To Aerial Is To Divine

April 1991 – USGS Image AR1VFNW00010094

People see all these trees and probably think it's Natural.

'The trees have always been here; this has always been a forest.'

People are, by Nature, delusional.

Wildergarten 5.3

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 4.6 4.7 5.2 5.3

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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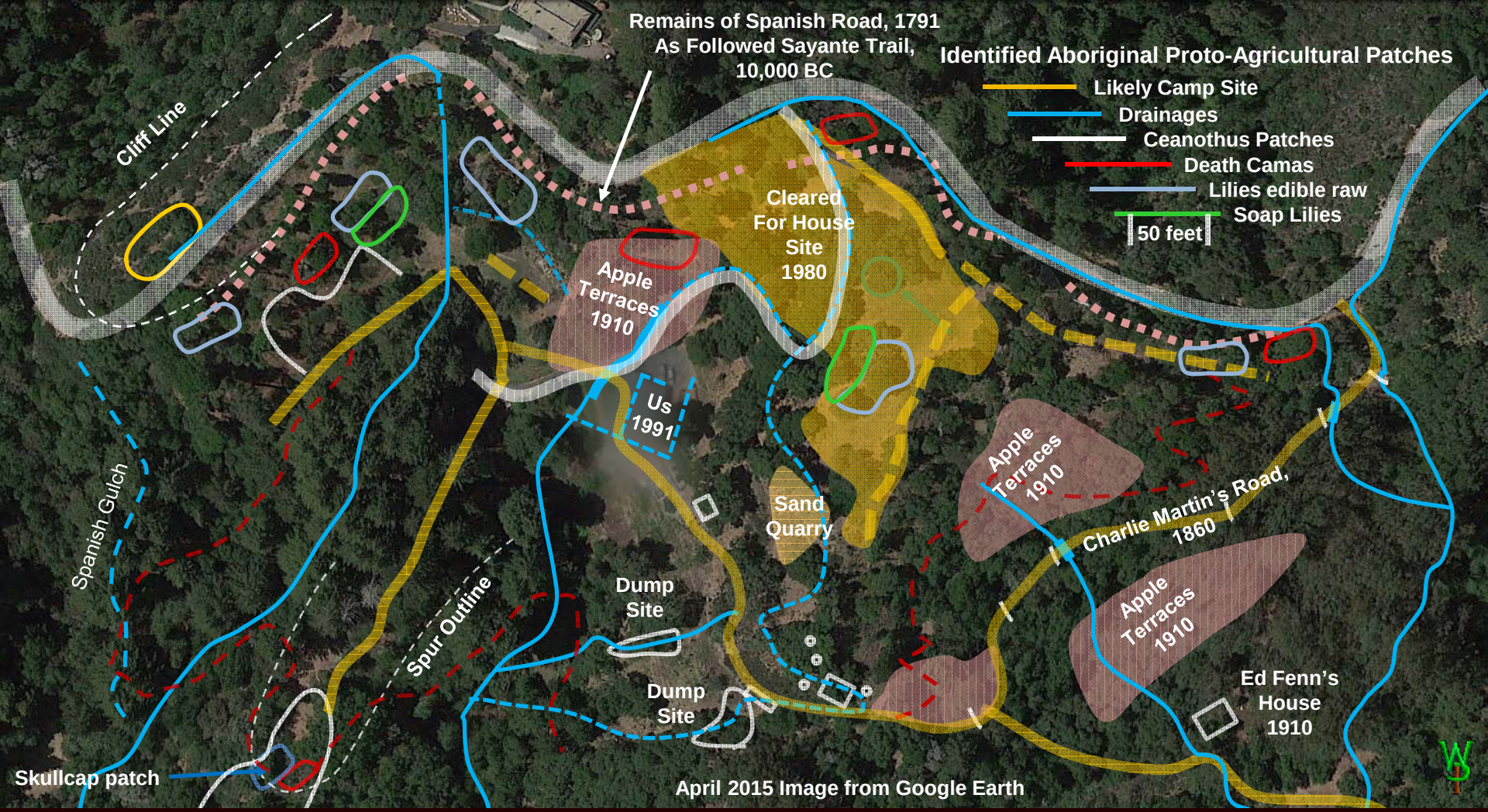
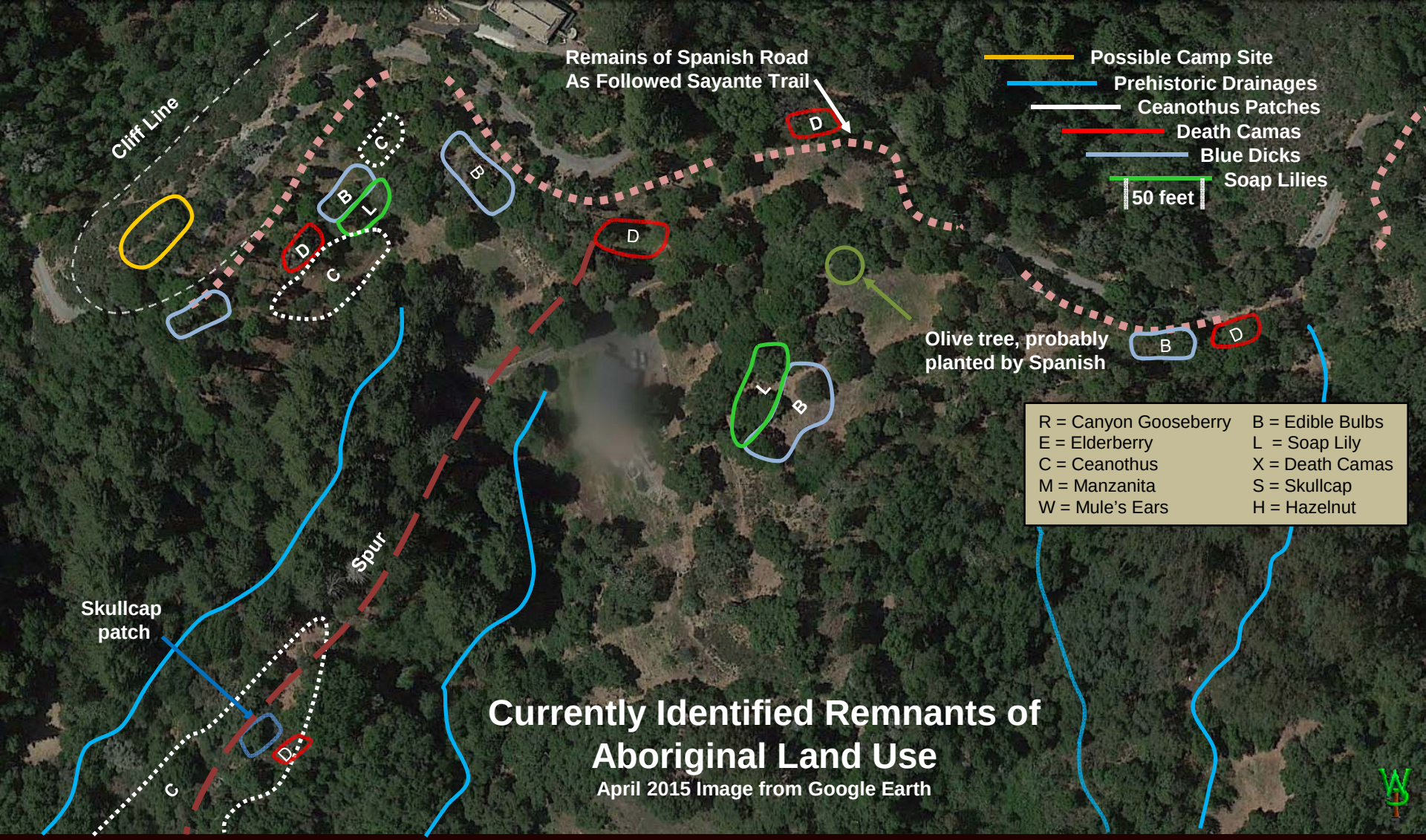
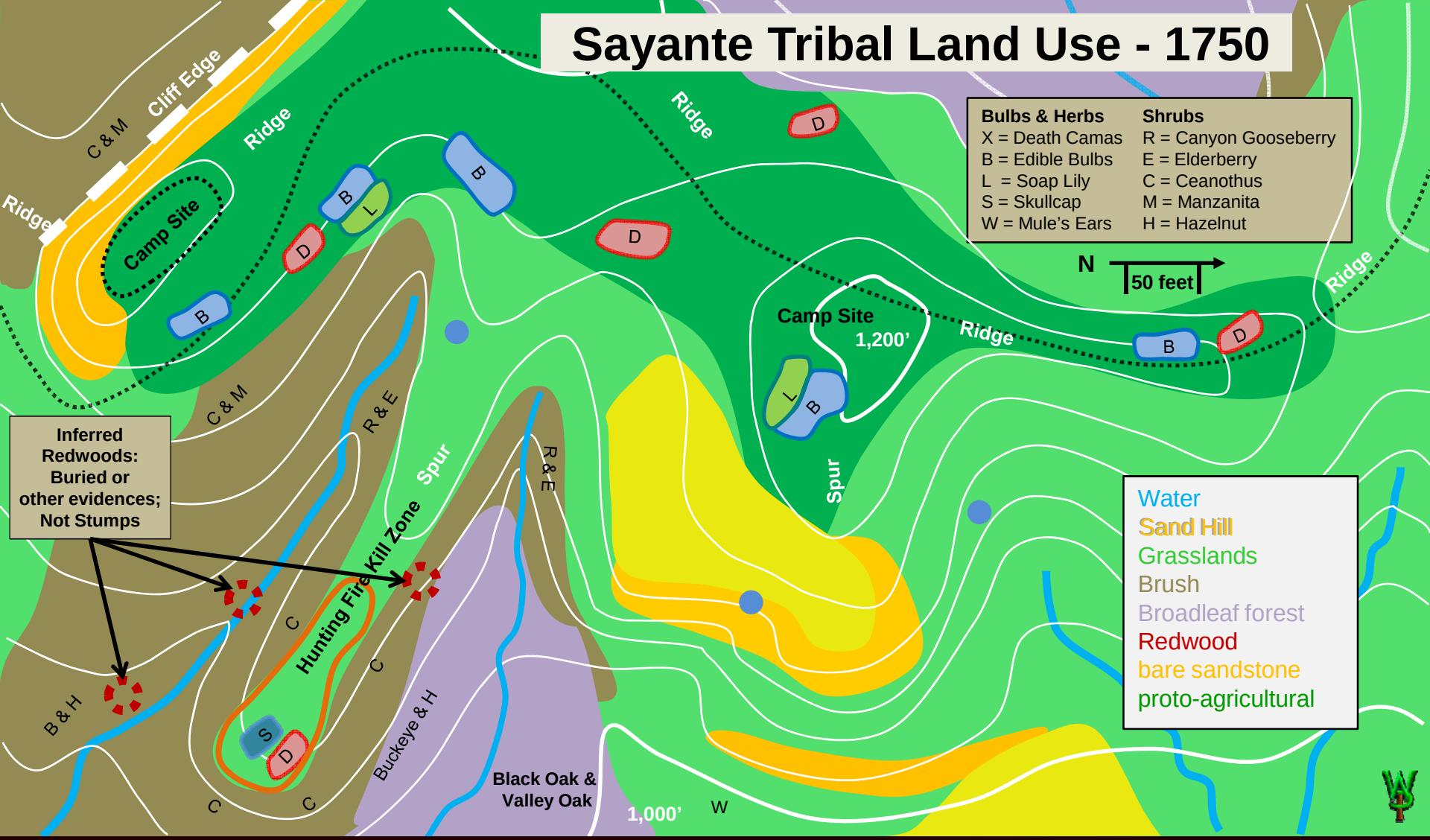


