Tools and Infrastructure for a New Industry

Land restoration is a professional discipline. Yet unlike most trade crafts, this “industry” is still in its infancy, partly because it is run by public agencies. As a result, tools specific to this ill-defined trade must be adapted from those of other trades. Firefighters have specialized equipment; so do gardeners, backpackers, loggers, tree trimmers, foresters, nursery people, rock climbers, and hunters, not to mention scientists taking data. None of those other professions do all of them at once. This one requires them all, and then some.

Getting things done here sometimes takes making the tools one needs to do things efficiently, simply because the ideal tools for this kind of work either do not exist or can only be found in a trade so unrelated it might as well not exist. In most cases, it would not take much change in existing equipment to make a very big difference in output. Most of the suggestions in this chapter would improve these products in general.

Most of these challenges represent a “systems integration” problem similar to what has been done for the products serving any other outdoor activity such as mountaineering, windsurfing, or biking, where the requirements for function, safety, light weight, and durability combine under harsh conditions. This discipline has its own set of demands. Nobody takes dictation notes or flags samples while biking or rock climbing. Nobody whips out a microscope with a camera while gardening. Yet I need the information these instruments provide while working in order to make management decisions on the spot. I must find standard tools for the things I do and make the necessary modifications to integrate them into that system. So as you read about each of these pieces of equipment, think of how one might need to combine them in various ways, carrying them simultaneously. The more there are, the more difficult that gets.

In fact, “carry simultaneously” is something of an understatement. Elsewhere in this book is mentioned the principal that this “habitat restoration industry” should rightly be borderline nomadic. To make its infrastructure portable at locations far afield is yet another serious demand upon engineers for this array of products as combined with all those other constraints.

Who is going to design and test that equipment? Well, obviously I would enjoy working on that very much but I am certainly no captain of industry nor do I wish to do it beyond part-time. So this section represents some of the equipment that I’ve bought, modified, or otherwise desire which together point to some of the development work I would like to see. What I am going to show you is what I have had to do to make existing products work for me. I am certain you will be surprised that many do not exist. Variations of them work fine by themselves, but not when using them together.

The technical issues are various, including functionality, portability, quick access, and survivability without inhibiting the function of any other element of the system (including me). When you don’t see an image, that is because the product doesn’t exist or there are regulatory or liability hurdles precluding me from even showing you what I did, but then that’s true of many portions of the book.

Wildergarten 5.8

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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Using different sized bags adds flexibility and allows nesting to save storage space.

The most commonly used tool here is a weed bag. It must be cheap, tough, and not get in the way. The best bag material I've found so far is for certain pet foods. They are tough enough to last a year; small twigs cannot penetrate them. They have a slick surface to empty quick and clean. The bag must stay open when carrying it one-handed because, to work fast enough, **I throw the weed into the bag without looking**. So I riveted this 2" X 1/8" polyethylene rim and stapled the bag to it. It beats just a bag, by a lot. I still need a better way to attach the bag to my tool belt and remove it quickly if I have to get into or under a shrub to weed, or if I'm simply doing something else. I'm hoping some rare earth magnets mounted in a convolution that precludes shearing it off will work (probably using a combination of steel and brass freeze plugs for an automotive engine).

Sometimes I bring garbage bags along (the typical roadside weed bag with a strap is too big for this kind of work). They tear easily but the system capacity for an outing is higher because one can fill the garbage bags from the weed bag several times, leaving them sprinkled around the property as they fill. The trick is to get the weeds out of the walking bag and into the garbage bag without spillage, which sometimes isn't easy. Think about it**:** all people need food. To grow food for all people takes crop land. Seventy percent of croplands are former grasslands. Yet the tools used for making functional grasslands are so incredibly lame that I have to discuss this. It's unbelievable, and possibly even racist that more attention has not gone into the design, production, and marketing of land maintenance tools because we assume that work is done by what kind of people? After all, identifying 241 native species from 130 exotics in split seconds while in their juvenile states is a job for valueless and uneducated grunts, right?

Just about every construction trade relies heavily upon some sort of tool belt with which to carry the many things one needs. This work is exceptional in that respect. I must go much farther from my base of operations, over very difficult terrain, for longer periods, and with more varied needs. No specialty belt for this work exists as a system of products for sale. Fortunately, with some fabrication and modification of a few elements associated with other trades, I have been able to cobble together parts of such a system. The core element, the belt itself, is awesome**:** 2” flat nylon webbing with stainless steel double eyelets looped through a very comfortable pad fastened with velcro. It is very secure, keeps things from slipping, very comfortable and easy to manage (the buckle rivets are wimpy). On it, I hang either or both of these TrueNorth® “thigh packs” as the need arises. These hold a great many small items I need to carry. Unfortunately, their design is tailored for wildland firefighting, search, and rescue, and less for what I do. It is an exceptionally well-made product line but the system does have its faults for my purposes.

The most important tool on the belt is a weed fork. I have bought (and lost) scads of weed forks. No one makes one that is ideal. I modify those I *can* buy and they're still not completely acceptable. I bought the fork at the top because it was such a stellar example of a cynical piece of crap. Like it, the second is a single hit with a die but has a good handle. The third (since discontinued) has a decent blade shape, but it rusts. The bottom two are the same Ames product**:** stainless steel with originally a bad blade shape and entry angle. I grind off the blade margins to make it easier to plunge into hard soil. I put a bend into the blade so that it lifts the weed more vertically before my hand hits the ground and allows an angle of entry to which I can apply more weight. It also gets rounded face edges, a filleted notch, and rounded tips (inset) to make the tool easy to insert into a scabbard that nobody makes, all smoothed for easy cleaning. Why? Wherever I am weeding there is a probability of more weed seed in the soil. I do not wish to transport it in the mud on my weed fork to where it has not yet invaded. Therefore, the whole thing is sanded smooth so that it wipes clean. Unfortunately, the comfy handle breaks way too easily (the red one is broken). I guess they started making them green to make them easier to lose.

I use a weed fork tens of thousands of times per year. Saving time and motion then multiplies to significant savings.

The whole point of a scabbard is to hold the fork so as to be able to withdraw and return it without taking the **TIME** to look (see “need for speed”). Nor do I want to waste the time to find the weed again after first detection because I had to look for the fork. The fork-scabbard system must be so easy to use, that I am not tempted to lay the fork on the ground and lose it. A lost fork takes at least ten minutes each way to walk back to the house to get another, never mind the time either look for it or make a replacement.

This is the best I could do for a scabbard so far. It is made from a piece of ¾” PVC conduit. The pipe is first glued into a ¾” to 1½” bushing. I file a fillet in the pipe edge to facilitate insertion (this works well with the rounded tips on the weed fork). Then I glue the assembly into a 1-½” to 3” bell-reducer. **Not all manufacturers of such bushings and reducers chamfer the inlet such that there is a uniform transition** (these PVC fittings are made by Spears®)**.**

The assembly then inserts into a loop on my thigh pack with a simple retaining screw through a handy loop in the webbing. I’m not crazy about the angle it sits in the thigh pack (I put a tie-wrap around the pipe end to hold the assembly more vertical), but I only lost one weed fork when using it for a year instead of the usual three.

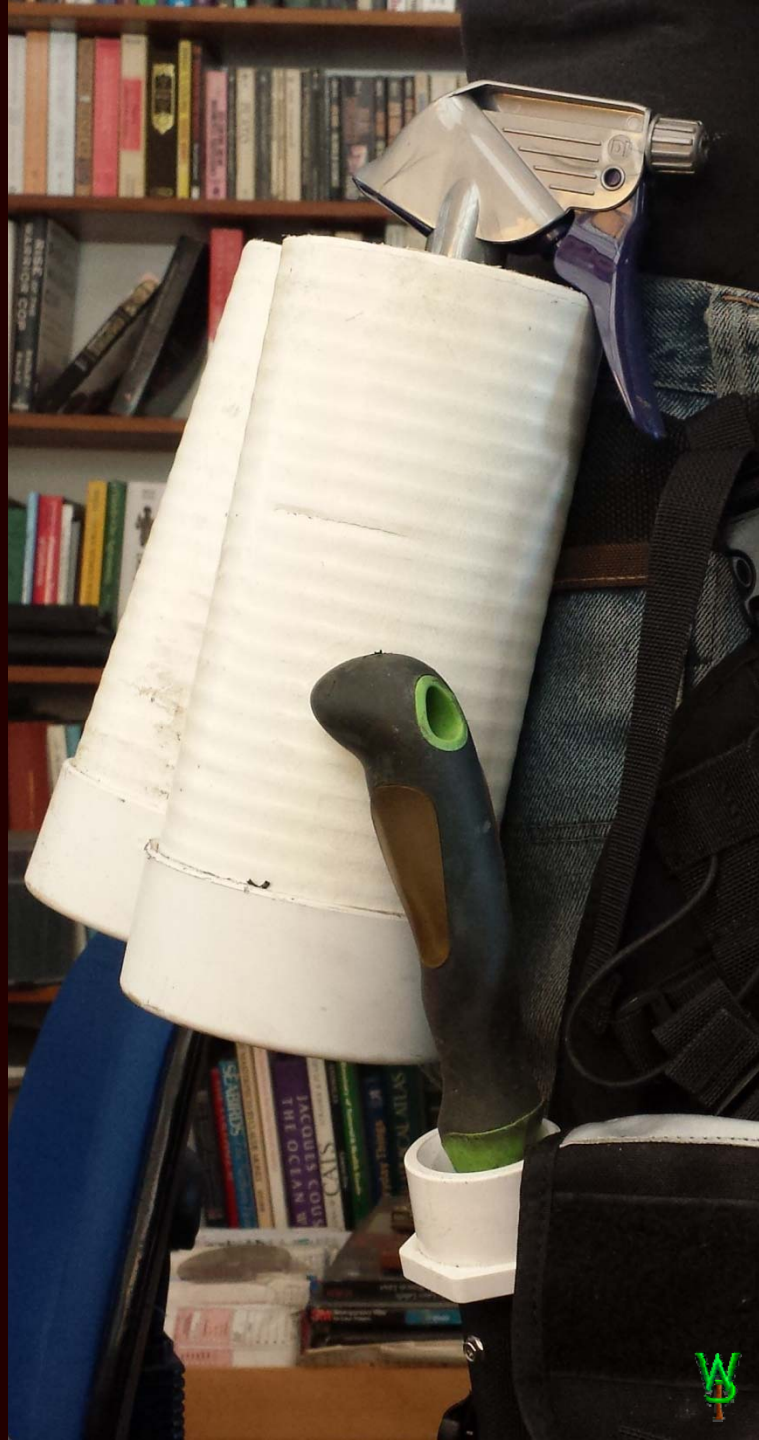
While getting rid of weeds, plant diversity increases. Some herbicides are chemically selective, in that they affect some plants but not others. Most herbicides require target plants to be actively growing from the time of application to 3hrs thereafter. Plant growth (and therefore herbicide translocation) varies relative to temperature both by species and degree of maturity. Some plants are susceptible only in certain phases of their development. This make herbicide selection variable on a plant-by-plant basis. Therefore, the ideal choice of herbicide varies with both target and non-target species and growing conditions.

A full backpack sprayer then becomes inflexible, unnecessary, and requires mixing too much material, also having more wastage and unnecessary damage to non-target species. One can't lug a backpack sprayer everywhere and it's very difficult to bend down to hand-weed when the herbicide with which it is loaded is inappropriate for a particular weed. Further, the relative numbers of each species one encounters is not always predictable.

All of that means one needs variable amounts of more than one herbicide available at a moment's notice; else one is stuck making multiple trips hoping for the right weather conditions to allow spraying before the weed breeds. One then needs to remember the locations of all those weeds that went untreated and how to find them all once the sprayer is loaded with the appropriate material. It just doesn't happen.

Accordingly, for most of my herbicide application, I use spray bottles, shooting tiny amounts of up to three herbicides on individual plants at distances varying from 4 inches up to 6 feet. Spray bottles are 4-5 times faster than hand weeding with much less damage to the hands. They are particularly effective where there are too many tiny weeds to pull in the amount of time before they seed (*Cardamine hirsuta* in particular; see the chapter on Pestilence about the need for speed).

This tool belt has room across the back to hold three 1-quart spray bottles. Speed demands that one not to have to look to pull them from or insert them into the belt. The relationship between sprayer and holster must be such that one doesn't cause the sprayer to leak by body movement against the trigger such as when crawling or climbing. Nobody sells such a holster. This one is made of drain pipe and caps with slots for the belt. This system has cut my herbicide use in half at increased efficacy.



All that whining brings us to the most offending, but **crucial**, tool of the bunch**:** the spray-bottle itself. **Nobody** makes an all-position, chemical-tolerant spray bottle with a controllable full-cone nozzle that doesn't lose suction efficiency, clog, or leak at the shaft complete with a quick no-drip filling system from a jug. Nobody. For a long time I couldn't find a single brand that fulfilled even one of those specifications.

I bought the "special" $9 Spraymaster® chemical-tolerant spray bottle. Of those, 6 out of 8 wouldn't pull a suction. Worse, they have a hollow-cone nozzle producing a "doughnut" spray pattern, thus putting the material everywhere except where one is aiming it! I went to the old Zep soap bottles, because they were cheap and had a full-cone pattern. They failed very quickly. Finally, after a half-dozen years of trying, I came across these chemical-resistant spray bottles made in Taiwan for TOLCO. They work for at least three years. They can produce a very fine spray allowing me to shoot from 3-4" so that the hollow cone nozzle isn't as much of a problem. They don't leak. BUT, the suction screen isn't big enough. The spray adjustment is very touchy but that does make it quick to change settings in the field (although it's so touchy there is material lost in getting it right). It still needs the weighted, flexible, and filtered pickup with a silicone suction hose for all-position spraying. I would pay more for the spray heads or even just the nozzle caps to come in colors and/or have an easy and durable way to mark them for what is inside. This commercial cylinder bottle is preferable because it doesn't press against my body when in the holster.

