Feeling Drainage

On the left is that same “wall of wood” I somehow discerned needed thinning. The stream ran in front of them and was starting to undercut their support (you will soon see what happens should that process progress). So now I’m going to show how logging can not only prevent landslides as we have seen, it can (1) help armor the bottom of the channel with impressive native plants *and* (2) it can *reverse* channel erosion that would otherwise undermine the slope above until it fails catastrophically.

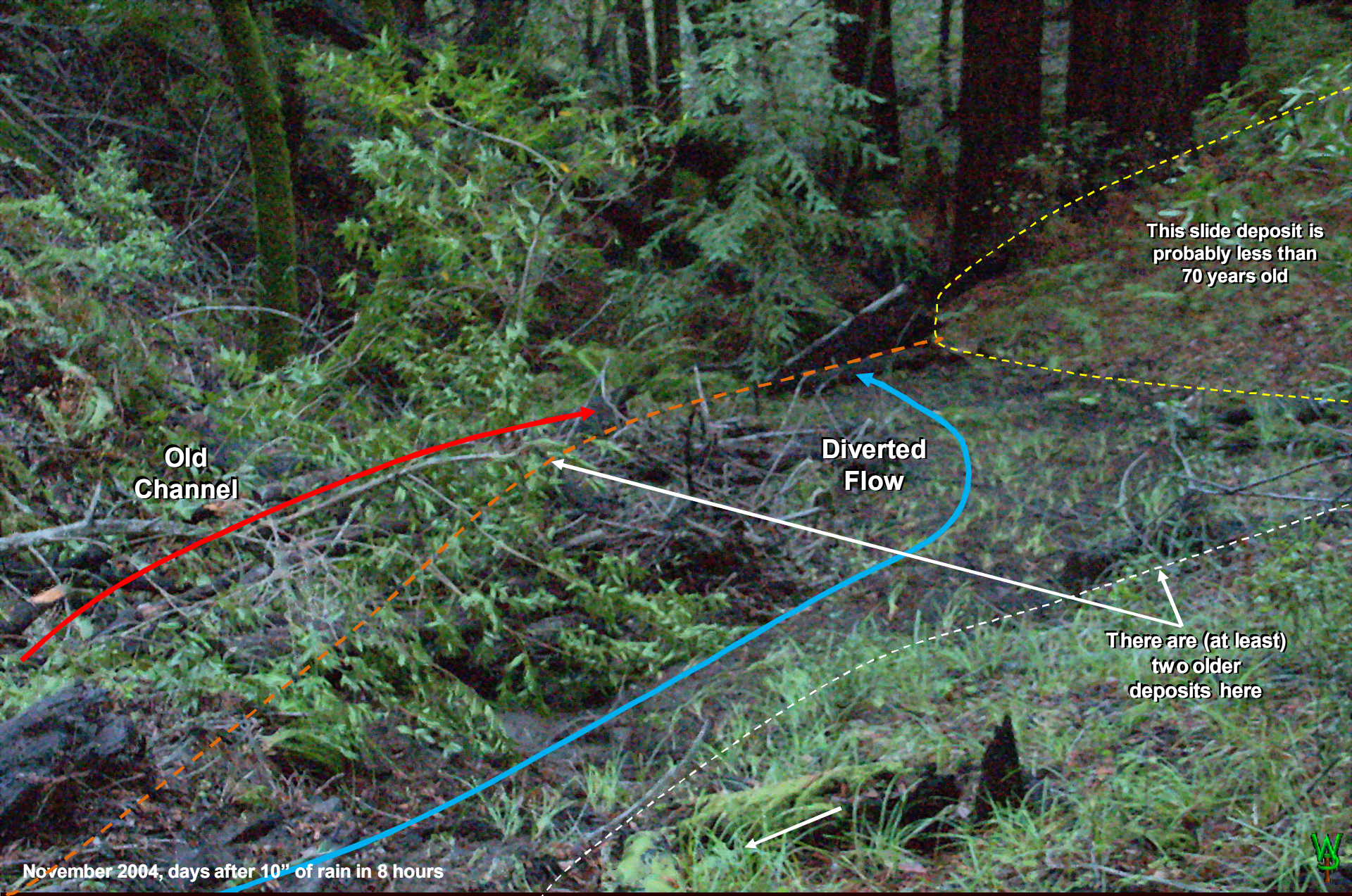
One of the ways in which the environmental industry has driven the timber industry into ruin has been with claims that logging releases sediment into streams, thus harming “endangered" fish (never mind the fact that the fish were more abundant at a time when fishing, timber harvests, grading, and drainage practices were totally unregulated). A logging job surely does release sediment, just as not logging can also do, in a much bigger way. This was one of two spots that taught me what to at least attempt, and why. Can you see it?

