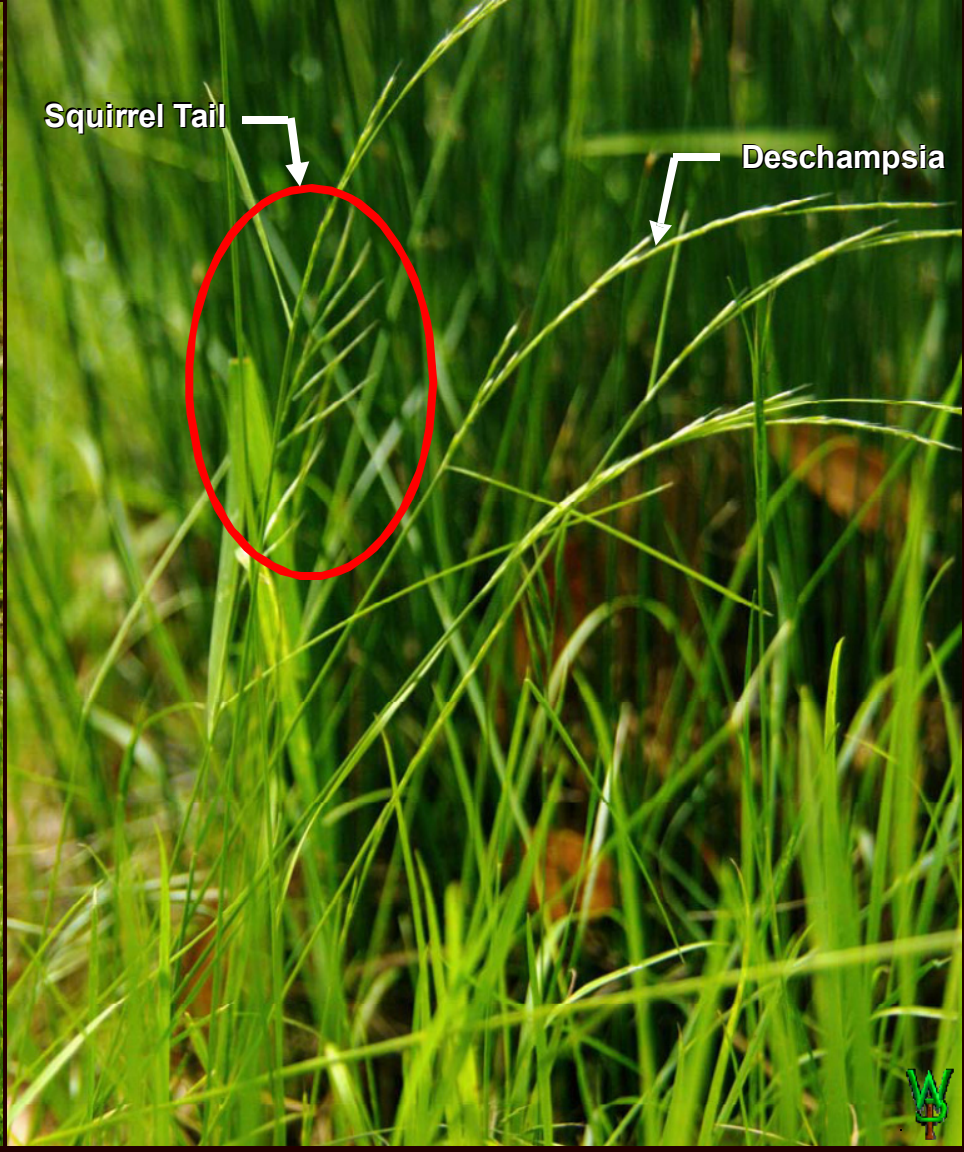
To most people, this looks like it's just grass and a few bushes. To me, this represents an awful lot of work.
I had just taken a 40 pound rice bag of weeds out of this area of maybe 25 X 40 feet the same day.

When you get them right, they can be immensely productive. This is almost all California brome *(B. carinatus)*.

There are even grasslands deep in the forest on steep hillsides. This one used to be a broom patch with bare ground. It now has Torrey's melic *(M. torreyana)*, pine grass *(Calamagrostis rubescens)*, and small-flowered needle grass surrounded with roses, hazelnuts, and ferns. But as remote as it is, this meadow shares one thing in common with all the others… weeds, no matter what.