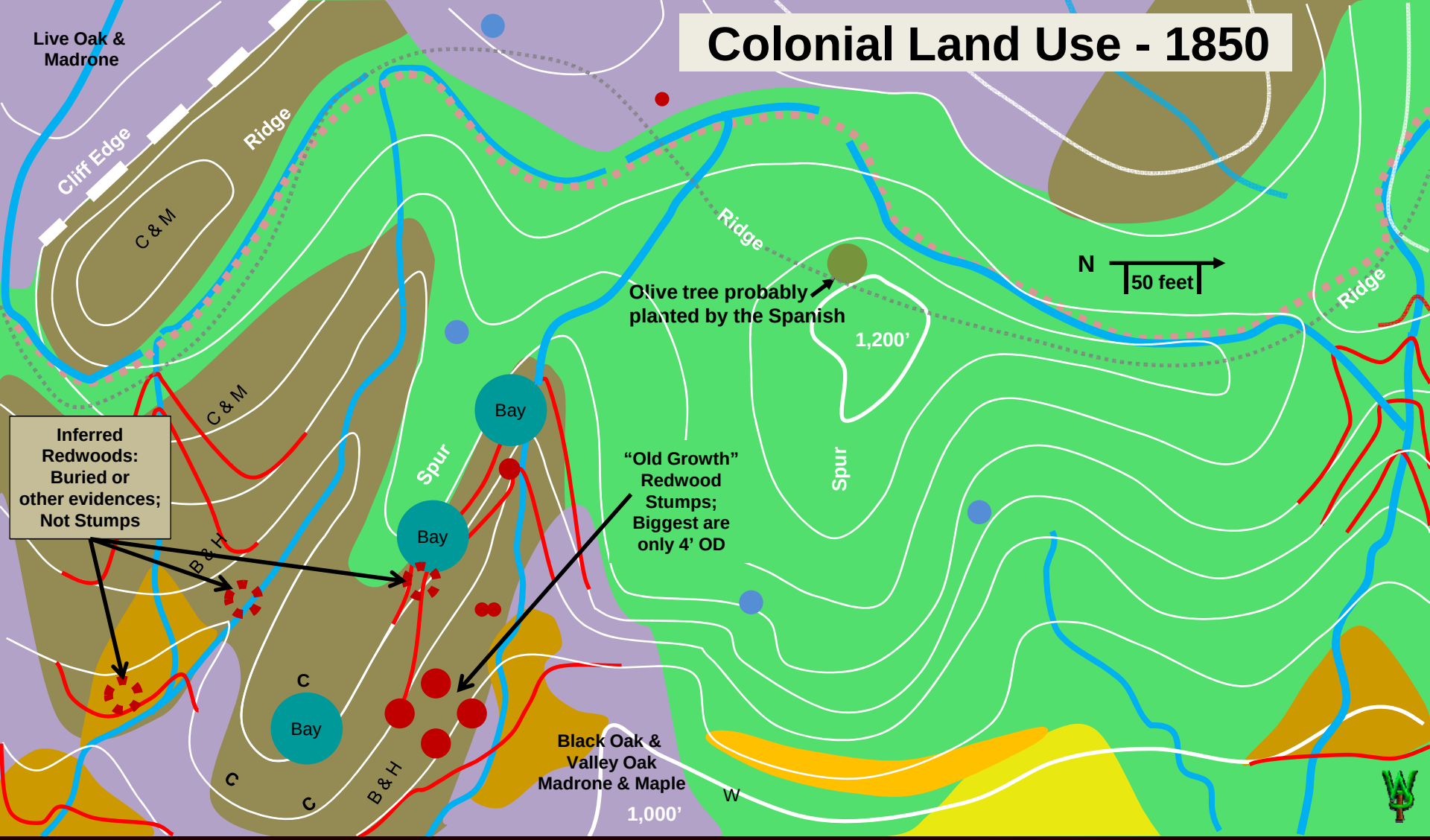
People get a sense of security by projecting stability onto what they see, a feigned familiarity that inhibits noticing the actual rate of change. Repeat photos, maps, and successive aerials facilitate visualizing change over longer periods, lest wistful memory (or denial) substitute for accuracy. In earlier editions of this book, I confined this chapter to aerial photos taken *since* we began. More recently, as the site history chapter developed, I started recognizing what were likely aboriginal vegetative patterns culminating with the realization of an almost incomprehensible (to most people) degree of change resulting from fire suppression, early road construction, and consequent drainage that greatly exceeded what I had theretofore envisioned. As that history chapter grew beyond reasonable limits, I chose to integrate a graphical representation of that massive change into this chapter, befitting a long-term perspective characteristic of forestry. Yet this change in temporal scope placed very difficult demands on this presentation because of a paradox resulting from that same subconscious preference for stability**:** We visualize the past in terms of how the land appears to us now. When the magnitude of change dwarfs what we can reasonably envision, it makes communicating that degree of difference just a bit challenging.



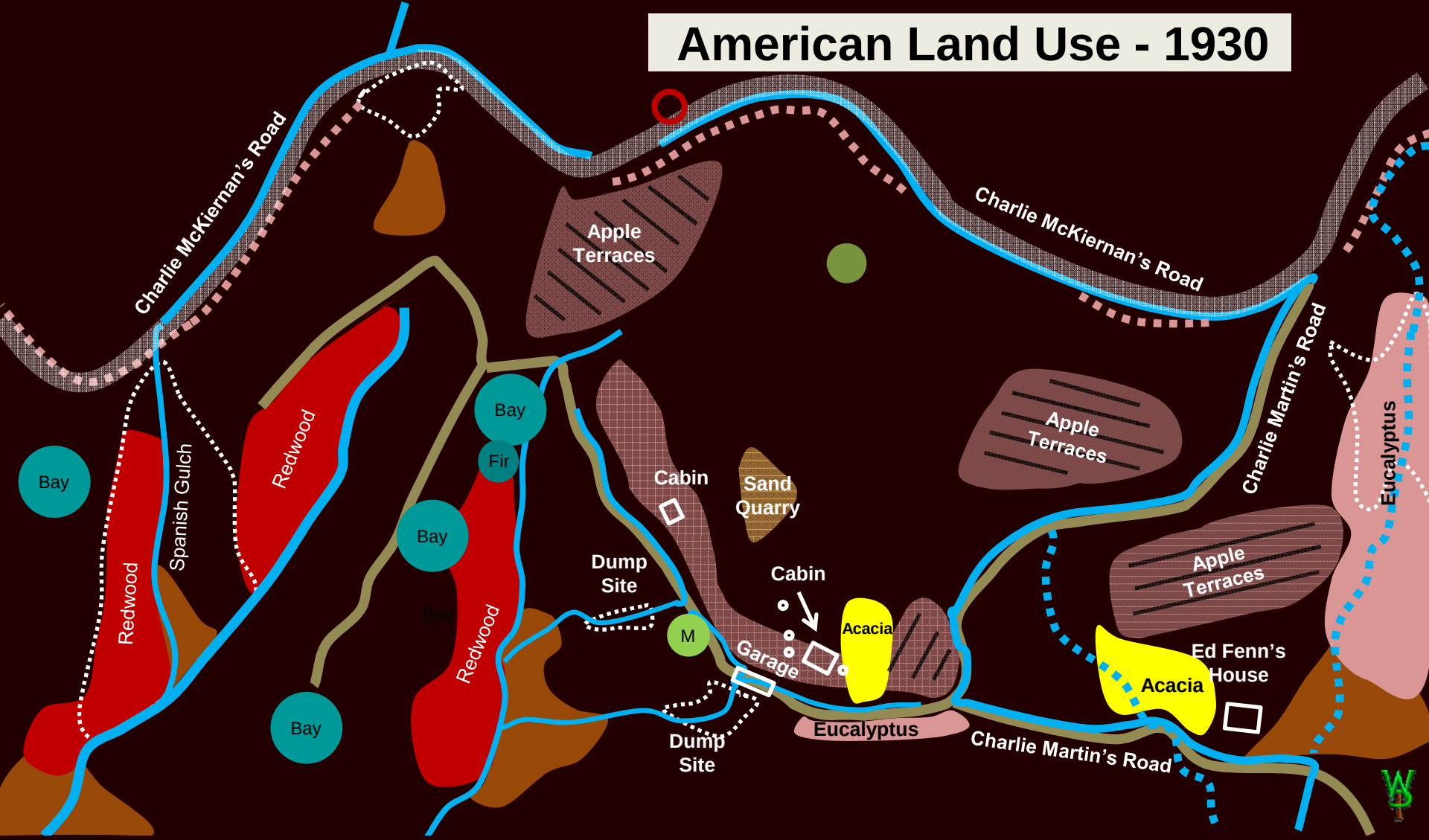
To recap our history so far, by 1791 (when the Spanish built the road), European diseases (particularly tuberculosis, influenza, and syphilis) had already spread to the tribes and the consequences were beginning to exert their influence on the land. Weeds came in with the road. The burn ban came two years later. Sayante tribal management virtually ceased by the next the year. As will be explained in the chapter on succession**:** as long as there is seed within the immediate area, vegetation here can progress from bare sand to an impacted forest in only 30 years. Between the ban on burning and the arrival of Mr. McKiernan, it had been 70 years. By the time Ed Fenn got here, it had been 130 years. Yet even then, it was still not heavily forested. Succession had been retarded by the distance from seed sources, slash fires, and grazing. When the Indians had it, there were very few trees here.