Here is the same cluster of redwood trees seen from the other side. It should be fairly obvious that the roots of these trees have inhibited a considerable amount of erosion of the stream bed , also called “channel incision” such as you see below them. What I do here reverses that incision process for reasons we’ll get to soon.

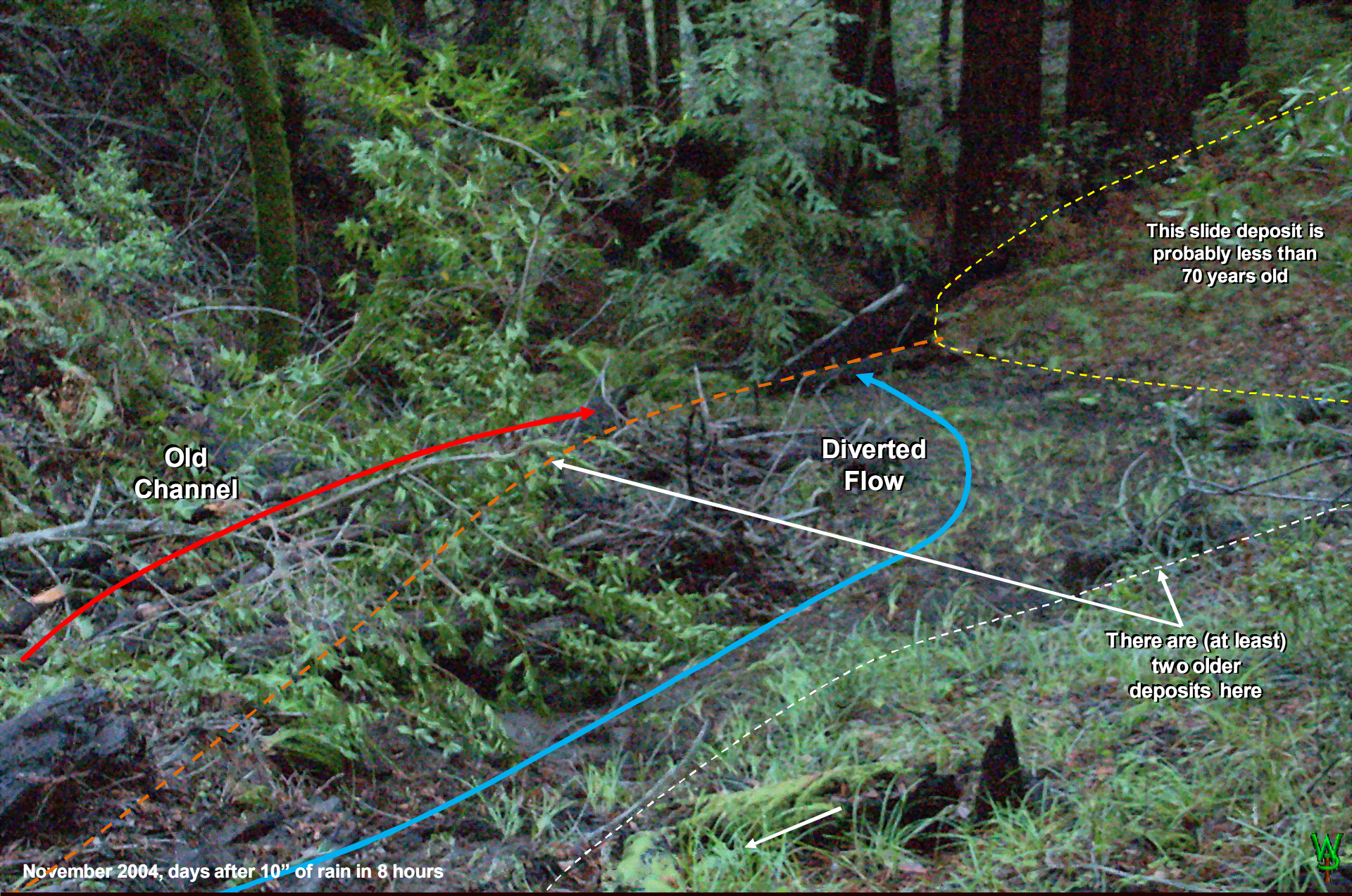
Looking down the channel from the same spot, it isn't hard to see another landslide deposit with trees on top at the lower left. At the top of the draw to the right is a rotational slope failure with a steep headwall. I suspect that the green swath behind the trees is alluvial deposition on top of a colluvial lens. Based upon the stumps I have counted in this area, none of these trees is over 100 years old. Unlike the next draw to the north (TBD), there are no large old stumps. This has probably all happened since it was first logged.

