

# TOOLS FOR A TRADE

Land restoration is a professional discipline, like any other. Firefighters have specialized equipment; so do gardeners, backpackers, loggers, tree trimmers, rock climbers, and hunters, not to mention a scientist taking data. None do all of them at once, which is what I do and then some upon occasion. I would like to offer that it is time to see specialized equipment for this type of work. It would not take much in the way of changes to make a very big difference in my work. Most of these suggestions would improve these products in general.

Who is going to design 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 that 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 now.

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 of these products do not exist. Variations of them work fine by themselves, but not when using them together.

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. 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 I might need to combine them in various ways, carrying them simultaneously. The more there are, the more difficult that gets.

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 isn't or there are regulatory or liability hurdles precluding me from even showing you what I did.



# WILDERGARTEN 4.5

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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.

Revision History [1.0](#) [2.0](#) [3.0](#) [3.1](#) [3.2](#) [3.3](#) [3.4](#) [3.5](#) [4.0](#) [4.1](#) [4.5](#)

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

[Articles at Wildergarten Press](#): collected writings on Constitutional history and regulatory racketeering by tax-exempt “charitable” foundations

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We'll start with my old flatbed dump truck, one of my most important tools. This is a 1969 W-200  $\frac{3}{4}$  Ton Dodge Power Wagon. I've had it for as long as we've had the property (thank you Don Scheel for finding it). There is a power takeoff to a hydraulic pump that runs the dump. It gives me a lot of reliable utility for a \$1,500 truck, and with no smog requirement. In return, I change the oil and lube it annually.



Some may wonder why I don't have a winch. I have enough roads that I prefer to yard logs on a cable snatch-block in a tree and drive the truck down a road. By comparison, winches are slow and limited by battery capacity. Winch cables take a beating. This method does take a bit of extra planning, but handles some fairly large material.



A winch won't load logs into the truck. This half-ton crane will.





In this configuration, Homer is set up to transport the piles of chips fly-by-night tree companies occasionally dump on the 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 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-open float-switch in the tank to shut off the pump if the tank is nearly empty so that the pump won't run dry and kill its 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 anywhere near a 1-1/2" hose outlet. 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.



3psi spring check

Air Vent  
when filling

Water inlet and  
discharge valve

Strap  
retains  
tank

Compressor

This watering system works on a different principle. The tank is an antique water heater that holds about 30-35 gallons. I fill it at the **discharge valve** from a garden hose until it comes out the upper **vent** on the end. Close the **vent** and it keeps filling until the pressure reaches equilibrium. Then I close the upper valve, 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 in series to protect the compressor from back-streaming water (I'll probably add a drain trap). This is a great setup to have around when burning piles of brush in the winter, as one can still load the truck with cuttings and dump it with the tank installed and operational. It is also good for root-watering plantings over the first critical summer. The sheet-metal compressor mounting enclosure protects it from tire splash.







The most commonly used tool here is a weed bag. It must be big enough, cheap, tough, and not get in the way. The best bag material so far is for certain dog foods. They are tough enough to last a year; small twigs cannot penetrate them. They have a slick surface to empty quick and clean. I don't ever want to need two hands for any use of this bag; it must stay open carrying it one-handed. So I added this 1/8" polyethylene rim. I need to be able to attach it to my tool belt but 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 and a convolution that precludes shearing it off will work, but still need a better way to attach the bag without tearing it in use. A custom extrusion would make it easy.

For now, I staple it to the polyethylene ring, made a dysfunctional hook for the belt, and accept the staples stabbing my fingers.



I have bought scads of weed forks because I keep losing them (because of the lack of a decent holstering system). No one makes one that is ideal; I modify those I *can* buy and they're still not completely acceptable. The fork at the top is simply a cynical piece of crap I bought because it was such a stellar example. 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 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 surface 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 higher probability of more seed. 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).