TOLCO makes a dispensing "carboy" jug (next page) that eliminates dribbles, spills, and reduces foam while filling. Better would be an integrated system that plugs the jug outlet into a fitted inlet on the squirt bottle. That's rocket science for this industry, because it is NOT easy to do without getting chemicals on worker's hands.

Herbicide concentrates cost $85-500 per gallon. These spray bottles cut my post-emergence herbicide use by 50% with more selective results than with a backpack sprayer. Ideally, a good whirl nozzle with a paddle on it to adjust it more accurately could cut usage by at least another 20%. Hence a $50 spray bottle that solve d all these problems would be well worth the money. There is plenty of room here for both profit and savings.

There is a need to develop spray equipment with great flexibility and accuracy, but also with minimal waste, overspray, and clean-up toxicity. What about a programmable backpack sprayer that one could carry loaded with water and a few vials (or bags) of concentrates including dyes and surfactants that would mix at the nozzle according to each specific weed… by voice command? We have ink jet printers for $150. Yet our weed killing machines used to restore landscapes that made the soils upon which we rely to sustain life are in the stone ages, in my opinion partly because nobody cares about the workers.

With this spray bottle system, portable batch tanks are needed for mixing herbicides and to take extra mixed materials to the work area. I started with used 2½ gallon herbicide jugs. By unitizing the volume, the various formulations could then be committed to memory, measured more accurately, and mixed by shaking. With a bit of foresight about what one is using and how much, they also serve to store mixed materials left over from the backpack sprayer, thus eliminating disposal of the excess. To fill the squirt bottles I tried stainless steel funnels but none was properly vented, had a big enough mouth to catch the stream and small enough volume not to make a spray bottle top heavy while filling, or had a screen to catch globs and particles. I tried a pump screwed to mouth of the jug with a filter from the pickup of an airless paint sprayer silicone with hoses and a weighted end to keep it in the squirt bottle. I had to wait for the hose to drain or it would drip after stopping the fill. It also made a LOT of foam that required time for it to break. These (cheaper) 2½ gallon carboys by TOLCO can be drained into the spray bottles quickly and with little foam without fully removing the spray head. For this work they should be heavier, UV resistant, and have imprinted vertical and horizontal volumetric scales and a raised boss for labeling. For filling, the vent cap is too small and at a bad angle for a funnel while pulling the valve instead is a hassle (although they could offer a mating funnel). They could be molded with mating dovetails to lock them to each other for stability on the truck but a strap would do that. Storing them with the concentrates in a truck box with a supply of water may work as a mixing station but spill containment is an issue.

For larger volumes, this four-gallon backpack sprayer by Field King® is the best I have used so far. Importantly, it operates on the principle of pressurizing air with a piston. This allows me much more control of the spray pressure than with a diaphragm.

Higher pressure breaks the fluid into smaller droplets. Small droplets disperse better, penetrate farther, and stick better than larger droplets. The trade-off is that smaller droplets tend to drift, potentially harming non-target species. Lower pressures produce larger droplets which go where they are directed, but they also tend to splatter, run off, and thus waste material.

I use high pressures when broadcast spraying. It goes faster and uses less material per target plant. I use lower pressures when spraying individual plants to minimize non-target deposition and drift. Employing thixotropic thickeners in the spray mix increase that sensitivity to pressure and therefore increase control of droplet sizes (as long as they don't exhibit extensive viscosity).

I was unhappy with Field King's prior model with an O-ring seal on the bottom of the tank of that leaked down my crack, but this iteration seems to have fixed that. On the other hand, they got rid of the mixing paddles that were useful for high solids formulations such as some pre-emergence herbicides. I am still not fond of the steel screws they use inside; those should be stainless. The waist belt is wimpy and so is the buckle. A decent belt waist band should have a pocket to store a phone. There should be a way to rotate the pump handle 90° so that one can hang it on a wall. Button detents would work.

Weed control strategies, processes, and materials are covered in the grassland chapter on weeding.

If a weed drops seed before I find it, I flag it and mark on the flag the radius over which I suspect most of the seed spread. In the fall just before the first rain I can apply pre-emergence herbicides within that radius. This takes flags, a way to carry them, and a permanent marker with ink that can withstand two year's worth of sunlight.

There are few flags that last two years. The only easily visible colors that do are blue or yellow. The flags often come off, leaving a piece of steel wire just waiting for a brush cutter or mower in dry grass, which is a serious fire hazard. **Nobody** makes a flag scabbard, for even one, much less multiple colors. I use pieces of heater hose held to my belt with a stainless hose clamp.

The flag at left is to remind me to spray a pre-emergence herbicide for *Poa annua* (Pa) within a radius of 2ft around the flag. Markers with ink that can survive a year's worth of sunlight are hard to come by (below). GPS could lead me to the flag by the record made for the picture kept in my phone database. I could then total the records to estimate how much to mix without waste. Is there an app for suggesting a path between them and tracking whether I got them all? Existing software is WAY too klunky and I won't have Google owning my photos

The information to be written on the flag is obviously based upon botanical information not commonly available or understood. Can ***you*** recognize any weed you might encounter? CalFlora.org does an OK job of showing location information where something might grow, but nothing behavioral or precise. UC Jepson *used* to link horticultural information. But if you see a plant and DON'T know what it is much less what the risks are, where is the app to take a picture, send it to an expert who identifies it and returns a database record about the plant telling you how to grow it or kill it for a small fee? Sounds like a business plan, doesn't it?

For many years, people with concerns about herbicides have asked me about burning to control weeds. Early observations here with the aftermath of burn piles were not encouraging, because the weeds (particularly broom) always came back first and with a vengeance. Most burning done here was in the same places because that was where it was reasonably safe to burn. As the process repeated, the exotic seed bank slowly degraded. As natives invaded and spread on the property, germination was increasingly native. Hence, burning became a more attractive option, particularly with annual weeds in which the seed is already fertile inside a stem, capsule, or pod.

The key is that burning destroys the seed at a time of year when it is often too cold to kill it by any means other than hand weeding. Even if the weed doesn't die and comes back from the root system, burning buys time to kill it before it can set seed as things warm up enough to make spraying effective. Burning produces a minimum 6" diameter blackened spot. That makes a small bright green weed recovering from burning very easy to see and kill with the spray bottle as temperatures warm. Perennial grasses come right back as long as it is done while there is still rain. When burned they do less to obscure seeing the target weeds as well.

I started with a 4-gallon propane bottle and a burner because one wants an adequate fuel supply to reduce trips to refill the bottle. It was terrible lugging the bottle around, but it worked well enough to see if that it was worth "mounting" on a standard ladder-frame backpack. Nobody sells a good one (again). Those that are available have a large diameter bottle, and a lousy burner with no spark igniter at a ridiculous price. At left is my second iteration. So far, it looks like 3-4 gallons would be adequate for a full day's worth of spot burning the way I do it. The cheapo Harbor Freight burner is actually the best I've used as it has an integral igniter. When full, its weight distribution puts an uncomfortable load against the shoulders. Ideally, it would be a side-by-side pair of taller and narrower bottles (similar to a CO_2 fire extinguisher or military flamethrower) or a specialized bottle contoured to the body integrated with the pack frame.

On occasion, this Indian Fire Pump goes with the burner, but it is also good to have around when using a chainsaw in the dry season too. This one is what has been made to Federal specifications for prison fire crews for many years. Hence, the pack hardware is terrible for a product that carries 42 pounds of water: no breathable back pad, no waist or chest straps, and thin shoulder straps. There is no excuse for this kind of treatment for any worker. I tried adapting the harness for the Field King backpack weed sprayer to fit this one (many of the pieces are the same between the two) but it's a kluge the manufacturer should fix.

Now, while wearing any backpack device, how does one carry the weed fork, phone, camera, flags, and other tools? This is where the TrueNorth thigh packs hung from said tool belt are so valuable. Note that the weed fork “scabbard” lacks the larger bell reducer. These early trials are made with what I have on hand, because I’ve learned that it is more important to use things a bit and learn what is needed than take that extra trip to town to get exactly what I had in mind before trying it. I change my mind to make improvements too often for that latter practice. Meanwhile, I get the benefit of better tools and time to make the next iteration sooner and at lower cost. Now that may seem like a lame excuse for lack of foresight in an engineer, but realize the number of subtleties which must be integrated into a flexible tool system with multiple developments ongoing simultaneously, each with its own limitations in what might be available.

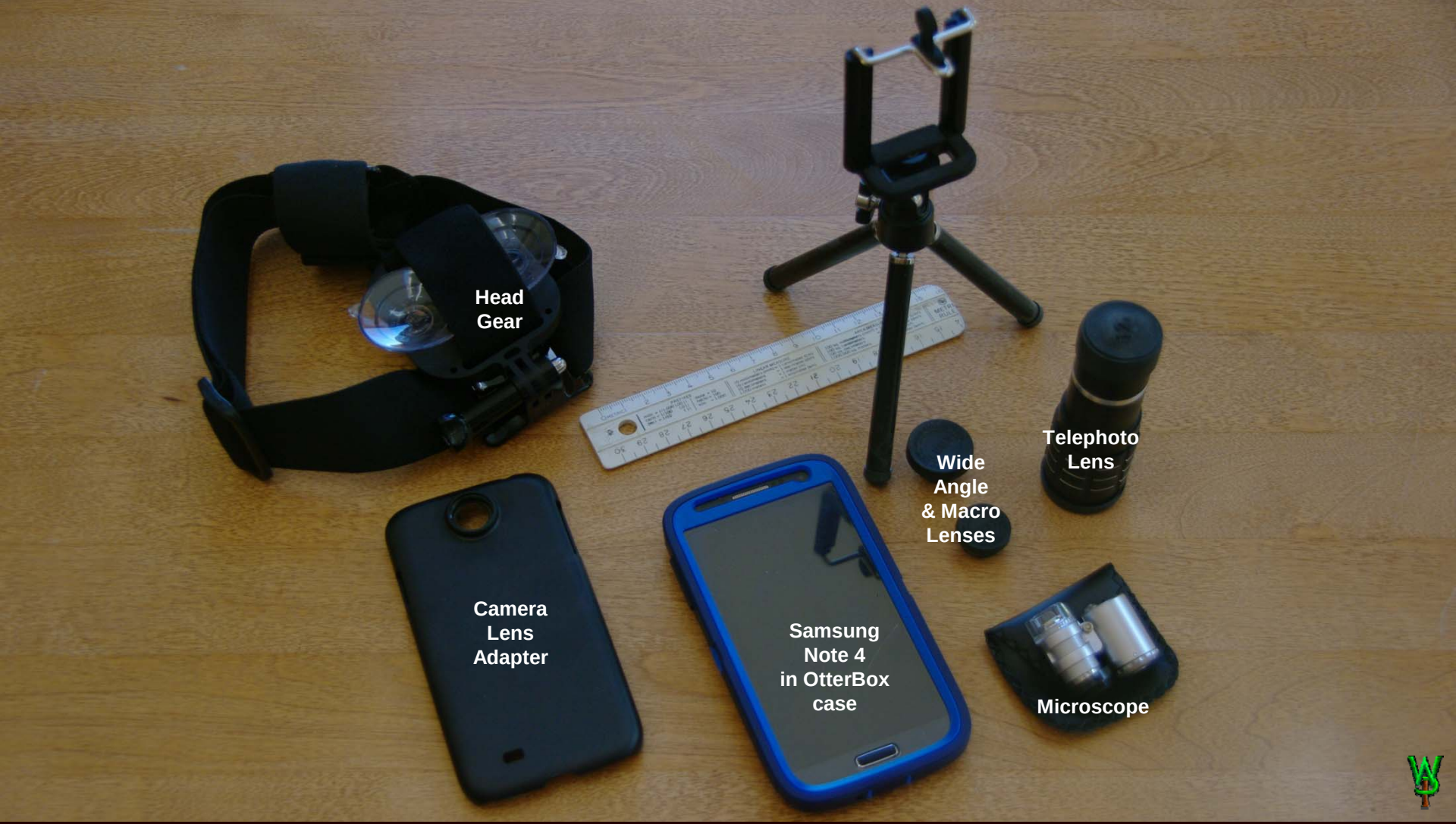
Like many tool systems, the problem with the thigh pack belt is, where do you put it? I come in and out of the house frequently. I don't wear it in the house. So it sat on the shop floor several times a day. So I made this hangar in which to keep it along with additional bottles of whatever I've made up depending upon the situation. I walk in, turn back up to it, hook the cups over the edge, unbuckle, and step straight into the house for Black Rifle™ COFFEE. Works but it needs an angled entry to guide the bottles into the holder.

One would think a proper herbicide-dispenser for stump treatment should be a no-brainer. There is one that is sort of OK, but it is a squirt trigger on a hose from a 2½ gallon jug, because tree crews are rarely far from the truck and cut a lot more trees than I do alone. Such would be way too bulky for me to carry far into the forest with the saws and all.

I carry two of this small flip-top bottle to treat stumps. Note: I am not "repackaging" an herbicide; this is a DISPENSER (that was for the lawyers; I am probably in trouble now because this product was not blessed by some helpful bureaucrat for herbicide dispensing; but it *was* sold to me as a dispenser for liquids; my defense is that I am not advocating this product for anybody else; I just happen to know that the material is the same as products I use that ***are*** so rated; so if this sounds tedious to you, you ain't seen nothin' yet).