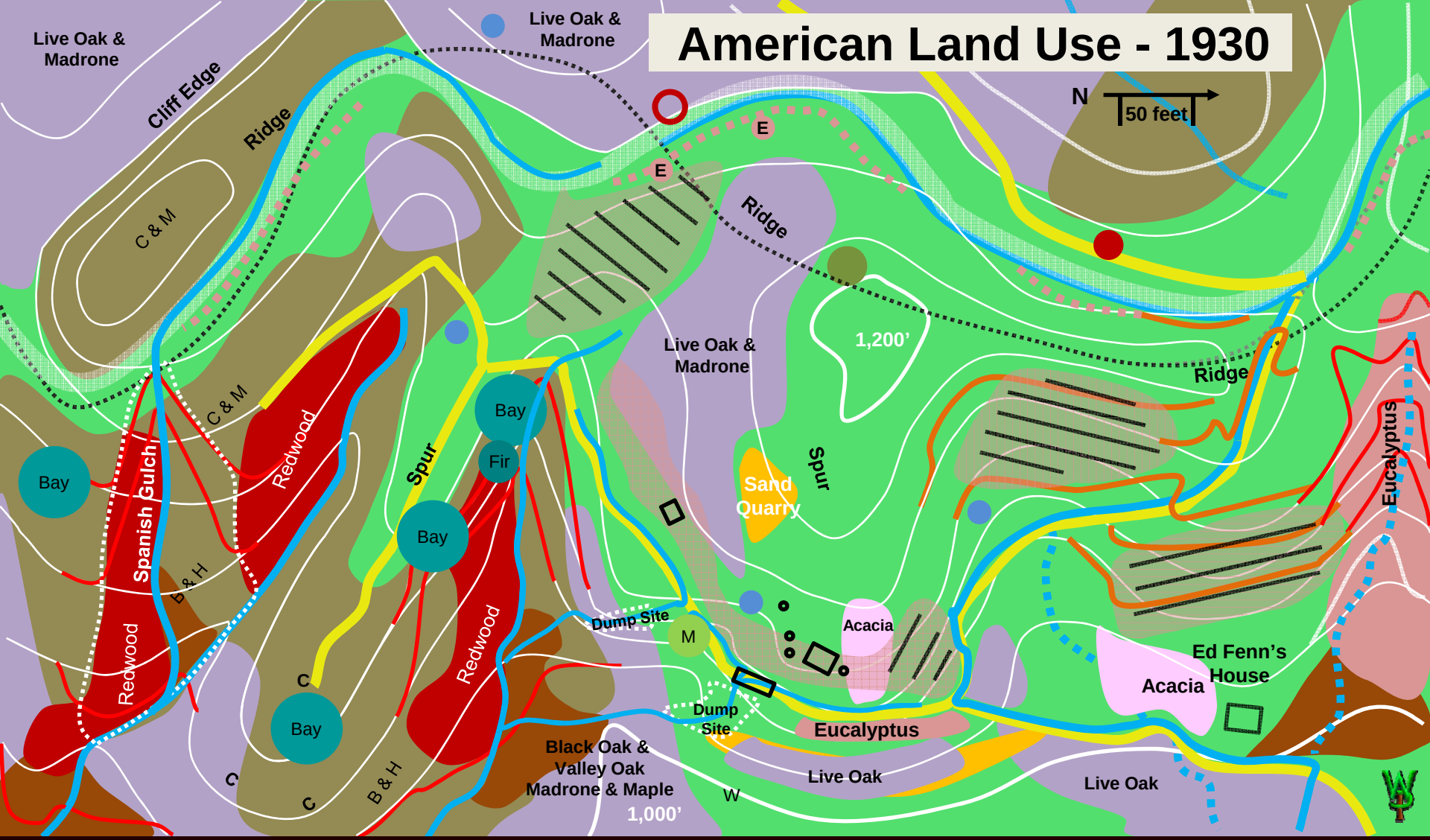
This is my studied guess at Sayante tribal land use in about 1750. Estimated contours are 25 feet, about 200' from the bottom of the property to the top. Seasonal drainages and seeps are in blue. Background colors depict what the cover might have been among the categories maintained today (boxes). These estimates were derived from compiled observations of patterns of returning plants, geology, drainage, burning, and shading by hills along with estimates of physical resource requirements to sustain travelers along the trail (food moisture and fuel) coupled with my experience of what would do well in a particular spot ("If I were an Indian, what would I grow there?") based upon Spanish observations, horticultural experiments, and ethnographic and archaeological readings. The reason there are more detailed inferences and evidences on the south (left) end of the property is that the changes imposed by orchard development and exotic tree introductions on the north end were so profound as to obliterate all signs of aboriginal land uses.



By the end of colonial control, any signs of Indian land use were gone. To get around the end of a hard rock cliff on the south end, the Indian conscripts had sloped the Spanish road down the ridge traverse, together with a drainage ditch. As discussed in the chapter on roads, the discharge from the ditch made a gully that grew to a soil loss of between 30-40,000 cubic yards. Each slide resulted in rather substantial colluvial deposits below. With the ban on Indian burning, woody plants spread, each in its own way. Redwood invaded the north-facing slopes, particularly where redwood seeds readily: slash burning, fresh landslides, or alluvium. Animals spread live oak woodland, with more bay and maple on shaded slopes, but no fir yet. There was not a single fir tree, nor is there yet proof of the age of the "inferred redwoods" above. At this point in time, the vegetative composition of the northern part of the property is less discernible because of later grazing, grading, and forestry (right side, next slide).

