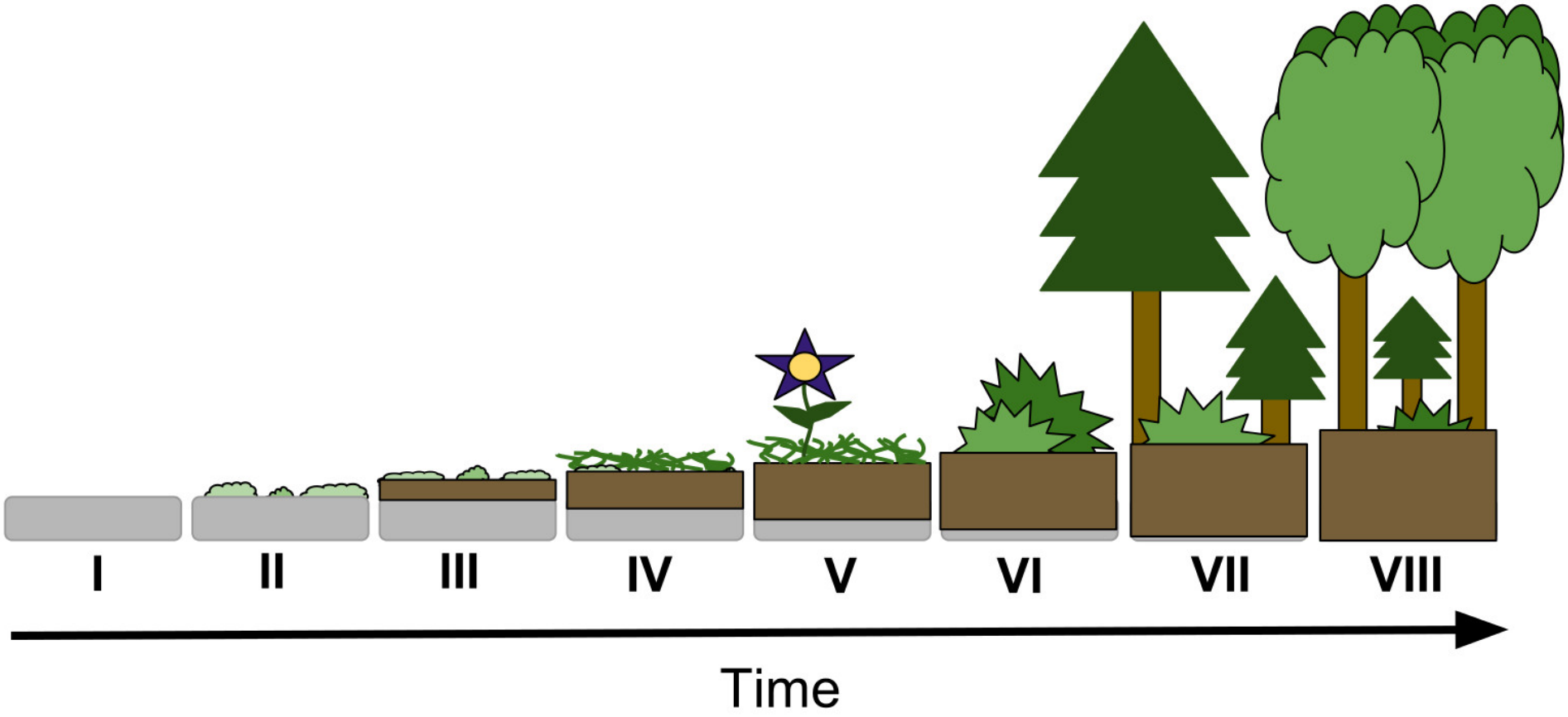
# There Is No Failure Like Succession

April 2013

As you may recall from the Introduction, I spoke about two major causes of destruction of the post-disturbance system: exotic weeds and succession. Now that the weeds are more under control and because this project is about systems and not just nativity, I can revisit disturbance in grasslands that had succeeded to perennials (thus crowding out the annuals), and forests 'preserved' in Phases 1-2 of stand condition which in places had reverted, to shade out groundcovers entirely. Forestry Phases 3&4 are a true disturbance, reverting succession to increase the variety and vitality of the forest as a whole. The key to both is managed




**Source: Joshfn, Wikimedia Commons, click image for source**

Anybody who has taken grade-school biology has been exposed to the idea of primary succession, with diagrams usually showing a bacteria starting on bare rock, lichens, soil, then forbs and grasses, proceeding to shrubs, and thence to either conifer or hardwood forests in turn depending upon which is perceived as locally dominant. This “final” state has been dubbed the “climax forest.” It’s a nice idea, ordered and understandable. Unfortunately, it distorts how we recognize what we see.



If what is there is a grassland, and it burns, you will get a grassland, albeit possibly with more forbs than before, for a while, but by the next year it will be back to where it was. At that point, the idea of primary succession might seem inapplicable, but it is not.

Manzanita regeneration, August 2008, three months after the Summit Fire

If what was there was a chaparral of manzanita, ceanothus, coffeeberry, toyon, or chamise and it burns, the brush will regenerate from the root masses or seed almost immediately and you will again have a chaparral in very short order. In but six years, the manzanita that burned in the Croy fire only a mile from here is already eight feet tall.

