Periodic Disturbance And Feed-Forward Stability

April 2013

Part I of this book assigned two major causes to the destruction of post-disturbance plant systems in this area: exotic weeds and succession. Once the weeds were more under control and because this project is about systems and not just nativity, I started revisiting disturbance in grasslands that had crowded out their annuals, and forests 'suspended' in Phases 1&2 of stand condition to reduce fire hazards while I addressed the weeds in grasslands. Forestry Phases 3&4 are true disturbances, reverting succession to increase the variety and vitality of the forest as a whole. This chapter is about that level of disturbance, or its lack.

Wildergarten 5.2

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

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Vande Pol, Mark Edward, 1954 –

Other writings by Mark Edward Vande Pol:

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

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

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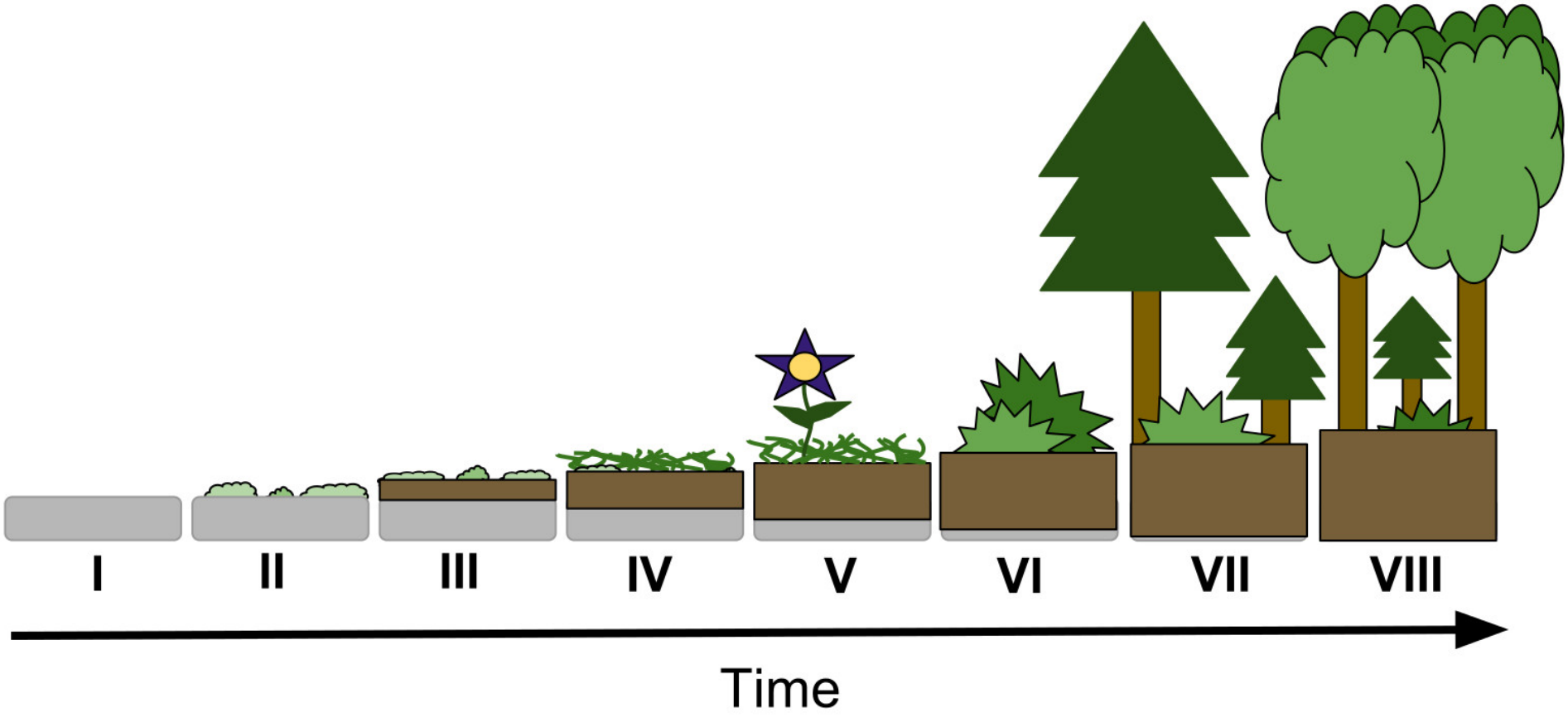
If at First It Succeeds…



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Anybody who has taken grade-school science 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 conifer or hardwood forests in turn, depending upon which is perceived as locally dominant. Notice also that the diagram shows the soil as continuously getting deeper, which is not exactly accurate when it comes to the differences between forest and perennial grassland soils. 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 and our understanding of how it got that way.

If one starts with a grassland and it burns, the response will be a grassland, albeit possibly with more forbs than before (for a while). At that point, the idea of primary succession might seem inapplicable, but it is not. In a few years brush will start to invade.