If I discover a weed I missed before it bred, I flag it and mark on the flag the radius over which I suspect most of the seed spread. This takes flags, a way to carry them that isn't problematic, and easy access to a permanent marker with ink that can withstand two year's worth of sunlight, minimum. There are very few flags whose materials last that long. The only easily visible colors that last are blue or yellow. Nobody makes a flag scabbard. The markers are hard to come by but Amazon has them.

Did I tell you there was a problem with tools?

This flag is to remind me to spray a pre-emergence herbicide for *Poa annua* (Pa) in a diameter of two feet around the flag. Soon, GPS will 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?

The information to be written on the flag is obviously based upon botanical information that is not commonly available or understood. Can **you** recognize any weed you might encounter? Would you like to know about plants? Only once you know what it is, can you get the data, but by the time you've learned that much, then you probably don't need it, but it is online and accessible on your smart phone! [CalFlora.org](http://CalFlora.org) does a good job of showing location information, but nothing behavioral. 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 for a small fee? Sounds like a business plan, doesn't it?





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 a half dozen 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. Yet the tools for growing food, that to this day includes hand weeding, 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 for what kind of people? After all, identifying 241 native species from 130 exotics in their juvenile states is a job for valueless and uneducated grunts, right?

This backpack sprayer by Field King® is the best I have used, which isn't saying much. It carries four gallons and provides continuous agitation, which is important when spraying a high-solids mixture like pre-emergence oryzalin. 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 produces higher exit velocity at the nozzle and therefore higher drag against the air, therefore higher shear within the fluid, breaking it into smaller droplets. Small droplets disperse and penetrate farther into a shrub and stick better than larger droplets. The trade-off is that smaller droplets tend to drift, potentially harming non-target species. Lower pressure produces larger droplets which go where they are directed, but they also tend to splatter, run off, and thus lose 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. I am not crazy about the O-ring that seals the bottom of the tank when the O-ring cracks and leaks down mine. Nor am I fond of the steel screws they use inside that rust (should be stainless).

For better control, xanthan gum (a non-toxic polysaccharide thickener) is highly thixotropic in shear but not in ligament extension. Thus, xanthan gum improves droplet control by increasing the range of droplet sizes over a wide range of pressures without increasing drift. Of course, I know this because I used xanthan gum in a formulation for an industrial process requiring minimal drift sprayed upon a hypoallergenic medical device used in direct contact with human skin. I could never use it for spraying herbicides because the USDA and the EPA have not approved it for that use. Instead, I must buy expensive additives specifically for herbicides from chemical companies, thanks to the same lawyer-environmentalists who banned relatively harmless DDT in favor of far more toxic organophosphates just when Geigy's 1940 patent on DDT expired. Good thing they're protecting us! What a racket.



There are weeds one cannot reasonably control by pulling (*Oxalis pes-caprae*, Vinca major, kudzu, or English Ivy being stellar examples). There are also weeds so nasty that pulling them is hazardous (spiny cocklebur), or let's say patches where there are too many tiny weeds to pull in the amount of time available and because of the amount of seed they produce, all one can reasonably do is to stop them from breeding (we talked in the section on *Pestilence* about the need for speed).

One can't lug a backpack sprayer everywhere when weeding and the correct herbicide varies with the weed species anyway. Moreover, once one has reasonable control of the property, a full backpack sprayer is simply unneeded and requires mixing too much material. Meanwhile the ideal treatments vary by the species one encounters but the relative numbers of each are not always predictable. That means one needs 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 where they all are and find them.

Can you carry three one-quart squirt bottles into which you can re-insert the bottle without looking and keep it on your backside tool-belt while you are bent over without the holster breaking or leaking chemicals down your butt? Nobody makes that holster either. This one does almost all of that.

The tool belt this hangs from is awesome. It is very secure, keeps things from slipping, very comfortable and easy to manage. The buckle rivets are wimpy.



All that whining brings us to the most offending tool of the bunch, the lowly, but crucial squirt-bottle, and lowly it is indeed. Nobody makes a decent, all-position, and chemical-tolerant spray bottle with a controllable full-cone nozzle that doesn't lose suction efficiency or leak at the shaft and a quick no-drip filling system from a jug. Nobody. For a long time I couldn't find one that fulfilled even one of those specifications.