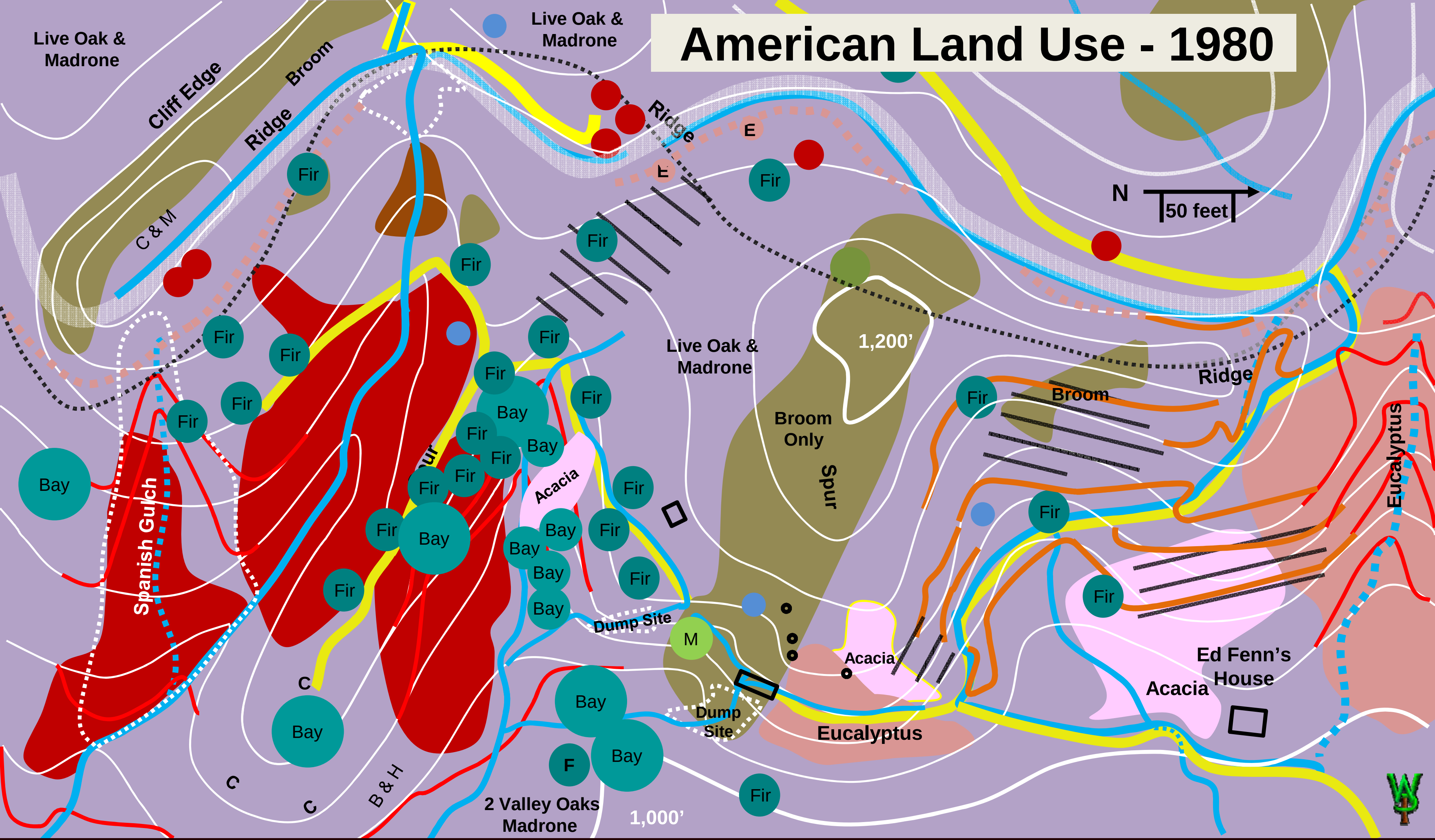


Then came the Americans in 1851, starting with Charlie McKiernan's Road along the ridge. Charlie Martin added his road from Glenwood about 1860, bypassing the original north drainage on a gentler slope. Around 1890 the redwoods were cut and the slash burned, which probably also wiped out the brush. A few trees left to seed the area had started three stands of redwood forest in bare soil on north-facing slopes where the few trees had been before. They were 30-60 feet tall by 1930. Ed Fenn terraced north-facing slopes for apple orchards, adding more roads and buildings inside what is now our property. Grading instigated new drainage channels resulting in terrible erosion problems. Ed dumped old equipment, pipes, tanks, engine blocks, a car, anything he could get into the drainages to slow the channel incision. For the most part, it worked too. If you are getting the sense that it is much harder to infer the contours of the land prior to deposition than losses due to incision and sliding, you would be correct.

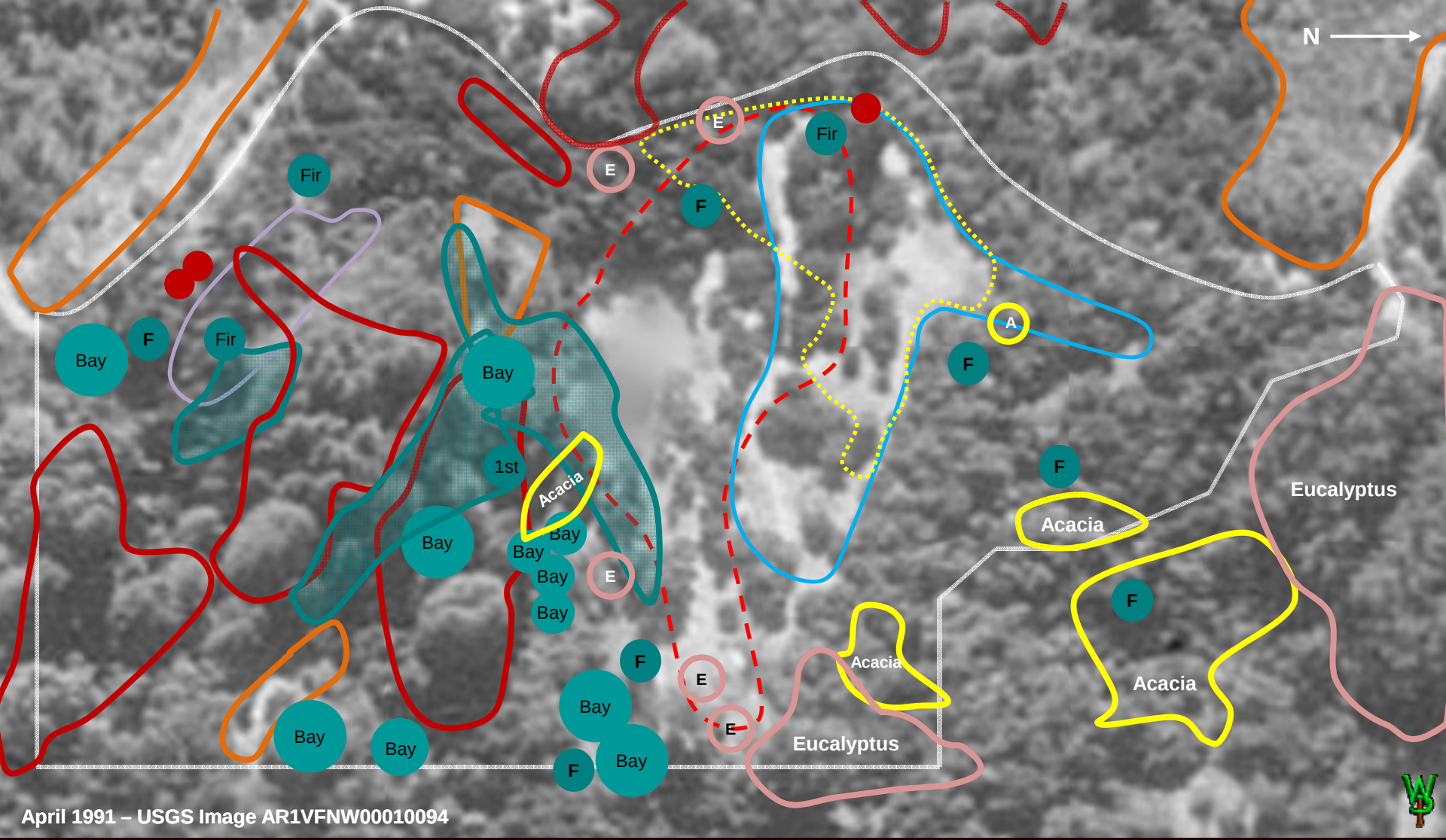


By 1930, the deciduous oaks at the bottom were old, but not shaded out yet (the few of those left died soon after we got here in 1990, as did the last of the apples). Live oak continued to invade the brush areas. Ed's terraces delayed the woodland invasion that otherwise would have happened sooner on the north end of the property. The sand hill species were disappearing but for the tractor due to invasive grasses and other weeds. Ed planted eucalyptus for erosion control and acacia next to structures for fuel wood use. There was a third stand of acacia later on by the time we got here, but my suspicion is that its location was incidental to seed moved by road maintenance. You will note that there were no black oak or valley oak invasions. It was at about this time that I suspect Douglas fir started to invade the property. When we got here, there was but one (1) fir tree over 60 years old. Without fire, Douglas fir effectively acts as an invasive species. In 1793, the nearest fir had to be a half mile or more away. Watch what happened.