If one starts with a conifer forest and it burns, it may show some grass, 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 now thin and not rebuilding measurably. This unhealthy forest is obviously ready to explode again.

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

If one starts with a chaparral of manzanita, ceanothus, coffeeberry, toyon, or chamise and it burns, it won't go back to grassland. The brush will regenerate from the root masses or seed almost immediately and you will again have a chaparral in very short order. Only a mile from here, the manzanita that burned in the Croy Fire of 2002 had regenerated to eight feet tall in only six years.

Like this. This is that six years' growth. 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?

July 2010, The Nature Conservancy Niobrara Valley Preserve

The successional model implies decades between stages. It exists because native Americans managed the land in early successional condition for so long that, once they stopped burning, the system 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 an area that was burned annually. There was no seed anywhere in the area to start those trees.

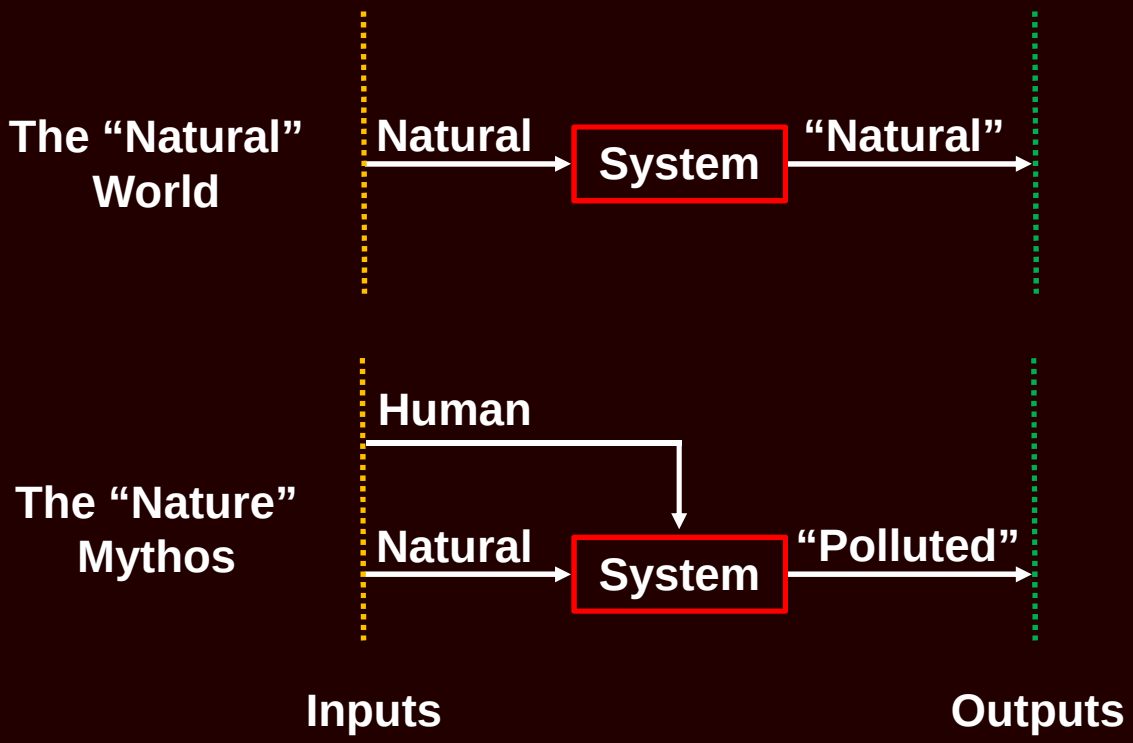
So to summarize (and perhaps preach a bit)… we as an American culture have adopted this pathological mythos about "the balance of Nature"**:** the completely unfounded expectation of stability**:** grasslands stay as grasslands, and forests stay forests, *only* if *we* leave them alone… a myth built as much upon the desire that *something* stays the same as we strive for comforts amid our mad rush into a technological future whose only certainty is that turmoil will come ever faster. We want *something* to be reliable, a foundation upon which to even recognize ourselves, while the social foundation of that stability in family is under increasing attack and disintegration.

And yet the demonstrable reality in nature is that the only true multi-century ecological stability this continent has ever seen was maintained by periodic disturbance initiated by very stable extended families. Disturbance inhibited succession at whatever preferred stage to maintain early seral groundcover for their own specific purposes, even in forests. Early successional plants are the vegetables and grains people need for food, as do animals. Even in forests, trees were typically selected for food. They were pruned in harvesting which reduced end weight and strengthened branches. They were spaced to maintain groundcovers and fruited shrubs were burned or coppiced to increase their yield before they went decadent. People *tended* nature to make it more productive and predictable, and sometimes, an even more beautiful place to play with their babies while they processed the fruits of the land (right). Can you imagine being there with them?