Besides airborne weeds, seed comes in on animals as mud on feet, poop, or burs in hair. In addition to hedge parsley and bedstraws, the most numerous are annual grasses, which dissipate over about seven acres. The challenge is when they infest native perennials with similar visual attributes. Realize, that in the pictures you have seen of native meadows, I have removed exotic annuals from **within** every one of the perennial bunches. Here is an example of annual rat-tail fescue *(Vulpia myuros)* and squirrel tail fescue *(V. bromoides;* neither are true fescues*)* among perennial slender hair grass *(Deschampsia elongata).*





In this case, early distinctions between native and non-native are often almost indiscernable until the squirrel tail seed head opens or the slender hair grass nods. This makes easy separation, but too late in the game to control the annual Vulpia over large areas. So, what I have to do is suppress the native perennial Deschampsia until the annual weed is brought under control. In the future, we will probably do this with pre-emergence herbicides that kill only the seed as it attempts to germinate, which favors perennials. The problem is that weed seeds can accumulate over a number of years before suddenly germinating in huge numbers under favorable weather conditions (as they did in 2010) or even if the perennial grass dies. That means they might not all try until after I’ve halted the treatment. This is one reason why I use disturbance (such as burning) to force that weed germination.

Here I must weed exotic annuals from native perennials of the same genus. This photo is toward the end of the season. Before there is seed, the differences are far more subtle, shape, color and texture being chief. To cover acres, they must be distinguished rapidly. Early on, I need be only 70% accurate, because that is good enough to reduce the problem to a manageable level at the end of the season when everything is maturing rapidly and I have little time to get the few remaining exotics before they seed. With seed on them, those exotics that do remain are more obvious than if there were a lot of them. I call this the “sore thumb effect.”

Do not let the color difference fool you; they'll both be red in a matter of days. In fact, Spanish brome *(Bromus madritensis)* is also known as "red brome." Each of these brome patches must be inspected almost bi-weekly to get enough bad stuff out to make it possible to see the exotics amid the natives. The annuals mature so rapidly that if I waited, the more mature would be dropping seed before the later germinators even headed out. That is why the native is redder; the red brome here germinated late.

This is the job: Clear the soil of weed seed by using up the "weed bank" while native annuals propagate. It's the hard way, but until I had developed some other techniques, it was all I had. Besides, it beat sterilization and seeding with collections, in part, because we just didn't know what might be there and we had so little native seed. The visual demand of weed control is intense, especially when spot-spraying (it takes so much concentration that after a few hours, you want to run for the exits, drained).

In this picture are (weeds in red): mouse-ear chickweed *(Cerastium glomeratum)*, the few-flowered clover *(T.oliganthum), pinpoint clover (T. gracilentum), Notch leaf clover (T. bifidum),* little hop clover *(T. dubium)*, small-flowered lotus *(L. micranthus),* Spanish lotus *(L. purshianus),* California brome *(B. carinatus)* which I had been pulling here until I got the foundation put back. Brome grasses have a fairly powerful allelopathic chemistry that excludes other plants. Also present are small-flowered needle grass *(N. lepida),* rat-tail fescue *(Vulpia myuros)*, pop-weed *(Cardamine ogliosperma* (supposedly native, but I hate it*),* wall bedstraw *(G. parisiense)*, two non-native vetches *(V. disperma and V. tetrasperma)*, slender madia *(M. gracilentum),* and coast tarweed (*M. sativa,* of disputed origin). The worst are the wall bedstraw and the rat-tail, but the chickweed is not far behind. We're getting rid of the chickweed first, because it is the earliest to germinate and set seed.

So, is this just an aesthetic exercise for a would-be intellectual with nothing better to do? Are the non-natives really so bad? After looking at this and the other picture books, I hope you share my opinion that the damage weeds do is far beyond the mere aesthetic. If exotic species are truly responsible for one third of all extinctions in North America, and I promise you, THEY DO NOT STOP SPREADING ON THEIR OWN, then this is the most critical environmental issue we face. If all the activists in your area can offer is futility, they need to be shamed, loudly and publicly. It is time to take the moral high ground away from the organized environmental movement and let people get to work, making meadows.