I have 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 spray pattern, thus putting the material everywhere but where one is aiming it! I ended going back to the old Zep soap squirt bottles, because they were cheap and had a full-cone pattern for the spray. They fail quickly.

Finally I came across [these unassuming bottles from Taiwan](#) on Amazon. They still produce a hollow-cone pattern spraying a doughnut pattern, but at least they work. They last at least a year. They do produce a very fine spray. They don't leak. The adjustment at the coarse end is a bit touchy but that does make it quick to change settings in the field, although there can be some material loss in getting it right. It still needs the weighted, flexible, and filtered pickup for all-position spraying. I would pay more for the spray heads to come in colors or have an easy and durable way to mark them for what is inside.

I want a separate filling system, either with the bottle having a separate cap and vent so that I wouldn't have to pull the spray core and drip all over or wait for the funnel to drain while pouring from a 2-1/2 gallon jug, or a screw on cap for the jug with a pump similar to a lotion bottle that shoots 4-8oz per stroke out a tube that inserts into said inlet on the squirt bottle. A plug-in to the spray head would be neat but expensive and tricky to do.

Farther "out there," what about a backpack sprayer that one could carry loaded with water and a few vials (or bags) of concentrates 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 upon which we depend to care for the landscape upon which we rely to sustain life are in the stone ages, in my opinion because of class-ism. There is a need to develop spray equipment with great flexibility and accuracy, and also with minimal waste, overspray, and cleanup toxicity.





One would think this product should be a no-brainer but it is not because of regulatory design considerations, *some* of which actually do relate to human health and safety. Here again, we can thank the lawyers for part of the problem: This is a squeeze bottle. Until I can get something better, this is what I use to dispense herbicides 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 *rated* by some helpful bureaucracy for herbicide dispensing; 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 nothing yet.

The big deal is the cap, how well it seals, and whether any of the material escapes its intended use. You see, 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 permitted. 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, a spout of sorts that keeps the valve away from human contact and 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.