Stability was built by regular disturbance**:** harvesting, gathering, burning, and hunting… *processes* initiated to satisfy human expectations based in *knowledge* of the land they maintained, taking action *before* the system drifted beyond control limits. Effectively, the land was stabilized by a human control system.

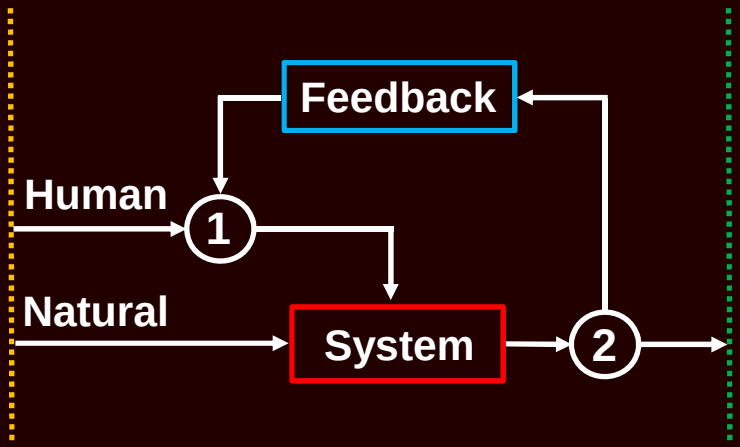
Acorn mortars
Niobrara River
July 2010

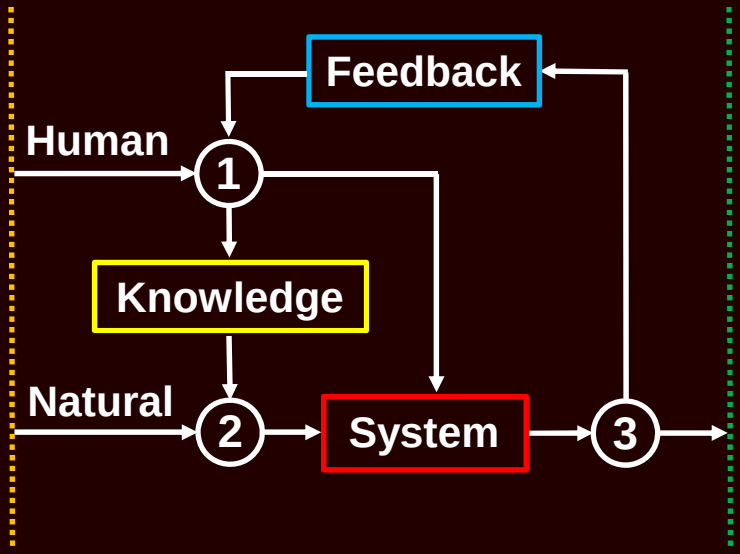
Mythos Versus Management



The way most people think "Nature" works, is that both human and "Natural" inputs induce change in the environmental system ("Outputs" above). They regard people as outside of "Nature" and that means anything affected by people is necessarily destructive to "Nature." Mentally, they remove themselves as a keystone species that, uniquely, has operated at every level of the biological system for tens of thousands of years! Animal poop full of parasites becomes "Natural" and therefore "pristine" and human poop becomes "Pollution" therefore to be eliminated. Living in their comfy cities, there's nothing to do *for* Nature but control other people.

Hence, the goal of environmental control freaks is to make human inputs negligible, while simultaneously holding that everything people 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 because said keystone species has been removed, it also means that the environmentalists would be in charge of everybody else, forever! No wonder they like that model.





Inputs

Outputs

The simplest type of management control logic is one with "feedback." A good example is the thermostat controlling your home air temperature. When a change in weather raises or lowers the temperature, the thermostat (circle 2) tells a relay (circle 1) to turn on the heating/air conditioning system. The equipment runs until the temperature *overshoots* the desired value to a set limit and then shuts the unit off until conditions drop *below* the desired temperature and the system reacts. 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 (if things get bad enough) they are liable to over-shoot.

At left is a more sophisticated type of control system**:** a loop with "feed-forward." A good example is stopping 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 sensory inputs ***plus*** a knowledge base) roughly at what pressure you'll drive your foot (2) against the brake pedal (part of the automobile system). This system requires smaller adjustments as you feel and see (3) your rate of deceleration, thus 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 feedback as a way to *correct system behavior* ***before it drifts beyond control limits***. It's what people do. The problem with the "Nature" myth is that the control freaks believe "Nature" is self-optimizing but under threat of other people. Thus the only thing to be controlled is other people. It is still a feed-forward control loop, but with mythology inhibiting the feedback.

August 2003, US Forest Service Land, Rodeo Chediski Fire, Show Low, AZ

Same day, same fire on nearby (logged) Apache land.
Yes, it burned too.