**Manzanita regeneration, August 2008, six years after the Croy Fire**

Six years. Does this look like enough fuel to burn again? But wait!

The primary succession model predicts that this system was supposed to “start over,” with forbs, then grasses, then brush, and then trees. Yet the trees and brush in this photo clearly started from adventitious buds on roots immediately after the fire. What gives?


If it is a conifer forest and it burns, it may show some grass here and there, but if it seeds successfully, it will not go back to the successional beginning but will return to conifer forest within a year or two. This is Yellowstone National Park, 22 years after the 1988 fire. This stand is but 6-12 feet tall. There was no diversity as predicted. There were nowhere near the shrubs, willow, or aspen as expected for wildlife. The topsoil is gone and is not rebuilding measurably. This unhealthy forest is obviously ready to explode again.


The successional model implies decades between stages. It exists because native Americans managed the land in early successional stages for so long that, once they stopped burning, the land developed in *primary* succession… starting from wherever it was. Hence, when biology texts were written 70-100 years later, that is how the authors saw things. This is why people are surprised when cedar trees invade a Nebraska prairie. There was no means for these higher order plants to invade the area when it was burned frequently.

**August 2008, knobcone pine and manzanita regenerate in place six years after the Croy Fire**

It takes time for successional invasions to progress. Yet once seed and root masses are established, everything already there wants to regenerate after a disturbance, in a sense, continuing the primary successional process that had been interrupted. Realizing this, biologists now use the term “secondary succession,” with all the qualifications characteristic of an idea stretched beyond practical limits. One can see this in the “succession” model taught to students that places hardwoods at the “climax stage” versus conifers, because that is how things once were… Where? Back East. That *was* the way things were there, but not any more. But won’t the Eastern system eventually return to its original condition? NO!!! Those pre-Columbian stand configurations once had dominant chestnuts and elms that are now virtually extinct because of chestnut blight and Dutch elm disease (both exotic pathogens). Indians maintained chestnuts because they were a source of food. “Nature” goes on from where it is with whatever happens to be dominant in a particular place and time, models notwithstanding. Models help us see, but they also distort what we see when we “re-cognize” our observations according to the model. Words have a way of doing that. Instead of succession, a better word in this case would be “regeneration.”

August 2008, six years after the Croy Fire

Even more confounding to the “model” I just offered, if a knobcone pine forest around here burns, it may be set back a bit with some brush here and there, but if the cones seed successfully (depending upon the fire temperature and the cone maturity), the forest will be knobcone again very quickly (left). On the other hand, if it does not seed successfully, it won’t (right, same fire).

**Musk thistle, cheat grass, and dead trees, Mesa Verde National Park, July 2005**
**Photo by Steve Rich, Rangeland Restoration Academy**

In other words, to say that we know what will be the “climax” stage of a site that for over 10,000 years has not been left to accumulate fuels like we now permit is the height of arrogance. To withdraw all management, suddenly, from so many interdependent systems of animals and plants and expect them to “know” how to optimize after a disturbance, particularly when the tendency of unmanaged competition is for dominant species to burgeon until they consume their nutritional or hydrological base (as do overstocked forests) and especially with exotic species present, is simply, well, ignorant, arrogant, lazy, irresponsible, distracted, and self-destructive (to fling a but few applicable missives). More importantly, such results virtually preclude locally-adapted post-disturbance species from expressing at all, which means that those species, some possessing important relationships with soil microflora, will eventually go extinct. At that point, restoration of the native system becomes an impossibility. One can then only replace it with something else.