You may remember this image from the repeat photos in the Introduction. The first thing I did to impede channel incision was to cut trees to the right side of this ridge, about 100 feet *above* the channel. Although cutting the bay trees up here was legal (not a timber harvest), it did reduce "stream canopy cover," which could get you fined on a commercial job. The thing is, "How much shade is the right amount?" It turns out that when it comes to canopy cover, sometimes more is worse.

This location is just downstream of the cluster of redwoods two slides prior and below the ridge on the prior slide. Thinning the trees up above allowed sunlight to stimulate the growth of Santa Barbara Sedge down here. Once it was established, I bucked this log bridging the stream (red arrow) such that it would deflect the flow to the right over the top of a colluvial deposit, just to see what would happen (I could always part it and send the water back into the original channel). The old channel was incising at the base of a steep slope I wanted to stabilize. I knew that if the slope failed, the water would go over the colluvium and carry away a considerable amount of sediment anyway. This dead madrone had gone down by itself, and I wish I'd cut it first as the root ball tore a heck of a hole out of the side of the hill (one of those things I just didn't get to in time). Turns out, I was just in time…



What came that October was the most intense rain event in decades. Ironically, we were in Santa Barbara; there was nothing I could do. This was major. The flow blew out leafy duff 6” deep and 10 feet wide within 50 feet of the highest ridgeline. The leaves plugged every culvert and sent the drainage flow out of the main channel and into this one (every major drainage system on this property has an alternative backup). The combined flow of water, ten feet wide, boiled right over the Santa Barbara sedge with no damage at all.



If you look carefully, in the background you'll note that the toe of the slide is cut off. The bulk of it rises above the plane upstream. That suggests there was once a "lake" behind the "dam" until it blew out (probably immediately) with the nose of that slide dumping quite a load into the stream and weeping more for some years. Correspondingly, the area immediately below this stand is nearly flat. There is a very interesting reason why this slope went no farther, staying stable long enough for the trees to grow on it.