Effectively, what we have today is a feed-forward control system, one in which *knowledge is the critical factor*, operated according to false knowledge**:** the popular belief that Nature will stabilize with no human inputs, mistaken ideas about succession, ignorance of exotic infestation, and no remedial action allowed; we simply ignore the feedback and endure the predictable catastrophic failure. Take a quick look at the consequences (above left) when it comes to a successional system and apply feedback to that belief. Is it working?

August 2008 - Back to the Croy Fire; knobcone pine and manzanita regenerated in place after six years

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, 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 planted chestnut stands and maintained them with fire 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."

Yet even the “regeneration” model I just offered is inadequate. If a knobcone pine forest around here burns, it may be set back a bit with some brush in places, but if the cones seed successfully (depending upon the fire temperature and 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).

October 2013 – Down the road along the Sayante tribal trail adjoining our property

Preventing disturbance effectively changes the species mix when “inevitable” finally happens, and therefore thereafter. Under Indian management by frequent fire, harvesting, and hunting, this particular spot was early successional, consisting of whatever they were growing along their trail. Uninterrupted succession has changed all that. By the time we arrived here, oak-madrone woodland was the dominant habitat, having displaced dying chaparral. Even though still young, the oak was in trouble, because so many had come up, again because of a lack of disturbance. Here, just down the road and even without apparent weeds, decades of fire suppression allowed this dense hardwood forest structure to shade the understory to death, eventually allowing Douglas fir to colonize the stand. A mix of successional stages like this has probably never happened before at this kind of spatial frequency.

October 2013

Besides its aggressive seeding, high resin content, and thin bark, Douglas fir leaves its own fuel ladder in place all the way to the ground (it usually does not make good lumber here for that reason). On ridges, firs are also subject to split tops that threaten power lines. Here, the manzanita is dying and trees below are exotic acacia. There is no telling what the composition would be immediately after a fire, but eventually the fir would take over with increasing density until either redwood or nearby eucalyptus succeeded them.

October 2013

People aren't used to how fir can respond after disturbance because they have no experience with letting succession run amok for so long. Here is a slope "re-covered" 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 (here) was only 6 miles from that school. Although this was not fir but knobcone pine, they both burn about the same. Yes, stand-replacing fires are believed to be “Natural” in knobcone stands 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 around here 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 in fir as here, a direct consequence of unprecedented **seed dispersal** resulting from primary succession due to fire-exclusion. Reversing course from here is expensive, difficult, and necessary, that is, if you care not to see post-disturbance species going extinct. Who is going to do that work?

When firs suffer from water competition and shading from redwood, they become more subject to attack by bark beetles, as were the two trees in the foreground here at the Wildergarten, now spreading to more. The response is analogous to a disturbance, and what we see is oak, bay, fir, and redwood in a density that cannot support them all. Unless I start thinning trees, the groundcover will be gone within 5-10 years producing no food for wildlife at all.

November 2014

The eventual winner would be a redwood monoculture with few groundcovers or shrubs of any kind. The reason this happened is that I could not afford to thin this stand because it is illegal for me to sell logs to pay for it. Blame the Sierra Club, please.

Musk thistle, cheat grass, and dead trees at **Mesa Verde National Park**, Photo July 2005 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 was never allowed to reach one, is the height of arrogance. The tendency of unmanaged competition is for dominant species to burgeon until they consume their nutritional or hydrological base (as do overstocked forests). 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, and *especially* with exotic species present, is simply, well, ignorant, arrogant, lazy, irresponsible, distracted, self-aggrandizing, and destructive (to fling a but few appropriate 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 and insects, eventually go extinct. At that point, restoration of the native system becomes impossible. One can then only replace it with something else. Like this (above).

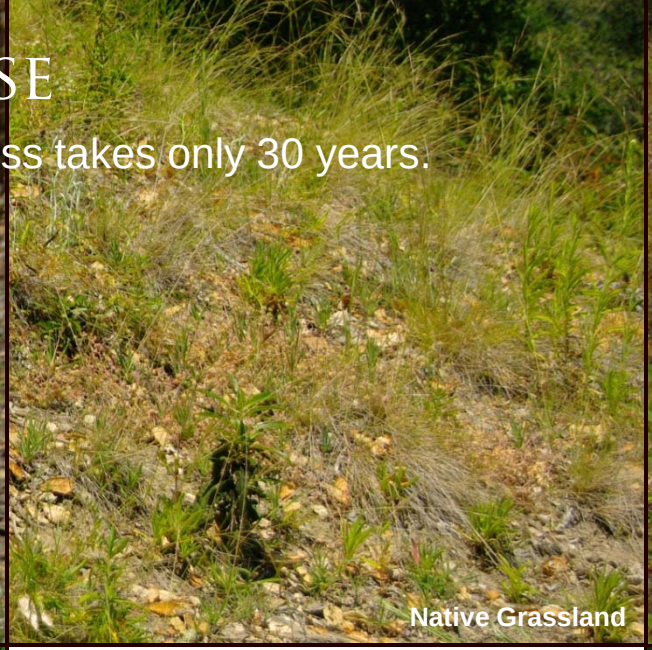
If what we want is true biodiversity**:** multi-aged forests with a vital, varied, spacious, and productive understory, clear of weeds and interspersed with occasional meadows and chaparral to support wildlife, then the best way to do that is to manage succession by limited and regular disturbance, careful and knowledgeable monitoring, and fuel reduction *before* it blows up. 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 here before? Me? What if **nobody** knows what is best among all these varied sites? How then do we develop the reliable knowledge base with which to rebuild this system without these catastrophes? The answers must come from the kind of long-term experiments and shared information (such as you are reading here) in post-disturbance system management to which grant funding is not directed. The answer is landowners willing to take risks, spend the money, and do that hard work, free to try something different.