**January 2013, the Wildergarten, monitoring germination two weeks after a burn pile**

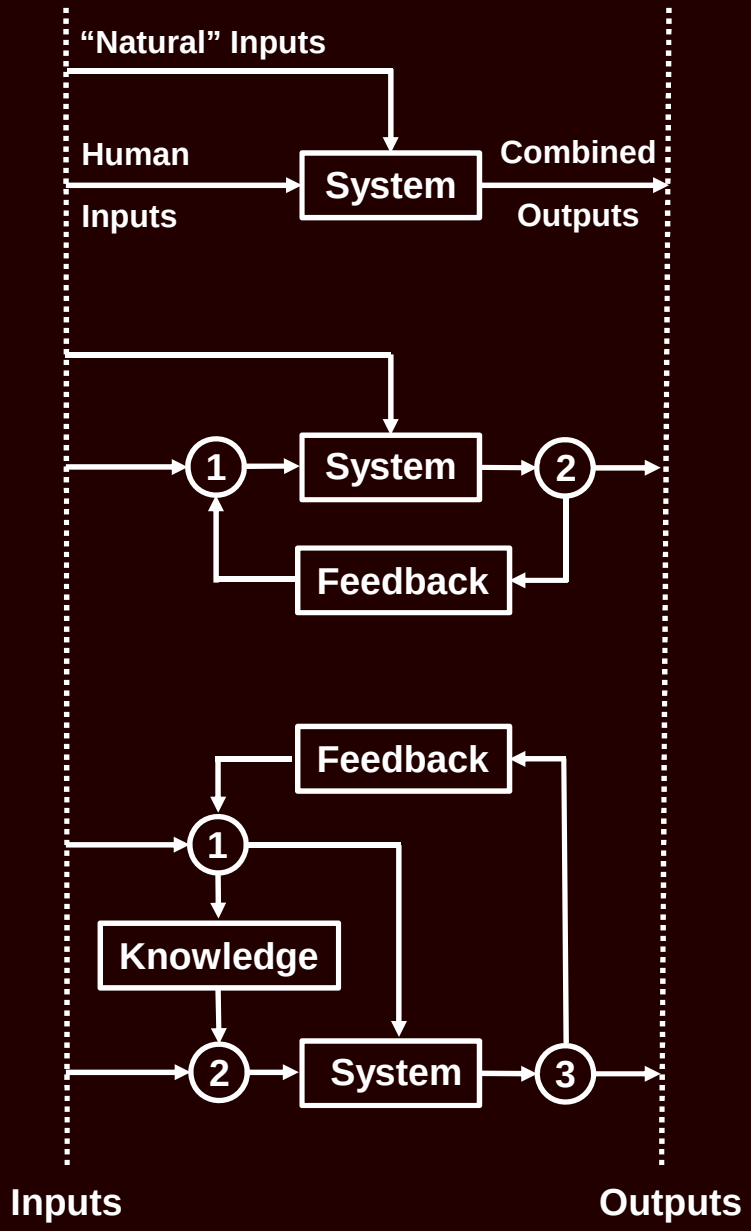
As discussed earlier, I had been using the disturbance of burning piles of tree tops to get the grassland “weed bank” to express itself so that I could see if it was ‘cleansed.’ In effect, I had reverted primary succession to post-disturbance forbs first by killing everything (I had used Roundup on this hilltop for 2-3 years) and *then* continued to reset it by burning repeatedly. But, what if I told you that there could be a need to cleanse the seed bank of certain types of *native* seed as well? Heresy! Well, if you want a grassland, maybe not…



Here I pull shrubs and kill trees in the sand hill to keep it from becoming a forest. Note the increase in the size, number, and density of the shrubs on the right in only one year (left to right from a different angle). So, in a historic sand hill, how did the Indians keep out the brush if it could invade in but one year if what they wanted was to harvest forbs?

**May 2014, Primarily *Filago californica* being invaded by *Bromus carinatus, Elymus glaucus,* and *Mimulus aranticus*.**

In this sand hill area, I burn brush piles here every 1-2 years to instigate a successional reversion to type, thus limiting succession to a degree. As the grasses invade it, I do it again, but the grasses start from where they were. Effectively, this is 'preservation by periodic disturbance;' else each of those successional cohorts becomes decadent, to be invaded, by the next higher rank. Wait longer and baseline regeneration happens at the next level (grasses to brush). Yet once the brush seed (such as monkey flower) is in the grass then the brush comes up *with* the sand hill species *and* the grasses until the sand hill species are crowded out, essentially a "recovery" of everything at once. The longer succession progresses before a disturbance, all levels of succession up to the highest present at the time of the disturbance respond simultaneously, if they can, thus increasing the rate of the successional system as a whole, simply because one does not have to wait for the seed to invade. If I want to take it backward, I must either burn before the grasses breed several times until that grass seed is consumed or use chemicals. Animals would augment the grasses.




The way most people think "Nature" works, is that human and "Natural" inputs both induce change (or "outputs") in plants, animals, drainage, etc.. The goal of environmental activists is to make human inputs negligible while simultaneously holding that everything we do affects everything else (thus justifying them telling everybody else what to do or not to do). Although that may mean "Natural" could never truly function as such, it also means that the environmentalists would be in charge of everybody else, forever. No wonder they like it!

This is the simplest type of control loop, one with "feedback." A good example is the control of your home air temperature. When a natural disturbance (weather) raises or lowers the temperature, the thermostat (circle 2) tells a relay (circle 1) to turn the heating/air conditioning system on. The equipment runs until the temperature *overshoots* the desired value to a limit and then shuts the unit off. The result is that the house is seldom at the desired temperature. This is how politics works when the public notices something has gone to hell and elects "that other party," at which point they are liable to over-shoot.