The big deal is the cap, how well it seals, and whether any of the material escapes its intended use (as you see here). One must open and close the fluid path to dispense and that means one must touch the cap. If it has herbicide dripping all over it, touching it is not OK. So, what is actually needed here is a 12oz oval flask that fits in my thigh pack with a valve that works reliably with turpentine and surfactants eating at it, and a spout of sorts that keeps the liquid away from human contact with an opening that either deploys or contains all the unused material downstream of the valve without a cap to lose… all of which still fits in my thigh pack without interference or dripping and survives the trauma of the work. Quick to use too. It's doable, but I certainly can't buy one.

Guess why I can't buy an herbicide dispenser that I can carry in my thigh pack with the removable, washable, and replaceable plastic sleeve it doesn't have as "secondary containment"? Yes, this is actually a nasty design problem, with highly integrated needs no one company is qualified to make, nor would the volume in any one product be in sufficient quantity to justify the development easily.



The “smart” phone represents a pending revolution in this work but it’s not there yet. I did not take them up until they were rugged enough to survive the treatment. The current unit is a Samsung Galaxy S10®. It has voice recognition to take notes and a 12MP camera of poor quality but at least now it takes RAWs. The compression is way too rough even in RAW mode. There is a way to link GPS data *and* voice-dictated notes to photos but it is too klunky to be practical. One can buy macro and telephoto lenses and even a tripod, although they too are of poor quality. The tripod is too short while a longer monopod with a soil stake or clamp would be better anyway. There is even a microscope attachment with a light but no way to hold what one is scoping. Unfortunately, while the OtterBox® case is fine for protecting the phone, it cannot accommodate the lenses, meaning that one must change cases to use the lenses *and* when one buys a new phone. OtterBox should integrate a lens mount *and* two ¼”-20 inserts for threading a tripod into the case. Equip it with a head mount and that would scare the heck out of GoPro.® Together, that makes it almost the system I need, but not.

Until the revolution, decent photographs without having to lug the bulky (and now 15-year old) SLR are still a priority. For that there is this 12MP Nikon Coolpix P7800. This is almost a great camera**:** The optics are wonderful, the ISO range is spectacular, and it takes decent macros. I wish there were more MPs, but I understand the tradeoffs between noise, speed, and resolution. It suffers from several deficiencies that would cost very little to fix. Most egregious**:** This camera was useless without an eyecup. It is very hard to see well into the viewfinder in daylight with glasses without one. This is just silly. Nor is there a dovetail slide for a standard Nikon eyecup that wouldn't have cost $0.10 to add to the casting. I ended up taking a file to a Pentax eyecup and glued it on. Second, Nikon should offer an elastomeric tulip hood that snaps onto the movable element (nobody wants lens flares). Third, Nikon straps and cases for this camera suck. A progressive control on the zoom speed is needed. The handy switch on the top for controlling programmed exposure offset is easily "adjusted" inadvertently; it should be a lift-and-turn switch or have some other lock on it. I have no idea why it loses so much image when the auto-focus is located manually. If one is going to all the trouble to offer a digital zoom in manual focus mode, an inset to keep the image properly framed is understandable, but why not allow the user to control the zoom magnification and location with the master thumbwheel? Other than all that, it was a very good buy.

Do you want to die while you are weeding? No? Well, the same problems of how to carry something that doesn't interfere with other equipment apply to a firearm for dealing with coyotes, mountain lions, and soon wolves and grizzly bears (thanks to Ted Turner's thugs at the Center for Biological Diversity, like many "environmental" groups shilling for the major stockholders of massive corporations). Given the crawling around I do, a leg holster would get the gun *very* dirty. Drawing from the hip is also very awkward when on one's knees and that spot is now taken by the weed fork. This Guide's Choice chest holster is the best way to keep the gun clean and quick to draw from the many compromised positions I must assume without loading my back too much when weeding.

So here is the Weed Warrior ready for battle! Weed-fork, squirt-bottles of three herbicides, notes, flags, a marking pen, weed bag, tool kit, a camera, tripod, Internet access, a database, different glasses, occasionally a projectile acceleration device for personal protection, food, and water for the dog and me, each of which requires rapid access and distributed weight because speed and fatigue are everything.

In the latest iteration, I can even wear all of this with a backpack sprayer or burner, albeit I have to drop the pack to deploy the squirt bottles.

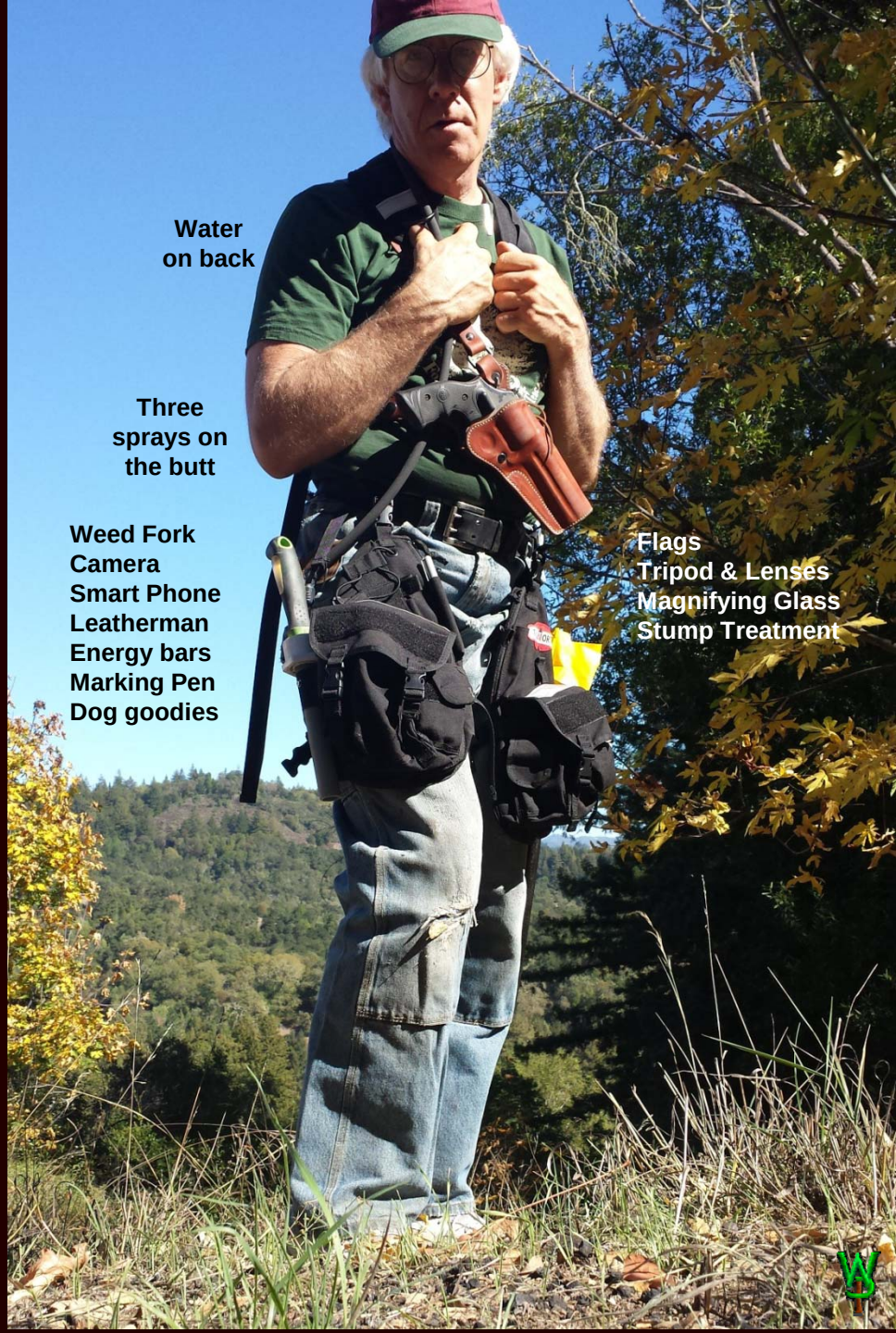
Thank goodness, I rarely need them all.

If the thigh packs had a pocket with padded dividers for lenses that would help. A magnetic attachment for a weed bag would be awesome, as spraying and burning are two-handed operations (one doesn't spray a plant with seed ready to drop). A simple rubber hose works for a flag scabbard but the attachment points suck and the flags don't take abuse well.

These modifications are necessary because special products for restoration work do not exist. Yet they can make a big difference in both productivity and career longevity. One would think such attributes would be applicable to home gardeners and sporting goods, which are much bigger markets than firefighting, but so far, TrueNorth is not interested. Their big customer is the US government. Maybe that's why.

If some of these pages sound like a commercial pitch, they could be some day. I wouldn't at all mind doing product development again as a hobby. The fun in tinkering with equipment or brainstorming new ideas and making them happen is why I chose that career.

For now, this is volunteer work. What you do with your own equipment and how you apply it is your own responsibility.



Meet the other half of our personal protection system, a dog to deter predators, alert me to their presence, and protect my wife when she takes a walk.

Dax was a Dutch Shepherd bitch. For 14 years she was a very sweet, beguiling, conniving, kind, tolerant, and independent dog with a vexatious sense of humor (who, me?). I selected this challenge of a breed because of their intelligence, independence, toughness, courage, and most important, drive for work. These dogs were bred as police dogs and NOT for conformation or sport competitions (less true today). Dutch KNPV dog training is physically grueling (a qualification trial takes two full days). They must be willing to work through pain against a real adversary while exercising the discernment not to attack distractions or human expressions of mere disability or curiosity, all while standing guard without the handler present.

What I do, crawling around, bent over, weeding, logging, digging, loading, involves long hours under often trying conditions (100°+ heat). Watching my back can be BORING, unrelenting, repetitive, uncomfortable, and occasionally stressful for a dog. She needs to know where to be as I move, undirected, and how to get there despite serious physical obstacles. She must be agile and persistent. She MUST break off a chase on command. She can't be spooked by bushwhackers, chainsaws, guns, or falling trees. And she'd better be nice to the cats.

As a puppy, Dax tried to steal my truck twice (we don't leave the keys in the ignition with her in the cab!!!). She thinks it's her truck. She always knows which vehicle I'm going to use before I get out of the house by the sound of the keys.

I loved this dog in a way that I'd never known to love. Yet in a way, she remained a tool for which special tools and training methods are needed. One cannot train in the wild with coyotes nearby the same way the pros do with padded floors in rooms with minimal distractions. Training a dog under these conditions is difficult and lifelong. In this photo, she's "looking" at my eyes, but it's my hand in my pocket that's got her attention.

Said special dog finally (she was 14½) got her special dog house. When we moved here in 1990, there were several old structures on the property needing demolition. The roof of one of them had been made of “terne metal” (steel dipped in lead). I had saved a piece of that metal with its cool patina with the plan of making a dog house and matching mailbox. The wood was logged and milled here. The roof opens to store leashes, goodies, training toys, and such. The mattress hadn’t arrived yet, but she seemed to like it.

January 2019 – He's serious about watching me too

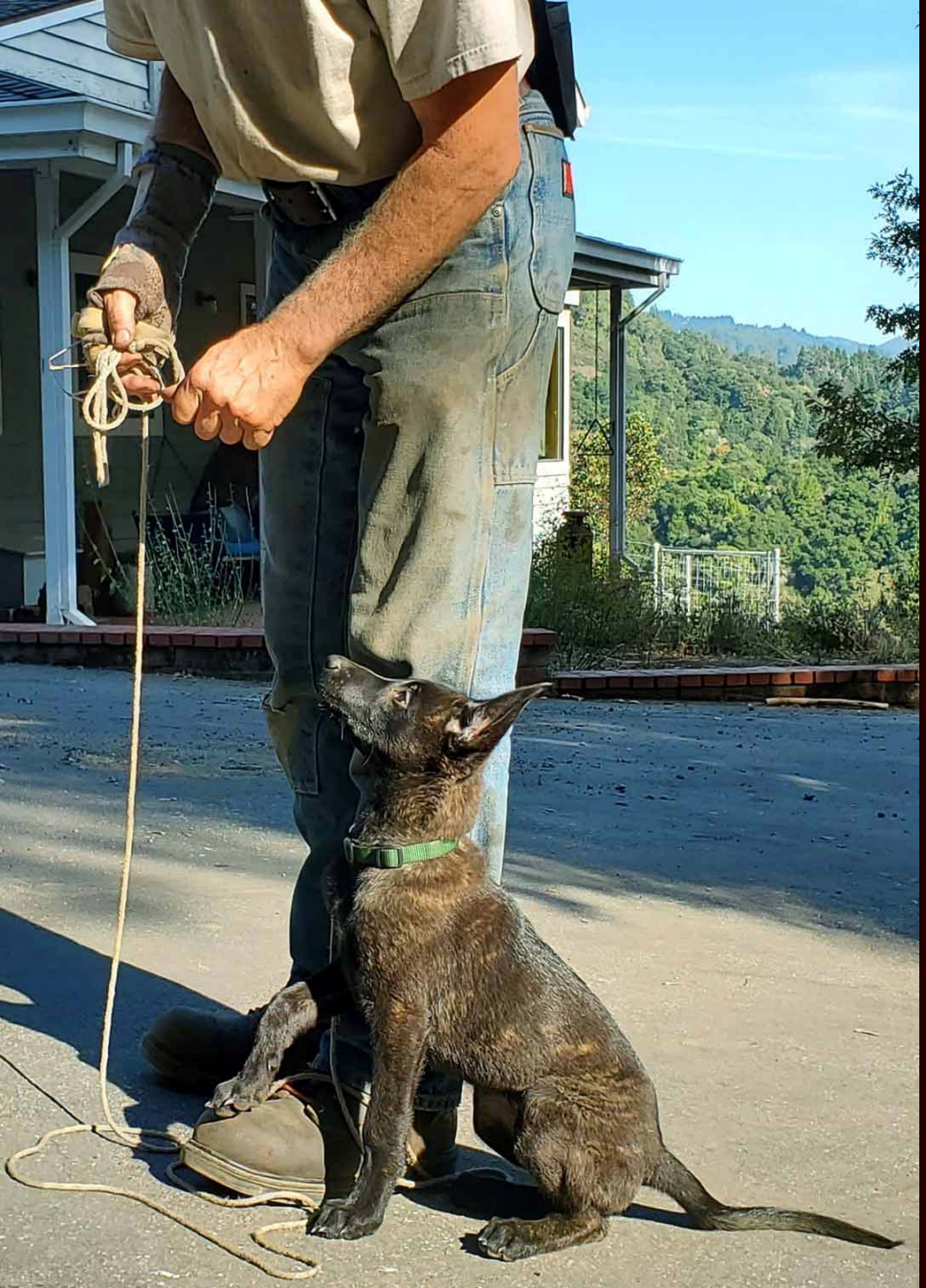
We started getting feral cats to keep the rats and mice out of the vehicles, and hopefully to control gophers around the house. What I didn't know at the time was the effect they would have on birds, particularly quail. Before we got cats, we had NO quail. When we got our first (a real killer of a barn cat) within two years, we had gobs of birds. The reason is not obvious**:** cats kill squirrels that would otherwise raid bird nests for eggs (that story is documented here).