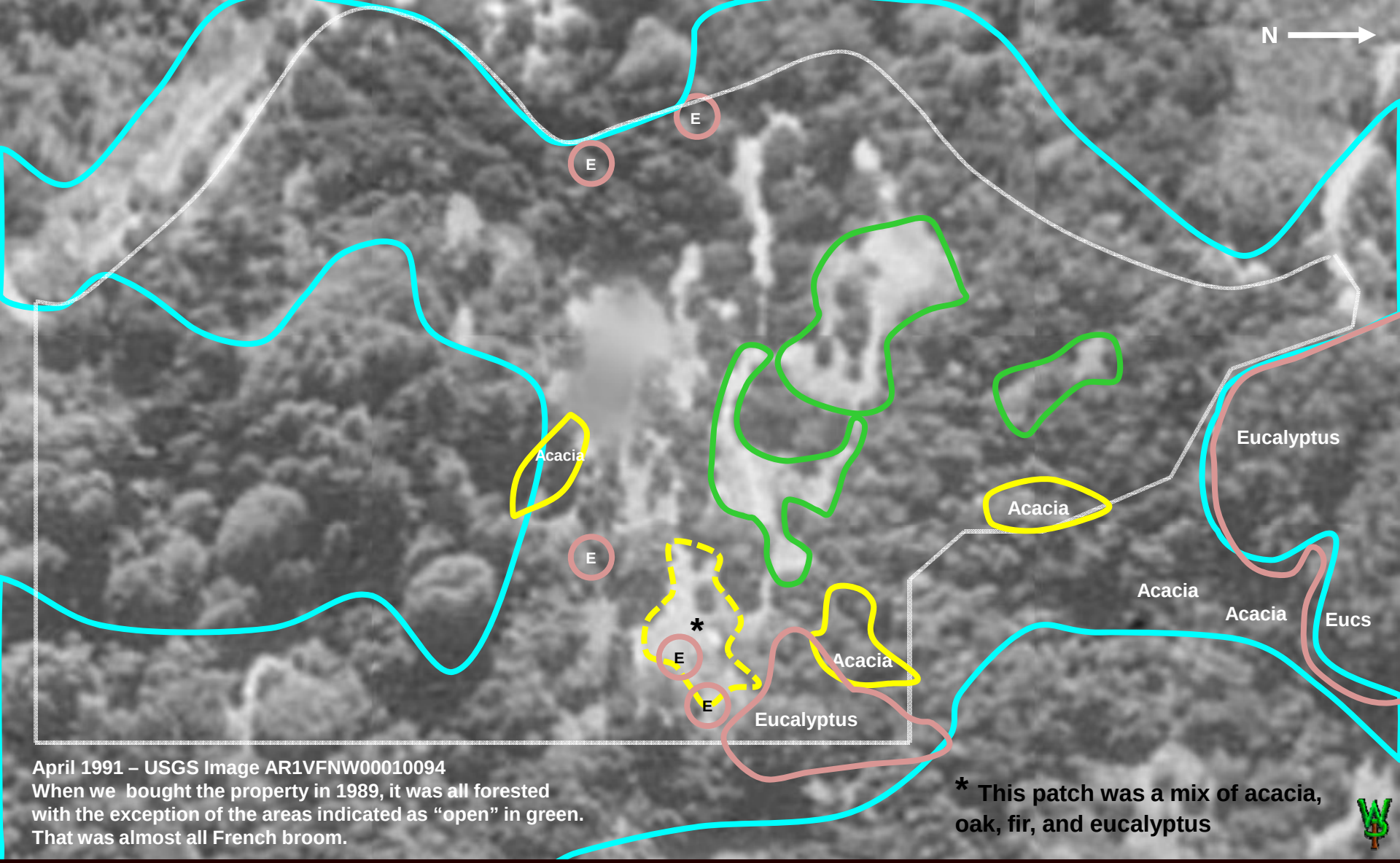
American Land Use - 1980



Note how fast fir spread once on the property and that they clustered around the pioneer tree. That they invade so rapidly and widely without having done so long before indicates how little seed there was in the area and how far away the nearest tree must once have been. Burning for 10,000 years would likely do that to such a resinous and flammable tree species, but I wasn't ready to see it until I mapped it out. That's what research can do to you. Just after 1930, "Old Man Rudy" settled the land across the road and built a house. He dumped his two acres of runoff onto the County road, just like most people do today, which then ran down the road to Spanish Gulch. Somewhere around 1970 the road was graded to reverse the flow away from the gulch, substantially increasing flows into the "natural" drainage. To a degree, it worked. It stopped incision of the gulch but it also washed out the upper draw and built an alluvium below. I started laying out the contour changes due to Martin's road and gave up (it's really complicated).



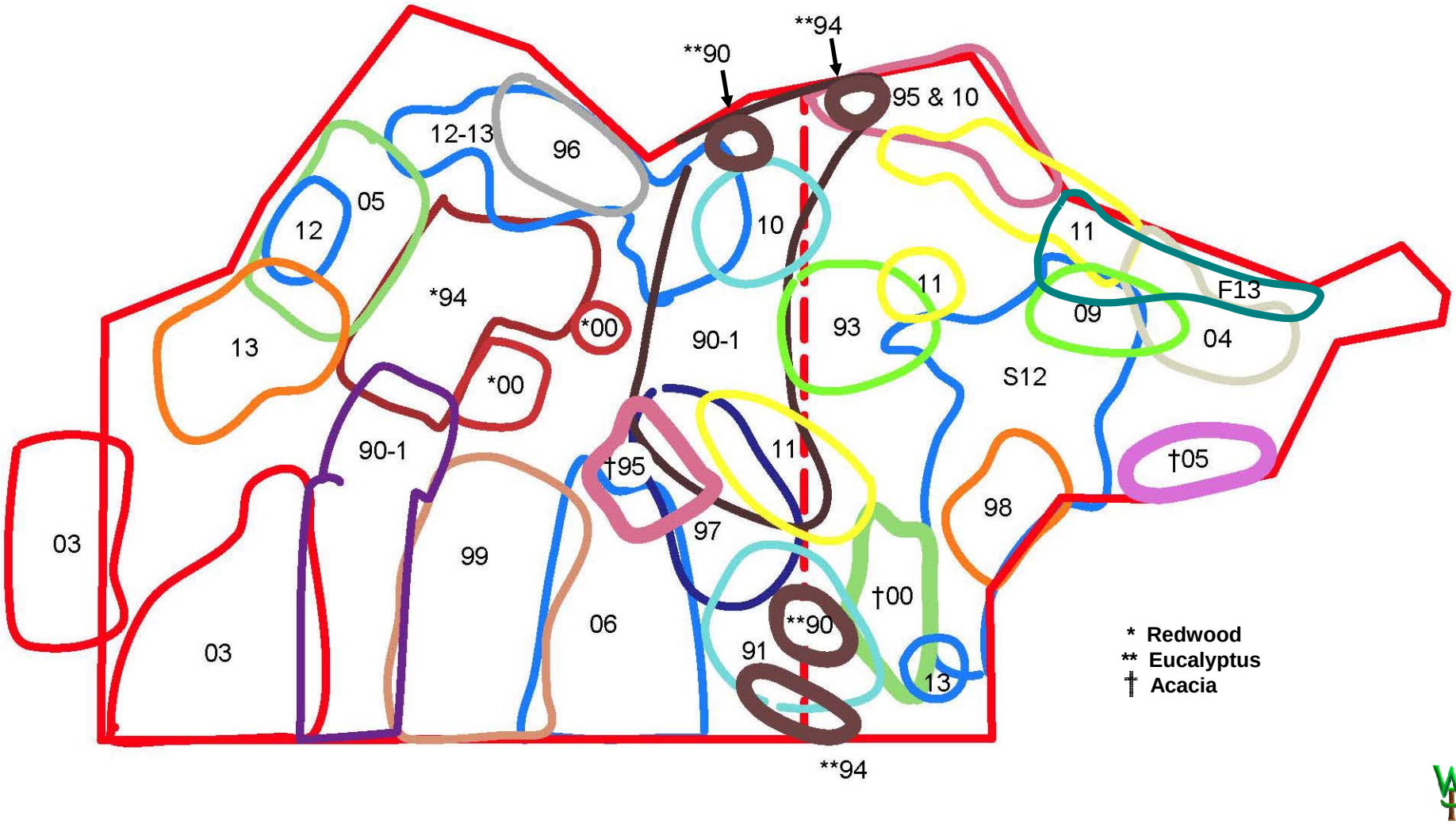
This is a map of forests from the prior slide superimposed over the 1991 aerial photo, with adjustments for angle, position, and scaling. Fir stands are summarized in shaded green redwood is deep red. When we started in 1990, the area in dashed red was totally forested; this 1991 photo was taken while the house was under construction and after I had cleared thereabout, primarily to reduce the fire hazard. As to the remaining area that appears to be open, as noted in the site history, the seller to us had done considerable brush clearing (blue line), most of it (yellow line) had been scraped off 8-10 years prior by a bulldozer clearing broom and other brush. Other than three impacted patches of decadent *Ceanothus* (one with tree cover, two with broken cover) and an opening of Yerba Santa (black), there was no other native brush, as most of what was left under forest cover was ether broom or it was dead from tree shade. There were no grasslands, anywhere. Yes, there were clearings, but that was a pavement of cut French broom and broom seedlings.



April 1991 – USGS Image AR1VFNW00010094
When we bought the property in 1989, it was all forested with the exception of the areas indicated as "open" in green. That was almost all French broom.

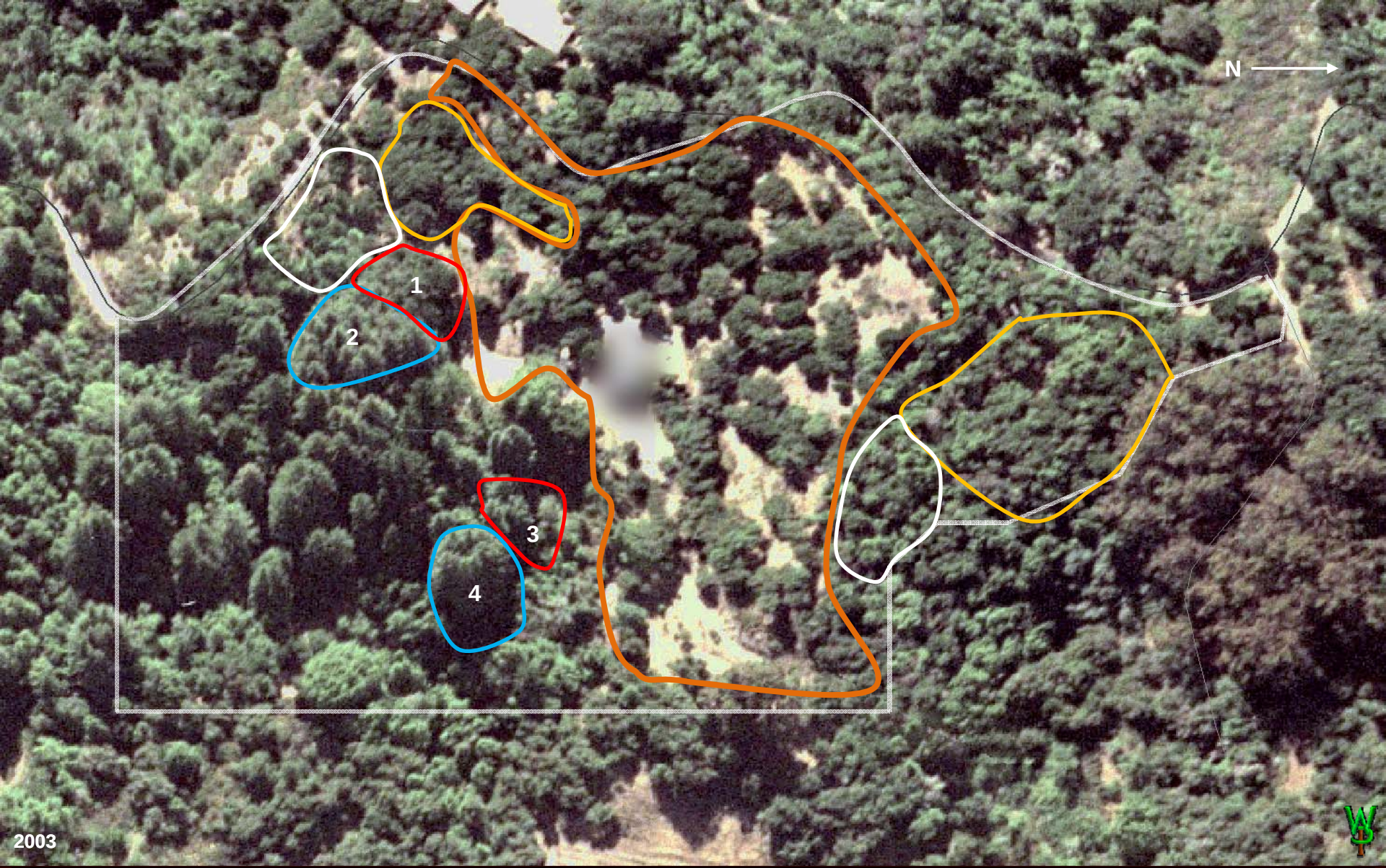
*** This patch was a mix of acacia, oak, fir, and eucalyptus**