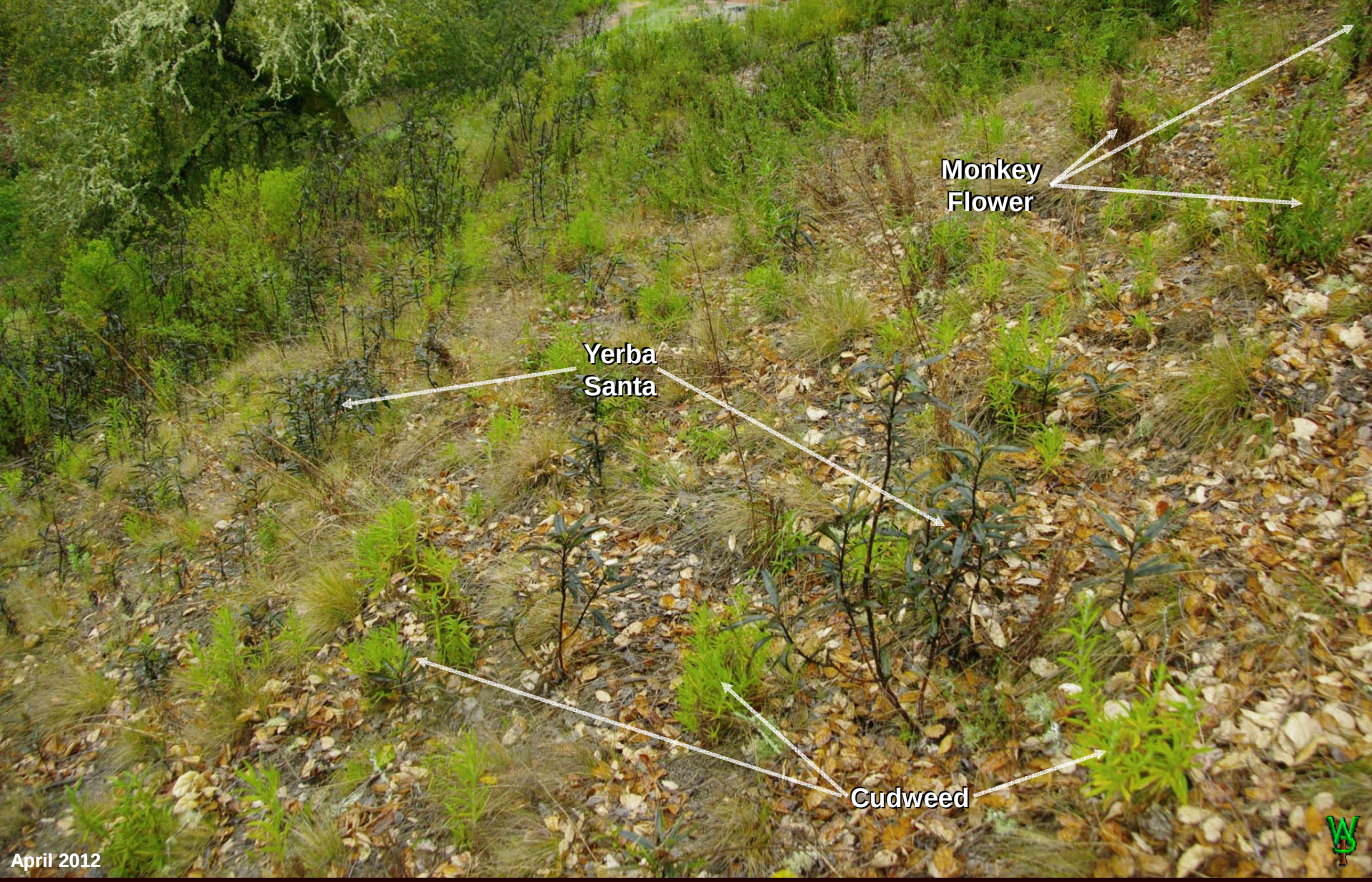
This is the most sophisticated type of control system**:** a control loop with "feedforward." A good example is your control of your car. When your visual sensors (1) see an external input (a red light) you use your sensors (1) to gather data and then apply brakes*, knowing* (from those sensory inputs ***plus*** an experiential base) roughly at what pressure you'll drive your foot (2) against the brake pedal (part of the automobile system). This system requires smaller feedbacks as you feel and see (3) your rate of deceleration making you less likely either to overreact (stopping short) or to under-react (hitting the car in front of you). Each time you perform the task, you *learn* by sensing the feedback as an input, increasing knowledge of how to do it with less brake and tire wear, not to mention possible physical trauma to everyone and everything involved.

Feed-forward is a control architecture that applies ***prospective knowledge*** of how a system will respond to both a disturbance and the corresponding input as a way to correct system behavior ***before it drifts beyond control limits***. It's what people do.


So now let us apply this idea to the temporal and spatial interactions among successional cohorts within grassland, scrub/chaparral, broadleaf forest, and conifer forest habitats. Each of these systems requires periodic disturbance in order to stay in each particular configuration; else each fails in its own characteristic way, whether by senescence, succession, or catastrophe. The easiest to see is the example of fuel load. Most people would *know* intuitively that this is too much dry fuel (this is my neighborhood; I didn't have to go far to find it). Most people ***know*** what must be done; else they ***know*** what will happen. Feedforward isn't a hard idea.


This next series of images shows how primary succession behaves in this native grassland (previously a French broom infestation). This needle grass meadow won't last more than two more years if I don't do something to set back the brush. It is being invaded by monkey flower *(Mimulus aranticus)*, deer weed *(Lotus scoparius)*, pink cudweed *(Gnaphalium ramosissimum)*, and yerba santa *(Eriodictyon californica)*. The monkey flower, deerweed, and cudweed I can simply pull. The yerba santa sprouts from lo-o-o-ong root runners from the parent bush below. It's a pain to deal with. I don't have a good method yet, as you will soon see!