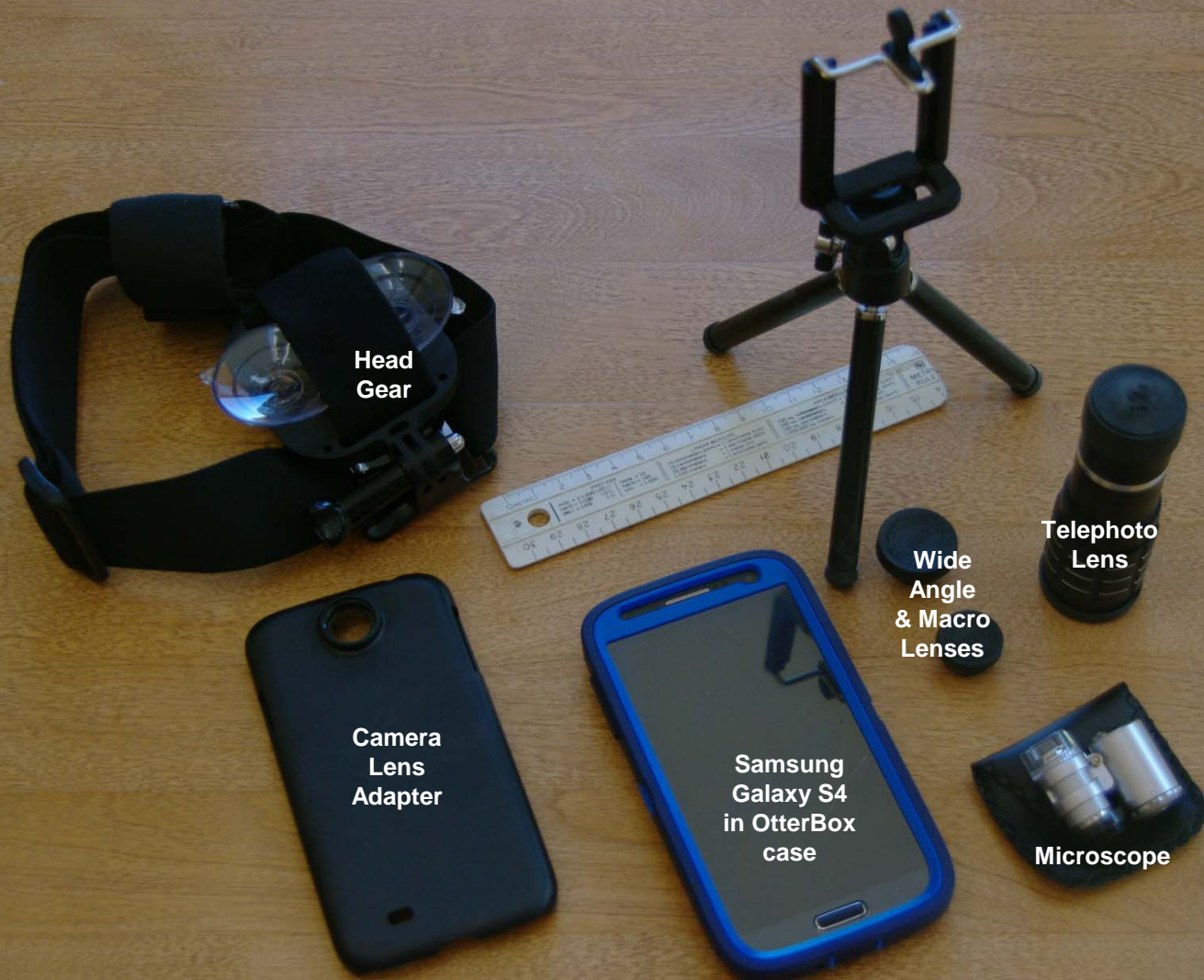
Guess why I can’t buy an herbicide dispenser that I can carry in my thigh pack with the removable, washable, and replaceable plastic sleeve it doesn’t have as “secondary containment”? Yes, this is actually a nasty design problem, one so integrated that it is very difficult to get done because no one company is qualified to do it all, nor would the volume in any one product easily justify a special production run.







Do you want to die while you are weeding? No? Well, the same problems apply when I must wear a firearm for dealing with coyotes or mountain lions and soon wolves and grizzly bears while carrying all the rest of that equipment, thanks to those hired thugs shilling for the major stockholders of massive corporations at the Center for Biological Diversity (and if you think they don't represent big corporations, just what do you think AOL/Time Warner, Sunoco, Citgo, BP, Shell, or Exxon/Mobil are)? Given the crawling and scooting 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. So far, 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. Ideally, the holster would be integrated with a backpack water bag.



Head Gear

Telephoto Lens

Wide Angle & Macro Lenses

Camera Lens Adapter

Samsung Galaxy S4 in OtterBox case

Microscope



This is a pending revolution in this profession. I did not take up “smart phones” until they were rugged enough to survive the treatment I would give them. This a Samsung S4<sup>®</sup>, which was free for the testing. It has voice recognition to take notes and a 13MP camera of poor quality. There is even a way to link GPS data *and* voice-dictated notes to photos but it is very klunky. One can *also* buy attachments for the S4: macro and telephoto lenses and even a tripod with which to video a particular technique, although they are not of good quality. The tripod is too short while a longer monopod with a soil stake or clamp would be better anyway. Amazingly, there is even a microscope attachment with a light (!!!) but without a way to hold what one is scoping (\*@%#\$&%). Unfortunately, while the OtterBox<sup>®</sup> case is fine for protecting the phone, it cannot accommodate the lenses, meaning that one must remove said case that protects the phone to use the lenses. 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.<sup>®</sup> Together, that makes it almost the system I need.