At left is Alger Hiss, our beloved "feral" tom. When we got him, he was on his back, hissing, with all fours extended, ready to make hamburger of you (hence the name). The Watsonville vet said he was the most violent cat he'd ever seen.

This little guy was a sweetheart, a cat who knew he was in 'kitty heaven' because he grew up in hell, living under houses in Watsonville. He loved his tummy rubs.

Alger also LOVED the dog. He followed us all around the property, sometimes finding us by scent. Even more amazing is that as Dax aged, Alger took up watch, growling if he heard something he didn't like.

Otherwise, the little guy was a riot to have around, exhibiting "Algility" doing loops around tree branches as small across as one inch, just for fun. As for the rats, mice, and even rabbits, he helped a bunch. With gophers, not so much, although he did get a few. After six years, he just disappeared, probably in the maw of a coyote.



October 2019 – This dog can really pay attention, when she wants to.

In 2019 we lost both of them. Dax to cancer and Alger probably to predators. Meet Katja, who is so bloody energetic it's scary and just 'knows' she's not only invincible but smarter than me (the coyotes are already after her and she thinks they're playmates). So, to you dog "experts" out there**:** How do you teach a puppy to be dog-social but antagonistic to coyotes? The first key is to establish territorial boundaries. Any canid inside the line not blessed by me are enemies. Outside the boundaries she is to be social.

The key to her training is the "restrained recall," if I decide she is to break off pursuit or attack, she is to do so, 100% of the time. We start with tug play, simultaneously teaching to track a treat rolling into the grass and to come when called. The first two are combined in teaching to fetch. Come-when-called is taken off-leash in a fenced area. Off-leash training begins in the house. When all of that works well, we fetch off-leash but hold her back to build drive and then release her to pursue. Then comes the restrained recall. Diane holds the dog back as I call her, releasing her when the drive builds to a frenzy. It might take a hundreds of repetitions over months. Then we bring in the e-collar, but only once I am sure she will do as instructed so as to minimize the need for reminders (an e-collar is not for punishment).

So, dog tools: e-collar, at least 8 different dedicated leashes, chew toys, tug toys, training videos, computers to submit questions, treats, treat bags, at least three crates (one for the car), indoor exercise pen, outdoor run, fenced yard, grooming tools, syringes for emetics, various dog beds, touch pad, head cone (for injuries), tick collars, anti-parasite meds, poop bags, puppy pads, "hot pants" (when in heat)… and I wish they made pocket liners. But then I wish they made those for weed seeds too.

How would this work in my fantasy "industry"? Bringing up a new puppy would be equivalent to a sabbatical. I really don't think it sensible to buy a trained dog. Too many site specific needs involving life and death issues for that. Until Katja is ready, the cat will have to wait.

August 2013 – Alger assessing his new situation

As for the replacement “barn cat,” he will have to wait until the dog is ready (probably a year). For cat introductions, I made this cage for Alger in which he stayed for two weeks while I distributed the poop around the property to help him learn that it is home. The cage holds a small shelter in which I fed him thereafter and folds flat for storage. Until his replacement can be found, it’s trapping.

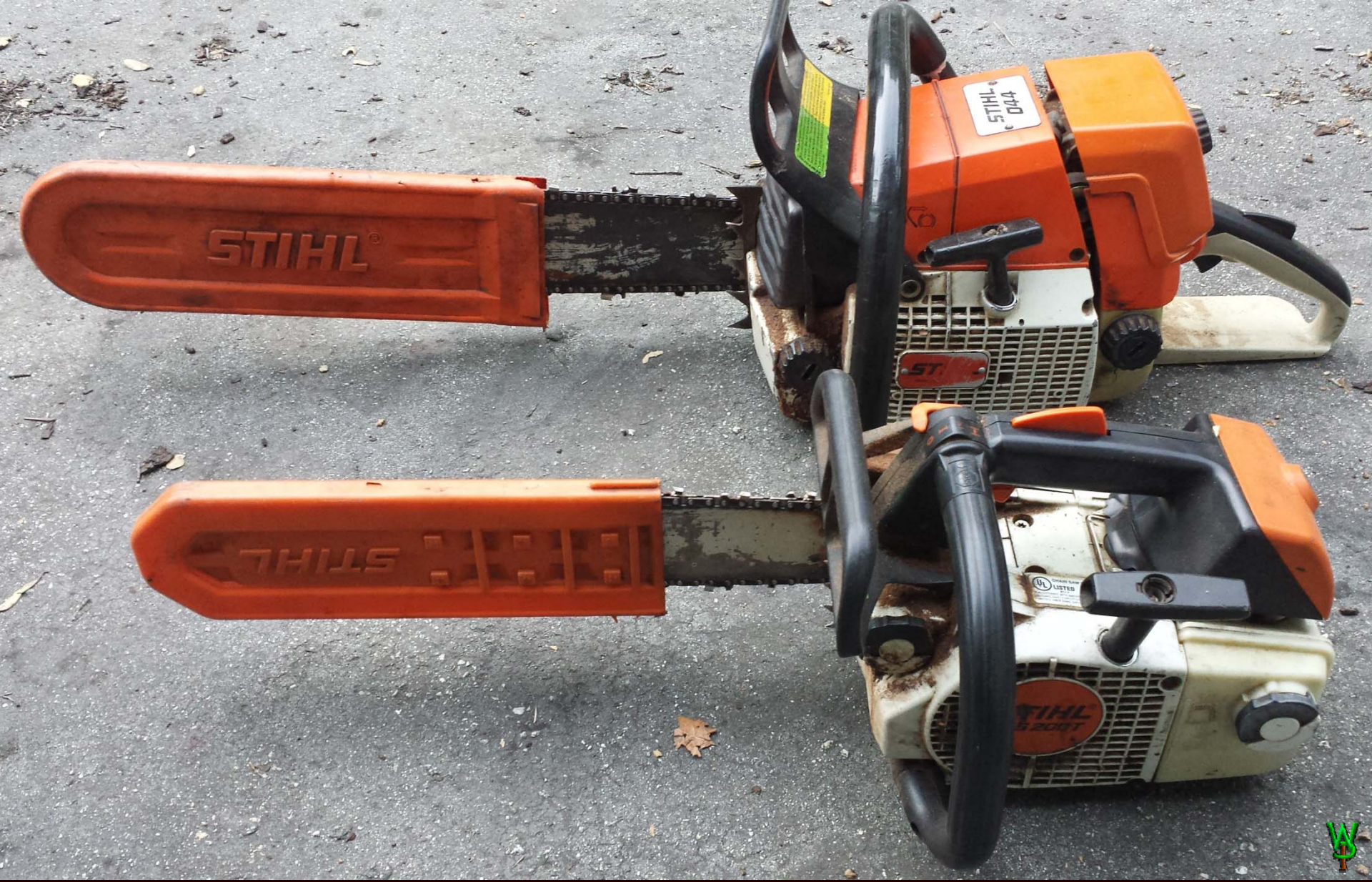
March 2019 – Only three hours after my first set…and she was pregnant!
Alger was most appreciative

For many years, I was “too busy” to deal with gophers with excuses like “gophers aerate the soil,” “gophers make topsoil out of rock”, etc. All true. We have had major problems with gophers destabilizing whole slopes, killing an entire orchard, etc. despite planting the trees in baskets Worse, they bury weed seeds I’m trying to kill. So the current idea is to “confine” gophers to areas where they won’t do so much damage or where I won’t mind the erosion. This is a very tough adversary. The **Gophinator** is the best gopher trap I’ve found and a very good value compared to traps that rust in 2-3 years. Unfortunately, it doesn’t come with a tether or a kit for making one. Stainless cable, aluminum crimps, and heavy shish-kebab skewers did the trick. Flags help find the traps in the grass.

We have a coyote and mountain lion problem in this area that drives the deer to seek the safety of houses, not to mention that there are tasty plants to eat in the garden. Fences are expensive and get in the way, but can also be used to measure the impacts of herbivory, as opposed to the lack (the scientific term is an “exclosure”). The terrain here is very difficult for fencing, making one much more expensive to build. So for 20 years, we played with ways to protect the garden directly. I was hoping to afford a high tunnel for an orchard instead of fencing, but that became just too much with all the rest I have to do. So, it was an 8-foot knotted steel deer fence.
This one encloses about a half-acre, has five gates and two drop-down sections. As of winter 2019, it finally got wire.

January 2019

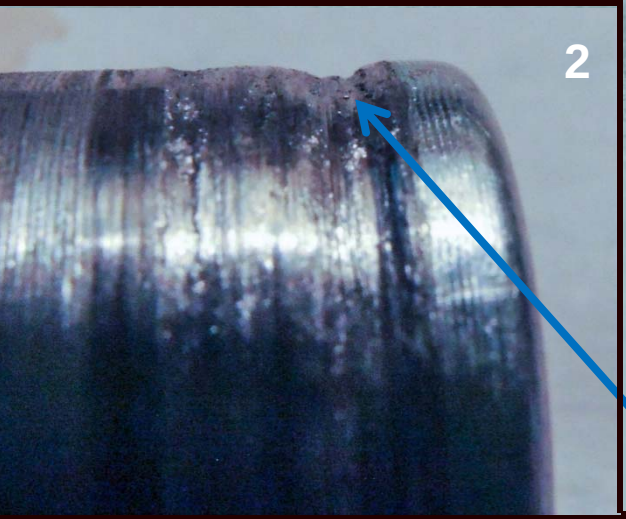
An 8-foot knotted fence, with 5 gates over rough terrain is not your typical DIY project. Cutting and tying off 20 wires per junction would be damaging to my hands. So junctions and terminations were made with Gripples®. To remove the stays for a joint without using cutters, the fix was a die-grinder. It's fast, clean, does less damage to the galvanizing, and is so easy on the hands it could stretch out a career (careful doing it with dry grass around!). Before stripping the stays and to slide on the Grippels, I use these ViseGrip® sheet metal pliers to straighten the wire, but they could use thicker plates with grooves and an offset for rebound.