Only a year ago, this area just down the slope looked like the prior slide. So, do I “have something against chaparral”? No. It is a habitat type with specific attributes that demand different types and degrees of management. There are hazards and benefits to it, just like anything else. The reason I do not want it taking over this grassland is that the latter is a buffer above an existing chaparral that allows a fire to lay back down on the ground after flaring in the chaparral below. It would probably respond well to annual grazing.




Although 2012 was a drought year, this was April after a March with almost 13 inches of rain. Yet this well-established small-flowered needle grass *(Stipa lepida)* has gone senescent with built-up thatch and is dying off. This area did not get mowed like most of my meadows do. The reason is that I have limited time and it's a pain to do with the shrubs moving in because the string on the brush cutter gets wrapped around the stems and shears. The other reason the grasses look bad is that pink cudweed sucks up nitrate. Yet I "must" keep the chaparral down here because this is the burn buffer above the chaparral below it (upper left of the photo).


Here it is again two years later. Obviously, “must” didn’t happen. The brush is so big I couldn’t take the photo from the same spot and is now a threat to the stand of trees immediately above. From here, the trees will invade the area and it will quickly becomes a forest again *unless* I burn it, whack and spray, or take goats to it. Else, the fuel accumulates. I still have time for a controlled burn in conjunction with State Forestry Vegetation Management.


A big chaparral fire is a fearsome affair. In the 1987 Lexington Fire above nearby Los Gatos, the updrafts carried burning chunks of manzanita upwards of a mile. Those chunks can turn into new spot fires far beyond defensive lines. Fearful of such an event, this neighbor cut his brush back from the County road. Hopefully, he understands that it will be back to full height in but 5 years.


On a 100%+ slope like this (over 45°), reversing succession can be hazardous. Unless I can burn this yerba santa, I get to ride a ball of trash down the face as I whack under my feet with a chainsaw (it's scary). Now, wouldn't it be easier if I could get something to eat it? Well, animals are a big commitment. Installing temporary electric fencing on a slope like this to keep a goat or two safe with the government's mountain lions and coyotes around is an unlikely prospect. Then there's building a safe pen, a barn, a water supply, cleaning pens, and making sure that the animals have enough food over the whole year. **I cannot import feed** (weed seeds).

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Poison oak succeeds the yerba santa here (foreground) making the project even more inviting.  Fortunately, I have earned an immunity.


Then come the trees, oak, maple, and bay in classic primary successional order. Yet this is a regeneration after the last time I cleared this slope eight years ago. It is *way* too steep here to allow a chaparral or forest immediately below a house. The oak and bay in particular are fire hazards, but any large tree on a slope of crumbly sandstone this steep like is also a likely threat to its geological stability. When competing for light, they tend to lean outward, which makes them likely to fall, tearing out a large hunk of soil with them, thus destabilizing the slope above.


Like this oak did at the foot of the same slope. I thought this tree was stable too! It was out of the wind and reasonably balanced. I should have cut it down when I was last in here in 2009. To the left we have a big leaf maple *(Acer macryphyllum)*. Of the trees, maple may be best on a slope as it is lighter aloft and allows more light for groundcovers but one still does not want them to get big here.


So, how do I apply the brakes to this successional process? Once again, part of our ultimate solution is Santa Barbara Sedge *(Carex barbarae)*. It holds steep ground, it takes full sun without irrigation, has low fuel value, responds well to fire, and is easy to propagate. It is not competitive with poison oak or blackberry but a few squirts on the first shoots with triclopyr fixes that (I might use a half-ounce per year for this). On the other hand, triclopyr is not an effective herbicide against yerba santa, but the latter has not invaded the sedge. As for shrubs, I'm tending toward buckeye and elderberry, which both have low weight and fuel value, and can sustain a groundcover below them without shading it out. Trees are fine as long as they are erect and tall enough for the fire to run beneath them. So, why the herbicide? I cannot burn it alone. It is both impractical (because of my neighbors' fuel loads) and massively illegal.


Another winner on steep slopes is seven-year grass *(Calamagrostis rubescens)*, so named because it spreads by rhizomes and seldom seeds. This is July. In partial shade this grass stays green all summer. It makes a beautiful groundcover and seems to resist invasion by higher ranked plants. This is my favorite erosion control grass but for the fact that it is hard to propagate and slow to establish.



Farther up that slope, I have hedge nettle *(Stachys adjugoides)* and California brome *(Bromus carinatus).* This slope is so steep that to expend the labor weeding annuals every year without causing more erosion is more than I am willing to tolerate. So I started a thousand plugs of *Festuca californica*, which is big but not tall, grows well on steep slopes, and (unlike the *Calamagrostis*) reproduces adequate seed. Thereafter I'll bring in coyote mint *(Monardella villosa)*, with the hope that it will be as beautiful a cover as I anticipate. This is an example of mitigating succession and fire and landslide hazards by selection of species that are light, have extensive root systems, respond well to fire and drought, and resist invasion. I could burn it every ten years or so and it should be reasonably stable here, but if I allow too many trees here, particularly bay, fir, and oak, or if I let any get too big, the system breaks down and becomes unstable.