Until the revolution, I still need to be able to take a decent photograph without having to lug the bulky (and now 9-year old) SLR. For that I have settled on this Nikon Coolpix P7800. This is almost a great camera; the optics are wonderful; the ISO range is spectacular. It takes great macros. I wish there were more MPs, but I do understand the tradeoffs between noise, speed, and resolution. It suffers from several deficiencies that would cost very little to fix. Most egregious: There is no eyecup, nor is there a dovetail slide for a standard Nikon eyecup. This is just silly. It wouldn't have cost \$0.10 to add to the casting. It is very hard to see well into the viewfinder in daylight with glasses without one. I ended up filing out a Pentax eyecup to fit and glued it on with silicone, as the camera was unusable without it. Second, Nikon should offer an elastomeric tulip hood that snaps onto the a 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 exposure offset is fantastic, but it 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 manually located. If one is going to all the trouble to offer a digital zoom in manual focus mode, I can understand using an inset to keep the image properly framed, but why not allow the user to control the degree of magnification with the master thumbwheel? Other than all that, it was a very good buy.

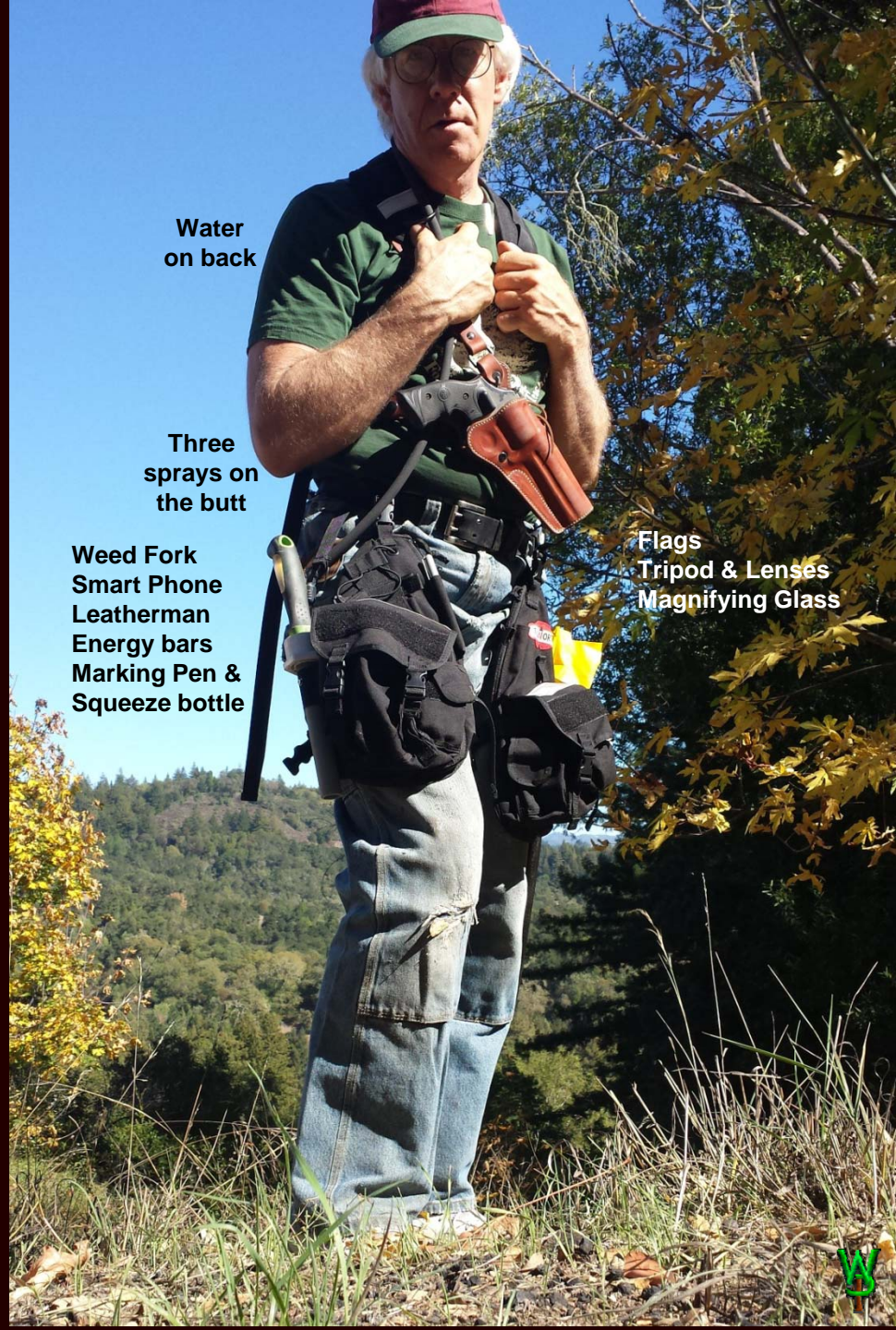
So, I must carry a weed-fork, squirt-bottles of three herbicides, notes, flags, a marking pen, weed bag, tool kit, a camera with telephoto and wide angle lenses, tripod, Internet access, a database, a personal protection projectile acceleration device, food, and water, each of which requires rapid access and distributed weight because speed and fatigue are everything.