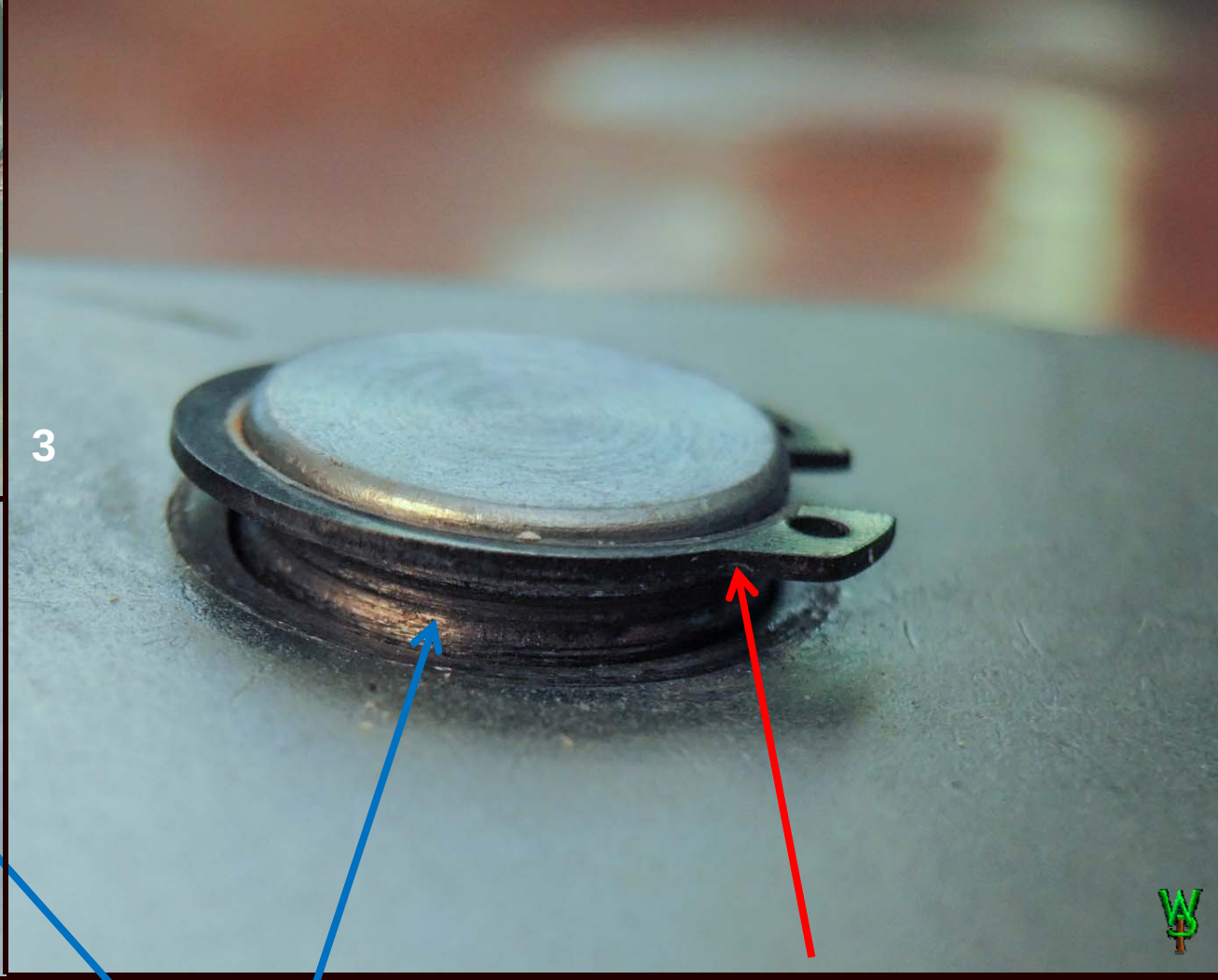


For chainsaws, there are three**:** a Stihl® 044 saw with an RS chisel point chain in 20” and 28”, and 36” bars with skip-tooth RS chains for felling and an MS880 for the big trees. For smaller work I use a Stihl MS-200T saw with an arborist’s chain. These chains, while fast-cutting, are more hazardous. The fuel mix In all two-cycle power equipment is unleaded **ethanol-free** 98 octane gas purchased from a local petroleum jobber. At $10 a gallon, it is very expensive gas, but it is a lot cheaper than the damage ethanol did to power equipment fuel systems. There is also a climbing belt, several flip ropes, wedges, chaps, hard hat, hearing protection, etc.

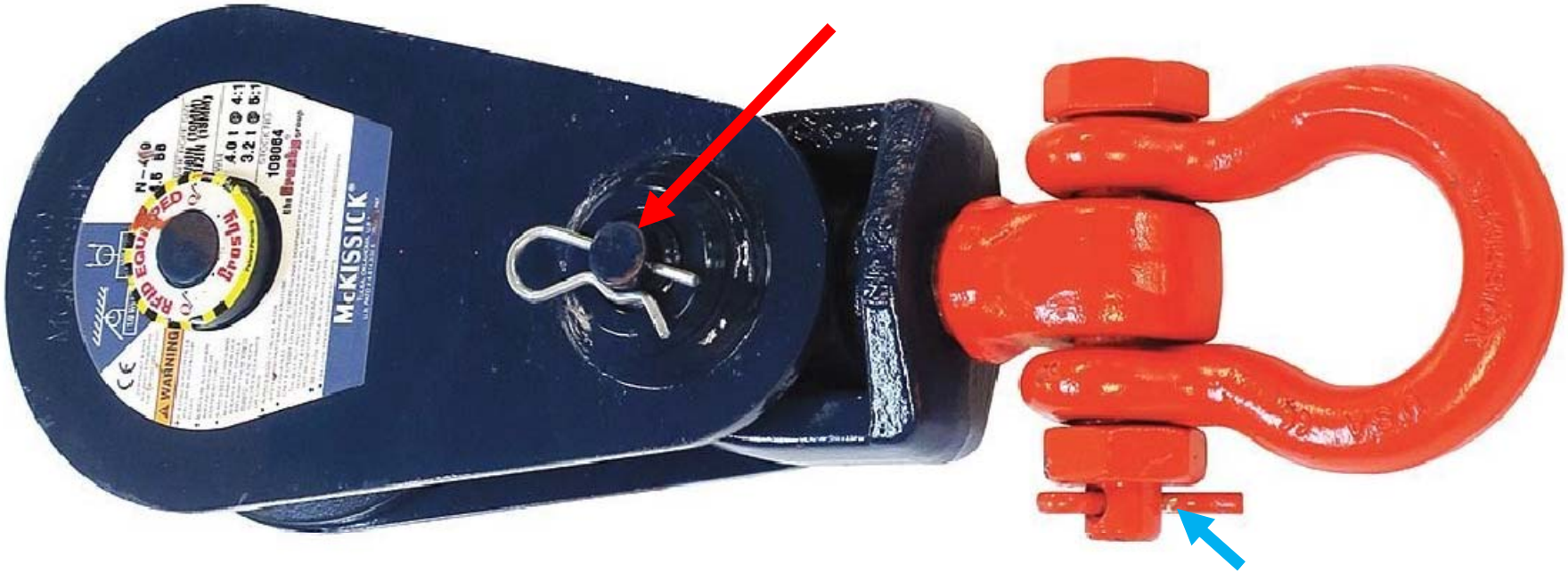
A recently deceased friend of mine left me his MS880 with an Alaskan mill for cutting big timbers. The 5 foot bar that came with it may also prove useful in felling 4-5 foot diameter redwood trunks. The mill is displayed prominently to remind me of Jan Jacobson, owner of the Everglades Institute, and one of the few people who understood the full scope of research here. I miss him.

Pulling logs takes rigging. Please excuse the following rant, because this has been a pet peeve of mine for 40 years. Above are two views of a pair of thimbles for terminating 3/8" wire rope. A thimble supports a cable through a 180° bend so that it can be connected to a hook or shackle and operated up to the rated load capacity of the cable/fitting system. The one with the tag is what you get in hardware stores. The one without the tag is made by The Crosby Group, LLC. The typical breaking strength for a 3/8" 7X19 wire rope is 14,400 pounds, assuming that the load is transmitted into the cable perfectly. Wrapping it over a thimble renders a rating of but 2,400 pounds (depending upon safety factors and the termination method). Hence, bending a cable greatly reduces its strength, which means that the radius of the bend matters, a lot. The minimum inside radius for a 7X19 wire rope to be bent without damage is twice the diameter of the wire. The thimble can keep that from happening unless it folds, although the manufacturers will not tell you that; they are supposedly only for reducing abrasive wear. The hardware store version is what is sold to people who are usually in a hurry and know next to nothing about rigging or ratings, this despite the fact that they buy it to support to a cable capable of transmitting deadly force (a cable snapping under load and whipping about is terrifying). The difference in cost is minimal compared to the cable and other fittings. To me, it is immoral to sell the consumer-grade thimble without offering the alternative. Thimbles, clips (forged, not cast), hooks, shackles, blocks… Industrial manufacturers take safety seriously. The difference in price is not worth a life.





This is a recreational-grade cable snatch-block (1), a pulley made of two stamped sheets of mild steel that opens to allow inserting the cable by rotating one sheet on the shaft. This block is “rated” at 10 Tons, is light and easy to handle. It stows well in a vehicle. Unfortunately, it is completely inadequate. I almost blew this one out at less than 6,000 pounds mounted on a ¾” shackle hanging on a 3” nylon tow strap that allowed plenty of twist. The principal weakness is that it is held together by this snap ring alone. There is no washer underneath to distribute the forces against it. The snap ring is of the minimum strength compared to others made for the same application. Hence, a relatively average load tore out what was a square ring groove (2) on a steel shaft that is way too soft. This puts the user at risk of blowing out the cable block under load, which could kill somebody. Nor is this the only manufacturer making cable blocks with this design. Even if it was acceptable (which it isn’t), the biggest maker of snap rings (TruArc™), produces an exceptional catalogue with all the necessary design criteria to have produced a far better product for but pennies more. The engineers and lawyers for this block manufacturer should be fired. I suspect that someday they’ll be sued and laid off instead.



This is an industrial-grade cable snatch block rated at only three tons. In comparing ratings, this is a rating for cable tension. That means a cable with 3,000# of tension bent 180° over the block has a 6,000# load on the block. An American-made industrial cable block like this is expensive. It is a pain to open because one must unscrew the pin locked with a hitch pin **(arrow)**.

In my judgment, while said trouble and expense are worth it when my life is depending upon it, there are limits. The main reason equipment like this costs so much to make is that it has so many complications added in the name of safety that they could get somebody injured. As an example, think of what you might do with this shackle if you were up a tree and dropped the hitch pin. Would you climb all the way down to get another pin? What if you fell trying to recover it? If doing so got somebody killed, should the family sue because it was *possible* to lose it? One might think that if it is so necessary to have a pin there, it should have a tether to the block. Yet designing something like that is not easy, because one must anticipate all the ways something could foul on or break the tether or somebody could screw up with it. That's how difficult design and testing of even simple things like this can be.

The industry has adapted by making variations of these products to fit each use. There are numerous types of shackles (Crosby sells 20), each with specific applications. Understanding them well enough to make a selection would require expert advice (another reason why we don't see good shackles in hardware stores). Yet because of the lack of a safer option, somebody will get killed, but at least neither the manufacturer nor the hardware store chain would get sued! Something is really wrong in a country that systematically deprives the consumer of safer options because everybody is covering themselves. The problem is lawyers.

For both mowing and brush-cutting this Shindaiwa® C-35 was a workhorse of the landscaping industry for many years. Anything less than this much power or lacking bike handles and a harness is both torture and a waste of time. There are many brush cutting blade designs for these machines, with chainsaw teeth, carbide, or other odd configurations. For French broom specifically, in my opinion, they operate on the wrong principle**:** Most blades remove material like a saw instead of simply slicing the stem like a machete (broom grows from a single stem). A "set" in the teeth making a wider kerf is unnecessary as long as one uses the correct technique with the brush cutter, which is to strike the stem from the side of the bush away from which it leans, usually from the uphill side. That way, the kerf opens as one strikes the stem, thus producing minimal blade friction. Using that technique and blade, a 1" stem can be sliced in 1/10 of a second. It is a violent operation, but very fast with minimal risk of kickback. The best blade for this technique ***was*** the 9" X 25mm 25pt steel blade Shindaiwa no longer makes. Oregon makes the next best thing, albeit with set teeth that slow it down.

Today, one cannot burn every summer like Native Americans did because the neighbors own excessive fuel loads. Neither is there sufficient forage or infrastructure to sustain grazing animals here and cannot import animals or feed because of weeds. I try to mow the place just after the grass harvest or after the first fall rain when things are damp enough that the trimmer doesn't strike a rock or loose piece of steel left over from old fences and such start a fire from a spark. The problem is that small shrubs and tree seedlings can shear off the string. This setup doubles the effective speed because the blade cuts off what the string cannot before the head gets close enough for the string to wrap around an obstacle and shear at the head. It helps shred the material too. Try taking on a heavy patch of sedge or wiregrass with anything less and you'll soon endure the problem. Unfortunately, an auto-feed head doesn't last long here. Worse, this tougher manual string head is no longer made, which means that the string ferrules can't be replaced. The aftermarket flavor has a hard shoulder where the string leaves the head. That shoulder is a shear point on the string, and boy is it effective.

Of course, one could always go in and take out the tree seedlings before mowing. This is the tool I mentioned a few times in the chapter on managing forest understory that has made such a big difference here after 5 years of use. It is a cut-down trenching shovel that I sharpen with a file. It steps through roots up to 1" in diameter below the root crown with a cycle-time of 3-5 seconds per tree (less if they're smaller) not including walking to the next tree. The process requires little effort when the ground is soft. The tool is not effective where there is hard rock or gravel. Like all sharpened tools, one must take care to avoid injury. Because I can not afford to carry product liability insurance, I am not selling them. If you want one, you'll have to make one of your own. It's a great tool.

Any mechanic familiar with the old saw, “if it doesn’t fit, get a bigger hammer” should smile at the sight of “Gentle Persuasion,” a sledge hammer you can wear in the loop on your pants so you don’t have to carry it. This is one of my favorite tools, and again, **you can’t buy one.** It starts with a 3-pound machinist’s hammer, to which I then have to shave-to-fit and epoxy on a 22” handle sealed with tung oil. To reach back and swing this beast one-handed, the momentum of the head is just awesome, but most of the time it’s two hands. It simply generates unbelievable amounts of power, great for driving steel stakes for erosion control tarps or concrete work.
It also works great on felling wedges. Pretty good for reshaping a truck bumper too!

Crushed charcoal recovered from burning gets run through this ¼" screener. All the crushing processes I have tried (soil rammer, compaction plate, pickup truck with knobby tires …) have had about the same 50% yield on each successive pass. All make a lot of dust. It is a very painful process. The poor yield is because charcoal tends to pack into a cake (particularly when damp), which then protects unbroken pieces inside the cake from being crushed.

What about milling instead? Unfortunately, unless one invests in a furnace (a "charcoal retort"), the harvesting and pyrolysis process to make charcoal entrains a residue of rocks, unburned wood, and other contaminants that do not crush as easily as charcoal, making hard rollers or millstones subject to expensive damage. One does not want to jam or break the grinder on those tougher materials yet grinding does produce a higher single-pass yield albeit at a slower rate. Hence, there is a fundamental choice to be made in designing the process machinery**:** Either the mill/grinder must be capable of chewing up or tolerating everything that goes in OR it must be possible to segregate those hard materials PERFECTLY first, neither of which seems likely. If the chunks go through the process, then the output must be screened and first pass yields drop.