So, as to initial conditions regarding exotics, we began with ten acres of impacted hardwood forests full of French broom, which dominated all other exotics present except trees. Cleared broom and exotic tree stands were combined into either native brush or grasslands, the latter of which were all I could handle once that process started in 2004. For 8 years thereafter, forestry was confined to thinning patches for fire control, fuel wood, and aesthetics, with the limit being available time. Once the grasslands were under control (or so I thought, until learning the truth about bitter cress), I went back to forestry in 2012 and opened up significant area to the residual weed bank for purposes of establishing forbs and brush in the forest understory and between trees.



This graphic represents my sketchy recollection of where and when I thinned **up to 2012-13**, when I returned to forestry in a more serious and impactful way. The graphic includes both hardwood and conifer forestry. Unless indicated otherwise (see key), these are primarily oak-madrone woodland, usually to include bay (not much maple here). There is no color code per se but heavier lines indicate exotic trees. It does not show how much was removed. It does not suggest what Phase was achieved (although most often I went from Phase 0 to Phase 2). Overlaid harvests usually indicate achieving Phase 3 on the later date. There is no accounting for growth-induced reversion from (for example) Phase 2 back to Phase 1 (it happened). The one excursion outside the property line in 2003 was by permission of the landowner to construct a shaded fuel break in a spot so rugged and remote that no material was removed (I just chopped it up where it fell). Yep, I logged just about everywhere. Looks like I hit it hard, doesn't it?

This was scanned from an image by a custom aerial photography company taken in the spring of 1995 (I contracted for a photograph for explicitly mapping and management purposes; they thought I wanted pictures of my house). It wasn't terribly useful, as it views down the hill in the afternoon, so I had to rotate, crop, and stretch the image to fit the property boundaries. Note how much the oaks have broadened in the thinned areas in only four years.



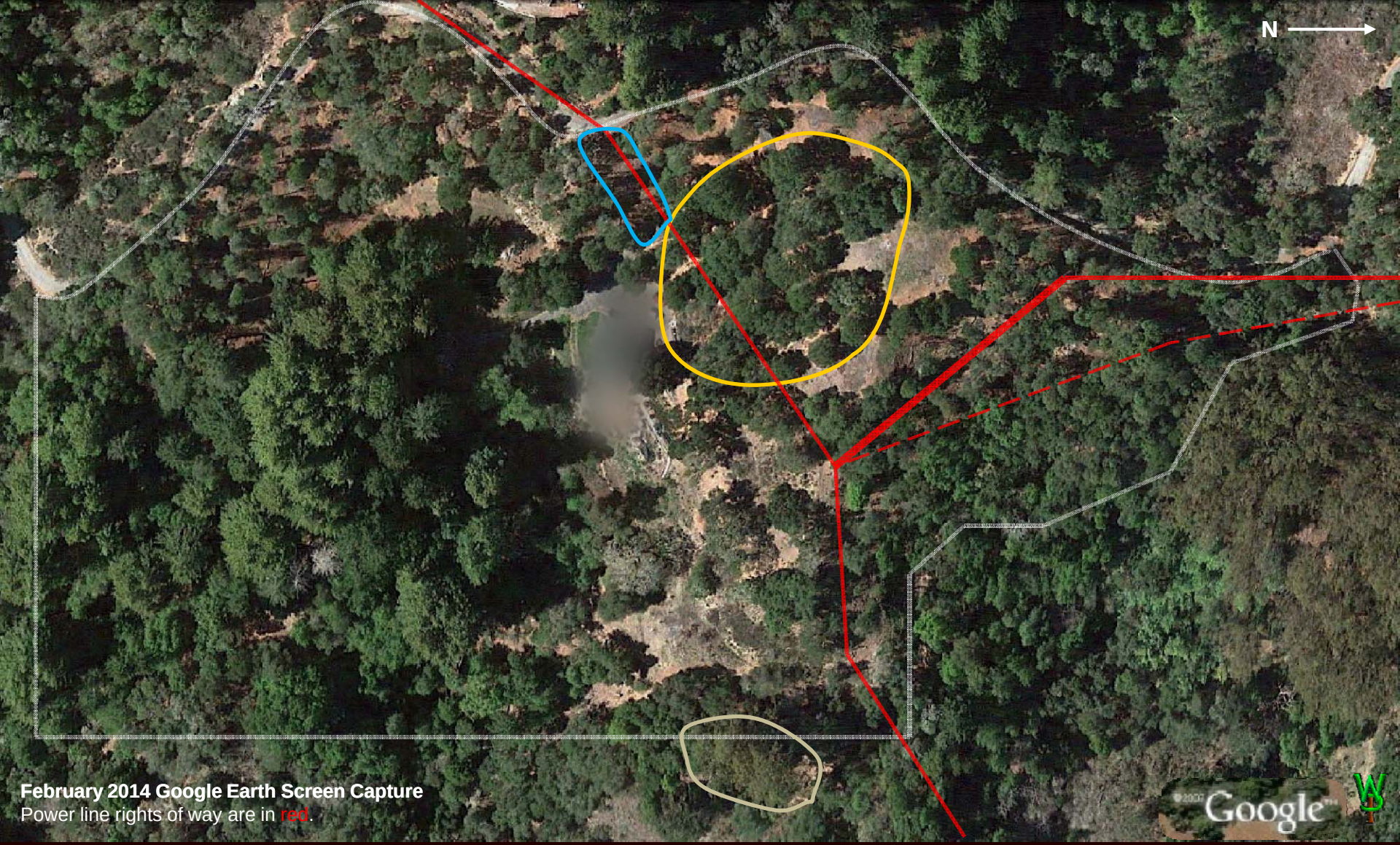
This is a screen shot from my computer of a 2003 Graphical Information System (GIS) image. Note how much broader the heads of the trees are in the area that had been thinned most aggressively early on compared to areas that **recently** or not yet thinned. Note also the difference between the seeded redwood I had thinned by 25% (1-red) versus the other half of the same stand that went untouched (2-blue, a difference that becomes more evident in coming slides as satellite photography improved considerably over the ensuing 15 years). Similarly stump cluster 3 (red) is the one with the vertical shots in the conifer forestry chapter, versus stump cluster 4 (blue) which I hope to thin soon to make siding and trim for the house and more room for monster trees.

This is a Google Earth™ screen shot from 5/31/2007. Note that canopy had increased from 1991 despite that I was still removing trees for firewood and thinning smaller, dead, and dying trees in various patches. This image was taken amid that long quiescent period during which I was more focused upon grasslands, much of which appears as shadows in this image or was under partial tree cover. One of the big problems with this kind of photography is that one does not have one's choice of lighting conditions or filtering.

This is another Google Earth™ screen capture of an image taken 6-5-2010, being closer to the summer solstice in which the angle of the sun is more vertical, sending light between trees showing more of the groundcover between them. This perspective and timing help communicate the relationship between hardwood and groundcovers. Unfortunately, it also flattens the conifers to the point of being unrecognizable. Keep that tradeoff with shadows in mind as we move into views to come, because I am about to begin some serious thinning of the hardwood, starting at the northeast (lower right) and working my way counterclockwise across the top of the property. This was taken near the end of that long period during which the focus was upon grasslands.

April, 2013. Again, the light green line was seller brush clearing in 1988-89 and the red line is tree removals I did prior to construction. This image was taken just as I was thinning the area in the dark green patch at the top left. I had also thinned the blue area in 2012. Within these two areas you can see that I am accelerating Phase 3 thinning. When viewed from above, Phases 1 and 2 are not really that distinguishable from the totally untouched forest that surrounds the property except as 'point count density,' or trees-per-area (next image). Note also the difference in point count density between logged and unlogged redwood. The tan lines enclose my neighbors' eucalyptus, with acacia in white.