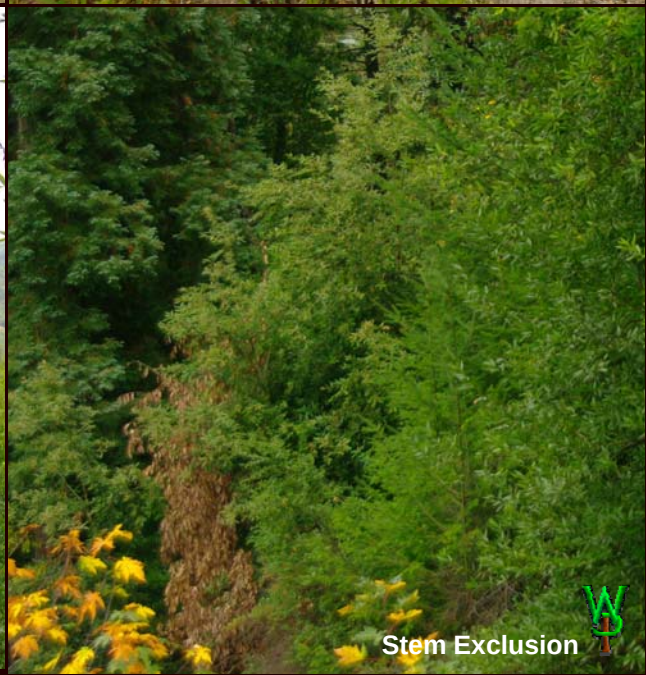
March 2016 – This sand hill reverted to brush and then went decadent in only six years.

Periodic disturbance has been used to help stabilize all five successional habitat types we have here at the Wildergarten. Each of these systems requires periodic disturbance in order to stay in its particular configuration; else each fails without it, each in its own characteristic way, whether by senescence, succession, or catastrophe. Each is discussed in the chapters dealing specifically with those habitat types in more detail**:** sand hill (forbs), grassland, broadleaf forest and understory, and conifer forest. What follows here will be an overview of how these systems stitch together in a successional system and how perhaps to slow it down.

High Speed Chase

This primary succession process takes only 30 years.





So now that we have covered successional processes between broadleaf and conifer forestry with the goal of mixed successional stages just short of a savannah configuration, we will move on to an example of succession from annuals in sand hills and grasslands, to brush invasion, and then to trees, with an experiment to slow that successional process and retain it in a more stable form.

Wildergarten, January 2013, monitoring germination two weeks after a burn

As you have learned in the grasslands section, developing a cover of annual forbs is a LOT of work. I had been using disturbance (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 with Roundup for 2-3 years and *then* by burning repeatedly. Accordingly, labor demands permit only 30-50% of the property to have annual forbs as a major part of the mix until I have more control elsewhere, preferring to maintain perennial groundcovers and bulbs there. 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…

I pull shrubs and kill trees in this sand hill to keep it from succeeding to brush. 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). There are also oak seedlings here that have to be pulled, cut, or treated every couple of years. Well, I got tired of that. So, what happened?