One of our overall goals is to maintain a wide variety of habitat types on the property in various successional stages, but there are limits to the amount of land one person can manage. Forests here are many times easier to weed than open grasslands. and redwood stands hardly require any weeding at all. Yet the primary succession to redwood that started with the Spanish burn ban 200 years ago and built the redwood monoculture to the left, now threatens this oak-madrone woodland, ideally (to me) a dense cover of varietal forest groundcovers interspersed among multi-aged trees and occasional shrub thickets. This is 2002, just after I had removed the fir from this stand. I used the redwood for a while to minimize weed transmission between sunnier areas.


Ten years later, both open areas are now relatively free of weeds while the oak canopy had closed in the background. So now I am removing the redwood from this stand, thus removing the “dark barrier.” Then I will thin the oaks in the background, and deal with the remnant weeds. The rationale for removing redwood from a deciduous woodland can be either that they are not doing well, or that they are doing ***too*** well; i.e., shading out an oak forest I want to keep. This was the latter.


October 2013

None of these redwoods was over 40 years old (15 when we got here). There were no old stumps, nor was this area terraced for apples. Effectively, I doubt redwood has been on this upper slope for at least 1,000 years, judging that the presence of conifers so high on this ridge was an artifact of fire suppression starting with the Spanish (there were 40-year-old firs up here too). The redwoods were shading the oaks and madrones to the point that they were showing signs of stress. So, what grew here when the Indians had it?


This is the subsequent Phase III thinning of that slope. I've piled and burned the tops; else you could not see the forest floor for all the material. This kind of thinning must be done in stages, in that one accumulates so many logs and tops that they tangle, making pulling them out a pain. After the mayhem, I go in with my plugs and transplants, particularly in burn spots (black oak in the cage ). Foresters often wonder why I don't simply slash the material and let it rot. **You can't weed it that way** and very little grows on the surface until the slash rots (which can take the better part of seven or eight years) after which the weeds come up anyway. I want the weed seed to germinate now while they are easier to find. After a couple of more years (and rain), this understory will be carpeted with life.


Even in July, with less than three inches of rain since it was logged, these groundcovers are already starting to spread.
Tree removal likely reduced competition for soil moisture. Getting the redwood logs out will take heavy equipment.
Other ecologists wonder why I leave so little wood for fungi or snags for birds. Good observations. For now, I have to get the logs out and weed it and logs lying around would inhibit that. Those processes begin with logs from the final phase.


An arborist friend of mine has a maxim about oak trees**:** “If it’s over thirty feet tall and only six inches in diameter, then it will never be any good.” Of course, it depends upon what one thinks is a “good” oak tree. These make great firewood: they have straight trunks and long branches with few knots. They are easy to split and do not produce a lot of foliage to deal with. Of course, a stand like that has no understory and the trees do not live long or grow well.

Now remember: these skinny poles were the *best* trees in this stand. None of them will ever meet that arborist’s standard. Nor should they. These are not *architectural* oak trees. I want trunks long enough to minimize fire hazards. I want them tall enough to provide both openings and shade with which to maintain an intense groundcover without excessive stand density. I don’t want tons of acorns. So in essence, my preferences in oak trees tend toward a compromise between my arborist friend’s standards and growing them for firewood. The emphasis is upon total productivity of a varietal system, lower hazards, and ease of maintenance.

Not all of them do I intend to keep over the long run. In fact, I went to great pains here to spare the few young trees with decent structure. Once they need the space they’ll get it. I also put in about seven black oaks *(Q. kelloggii,* one of which is in the cage on the prior slide*)*.

This is the last major thinning I have do on this upper slope. The near future will be culling individual trees, weeding, developing shrubs, shaping seedling trees, weeding...


Thinning brings grasses (there are at least nine stumps in this photo). For the most part, from a management perspective, grasses are undesirable simply because it is harder to weed among them and grass therefore slows me down at a critical time of year. I am counting on these blackberries and such to take over from the grasses in short order. It is a gamble from a management perspective.

**October 2013**

Here is that other redwood successional condition: these 60’ trees are obviously *not* doing well. Their tops are frying and dying, despite being in the afternoon shade of a prosperous stand on the other side of the County road. Nor are they doing any favors for the oak-madrone woodland below them. Given the gangly state of the hardwoods, I am seeking to develop the few smaller oaks in here to be broader and lower trees interspersed with more productive fruit-bearing shrubs for wildlife. Therefore, these redwoods were the next to go, *after* the forest yellow-jackets nearby were done for the year! *Vespula acadica* is an aggressive little beast.


This image is a good example of this forest in transition between its original condition as I found it and what we are trying to accomplish in restructuring it as a multi-aged oak/madrone woodland. The redwoods in the prior slide have been removed in a Phase III thinning. What you see remaining are some very spindly oaks remaining along the road and a few with potential down below. I'll be leaving these "spindlies" as a source of partial shade until the groundcovers and shrubs have recovered from the transition. Note the madrone (black arrow) overhanging the nicely shaped young oak below it (red arrow).

January 2014

This madrone in the middle of the stand was the last hazard tree to remove for the season. It leaned over my power lines and was rotting in the middle of the trunk. Eventually, it would have broken and fallen on both our power lines and said nicely shaped young oak tree below it (such trees are rare here). Hazard trees like this one cost about $350-500 apiece to take down. They are common in these mountains.