This fooling around taught me a lot about the desirable properties in a grinding process. Knobby truck tires obviously suffered no damage at all. So perhaps a 80-90 durometer carboxylated nitrile roller mill similar to meshing tires would be the ticket. It would crush fine charcoal and pass wood and rocks. But no matter what, the material must then be screened.

So the screen was the first thing I made. I already had the redwood and the electric fencing stakes to use as springs, so it was less than $25 to build. The wheels suck. The screen lifts out for returning unbroken pieces to grind or crush them again. Why so crude?

The project of converting excess forest to charcoal here totaled about four or five years, of which this design was easily capable. Needless to say, this is a completely unsatisfactory process for industrial purposes but I will have ended up converting an awful lot of wood into 20-25 cubic yards of charcoal for very little capital.

To store the charcoal “biochar,” these tarps are used billboards, and they have MANY potential uses here. The material is a fiberglass reinforced vinyl. As an outdoor tarp, the sun eventually destroys them, but it does take a good five years, longer than anything else I’ve tried. This is about as unfriendly a material in a landfill as one could imagine**:** buried it can last for centuries, messing with groundwater percolation and trapping it as a possible source of slope instability. The good part is THEY’RE FREE (if one drives to the outdoor advertising company to get them). They have “white backs” and black. The black lasts longer. White keeps things cooler and can be used to keep redwood stumps from sprouting.

If you've read the forestry chapters on roads and drainage, you noted heavy equipment was used for shaping and moving large amounts of dirt. In general, I have found it preferable to rent heavy equipment. First, a 4X4 loader with a 4 in 1 bucket costs $15-25K used. Most of the time, it sits. Sitting unused is not good for power equipment; as occasional heat purges water, lubricates parts, and keeps seals in shape. Worse, with purchased equipment, one is stuck adapting to what one has even if it is inappropriate to the job. A loader can't be a backhoe, but the latter doesn't make a good loader on rough terrain (very scary). Neither can go where a small excavator can. So when it comes to heavy equipment, rent or hire. Most heavy equipment operators are notoriously fickle. It's why I usually rent.

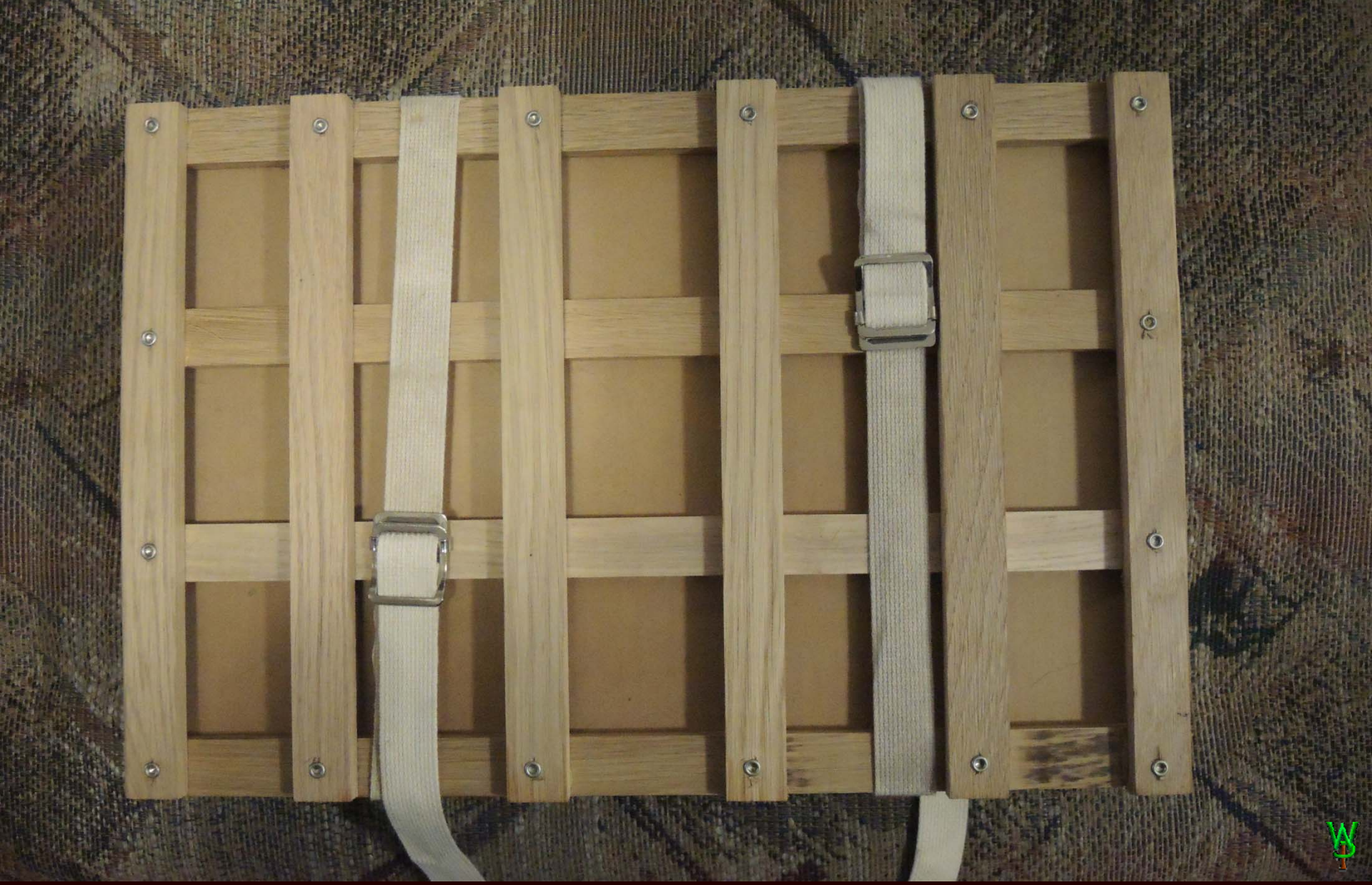
For specialty small power equipment that doesn't get used often, buying used on Craig's List or eBay usually pays for itself on the first couple of jobs compared to hiring or renting. We have a concrete mixer (also useful for blending planting mixes) and vibrator, a rototiller (especially useful for mixing cement into soil), both "jumping jack" and plate compactors, a small post drill, wet tile and brick saws, and of course a log splitter. Most of that sits a lot too, but it's cheap compared to hiring or renting. Ideally, these would be neighborhood assets, as opposed to single owner. They'd probably last longer in more frequent use and would surely last longer if I could get a shed built to house them instead of using garbage bags (one of those projects that keeps morphing toward the surface). For equipment involving personal safety, critical in emergencies, or frequent demanding use, we then buy new and the best we can afford.

Power equipment needs fuel. That requires means of delivery and storage at least 30 feet from the house. Fuel handling has been a minor hassle here for way too long. For the small power equipment we get 55 gallon drums of this Sunoco 98-octane ethanol-free racing gas split among 2-3 neighbors. Big projects involving heavy equipment take a 55-gallon drum of "red diesel" (no highway taxes) which saves time for **using** rental equipment instead of making trips for fuel while paying rent for machine time. Moving, storing, and dispensing from 55-gallon drums is not trivial. It takes cradles for trucking, a crane and clamp for loading and unloading it on the truck, a drum dolly to move it, and a special bronze drum wrench. The key to this system as configured is the pump which then allows maintaining vertical drum orientation, but that takes a roof to keep water from pooling atop the drum head or rusting the bottom (demanding said shed). It's easy to store in a simple cut off piece of drain pipe (inset). Unfortunately, the manufacturer does not specify it for use with solvents. Drum pumps for fuel are available at 4-10X the cost. Someday.

For the truck, we fill 5-gal. jerry-cans on trips to town. If you have jerry-cans, keep them; the latter day metal "safety" cans made by Just-Rite SUCK. They leak, they spill, and they take too much space while plastic fuel jugs puncture and are a fire hazard. The truck gas is stored in a 55-gallon drum along with stabilizer good for about 6 months just beyond the propane tank, but it too needs a shed with secondary containment. Together, these measures save time and fuel that would otherwise be spent trucking fuel up here. Unnecessary driving accomplishes nothing.

The farther one must travel to get what one needs, the more a stock room becomes important (and this is only a small part of it). Every plumber or electrician I've ever known carries a lot of odd pieces in their truck. Again, a stock like this is bigger than an individual needs, but between me and the neighbors, one of us usually has enough of what is needed to make something work.

This project is about a lot more than killing weeds, thinning forest, and fixing drainage; it is a laboratory because it had to be. The deeper one looks, the more one realizes how unreliable academic, official and industrial information is for HOW to accomplish what has been done here. For example, there are over 375 plant species here. Most were identified by photograph and email. Often a camera is not enough. Botany books often identify grasses in particular by features on seed, which needs magnification for ID. Sometimes the botanical keys are functionally useless or even wrong. Botanists choose the features they do because they need to distinguish dozens of species over the whole State. On the other hand, with the notable exception of brome grasses, there are usually at most two species within a genus here some of which present more than one variety. A microscope facilitates positive ID, with which to develop a macroscopic *vegetative* identification key for practical management among fewer species. Vegetative distinctions can then be made early enough in the season to allow time to get them all before they drop seed. The scope has also found a frequent use in removing broken thorns from my fingers! Needed is a high power scope for fungal ID, as many are identified by spores.



There are scientists interested in some of the plants we have found here. For them to have acceptable specimens one needs to make dried “pressings” suitable for an herbarium collection. Besides the necessary press apparatus (above), preparing pressings requires a place and materials to wash roots. So far, crème rinse for human hair seems to do a good job of dispersing dirt while reducing root breakage. This press is on loan from the Norris Center of Natural History at UC Santa Cruz (with my thanks to thanks to Chris Lay), who also supplied some of the necessary materials to make my collections more useful to the research community.

For several years while still planting grasses, I made these shade houses for summer propagation. The eventual goal was to address the critical need for portable nursery technology with which to assure site-compatible genetics and minimize the spread of pathogens to facilitate revegetation of residential construction projects. The idea also has the huge benefit of minimal real estate requirements compared to conventional nurseries. This structure tilts for differences in sun and rolls up around the ridge beam for minimal trucking. So I fuddled a bit with it, but didn't get far when writing another book took over that time. With the introductions of yet more soil pathogens in *Phytophthorae tentaculata* and *P. cimmonii*, maybe time people will regard the need for such process and tool development more seriously? I have identified a manufacturer capable of producing the controls. If people in the business would help me convince them there is a market, maybe something productive could be done about this pending disaster of exotic pathogens.

Growing plugs from seed for transplanting makes nothing but sense; it increases reliability, productivity, and yield. To that end, besides shade houses for fall starts, for winter I built an experimental **cold frame** on casters to be equipped with a thermo-controlled actuator (using a wax that expands at a particular temperature) to open the top to release heat. I would have liked to add automatic watering, but that was adding weight to the overhead. This has been one of those projects that suffered because I have reached the point with most species that I have sufficient cover. That rendered this aspect of development work more a matter of curiosity than priority. The covered piles are composting weeds that get two years of decomposition before being used in a vegetable garden also used for growing out transplants and as a test bed for studying the behavior of native plants when grown in optimal soil. I have yet to develop the tiered composter that can turn the material from level to level without undue labor.

2003 – Don't blame me, I voted for McClintock

We'll finish with one of my most important tools, my old flatbed dump truck. This is a 1969 ¾-Ton Dodge W200 Power Wagon. I've had it for as long as we've had the property. This one has a power take off (PTO) to a hydraulic pump that runs the dump (thank you Don Scheel for finding it). At one time, it was the dump truck for a cemetery (why I tell people it has a "stiff suspension"). Fabricated the bed. It gives me a lot of reliable utility for a $1,500 truck, and with no smog requirement. In return, I changed the oil and lubed it annually.

It didn't have a winch. Wish it did, but for the most part there are enough roads that one can yard logs on a cable over a snatch-block in a tree and drive the truck down a road to pull it. By comparison, winches are slow, and some are limited by battery capacity. Cables take a beating. This method does take a bit of extra planning, but handles some fairly large material. These oak logs are 14-18 inches.

A winch won't load logs into the truck. This cheapo Harbor Freight half-ton crane will. It could do a lot more with a supported backbone and relocating the winch on the column. I added a fair lead at the end of the boom to make the cable track over the pulley at the end.

In this configuration, Homer is set up to transport the piles of chips fly-by-night tree companies occasionally dump on our property without permission. Note the aluminum tubes that fit in the tops of the stake pockets. This design allowed me to use two 5X10 sheets of plywood and still get the height to hold a maximum load. It installs in 5 minutes (or would if I'd labeled the pieces).

In this setup, it is a water truck for compacting soil or firefighting. The setup can be loaded and connected in less than ten minutes and fills in seven. Once readied, I can start the pump and deploy 100' of hose with flow in just over 30 seconds. The tank is a standard 275 gallon tote, common in industry. The pump pushes 30 gallons per minute against 30psi. There is a **return** to the tank on a 30psi relief valve so that I can shut off the hose without harming the pump. There is also a normally closed float-switch in the tank to shut off the pump when the tank is empty so that the pump won't run dry and kill the seal. I bought a POS Moon American hose reel and modified it with a crank handle and a quick-switch hub and stanchion made out of an old cement mixer. This allows me to mount the hose reel in a 2-1/2" square tube socket (in this case as part of the tail gate on the stake bed). I'll mount similar tubes near our 1-1/2" hose outlets elsewhere on the property. The reason the vibe plate is on the back is that this operation is using the water for compacting trails.