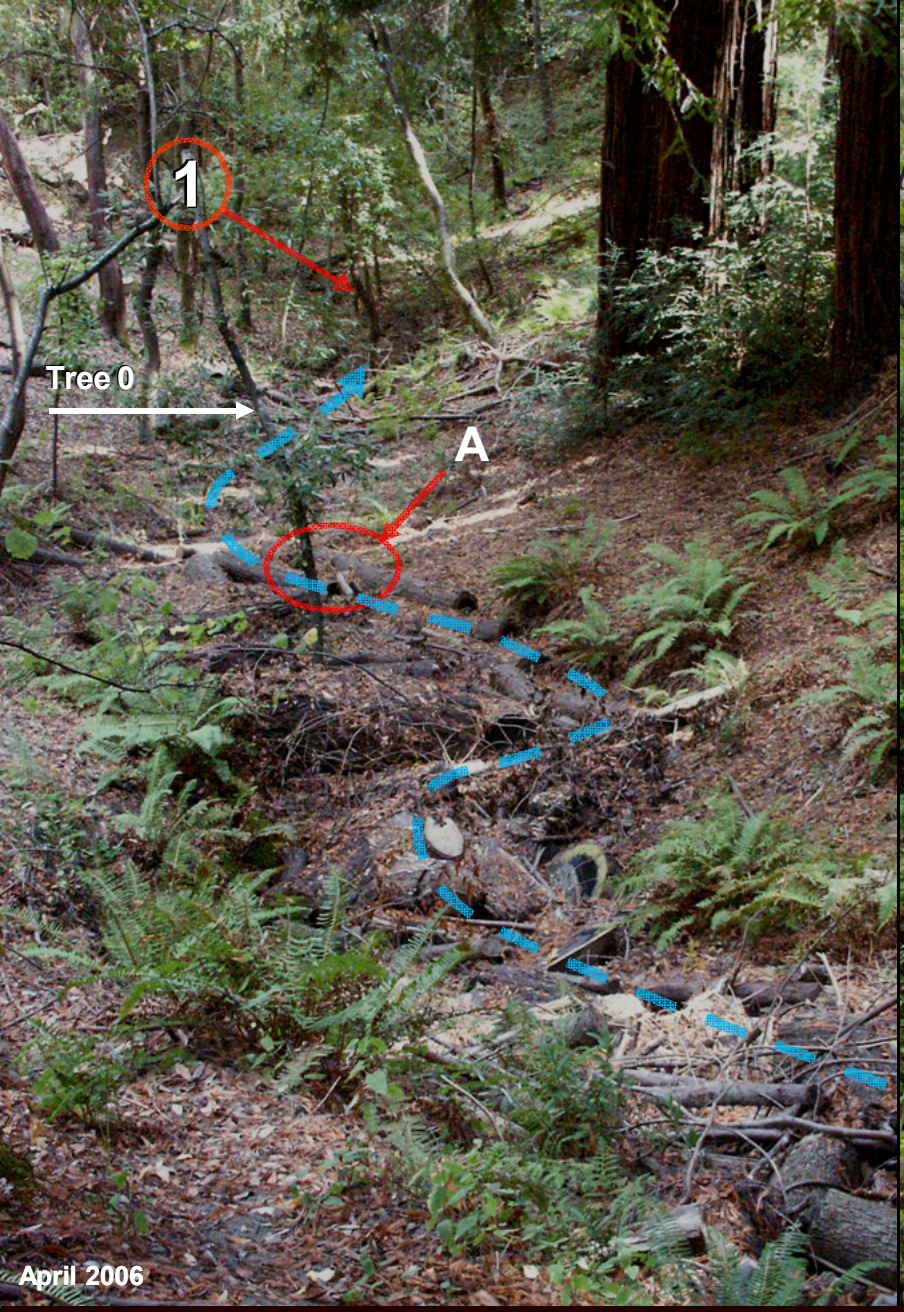
Here is the other 'thing that taught me what to do,' and it is what shaped the toe of that slide. This log is *underneath* the landslide with the trees sitting on top. It is one very substantial log. It was cut by a saw on one end, so it is impossible for the slide to be over 150 years old. From the size of the trees, my guess is that it has been here about 90 years. If the Vaquero sandstone substrate is relatively uniform, it may be that wood has been *the* critical factor in defining channel shape and distribution in this region. Once the channels start, they tend to keep cutting in the same location, unless there is faulting or somebody does something, as we shall see.

All I am doing here is taking the principle one step farther to reverse channel incision. Most people would never guess that reducing canopy cover has anything to do with that goal, but then, most people do not understand how powerful sedges can be in managing erosion. As to the risk of a debris flow, there is a big flat area just below the outlet to this stand for the water to fan out and lose energy.

Here it is after five years of winter rains and just after another monster storm. If you look carefully, you'll see not erosion but *deposition* of sediment in the foreground at the head of the diversion. That material is from all over our property, from the my neighbor across the road, various stumps from fallen trees, etc, but probably the biggest source is gophers, ground squirrels, moles, and rabbits. I use that material to stabilize the draw over time, as you will see in our next example in the next channel just to the north.

All those tiny sources add up to a fair bit of sediment once lost off the property every year. So, I decided to solve a problem with it. This photo was taken six years after my original redwood 'logging job' in 2000. These interlocked structures of left-over logs form stepped weirs with vertical drops and slow runs that trapped sediment. There are raised sidewalls to contain the flow. The sediment has almost completely filled a channel 6-8 feet wide and 2-4 feet deep. Note the circled structure “A” for reference from slide to slide.