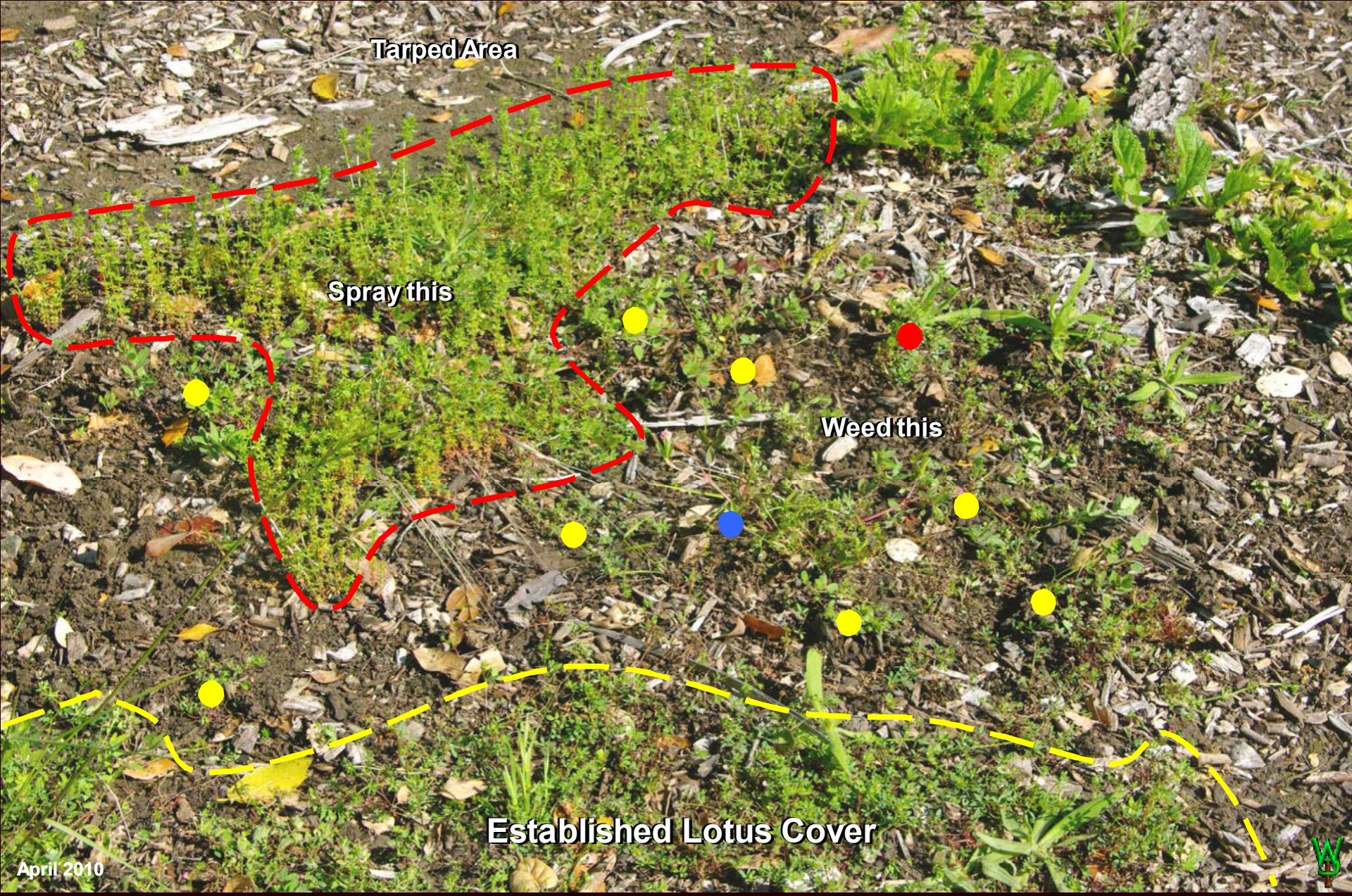
Deer weed (native) can be very dense and lush, but it is quite invasive in grasslands. For the first few years, it looks good. It does make considerable organic matter, albeit it is woody and rots slowly. The hazard is that it hides weeds and inhibits removal.

Deer weed get's old and decadent after only a few years, leaving behind this mat of dry twigs that keeps weeds from germinating. In a hot summer environment like this, it will take at lest five years to rot down. If I were an Indian three hundred years ago, I'd burn it.

When I last burned brush in this meadow, most of the bunch grass *(Nassella lepida)* died. Then the filaree and madders went nuts. These grass plugs were planted in February 2007. They survived with almost no rain thereafter, from the end of February to October with over 40 100°+ days and most of the rest in the 90s in a soil with less than 2ppm nitrate. Yet they hardly seed and have not spread since then (2013). However, the lupine, purple cudweed, various clovers and three lotuses have increased in density considerably with deer weed *(lotus scoparius)* and monkeyflower trying to cut in. I'm not thrilled with the idea of a chaparral here. So I pull deer weed here, with the secondary goal of disturbance to germinate the weed seeds to remove them from the seed bank. This is a very sandy soil within 100' of my sand hill. If I burned this spot regularly as the Indians did, there might not be grass at all. There are a couple of Clarkias in the area too, which the aboriginal tribes also farmed. So, was this spot such a clarkia farm too? There is no way to know. Blue dick seeds seem to remain viable for a long time. I am told Clarkia seeds are good for only three years.