This watering system works on a different principle. The tank is an antique water heater that holds about 30-35 gallons. It fills from a garden hose through the **discharge valve** until water comes out the upper **vent**. Close that valve and the tank keeps filling until the pressure reaches equilibrium. Then I close the valves, reverse the garden hose, and activate the 12VDC compressor located under the bed on the right (red **arrow**) on a pressure switch that keeps the tank between 60-80psi through two spring-check valves to protect the compressor from back-streaming water (I added two drain traps). The sheet-metal compressor mounting enclosure protects it from tire splash. This is a great setup to have around when burning piles of brush or managing small amounts of dirt, as one can load the truck with cuttings to burn and still dump it with the tank installed. It is also good for root-watering plantings over the first critical summer.

OK, so that was one awesomely useful truck that took a lot of abuse and neglect and kept working. The problem is, it was. I punched out the radiator and the truck is too worn out to justify fixing it. The body is falling apart. I can't lock it. The floorboards are rotten. The frame is bent. The axles are too shot to fix. It chronically overheats. The brakes are dangerous. No heater. The interior is rat habitat. Effectively, what I need is a new truck, but a truly new truck capable of doing all of what this one does would cost close to $100K. A new truck also has features I DON'T want. The bodies are thin. The interiors are way too cushy to survive a high-drive puppy, much less a VERY dirty landowner covered in mud, wet ashes, or grease. Carpets? Electric windows? Air conditioning? Stereo? Don't want any of it. I don't want the electronic flimflam. I want a truck that is simple enough to fix myself, and rugged enough for real work. I don't drive it enough to justify the expense of a high-mileage engine. Torque is more important here than speed.

Spring 2018

I really wanted a winch but I'm not willing to give up any of the functions of the old truck. So I bought another just like the old one to which to swap all those features and add more. This one has a very special feature that makes it all possible**:** The observant will note it has a winch, but that's not all! This one has a military (PTO) with dual outputs, front and back (never seen one before). It can run BOTH the winch and the hydraulics for the dump bed!! Max (the new truck's name) has a big block motor too.
So it's upgrade time, with disc brakes, a bigger gas tank, and overload springs. The problem is that Max has body rust; so I bought yet a third two-wheel-drive truck with a new motor and a good body. We shall see how this goes, as this is a very challenging project.

The first big steel project is the winch bumper, which also supports the front rack and forms a brush guard that both curve to fit the front of the truck. The rack inserts from the top of the two outside tubes, meaning that they had to be accurate and parallel to 1/16”. Those two tubes will also hold jacks for supporting the axle while pulling logs uphill. The bumper itself had to be extended on the ends with sections from a parts truck bumper formed with a rosebud, gentle persuasion, and a crescent. From here I’ll add chain grab hooks and gussets that hold shackles for anchoring the winch cable when doubled over a block. The two side pockets behind the bumper will be boxes for chain, shackles, straps, hooks... The brush guard grille will also get expanded metal. With this much weight on the front of the truck, and when it is under load, I will obviously be exceeding the 3,000# rating on the axle. To the right you see a Dana 60 axle rated at 4,500#, also having disc brakes. That will be done after adding power steering, the bed transfer, and working up both PTO shafts…

This was a good idea corrupted by evolution into a stupid execution. It started as an oven deck in a lab where I worked (the white part on the near side). That turned into a 16X2X4 foot firewood rack, but it only held 1 cord. So I added the far side so that it held 2 cords, which is plenty. Then I had a bright idea**:** Put axles on it and make it a trailer! That way I can mount the splitter in a box receiver, split the wood, and load the wood storage unit, all on site, leave it in the trailer/rack to dry, and when winter comes, back it into the garage, and unload directly into the stove, thus cutting out at least two expensive handling steps!!! So I bought axles sufficient to take the load without asking if my truck could haul a two-cord load up a steep muddy track without getting killed. OK, so it should have been two one-cord trailers. Sigh. So it sat… tacked together in the garage for 23 years, just being a wood rack. Now that I needed a place to build a truck, it had to go. So on 9-11-18, I drove to Watsonville to get some steel and there incurred a change in plans.

9-11-18

While exiting the steel loading dock, my view of the street was obscured by a truck with a utility body. As I inched out into the roadway, I saw a delivery truck about 100 feet up the street, still with plenty of time to stop or swerve. He didn't, plowing straight into my into my beautiful new winch bumper. That Dodge Caravan spun my Power Wagon 90° and threw it 40 feet, bending the frame over 2 inches and even breaking a piston inside the engine! The driver said he was busy with a clipboard. Max is dead. What to do? Back to work.

Three work days later, there were two trailers, one framed. I could have been depressed about the loss of the truck, and I do mourn the loss of so much work that went into the winch bumper, but more work fixes that. It's just how things are when you know you're lucky not to have been 3 feet farther into the street. Just get things done a step at a time (or in this case, a trailer at a time). Besides more expanded metal and the tongue, I'll probably add jack-stands to keep the weight off the tires in storage and to make it easier to slip garbage bags over the tires to keep the sun off. A storage box for wheel chocks, cover tarps, rope, or straps would also keep these tools closer to where they are used. Then comes a socket on the tail so that the splitter can lift itself like a forklift on a delivery flatbed. Were I to do this from scratch, I would make the frame of 2X4" rectangular tubing, but a commercial variety would be 5" channels folded out of sheet and boxed at the shackles with the expanded metal tacked to the bottom side of the top flange.

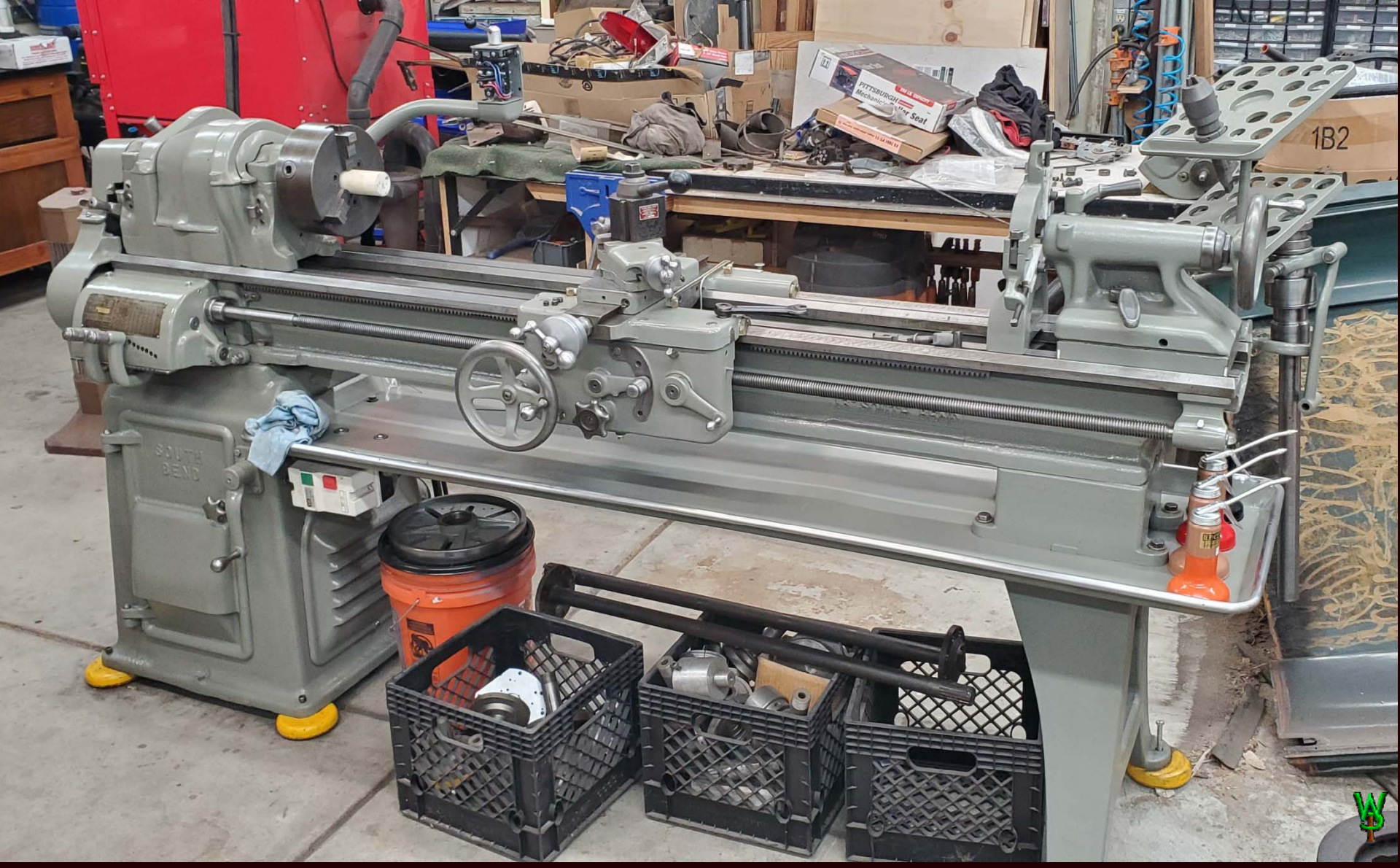
By mid December, I'd bought a fourth truck to run while I built the "new" one, demolished the wrecked truck, got one of them running (new wheel bearings, switching to right-handed lugs on one side, playing musical brake drums, seals, rebuilt locking hubs, brake and clutch hydraulics, cleaning out the heater/cowling of mouse detritus, freeing up heater control cables, defroster hoses, switched out a rusted out window lift track, inside gas tank, fixed random electrical, added a hitch, straightened up a rear bumper from the white truck, spare tire brackets, exhaust system swap (with short headers), wiper arm bearings, motor mounts, radiator, pulling goofy (and dangerous) plastic fuel tubing and pump with an oil pressure switch. All this for the truck that has to run until the "new" truck is done. Got the trailers working, and was splitting firewood, getting it into the shop the very day we ran out of dry material to heat the house! This is a plant restoration project, right? If life doesn't go on, it doesn't get done.

To get things done takes a shop, something few plant restoration projects have on-site. For some strange and wonderful reason, most of the biologically-inclined aren't tool geeks, but this place is a process development lab and that means tools. This finished garage was built with a level 4" slab reinforced with ½" steel on compacted base-rock to support machine tools. Capabilities include welding, wood, plumbing, electrical, mechanical, and machining work supported with industrial-grade piping and wiring.

Cabinets going in.
Making space for work requires organizing every little thing.

Trace mineral experiments require precise weighing and mixing, while rain gauges need calibration and maintenance, both requiring graduated cylinders. Some seeds need grinding with a mortar and pestle to amend germination, involving extracting them from pods, mechanical abrasion, hot water or hormonal treatments, or long term refrigeration. Starting to sound like a development laboratory or research station, isn't it? At least one can fantasize as much. This laboratory sink was being tossed by Harvey Mudd College just after my graduation (thanks Larry Hartwick!). So I made the cabinet and broke it down with each move. Other than the one set of purchased cabinets above, the rest are repurposed throwaways.

In the likely event of a less-than-catastrophic earthquake, the steel shelves for small goods are upside down and the wood shelves have ledges to keep small stock from winding up as piles on the floor. Every tall cabinet is bolted to the wall which also has extra shear plywood. The poor-man's dust collector under the saw bench is about 95% efficient. The cabinet at left was a Steelcase desk, while the lower shelves were drain pans in a chemical dipping process. Compressor piping is throughout, which greatly facilitates cleaning.



The first machine tool is a South Bend lathe. Bought it from a distressed sale and it was a mess requiring complete disassembly. Next will be a rolling cabinet underneath the pan to hold chucks, faceplate, bits of stock, cutting tools and holders, collets, and a few measuring instruments. All I need now is a vertical mill. These are tools to make tools.

A heavily modified and portable Harbor Freight blast cabinet with air filtration, foot pedal control, and cyclone dust separator.