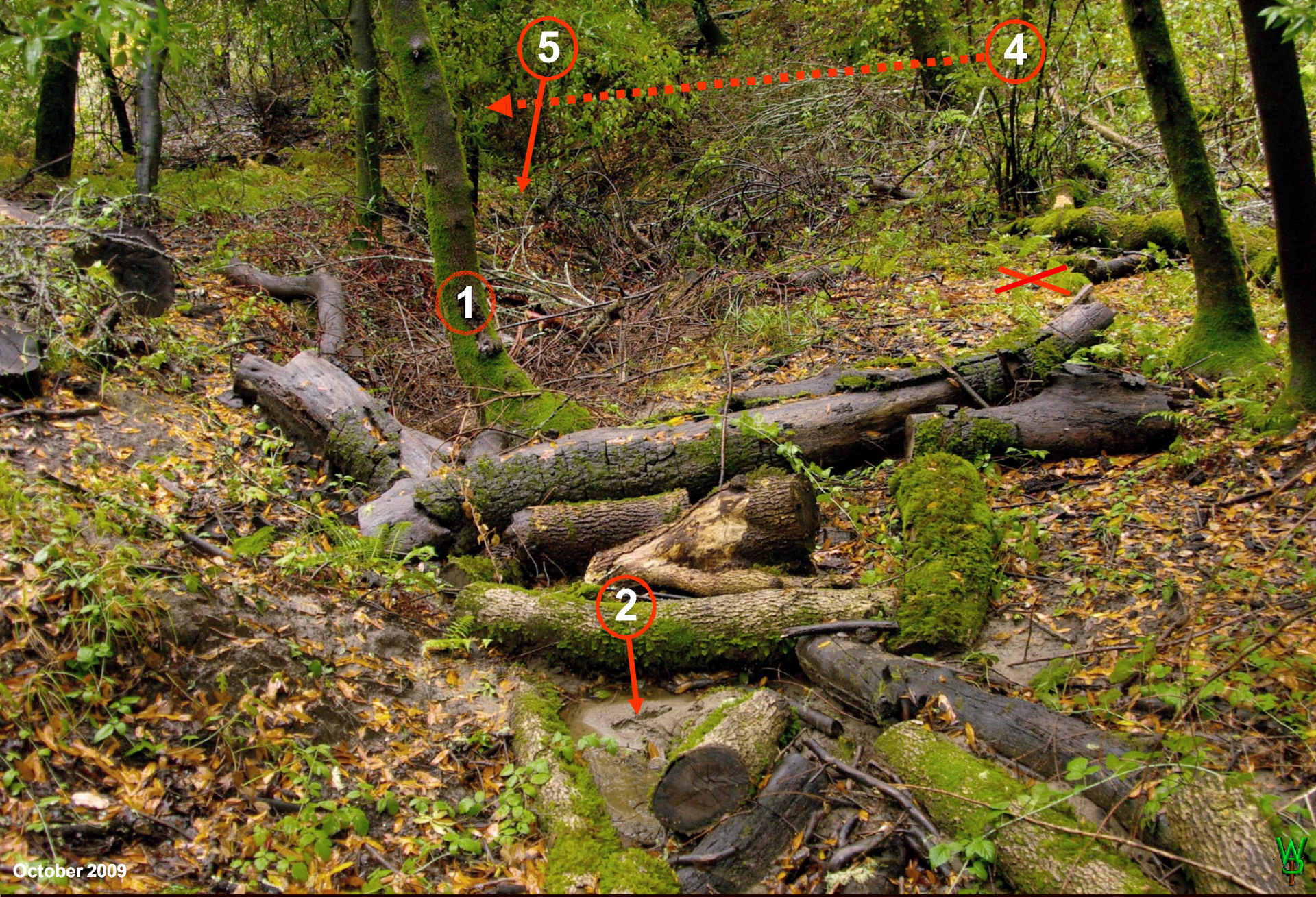
This is the same channel three yeas later from a little wider view. Logging made the material to line the bed and collect the annual deposition. Logging thinned the slopes so that light could reach the canyon bottom to stimulate the vegetation. It's working, but more thinning is needed for the sedges to really take. More sediment will help too. Note "Tree 0" with the white arrow for location.