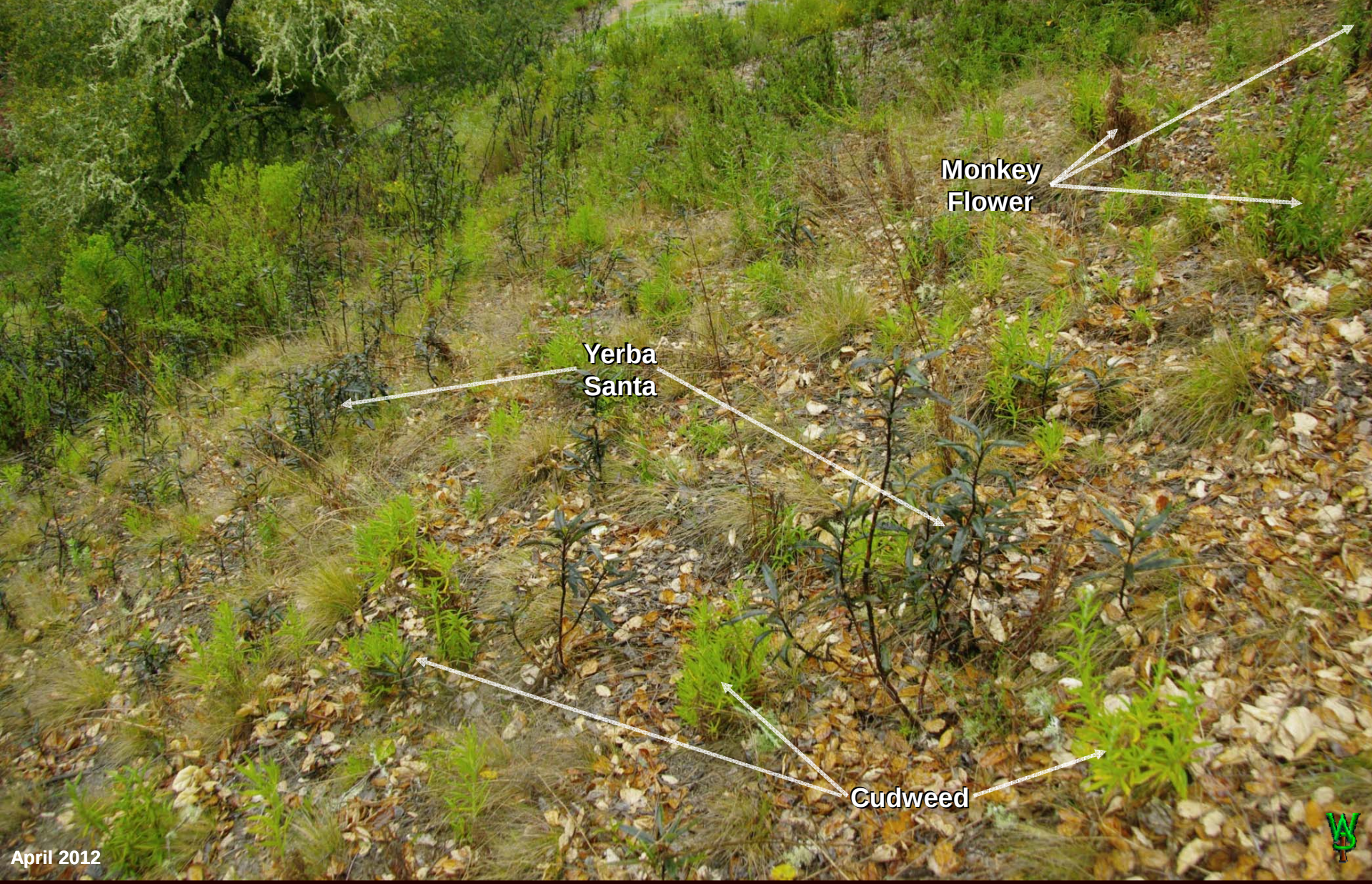
Here it is six years later. Despite my having burned a pile of tree tops in the remaining open spot three years ago, the brush has not only taken over, it's going decadent, with lots of tree seedlings coming up. Well, the power company had taken down a tree just up the hill giving me another pile to burn, so I decided to go back to sand hill. But how did I know how to do that? How did the Indians keep out the monkey flower and yerba santa? They burned it, probably every year or two. How do I know?

April 2016 – Primarily *Filago californica* being invaded by *Bromus carinatus and Elymus glaucus*.

I had *made* this sand hill area from a similar patch of scrub because the other one was too much hassle. I burn brush piles here every 1-2 years to instigate a successional reversion to type, thus limiting succession here, somewhat. When grasses invade it, I do it again, but if they seed they start from where they were. Wait longer and baseline regeneration includes the succeeding higher level. Once the brush seed is deposited 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 succession in the 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. Grazing would abet the grasses.

This is about 70 feet from the prior slide. This area (previously a French broom infestation above an acacia stand) has been maintained as a grassland. This needle grass *(Stipa lepida)* won't last more than two more years if I don't set back the brush invading it from just down the hill. These are monkey flower *(Diplacus aurantiacus)*, deer weed *(Lotus scoparius)*, pink cudweed *(Gnaphalium ramosissimum)*, and yerba santa *(Eriodictyon californica)*. The first three I can simply pull. The yerba santa sprouts from lo-o-o-ong root runners from the parent bush below; it is a total pain to deal with. I don't have a good method yet, as you will soon see!

In 2011, this area just down the slope looked like the prior slide. So, do I “have something against chaparral”? No more than I do against grasses invading sand hills. Each is a habitat type with specific attributes that demand different types and degrees of management. There are hazards and benefits to all of them, just like anything else. The reason I do not want the brush taking over here is that the meadow is a fuel reduction buffer above an existing chaparral that allows a fire to lay back down on the ground after flaring in the chaparral below. This interface would probably respond well to the disturbance of annual grazing and browsing.