I don't like climbing leaners. The flip rope tends to sag and slack as you climb, making it easy to roll off to the side and turn upside down in the process. I was also worried about the extra load on the trunk with the rot in the middle causing the trunk to snap with me tied to a log 40 feet up. So I called in a tree service. Their lead came out to look at it. Nice guy! He got out of his truck and just stood there, looking at the forest most respectfully. He knew how much work this had been, so his silence was quite the compliment. After a pleasant exchange, he looked at this one for me and said. "I'd climb it, but then," (with a smirk) "I weigh 140 pounds." Knowing my trepidation (and that I'm 180), he suggested a very effective trick of wrapping the flip rope around the trunk once to keep it from sliding so easily. We shook hands and he left, no charge. To him, it was a job too small to bother with, one he knew I could do anyway. To me, his appreciation was an honor and his advice a potential life-saver.

So I waited until Sunday to do the job so that my wife could be around in case I had a problem. Among other things, giving her the job of taking pictures might make her a little less likely to fret (it's not good to be listening to your wife getting scared while you're up a tree). Besides, I don't get many pictures of me working, so it's nice to have it to share with people to give them an idea of what this involves. So… I sent it around to some friends and, frankly, their reaction was rather surprising to me…

"Is that you???"

Really, I thought they knew me better than that.

There is a lot yet to do. But in places, we are getting there.


Even though oak-madrone woodland is the dominant habitat on our property, when we arrived here, it was in trouble. Here, just down the road from us and even without apparent weeds, decades of fire suppression distorts hardwood structure and shades the understory sufficiently for it to die with Douglas fir colonizing the area. After a disturbance, it does not necessarily just “restart.”


Fir is best kept in more shaded areas farther down slope. Besides its aggressive seeding, high resin content, and thin bark, it sometimes leaves its own fuel ladder in place all the way to the ground (it usually does not make good lumber for that reason so they are worthless to a mill). On ridges, firs are also subject to split tops that threaten power lines. Here, the manzanita is dying and the oak is rotten. My guess is that once this blows up, it would quickly go back to brush but for the new weeds in the area and fir seed.


People aren't used to how fir responds after disturbance because they have no experience with having let succession run amok for so long. Here is a slope "recovered" with Douglas fir at the entry to our local middle school. In this spot, they just graded it off and let it go. With enough light, this is how dense fir stands can get if you do not thin them. The students at the school ride the bus by this spot **every day** having spent much of that day learning "how to protect the environment," probably without a thought about what they see. They have been taught to see this as "Natural," hence there is nothing to notice, and nothing to be done about it. This is what happens when propaganda displaces knowledge in a feedforward control system. There are consequences you know.


The Summit Fire was only 6 miles from that school (although this is knobcone pine, not fir and redwood) with primarily decadent chaparral in between, just like the 1985 Lexington Fire. Yes, stand replacing fires are “Natural” in knobcone stands and chaparral to a supposedly greater degree than Douglas fir, but is this a matter of fact or is it a matter of experience uninformed by the consequences of a change in management? There were no similar fires in fir stands when the Indians burned every few years, and probably not for nearly a hundred years thereafter. But in the stands we are growing today, there is no doubt that it would be just as bad, a direct consequence of fire suppression and the resulting **unprecedented seed dispersal** pursuant to uninterrupted succession. Reversing course from here is expensive, difficult, and, if you do not wish to see dozens of extirpated species, necessary. Who is going to do it?


Unless we manage fuel carefully *before* a fire, what we get is more of the same thereafter, plus weeds, and with older dead or badly damaged trees as additional standing fuel. This knobcone pine is six years after the Croy Fire about 1 mile from the Summit Fire. From what I know, if we want multi-aged forests with a vital, varietal, spacious, and productive understory, then the best way to do that is to manage succession by regular disturbance *before* it blows up. "Nature" does not care what it becomes. So, who ***knows*** what to do here… the "environmental experts," activists, and government currently making a forest structured such as no one has ever seen before? Me? What if **nobody** knows what best to do among all the varied sites? How then do we develop reliable knowledge?


This slope is also below my house just to the south. At one time, this monster 180-foot fir tree made enough shade and dropped enough material to keep the surface fairly clear. After a heavy lightning strike made its future untenable, I had Steve take it down. With the extra light, this slope went bonkers with new trees. We have a new law around here: “What goes down must come up.”


Which it did. The cluster of bay is also a bit close for comfort considering its size. With a slope of fuel like that below it, I am certain that at only 70 feet from the house it would be a problem in a fire. The goal on both slopes (this and the prior slide) is to put the material on the ground, do a controlled burn, and select the results (I have seldom been disappointed by the results of burning here). I am planning perennial grasses and sedges on that slope as discussed before, which will help to slow it down. They do well nearby.