From above, L+6, same channel. This year, I thinned bay trees above the left background and put more wood into the stream along the dashed line down to the circled tree (1).

Here it is L+9 from a spot just to the right (new vegetation was in the way). Thinning the hillside on the left allowed in a lot more light. The stream bed is still filling in and more plants are taking root.

This is just downstream on the way to that (1) tree, immediately after that 12” deluge in as many hours. The logs are chocked to cause the material to drop. When a section fills in, the water carries the sediment down to the next trap. From this storm, the additional buildup was a maximum of about 3” thick. The trees anchor the system but they make it dark. I want to get the sedges going, so I thinned them a few years later on after this had time to settle and consolidate.



Same day looking downstream. Tree (1) on this photo is the same as that two slides prior. Note deposition beneath the log in the foreground (2). Just beyond the logs, the channel is 4+ feet deep and about 10 ft wide (about what it was when we started). The next photo was taken from the "X" with the camera at (4) looking over the mini-promontory below (5).

Below the property line, the channel now averages fifteen feet wide and 6-8 ft deep, with a secondary embankment two thirds of the way down upon which the tree (5) is sitting. The channel cross section stabilizes from there at about 20-30 ft wide and 10-15 ft deep. What you can't see is the pocket to the left that has probably lost about 60 cubic yards of soil. No thinning, no groundcovers. Without treatment, the incision here will only get worse and the banks will fall in and be carried away.

A valley oak (Q. lobata) had died of old age nearby and in falling took out an old madrone, so I cut up the logs, dropped a couple of bays, and added another layer in 2013. From here on, the material will be redwood if I can afford to thin some of the nearby trees.

But isn't erosion natural? What if I had done nothing? That experiment is easy to find! Let's take a look at the "Natural recovery" of a nearby redwood grove. I did not have to go far looking for this mess in order to make people look bad; it's the first one I found down the road about a mile from our place.

The activists' goal is to ban all logging near seasonal streams 'to prevent release of silt and maintain shade to keep the water cold for endangered coho salmon' (actually introduced). One has to wonder why shade matters so much where there is no summer water. None. The belief is that streams cause logs to fall into the channel and do things similar to what I did artificially on our place. The process is called, "recruitment."

The channel here is 30-40 feet wide and well over 20 feet deep. The culvert in this photo is 24" in diameter (a fairly small flow in these mountains). There is another channel up the road, that was abandoned when this culvert was put in, but it is not nearly so bad (this pipe looks to be about 30 years old). There hasn't been ANY logging here for at least fifty years.

It's shady here, so they've got their canopy cover. As a result, there is no green vegetation. See how the root masses on the left are undercut? As bank erosion causes the walls to collapse under the weight of the trees, they fall in and then hit the opposite bank while still hanging from their roots. They are *bridging* the channel with the water running *underneath* the logs while the stream washes the soil on the root mass away and keeps cutting. The fallen trees do virtually nothing to halt the flow or armor the channel.

This particular spot has unusually gentile average slopes around it for this area, so it is an ideal location for such a trial. Were it at the bottom of a steep canyon, there would be significant risk of undercutting the slopes above the channel, thus destabilizing the hillside into an eventual landslide. So much for "recruitment." Despite the culvert modifying the flow, if this method worked, then the water would eventually slow down and the "Natural" method would start to take effect. Well, it doesn't.

This is about 100' below the culvert outlet, looking downstream. Again, there are no effective groundcovers because it is way too dark. The logs bridge the channel so the stream is still down-cutting beneath them. **This stream bed was not here before the logging.** In fact, this flow was channeled away from a failed culvert into this one long after this area was logged and new trees were well established. This is "preservation," "recruitment," and "canopy protection" at its best. What you see is what you *will* get.