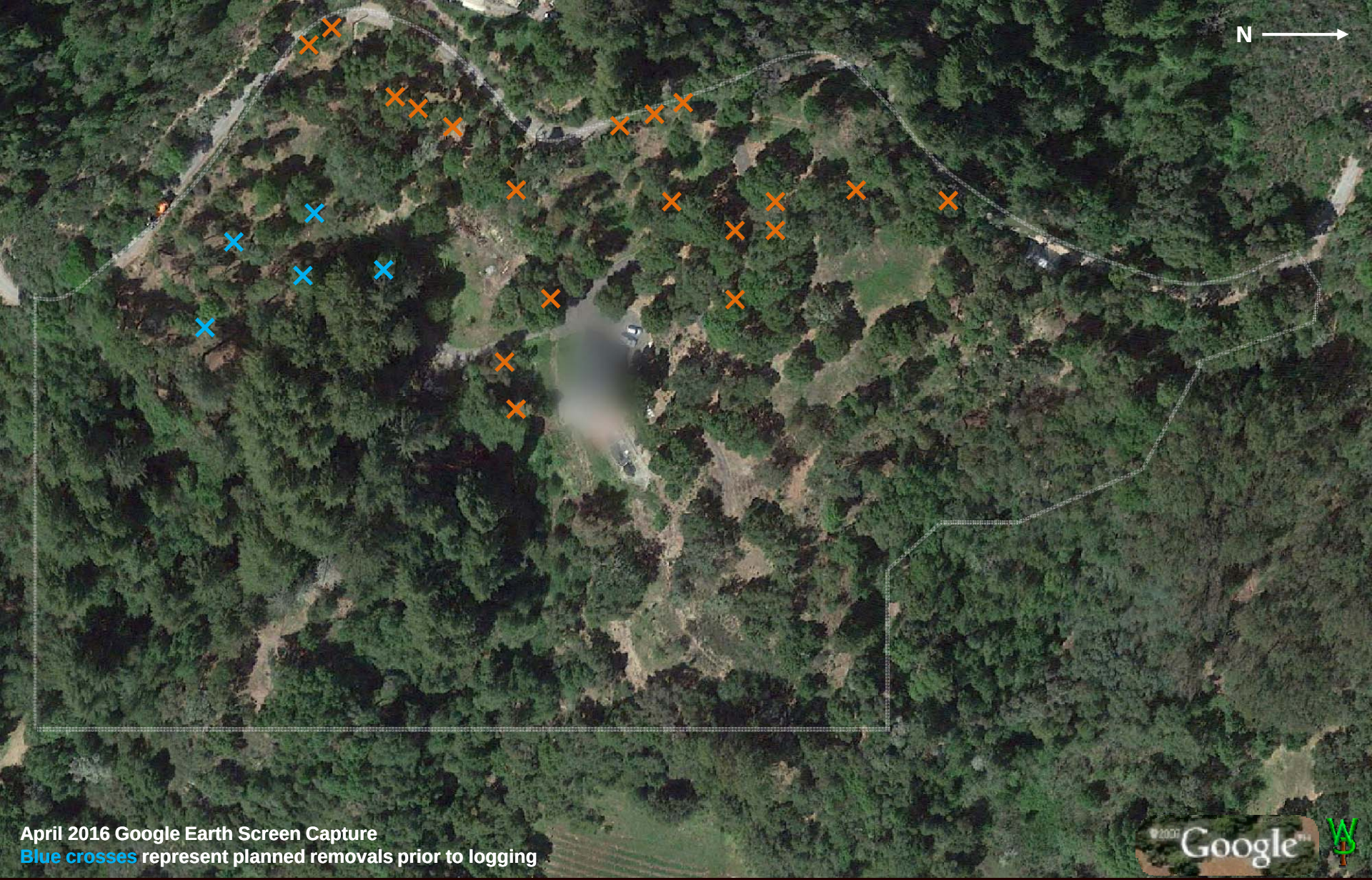
Back to 1991 with the outlines of recent work. It is hard to distinguish individual trees in forest stands in this image, but the high stem count is unmistakable. The gray-circled areas are Phase 3 projects to be completed in but three years ("planned" areas are in dashed lines). This reflects the change in priorities discussed in the forestry overview re accelerating thinning both because of (1) our control over grasslands and (2) because of the approaching decline of my physical working lifespan. The red arrow indicates a small opening within the stand where the blue dicks first came up. Somehow, the forest had never closed in that spot, nor had brush invaded it. Note also the spacing between trees in the center area in gold.



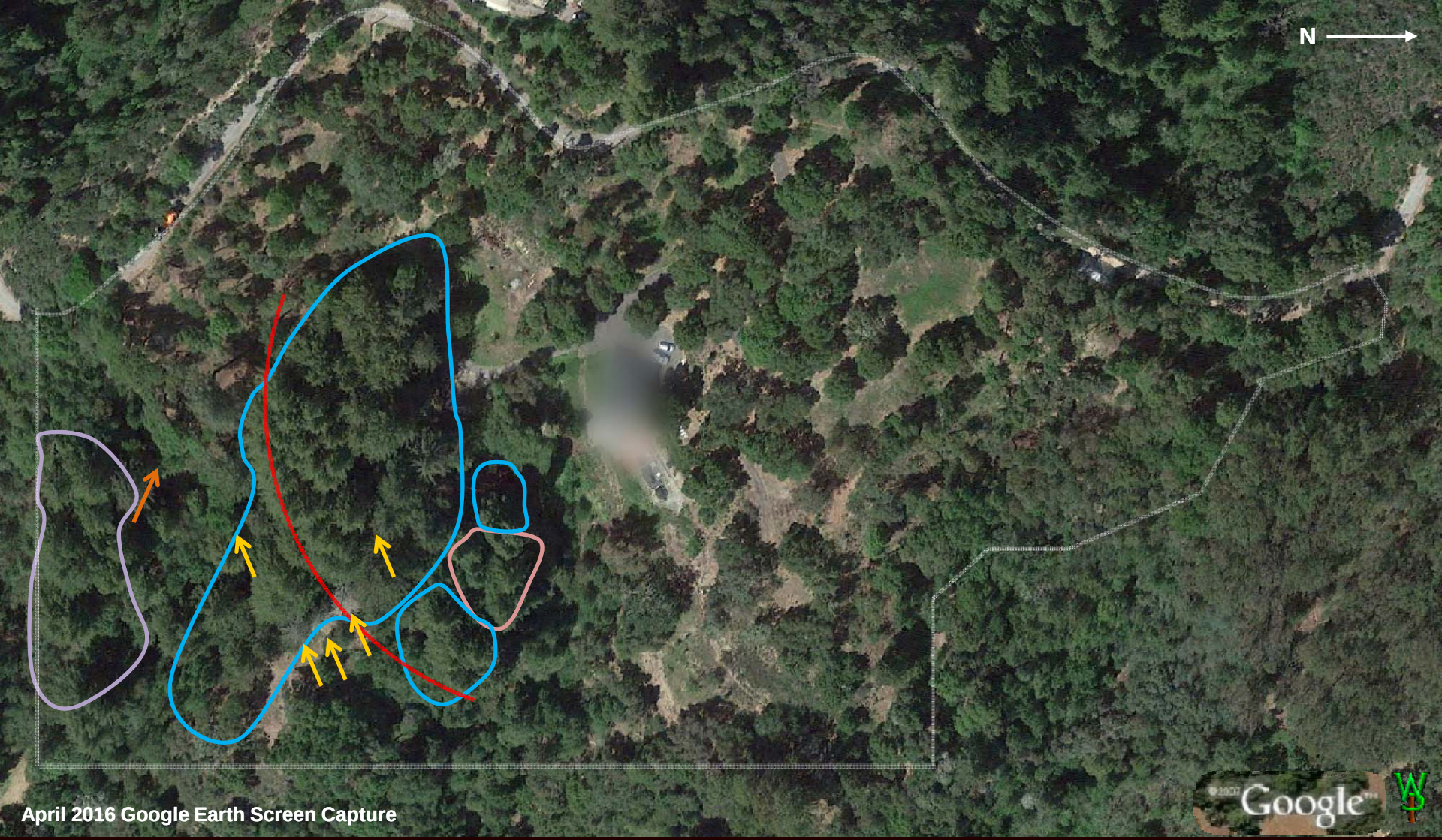
February 2014 Google Earth Screen Capture
Power line rights of way are in red.

You can see how much the canopy in the gold area has closed since 1991. The rate at which I have been thinning recently is less obvious. In a way, it is frustrating seeing it from an aerial perspective (especially with the shadows of February). I cut a bunch of trees, worried that I might have hit it too hard, then when I see it here, it looks like I had not done that much. Yet as we saw in the chapter on understory, the change on the ground is profound when the grasses and forbs take off. The one area that is "iffy" is the eucalyptus at the bottom edge (tan). Those trees are so big that the owner is unlikely to participate in their removal. It's expensive. Existing power line corridors are in red, (with dashed red being what I wished they'd done). The line corridor described in the understory chapter is in blue. The fat red line is the corridor shown in the phased forestry chapter.