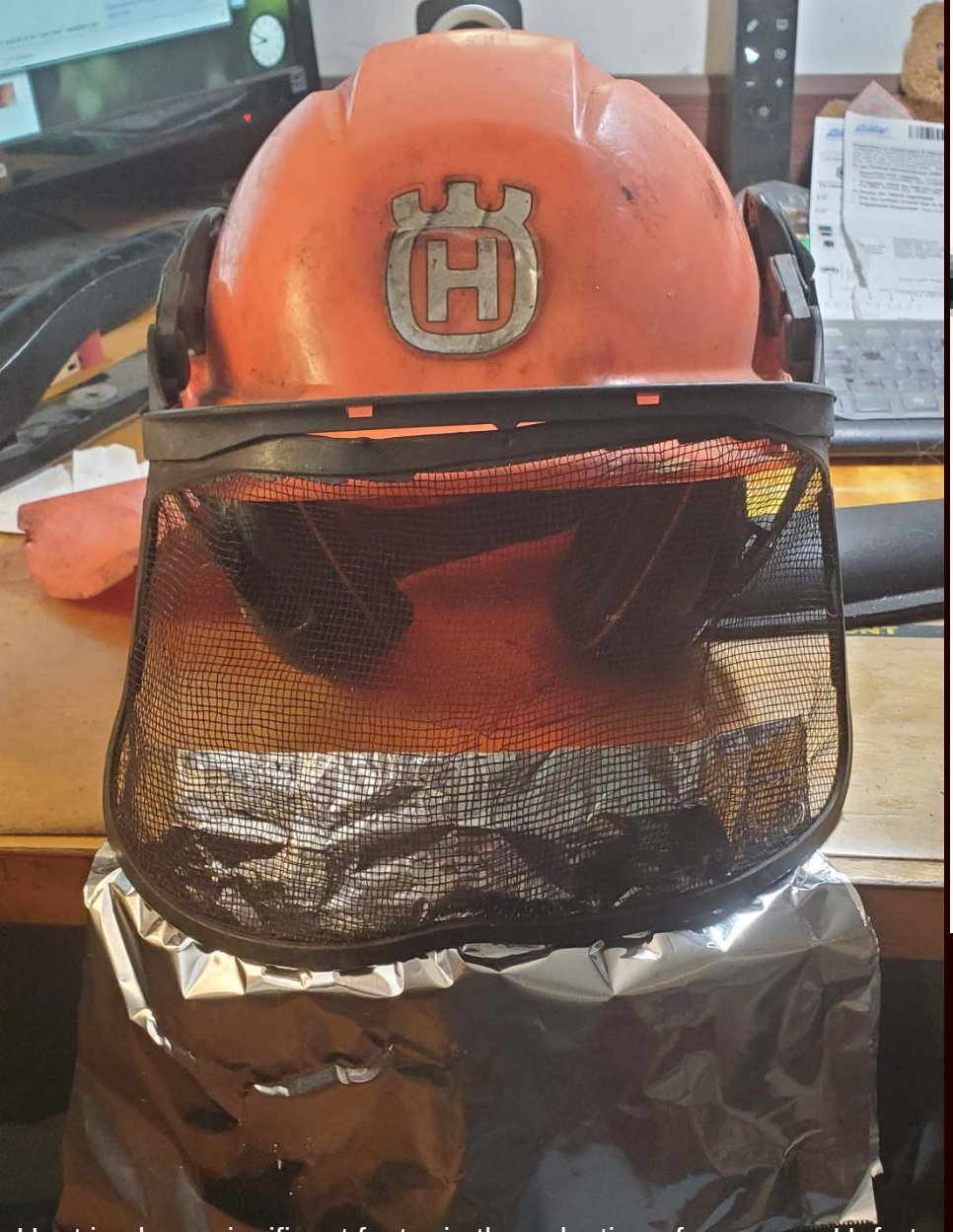
Between a parts washer, wire wheel, blast cabinet, pressure washer/sand blaster, and a winky plating line of plastic buckets, I should be able to prep the parts for a truck that will last as long as gasoline is still available (which in California may not be that long given our "environmental" regulations intended to enrich the investor class, developers, and bureaucrats). Economic suicide is effective, eventually.

ASY Outdoor Sun Hat UPF 50 Protection Waterproof Fishing Cap Face Cover Summer Neck Flap Hat at Amazon.com

MG Flap Hats (03)-Desert W15S46D

As to personal protective gear, there is no perfect hat for weeding. For summer, this one is close. Better would be a mesh back flap to protect the neck from sun while allowing air to keep cooler. Being synthetic, the sweat band doesn't wick efficiently, pull out, rinse, wring out clean, reinsert quickly, and last many washings (no, that's not easy to do with skin oil). For winter, cotton legion hats are warmer.

Imagine distinguishing thousands of tiny ½" weeds from among many times as many natives or separating individual invading grasses from a large fine-bladed bunch. Some species (such as native v. exotic clovers) are quite similar in appearance requiring distinguishing them by edges, veins, or even tiny pores on the leaves. Once you see it, identify it, select the correct process, and note the vulnerabilities of the surrounding native plants**, then** you target, select a spray pattern and trajectory, and make a tightly controlled stroke with the squirt bottle, all within tenths of a second for hours on end. Bifocal or progressive lenses can inhibit finding weeds when standing because one is looking downward where the "close focus" prescription takes over. On the other hand, bifocals are useful on hands and knees or when crouched, but set with a near focus at 3-4 feet (not the usual 12 inches; the optometrist can do that, but you have to ask for it). I use a high-powered prescription, which is harder on the eyes, but edges and textures are second only to color when distinguishing tiny weeds from so many natives at a distance. Marchon® Flexon eyeglass frames have stood up to the abuse they endure routinely for over a decade but are no longer available. Notice also that both the shaded and the fixed prescription glasses are all oversized, as opposed to the everyday glasses. These lenses are also tall. The reason is that one often first detects a weed with peripheral vision; whether by shape or by color. Tints seem to have positive effect in terms of detecting *some* weeds, in part because the non-native plants most commonly found here (particularly annual grasses) tend to have more of a yellow-green color. Shades help with detection by shape, but just don't work for making distinctions by chrominance. They do help with visual fatigue which is especially important when spraying. So at this point, the evidence points toward using tinted glasses, but somehow I seldom do. Nor is the distinction in tint or focal length the sole determinant in which glasses I wear for a particular kind of work.



Heat is also a significant factor in the selection of eyewear. Unfortunately, scratch resistant coatings on regular glasses (such as Crizal®) fail instantly if one gets too close to a fire. Historically, I used a helmet with a face screen (left) because the screen caused interference in the infrared radiating from the fire. Even so, that left my neck exposed, which then burned from the radiation. So I had to staple aluminum foil to the screen for that work. Even then, the coatings on the glasses failed anyway and it was very difficult to know how hot a fire they could withstand without damage. So I am testing the Uvex Horizon frame (above) with its flip down heat resistant filter lens.

Even pants are deficient. I use Riggs Workwear jeans for most tasks as they are at least rugged because of the doubled knees but the cotton doesn't wear well. Pockets are a problem as they should be able to handle many of the same needs thigh packs do**:** keys, dog treats, smart phone, knife, wrenches, flags, pen, and weed seeds, as I have no alternative to pockets to hold and carry seed when I don't have a bag with me. Their Ranger Pants have a better pocket system, and are better on hot days because the fabric is lighter. Changing out pocket contents is a hassle. I try to clean and wash them inside out, but they still don't come clean well, and it sucks when seed gets mixed in with dog treats. Yet look at those long patches on the upper leg of the jeans. What would be great would be jeans with a modular system of removable pockets of various sizes hanging inside slots cut into these doubled pant legs.

I do not wear gloves while weeding, as texture is a very powerful identification tool. Many native grasses have “scabrous” (sandpapery) surfaces, some weeds are rubbery, some are cool to the touch... One also needs to feel roots letting go before they break, literally feeling root hairs breaking and a taproot elongating before adding removal tension. Gloves are expensive, yet they are a necessity for setting rock, welding, burning, handling chemicals, concrete work, or handling a chainsaw. Geier elk skin gloves (1) are excellent as an all purpose work glove**:** supple after getting wet and drying, they fit well, and are very tough, but expensive at $60. Kevlar gloves for work with saws (2) are improving considerably in value and performance. Heat-resistant silicone/aramid gloves (3) are a big help when burning, but that is a commodity market too fluid to have a preferred brand.

Shoes and boots encompass several very difficult design problems, starting with good traction and ankle support on steep slopes, both on slippery dry leaves or in mud. That requires both surface grip and particularly hard sharp edges. Yet one also does not want to be tracking mud full of weed seeds from place to place, which requires letting the mud go, except that lug-soles grab mud for traction. It is the friction *within* the mud that provides the grip anyway but mud does slip more easily under shear in a plane while a texture would be unlikely to last long. I save the lug soled boots for logging and steep terrain.

One does not want welts or a lace up front, because they gather mud and weed seeds too. Lugs, welts, and laced tongues also leak water and make boots hard to clean, but bonded soles just don't last. Leather works while synthetics can't take abrasion. Boots also need to withstand heat of burning, which is really hard on leather. Boots need to fit tightly well up the leg to provide ankle support on rough terrain which laces obviously facilitate but I also get to kneel and crawl, thus requiring flexibility (velcro does not last). As of now, Redwing® "Irish Setter" boots are for everyday work, Rockport walking shoes for weeding on easy terrain, and Wesco® logging boots ($400-600) for tree work and steep slopes when wet, but used only when necessary and oiled as required they last 10 years.

Then there are laces, and this is the most inexcusable problem in the industry. Laces gather abrasive dirt cutting at soft brass eyelets. Skinny nylon laces cut notches into and eventually through the eyelets, shredding the lace immediately and quickly destroying the whole boot. The historic remedy has been to insert a screwdriver in the eyelet and turn it so that the lace can work on a fresh surface. This can be done 2-3 times. By that time the boots need to be resoled and the eyelets replaced. There is no excuse for any of this. Fat laces are better in every respect (they hold knots better too), but are hard to find in long lengths and are usually made of poor materials. Mercury+Maia Honey Badger Laces w/Kevlar solve all of those problems. Why boot manufacturers don't seem to get it is beyond me.

For rainwear I have settled on Frogg Toggs® (above). They keep you reasonably dry without too much sweat buildup. An amazing material, they are light, drain and dry quickly, inexpensive and easy to pack. They are flimsy but last one to two years, which is fine for the price. I do wish they had reinforced knees and at least a couple of pockets. DO NOT get them near heat while burning; the rate at which they melt one might as well be wearing wax. Expensive Goretex® rain gear doesn't work when it gets dirty, and doesn't vent, clean, or breathe as well as the manufacturers claim. Unless standing in water, just oil regular leather boots instead of rubber.

Ishi, the last of his family

Tools are the difference between civilization and clawing our fingers in the dust barely to survive. Yet our dependence upon them actually puts us at risk, for it is obvious how fragile civilization is. Tools provide comforts, or they can destroy. The difference is in how we use them.

As was suggested in the site history chapter, it is my goal to see the nascence of a new society in parallel with agro urban civilization, a mobile, light impact society dedicated to restoring and maintaining the land around us**:** thinning forests, controlling weeds, processing water, food, and waste, hunting, propagating natives, running animals, doing research and analytical work, refining tools… Why? Who is going to do such work and raise their families without living in the reasonable comfort and safety only tools can provide? The dual requirements of civilized comfort, information systems, ruggedness, and low impact portability is a very difficult engineering challenge, a need for tool development the like of which humans have never seen, embracing technology for a better future both for ourselves and the life of the planet, one that portends a social transformation capable of bringing the human race to express its potential in learning to foster life.

This chapter started as almost a throwaway but for the fact that my dissatisfactions with available tools were so many and so deep. Strangely, it took longer to revise than any I have yet written. The reason was that the tools and infrastructure kept changing while writing it. What I didn't realize was how many had been bought and modified over the years and how broad is the scope of things needed to get this job done and how many remain so terribly deficient for my purposes. To confront the list was almost scary. Creating places for every thing to turn a garage into a functional shop, such that work can be done in an organized and safe way, forced that observation. And here, there is one more thing about tools, and this involves the most important tools at work here.

In about 2014, I got a cold, the first I'd had in ages. I was sneezing blood, I had sensations of numbness, my head was foggy… it was terrible. Almost immediately thereafter, I started having pain in both hands. In only a few weeks, it got to the point that I couldn't button the cuffs on my shirts.

Now, please think about what that means for a guy who made a multi-decade commitment that entails hand pulling a million weeds a year. It's a lot of pain, every day, all day. So after a few months of rapid degeneration, I did the only logical thing I had left. I prayed. Within minutes I was at the computer (hitting the space bar hurt too) and learned that arthritis can have bacterial or viral causes. Now, I know that an infection isn't entirely at the root of my problem, but I also know that, if there are inexpensive ways to reduce the number of insults to the system, then one should attack those within reach. Within weeks of dosing a sublingual colloidal silver suspension, the pain was subsiding. I was back to full capacity in about a year.

Then I went to doctors because I wanted some idea of how much irreversible damage had been done. They refused to do any diagnostic work, not even an x-ray, because my symptoms were more or less abated. Really?

To reduce the cost, I bought one of those kits to make my own ionic silver, but I didn't like the lack of quantitative dosage feedback such a method entailed. So in 2017, I decided to get "scientific" about the process, ramping up the dosage on carefully timed batches and was soon in pain again. This time I had changed physicians to one that would actually work with me. She agreed to take x-rays. The diagnosis came in as diffuse osteoarthritis. I was not in the least surprised. So I'm trying every treatment known to mitigate inflammation (including the still-effective colloidal silver at higher dosage) and am getting some positive benefit out of it all, but at this point all I can say is, "We'll see." The land can't afford to lose these tools.

Tools and equipment are necessary to sustain the fossil in charge. After decades of touting the maxim, “Why work out when you can work outside?“ unfortunately, I don’t just go out and climb a tree anymore; I have to work up to it. That takes tools too. And this brings me up to yet another peeve**:** the “post-industrial economy,” a term of elitist wishful thinking, telling “all of you” to expect less. There isn’t any less “industry” in the world now than at any time in history. Mechanization has made work different, but that doesn’t mean we rely upon industry any less; if anything, we are more dependent upon manufacturing than ever. People get more done with tools, and if this book has taught you anything, it’s that tools are key to all that needs doing. That means jobs for people who research, design, test, make, sell, ship, and service tools for land restoration and management. Let’s make it happen!

Other Books by Mark Edward Vande Pol

Quick Read Picture Books

Range Management

Zion National Park

Canyonlands National Park

Deseret Ranch

Fuels Management, Succession Run Amok

The Cone Fire (the benefits of active forestry)

The Warm Fire (what happens without it)

Fire Aftermath: Mesa Verde National Park (weeds)

The Croy and Summit Fires (the wildland urban interface)

Socio-Ecological Paradigms

Environmental Consequences

Meadow Encroachment in Yosemite Valley

Why we can't accept how the original forest as it once was got that way

Living Sheepishly

Why we need a culture of animal husbandry

Sustained Development

Cities are becoming prisons

Katrina: What Did You Expect?

Environmental bureaucracy can be deadly

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

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

Articles at Wildergarten Press: collected writings on Constitutional history and regulatory racketeering by tax-exempt "charitable" foundations. http://www.wildergarten.com/wp_pages/articles.html

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