These TrueNorth® “thigh packs” are a key step toward solving that integration problem, but their designs are tailored for wildland firefighting, search, and rescue, and less for land management. It is an exceptionally well-made product line but the system does have its faults for my purposes. I have asked the manufacturer to adapt the Lynx® watering system they make to the shoulder harness supplied with the thigh packs when they are worn over the chest (the AeroVest®). No reply.

I added a scabbard into which I can insert the weed fork quickly but it needs a bigger funnel to insert without looking. If the bags had a pocket with padded dividers for lenses that would help. An attachment for a weed bag would be awesome. A simple curled rubber hose works for a flag scabbard. Maybe they’ll listen. If not, I’ll do it myself.

I must make these modifications 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, the company 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. As an engineer, the fun in tinkering with equipment or brainstorming new ideas and making them happen is why I chose that career. So what you’ll see here consists of tweaks on existing products. I will tell you what I did and how it worked for me (in most cases). What you do with your own equipment and how you apply it is your own responsibility.



**Water  
on back**

**Three  
sprays on  
the butt**

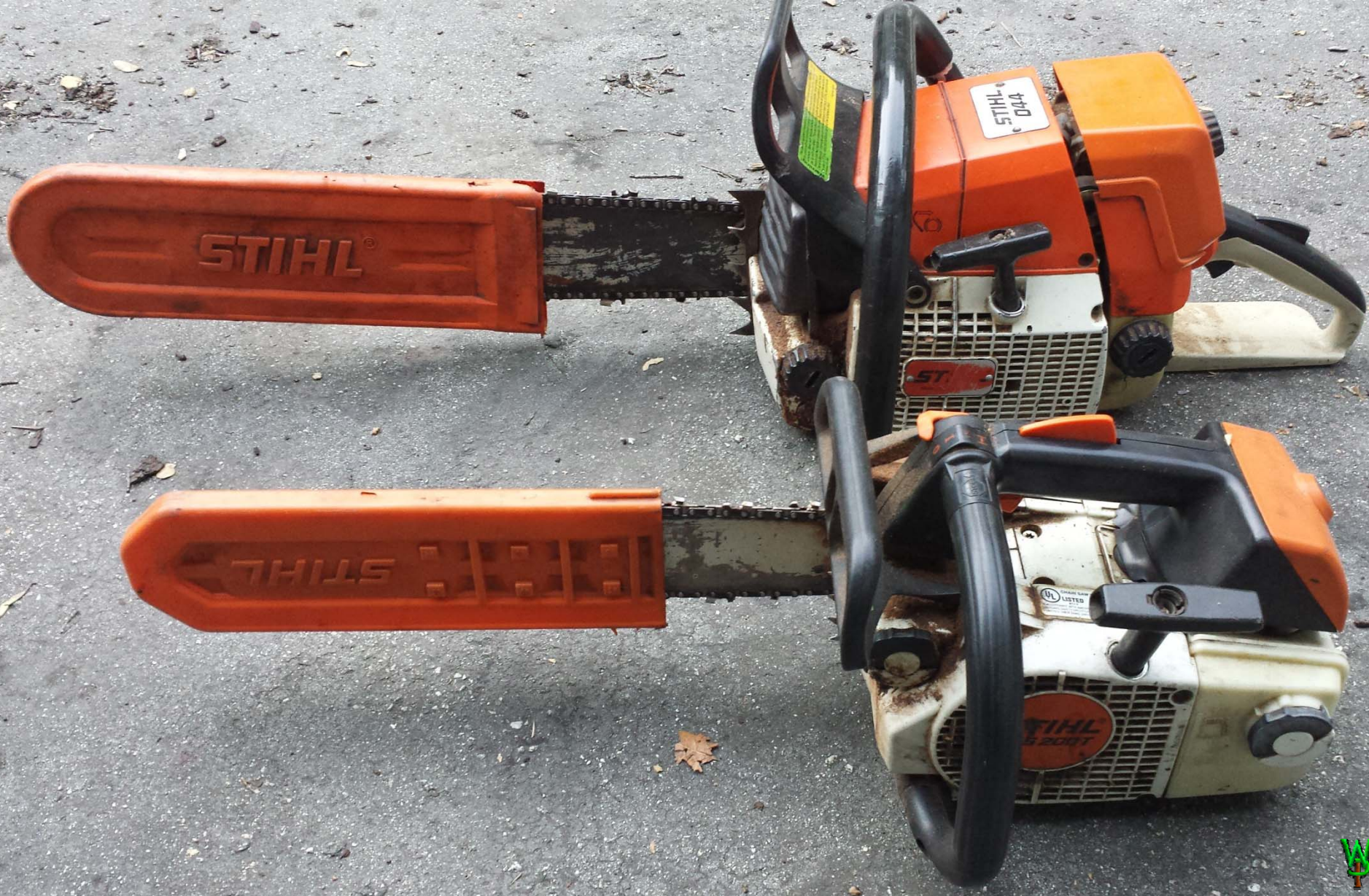
**Weed Fork  
Smart Phone  
Leatherman  
Energy bars  
Marking Pen &  
Squeeze bottle**

**Flags  
Tripod & Lenses  
Magnifying Glass**





These early changes are made with what I have on hand, because I've learned that it is more important to use them a bit and learn about what is needed than to take that extra trip to town to have exactly what I had in mind before trying it. I change my mind too often for that latter practice. Meanwhile, I get the benefit of better tools and time for the next iteration.