These 1-2” tall bedstraw plants *(G. parisiense)* are from dormant seed (as opposed to newly imported). The seedlings are evenly dispersed over large areas, as opposed to clustering around a spot where an animal may have bedded down for the evening or a plant was missed the prior year and bred successfully (what I call an “incidental error”). We had a lot of rain in fall 2009, followed by warm temperatures. The next spring we had a succession of warm rains. These combined events made the blast from the weed bank especially virulent. Here, the bedstraw stem is strong enough to pull the root, but the root is not too deep. Optimal weeding conditions are after rain but then deteriorate within hours (yet another reason why it is important that a land steward live on-site).

Remember that I said wall bedstraw can wreck a meadow? This is the same area, only **six da**ys later. The bedstraw has almost doubled in size. I promise you: the roots have grown just as much. These plants are now at the extreme limit of what one could weed by hand with effective yields in this hard packed soil. Elsewhere, in looser soil, this size is just right, a level of detailed site knowledge that is difficult to replicate when it comes to planning where to be and when. Once it sets seed, one can tear the root, but one does not want so much left that it drops before getting it all. So, because we need to get a lot of it early and are at the size limit *here* and because we have many spots just like this one only vastly bigger in area, and with other weeds just as bad, do we spray it or weed it?



In this case, the answer is “both” because a black plastic tarp over a compost pile had precluded bedstraw germination across the top left of the photo. We do not yet have much native groundcover here, so we hand-weed around native plants (the tree clover (blue) and lotuses (yellow)); then spot-spray the area inside the line. Next year, I expect a similar problem where the tarp had been. Note the difference between the area treated similarly last year (bottom) and the sparse lotuses in the "weed" area with the dots).

Once the bedstraw seed bank (prior slide) is mostly depleted, that spot will start to express other weeds. Only ten feet away from the last slide here we had a sparse weed bank "layer" of scarlet pimpernel *(Aganalis arvensis;* red), with two non-native clovers and some random grasses. Some, such as small-seeded rattlesnake grass (*Briza minor;* green) are imported annually, while others, such as this remnant of nit grass *(Gastridium ventricosum;* blue) are from the weed bank (note: I am only circling one example of each weed species present here). I need the few natives to breed. Pimpernel is easier to remove than bedstraw, but more toxic and harder to wet with herbicides. The pimpernel is often the last broadleaf weed layer in the onion, so now clovers and lotuses are doing their thing. Typically, the first clover is exotic hop clover *(T. dubium,* not in photo*)* or rose clover *(T. hirtum,* yellow thanks to you US government and Santa Cruz County). Then the natives slowly colonize the area from elsewhere. The pimpernel is a much slower developing species than the wall bedstraw, so it won't drop seed until June. So, do I weed or spray? If so, when? Weed, NOW. Why? The natives and weeds are closely mixed with two cat's ear plants starting to put up stems (white; just one in the photo). At that stage, it will blow seed in three weeks. The small seeded rattlesnake grass will drop seed almost as fast but the Gastridium won't seed until June. So, once I started, and with so many species calling for varying processes, I finished. If the spot had been larger or if I had more demand elsewhere, I'd have addressed the immediate needs here and come back later. It's all about speed.

May 2010

Now that you know what they look like, find them in here! This isn't like weeding in a suburban back yard; this is serious work requiring at least intimate guidance by an educated person. This is mostly California brome interspersed with a clover/lotus groundcover.

This (foreground of the prior slide) is the way it looks when weeding. Finding a few 6” tall bedstraw plants, or any of the other 110 weeds we manage in a half-acre of this is a challenge, but if you want a native meadow, this is what must be done until we have better processes (more on that later). It may *look* impossible to do by hand, but there are ways to take it from virtually impossible to merely painful. First, the grasses mature before the bedstraw does. I have developed visual vegetative keys to identify and remove the exotic grasses when they are small, long before they set seed. This means that I can ignore them unless they are “sore thumbs;” i.e., the few that I missed before. Similarly, I reduce the bedstraw to a few per yard long *before* the native annuals get big enough to make things difficult. By this time, the bedstraws are few and large enough to reduce the mayhem one inflicts while looking for that last one. As you will see, we have more powerful processes in the works that may make this type of effort far less arduous.