This drainage channel is only about 75 yards long. There isn't any part of it where "recruitment" or dark canopy are working. At right is the bottom of the channel at the lower County road, which effectively limits the cutting by making a hard bottom. Here you see a root wad spanning the bottom of the channel. If "recruitment" was going to work, you would see it here. It did not. The belief that 'Nature can heal anything' underlying the regulations are just as dumb as was fire suppression and for the same reason: Suppress fire and you get catastrophic fire; suppress logging to stop erosion and what you will get is catastrophic landslides into incised channels.

There are other projects on our property designed to reverse or mitigate historic erosion problems.

First some background. In steep sand-"stone" mountains like these, reversing the damage from poor drainage control is a high priority. The slope up the hill had originally been cleared and terraced for said abandoned apple orchard. The resulting incision required repair, else the slope below our house would have been destabilized. The very expensive soils engineers the County required me to hire for our building permit missed the whole thing.

Drainage control projects to reverse historic damage are usually expensive and protracted, especially because bureaucrats, engineers, suppliers, and contractors have colluded on permit specifications without any other public input. Hence, the usual homeowner response is to do nothing while the consequences grow, a mechanism that has wrecked havoc compared to timber harvests.

In this project, I collected surface water into the rock lined stream to preclude rilling in a manner similar to engineering designs over the last 100 years except that this slope was shaped like a watershed with benches mimicking lateral tributaries. It does require monitoring for damage from gophers and ground squirrels just as "natural" slopes also do.

The plastic was stapled to battens, rolled around them, and either screwed to timbers or to steel stakes. This tarp system has survived 50mph winds undamaged, a design that could allow work to be done in the dead of winter between deluges when the soil is damp enough for good compaction. So far after nine years, no problems and no maintenance other than clearing the channel annually of tree branches and other plant debris.

In parts of this project I used the equivalent of a half-sack mix of cement in the soil to reinforce the structure to simulate the attributes of the parent rock and withstand tunneling by ground-squirrels without caving in. It is steep here. Interestingly, the grasses seem to prefer this cemented fill compared to the parent material.

The slope is steeper than it looks. The extra dirt was brought down in buckets. Footing was treacherous.

The hand-tamping marks on the face are visible. I don't think I'll ever forget slamming that iron plate into it over and over. Day after day, wrestling that thumper out of the way and on top of the pile, starting it up and getting control on a tiny bench like that. This was one heck of a lot of work.

The 5 X 10 rock is set in filter fabric with periodic dams of rocks set into concreted cross ditches about every ten feet. Dry sack concrete was poured into the gaps as a "mortar."