For chainsaws, I have two: a Stihl® 044 saw with a 20" bar and RS chisel point chain and 28" and 36" bars with a skip-tooth RS chain for felling . 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 of my two-cycle power equipment, uses unleaded **ethanol-free** 98 octane gas that I purchase from a local petroleum products jobber. At \$10 a gallon, it is very expensive gas, but it is a lot cheaper than the damage ethanol did to the fuel systems on my power equipment. I also have a climbing belt, several flip ropes, wedges, chaps, hard hat, ear protection, etc.



In recognizing two year's worth of thatch I'm wishing I could burn it



For both mowing and brush-cutting I use this Shindaiwa® C-35, 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 money and 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: They remove material like a saw instead of simply slicing the stem like a machete with alternate facing serrations (broom grows from a single stem). No set in the teeth to remove material is necessary as long as one uses the correct technique with the brush cutter, which is to approach the stem from the side of the bush from which it leans, usually downhill. That way, the kerf opens as one strikes the stem, thus producing minimal blade friction. The best blade for this technique **was** the thinnest 9" X 25mm 25pt steel blade Shindaiwa no longer makes. I used to regrind them and file the tips, but alas, no more. 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.



I cannot burn this land every fall like Native Americans because my neighbors own excessive fuel loads and I do not possess sufficient forage or infrastructure to sustain grazing animals, nor can I import them or feed because of weeds. So I try to mow the place just after harvest or after the first fall rain when things are damp enough that the trimmer doesn't start a fire from a spark caused by contact with a rock or loose piece of steel left over from old fences and such. The problem is that small shrubs and tree seedlings can shear off the string. This setup doubles my 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 patch of *Carex barbarae* or wiregrass (*Juncus patens*) with anything less and you'll soon see what I mean. *Carex* responds especially well to mowing.