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 *(S. 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 just like purple cudweed does. Yet I "must" keep the chaparral down here because this is the burn buffer above the chaparral below.

Obviously, “must” didn’t happen. This is two years later (I did say this happens fast, didn’t I?). The brush is so big I couldn’t take the photo from the same spot. It is now a threat to the stand of trees immediately above. From this point, 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.

And So Fourth

October 2013

If I leave that prior slope of yerba santa alone, it would grow to 6-8 feet tall like this but in 3-5 more years. On a 170%+ slope like this (it averages 60°), reversing course can be hazardous. Unless I can burn this brush, I get to chop it with a chainsaw while dangling from the end of a rope (done it twice; 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 from the government's mountain lions and coyotes is an unlikely prospect. Then there's building a pen or barn, secure from the government's mountain lions, a water supply, and making sure that the animals have enough food over the whole year. **I cannot import feed or hire temporary animals** (weed seeds).

When we first got here, this slope was a mix of acacia and fir trees with a few buckeyes and some monster eucalyptus. The fir went down in 1990, before I built the house. The eucs were gone a few years later. I chopped up the acacia and filled a groove in the side of the hill with a pile of chopped cuttings about 100’ long, 20 wide, and 7-10 feet thick. I contacted the fire department, borrowed a hose, and it took a week to burn. I trimmed the buckeye and cut the bay trees without treating the stumps. After fighting rip gut, broom and other big weeds, it slowly filled in with the yerba santa and bay trees. By 2006 it looked much like the previous slide, so I went in and chopped it up again, cut and treated the bay (a fire hazard on a slope like this and also destructive to groundcovers), and planted more buckeye with a poor yield. Poison oak succeeded the yerba santa (above foreground) making the project even more inviting.

In classic primary successional order, after the shrubs, in came the trees**:** oak, maple, and bay. 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 is also a possible 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. To start them straight growing upward for sun, one must keep the brush down.

At the foot of the first slope I cleared this oak had gone down. I thought this one was stable too; it was out of the wind and reasonably balanced. I should have cut it when I was last here in 2008. 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.

Poison oak is a tremendous erosion control plant. It has roots like cables across the entire slope. It provides great cover for quail who (once I got a cat to take out the ground squirrels), came in great numbers because of the abundant food (grasses and tarweed) nearby. Poison oak can get pretty dense, so it can be a fire hazard too and the fumes can be fatal. These are trade-offs. What to do?

I chopped it with a chainsaw dangling from the end of a rope, again. This is the third “periodic disturbance” of this type in 23 years. Being 60 years old, an area about five times this size took about a week and a half. The plan is a combination of earlier successional groundcovers under deciduous shade. For shade, the buckeye, maple, and elderberry make enough to slow things down while losing leaves seasonally to allow a groundcover sufficient light in winter. Farther down I could use hazel nuts for that. As for groundcovers…

This is a view of the same slope from farther back but before cutting. This was a trial using Santa Barbara Sedge *(Carex barbarae)* as a retardant groundcover under a maple with buckeye immediately below. The sedge holds steep soil, stays green in full sun without irrigation, burns easily and slowly with low fuel value, responds well to fire from rhizomes, and is easy to propagate. It is not competitive with poison oak or blackberry but a few squirts on the first shoots with triclopyr (¼ oz per year here) fixes those until their propagating root masses recede. While triclopyr is not very effective against yerba santa, that has not invaded the sedge in the shade of the maple. So, why the herbicide? To simply burn it by myself is both impractical (because of my neighbors' fuel loads) and massively illegal. That leaner oak has to go, but because of the buckeye underneath and lack of room to winch it, I'll probably have to climb it.

Here at the bottom of the slope is another trial of 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 because it is great for holding soil on steep slopes but for the fact that it is 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 a damaging job every year. 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. From there, I could burn it every ten years or so and it should be reasonably stable, 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.

Bracken ferns LOVED this disturbance. For groundcovers I transplanted sedges, blue witch, California fescue, morning glories, yarrow, and snowberry in what was poison oak. All were selected for low fuel value and the ability to impede the more flammable brush such as the yerba santa, poison oak, Ceanothus, and manzanita (I'm not fond of clambering in blackberry here!!!). I'll add paintbrush as a saprophyte (parasitic plant) to see if it can help slow things down. Things happen fast here.

Yep, with disturbance comes weeds, which could then launch their seed all over the property. In particular here were bedstraw *(Galium aparine)* and horse weed *(Conyza canadensis)*. Also prevalent were resurgent blackberry, poison oak, and yerba santa *(Eriodictyon californicum)* sprouts which I spray with a hand squirt bottle. I am favoring snowberry *(Symphoricapros mollis).* I planted yarrow, blue witch *(Solanum umbelliferum),* and sedges raised in the garden. I will be adding paintbrush to slow the system because that species is parasitic. I am leaving buckeye and elderberry to provide occasional shade, again to slow things down and keep the groundcover green. Over time, as the elderberries grow, I'll take the weight off the bottom side to get them to balance.