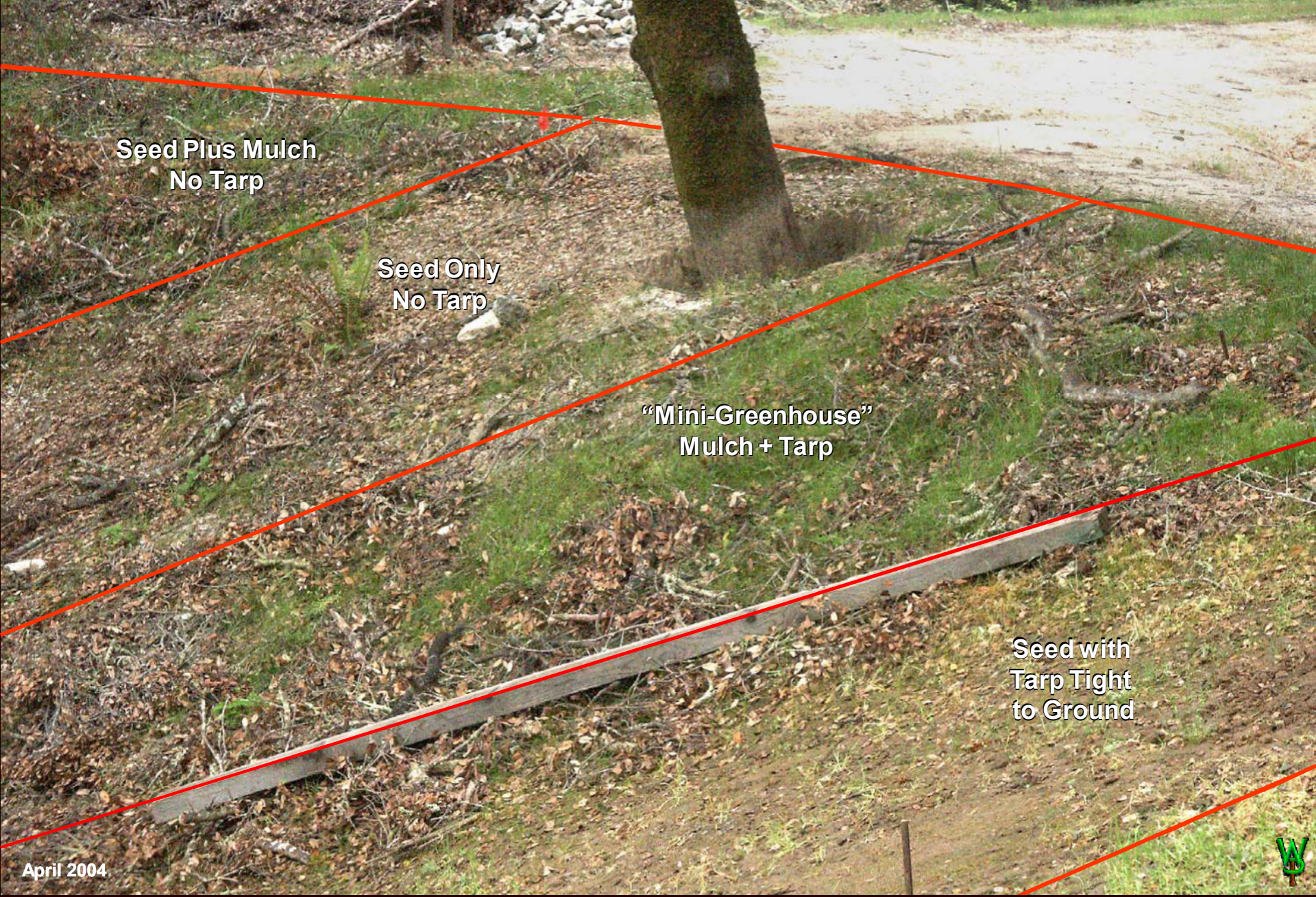
By the time the job was done, that yellow shovel was worn down to the point that the blade had a reversed curve where it had once been pointed. When it finally cracked, I retired it in honor.

Several years prior, I had attended the "Klamath Bucket Brigade" protest in support of the farmers of the Klamath Basin in their struggle to keep their land from the "green" activists pretending to save a bogus suckerfish listing (actually operating as witless agents for developers). There, I had noted a collective memento**: shovels**, all donated by farmers from around the West in support of a similar protest in Jarbridge, NV fighting a road closure. Some of those shovels had been a lot more worn than mine.

I realized at the time how much work it had taken to wear them that far. What I hadn't considered was what the attachment one develops to such a simple tool. You remember the projects that you did with it. Those shovels were princely gifts.

The vegetation on the far side is now native blackberry. So the primary maintenance is keeping it out of the channel so that it won't catch material.

It is steep here. The arrows indicate the alternating benches to catch and redirect sheet wash to the channel.



The plastic was part of an experimental array for revegetation. It was either tight on the surface or held aloft by a "mulch" of chopped tree branches forming mini greenhouses to improve the establishment of the grasses. As long as one doesn't use too much mulch and there is enough moisture getting under the plastic to keep the grasses going, these tarp-houses at least **triple** grass growth.

This drainage farther north is sized to handle the water off the north half of the property. You do not always get your choice of routes for runoff because of the history of how the land was used. In this case, there is a series of old benches of perched fills that once supported various out-buildings. The slope below the road is so steep that if this much water were to go over the outside of those fills, there would be severe damage to the hillside. So I transit the flow above them on a low slope, this area serves as a catchment basin for sediment. About every 10 years, I dig it out; else the water would eventually dump down those erosive fill slopes.

2013 – still under construction

Next

I built this upgrade to that channel to drop the water onto the lower road which acts as a secondary transit and sediment catchment area. The sediment I dug out was packed into what once was a rather ugly eroded hole cut by water diverted around one of the old structures. The bridge is a way to get the sediment out of the place I don't want it to build a larger water-bar in a safe spot that assures the flow will head the right way. Each of these projects deals with that history. They are expensive and time-consuming.