# So, What Is He Getting At?

Periodic, and sometimes frequent disturbance of successional systems is necessary to build varietal habitat, both by species and by successional stage. Essentially, programmatic disturbance constitutes a form of feed-forward stability for the system, without which the system proceeds to an eventual catastrophic failure. Frequent fire, grading (landslides and floods qualify), harvesting, grazing, and even herbicides are all means of effecting disturbance; they are tools. Some tools are preferable to others, but in general, one can say with confidence that "the right tool for the job" varies by the situation, both spatially and temporally. No two places are exactly alike at any particular time, if only in terms of their site histories. Even within my neighborhood, I can have a tough time finding places that resemble ours before we started. A long record of observation of the system response to small disturbances lends tremendous insight into how the system might react to a larger event.

It is this combination of site specificity and dynamism that is just another reason why I think it such terrible hubris to think that anybody, and especially a public agency subject to the winds of organizational fads, career ambition, lack of local knowledge, political corruption, incompetence, organizational momentum, unionized job-security, communications overload, and simple distraction is such a terribly poor means of making such decisions. Errant knowledge in feedforward systems is just as perilous as no control at all. If you doubt that, just look at what fire exclusion and borders open to exotic species have done.

We now have amazing communications tools with which to find accommodation with our neighbors to manage the influences our choices in land use exert upon others. What we don't have is sufficient reliable **knowledge** with which to build an objective actuarial risk assessment of the host of options under consideration. One is oft tempted to think that this was a role for government and universities (and certainly has been historically), but no, the power to inflect "knowledge" can be just as influential as a thousand page rule book (which is how big the California Forest Practices Rules have become). Unfortunately, politicized grant money and group think have done just as much damage to the university system.

This is why I quit my career and wrote *Natural Process*, because I wanted to understand that problem. As I began to grasp that the source was really collectivized control without accountability for risk, the engineer in me wanted to come up with a workable solution (we're hard-wired that way). It really does center on data collection, processing, "lumping variables" and all the other impenetrably complex problems markets have solved, from making cars to developing the computer you are using. Developing those automated data collection systems, calculated risk architectures, and real-time actuarial risk-offset contract management software as a way to manage mobile commons (such as air and water) was the dream of that book in 1998.

Yet since publishing it in 2001, I've realized that people prefer specifically that "knowledge" which gives them power, whether it is true or not. They don't want to give up their share of government police power with which to control somebody else, because they assume that the exercise of that control is, by "virtue" of *their* good intentions, necessarily benign. So I thought a dose of reality-based feedback might help, and duly gathered together gobs of ugly pictures of National Parks as compared to photos of far better private ground nearby to indicate otherwise and put them on the *Shemitta* CD.

# Manage Succession, or Face Failure

But of the picture books on that CD, the one that became this one was to be different, because virtually nobody who manages land today owns the means to market services for management of *all* of the living possibilities that their land *could* produce: aesthetics, insect habitat, landings for migratory species, contracts for forage improvement, soil science research, monitoring quantitative impacts of introduced species or GMOs, drainage management, improving hydrological infiltration to mitigate flooding and replenish groundwater, development of processes to mitigate or improve infrastructural development, or refugia for reproducing plants and animal symbiotes (of which a pure post-disturbance native plant habitat might qualify as a paragon). It is about building the data with which to develop the knowledge to manage that bigger actuarial picture of long term productivity at minimized risk. One purpose of this book was to help people recognize those needs and opportunities.

Was I Successful? If not, what is it going to take? You see, it certainly looks to me like we're headed for catastrophe when it comes to America's soils, never mind its economy. Agro urban civilization is a system in need of a periodic reset too, albeit I wouldn't let the horde of politicians, lobbyists, and bureaucrats in Washington DC manage one any more than you would. Urban control of rural areas has never worked.

That was the whole point about the Biblical Sabbath for the Land as it was originally intended but never understood. It was to be a year to "let it go," a year in which cultivated lands were to be cleansed and renewed by the impact of animals, a year to realize that we have basic responsibilities to **develop** the poor, maintain productive wildland habitat, and recognize our frailties. It was a year to rebuild relationships with the people who manage the wild, thus strengthening the nation by inculcating knowledge as supported by hands on experience. It was designed to interrupt the otherwise inevitable cultural propensities that lead toward the collapse of civilizations. This was a form of periodic disturbance and feed-forward stability.

The point about this is ***not*** religious; it is cultural and technical. The observations that precipitated this idea had repeated throughout history, as collected into the knowledge of a people with thousands of years of continuity with which to recognize those patterns, propensities, and instabilities in civilizational behavior. Spending time with a nomadic people with which to learn respect for their observations, intelligence, and perspective, was to be the other point of instituting the Sabbath year, an extraordinary idea unique in history. Yes, I want you to read it, and not just because I am the author. It was simply an amazing political, social, economic, and ecological feed-forward control system from totally outside our urban experience.

Tragically, we have nearly killed off the last vestiges of such tribal nomadic peoples, worldwide, many now surviving on EBT cards in the shadows outside and among us. Nor am I convinced that any one ethnic group inherently possesses particular wisdom when it comes to land management. Hence, I am proposing the deliberate construction of a 21st Century nomadic cohort operating in a competitive market of land management by making conscious allowance for them in our laws and land use practices. We really do need them to manage predators, fuels, and simple awareness of what is going on around us. It is an economically valuable service, to renew soils and help keep the mess around us from harming itself.

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