Of course, one could always go in and take out the trees before mowing. This is the tool I mentioned a few times in the forestry sections that has made such a big difference here. It kills juvenile trees very rapidly with little effort by slicing them below the root crown during the rainy season when the ground is soft. It steps through roots up to 1" in diameter with a cycle time of 3-5 seconds per tree (less if they're smaller; not including walking to the next). 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 do not carry product liability insurance and could not afford to, I am not going to provide design details. If you want one, you'll have to invent one of your own design. Sorry.

I crush charcoal recovered from burning and run it through a ¼” screen. All the crushing processes I have used (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, 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 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. Hence, there is a fundamental choice to be made in designing a process: Either the mill/grinder must be capable of chewing up everything that goes in OR it must be possible to segregate those hard materials first 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 suffer no damage at all from the process. So perhaps a 70-80 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 will total 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.



As to boots, again, nobody makes anything even close to what is needed, and this is one very difficult design problem. One needs 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. 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 cleats and lugs grab mud for traction. I've thought of playing with coatings, as it is the friction *within* the mud that provides the grip anyway. One does not want welts, or a lace up front, because they gather mud and weed seeds too. Lugs, welts, and laced tongues make the boots hard to clean. On the other hand, they need to fit tightly well up the leg for dealing with rough terrain which laces obviously facilitate. I have worn synthetics as well as leather and the synthetics do not take the abrasion. They also need to withstand heat of burning, which is really hard on leather.

Of all the manufactured products upon which I rely, it surprises me that socks are the one product about which I have no complaint. I can't remember how many troubles I had with socks while mountaineering as a young man, but it looks like the manufacturers have fixed every problem. For a hiking liner sock it is hard to beat Point6® crew socks. For a boot sock, Gold Toe men's Powersox® are almost their match. These are rugged, comfortable, rarely slip, don't degrade after washing, and stay that way for years. Both of these products are merino wool, so they are expensive, but they really do last three years.

The best pants I have found are the Riggs Workwear® Men's Utility Jeans. I actually prefer the pocket design on their Ranger Pants which have patch pockets but now that I have the thigh packs those are unnecessary. Unfortunately, for a guy who spends as much time on his knees as I do, the rip-stop material for the Ranger Pants is not sufficiently durable or comfortable as are the Utility Jeans. The rip-stop does breathe better on hot days.

No, not even hats are suitable. I need the equivalent of a breathable shaded mesh top with a 360° ovular brim (not round). The sweat band should wick efficiently, pull out, rinse, wring out clean, reinsert quickly, and last. No, that's not easy to do with skin oil. So I use different hats and wipe the sweat from my eyes. Baseball caps in winter and similar caps but with a flap to protect my neck and ears from summer sun.

For rainwear I rely upon Frog Toggs®. They keep me dry without too much sweat buildup. They are light, inexpensive, and easy to pack. The material is not terribly durable but it usually lasts one to two years, which is acceptable for the price. DO NOT get them near heat while burning.

Finally, there are glasses. I do wear prescription glasses and I am older. Progressive lenses do not work for weeding. I use a prescription that is as high-powered as possible, which is harder on the eyes, but edges are second only to color when picking out tiny weeds from so many natives. As to coatings, the scratch resistant materials such as Crizal® fail instantly if one even gets close to a fire. I have used tints to some positive effect in terms of detecting *some* weeds, in part because non-native plants around here tend to have more of a yellow-green color. The "blue blocker" amber tints tend to band-pass those weeds making them stand out. I then have to learn not to overlook the few weeds that do not share those chrominance properties. The jury is out as to whether using shades helps with detection, but wrap-around shades do help with visual fatigue which is important weeding and especially when spraying. So at this time the bias is toward using them.



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