Fir is an example of how fast trees grow here. This 180 foot monster was only 80 years old and 50 inches in diameter about 150 feet from the house. In 1994, it was hit by a massive lightning bolt. Five years later, I examined the base of the stump and noted developing rot, so I concluded it should go. This was a job that was too big for my equipment so I brought in Steve, and his.

This is the same view only 13 years later. As you can see, the stump is now somewhat obscured by (surprise!) fir trees. There are obviously way too many here for them all to get big. The tanoak is dying (it may not be *Phytopthora;* no weeping cankers or sign of amphora beetles). Which trees do I want to keep? The 30 foot maple immediately to the left of the stump. Don't see it?

November 2014 Photo by Diane Vande Pol

Here it is! It is simply counterintuitive how fast this system changes. On the near side of the stump, one fir had grown 36' feet tall in but 12 years. Note the redwoods to the left where14 trees all sprouted from a single stump about 36" in diameter (*maybe* 50 years old when it was logged 120 years ago). With one root mass now supporting 14 trees, they do not grow as fast, but they are still getting large, some leaning out from this *very* steep slope, which below them is close to vertical.

Experience and observation taught me the *knowledge* that to maintain slope stability I must remove trees on a programmatic feed-forward basis; else, they will fall across the gully, break, and tear out other trees on the equally steep slope opposite this one. Removing the weight of the trees will reduce the shear stress against the hillside. Retaining one tree on the upper side of the stump will reduce the moment load on the hill while keeping the "living retaining wall" alive. This plan requires that the outer trees must each be climbed to set chokers to pull them over, as they lean *away* from the slope. Doing it takes extra time and money, to which permits and oversight add no value. If I cannot offset those cost by selling the logs, then it can not be afforded, and the slope will fail. That means much more sediment in the precious public streams than would be released by my tree removal effort.

If you think this is just speculation, please read the chapter on conifer forestry. It discusses an old landslide due to an oversized tree that once stood just behind this stump cluster. Slope failure resulting from oversized trees is a significant cause of erosion in this area. Guess where the environmentalists want to ban tree-removal to inhibit erosion? Steep slopes. Please, call off the activists and bureaucrats and let us get this kind of work done. This is not about wishful thinking, but real choices, real money, and serious risks to life and limb.

As to what to grow under the maple on this north-facing slope, there are toyon bushes to which I will add hazelnuts, coffee-berry, sedges, seven-year grass, and ferns. That's the fun part.

November 2014, still breathing pretty hard
Photo by Diane Vande Pol

For me, this kind of thinning is not for the sake of entertainment; it’s about the satisfaction of seeing the land respond.

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, soil movement (grading, landslides and floods), harvesting, grazing, and even herbicides are all means to effect 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. One can reduce the necessary frequency of disturbance by species selection to reduce the rate of succession.

This combination of site specificity and dynamism is just another reason why I think it such terrible hubris to believe that a public agency subject to the winds of organizational fads, career ambition, lack of local knowledge, political influence, unionized job-security, communications overload, and simple distraction is capable of making just, efficient, or technically correct decisions. Errant knowledge in feedforward systems is even more perilous than no control at all. If you doubt that, just look at what game mismanagement, fire exclusion, and borders open to exotic species have done in Yellowstone.

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 sufficiently reliable **knowledge** to make objective actuarial risk assessments to weigh the host of options under consideration. While one may be tempted to think that this is a role for government and universities (it certainly has been historically), no, the requirements are too site-specific, while the power to inflect "knowledge" can be just as influential as a thousand page rule book (not uncommon), while politicized grant money, group-think, and over-specialization have unfortunately 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 problem 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 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 *Natural Process* in 2001, I've realized that people prefer specifically that "knowledge" which gives them power, whether true or not. They don't want to give up their claim with which to control somebody else's property, 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 and put them on the *Shemitta* CD to convince people otherwise.

Manage Succession, or Face Failure

But of the picture books on that CD, the one that became this book was to be different, because virtually nobody who manages land today owns the means to market management services for 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 economy, never mind its soils and native plant systems. 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 for the landed to "let it go," 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, strengthening the nation by acculturating knowledge acquired by experience. It was designed to interrupt the otherwise inevitable cultural propensities that lead toward the collapse of civilizations. It too was to be 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 *Shemitta*; it was simply an amazing political, social, economic, and ecological feed-forward control system developed 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 in America possesses particular inherent wisdom about land management, as that knowledge is for the most part, long lost. 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 such in our laws and land use practices. We really do need people to manage predators, fuels, and simple awareness of what is going on around us on a scale beyond sole proprietorship. It is an economically valuable service to which a truly free market is especially suited. But that's the next book, so let's get on to the next chapter!

Table of Content

Each line in the TOC is a link that opens the corresponding chapter in a new file

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