In but four years, 90% of the broadleaf forest is treated. The rate limitation has been the volume of material to be dragged, piled, and burned, logs split and converted to charcoal for grasslands. I have only so much space to accumulate and process material and only so much time. I left shade screens (pink) on the upper left to reduce the sun scald on the trees remaining after thinning in 2013-14 (severe drought years). On the right, some of the work will encroach my neighbor's land, with his agreement. I will finally be dealing with some of the eucalyptus overhanging our property and clearing out some of the dead and dying material along Fenn's road. If I have the energy left, in 2017 I will start removing the remaining acacia on Fenn's former estate. My neighbor *says* he plans to remove the eucalyptus (which requires heavy equipment) and he will then reforest it with redwood seedlings. Too bad he can't harvest it later to cover the cost of conversion. It's all about time, money, and my advancing age. I can only do this kind of thing for so long.

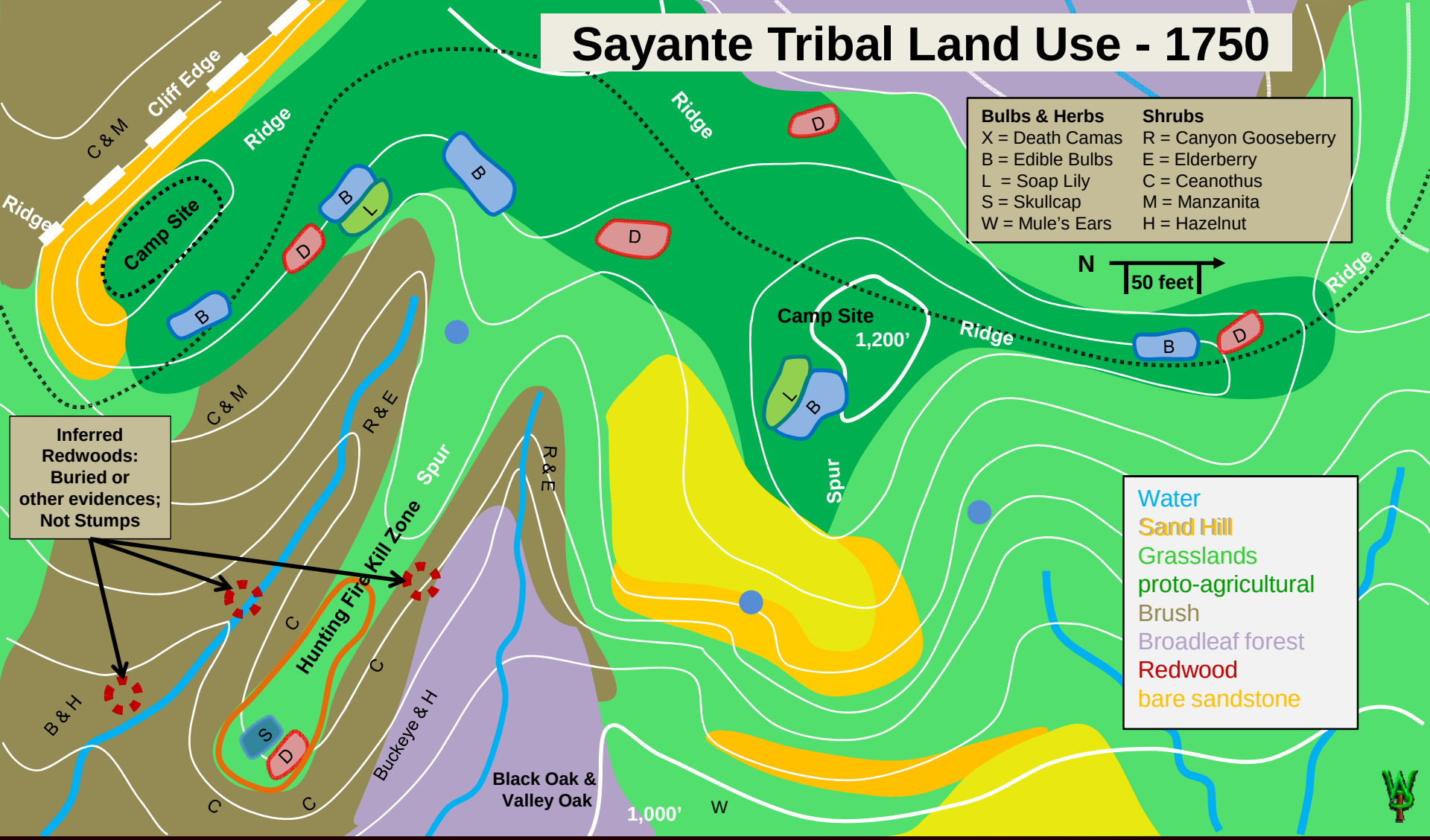


Once I have all of the hardwood to Phase 3, the future of removals will be selected individuals, as opposed to treating whole areas at a stroke. Some were left to shade certain areas until the groundcover and shrubs had recovered from the shock of thinning, others are retarding groundcover as more valuable trees grow. The good news is that in places young trees are starting to take shape to replace the “lollypops” overstocking produced. It does take time, but in a way it is surprising how fast the response can be, then necessitating tough decisions over spacing when so many older trees are so spindly as a result of how they developed.

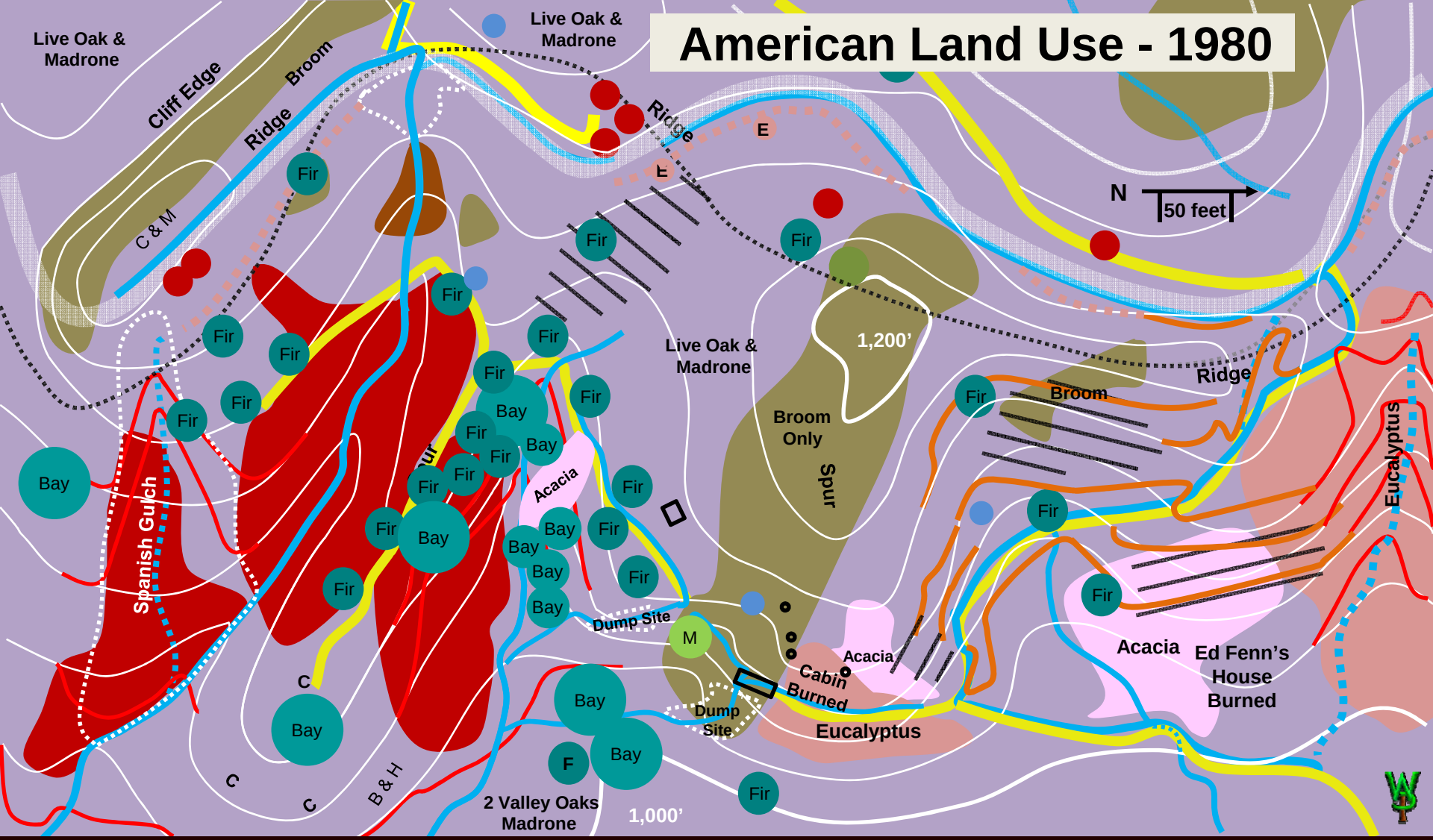


What's left? Conifers. As of 2015, we have a new law that allows me to thin my redwood within 300 feet of the house and sell the logs. When I built my house in 1991, we just did not have the money for good siding and trim, despite that I had all this beautiful overstocked redwood with which to make it. So now that the kids are in graduate school, we can thin these stands inside the red curve and our redwood will finally be to a sane stand density. One goal will be to inhibit sprouting from the root crowns without harming the remaining standing trees so that I can then encourage some biodiversity, both by burning and transplants. The fir trees at the end of the arrows have bark beetles, probably due to redwoods shading them and a stand too dense to survive drought stress. I'll see if I can entice some acorn woodpeckers to make a home of one. The rest will have to go. The orange arrow indicates a junky curved and leaning "trap tree" I felled in fall 2015 to keep it from tearing out a hunk of the hillside and slow the beetles from going any farther.

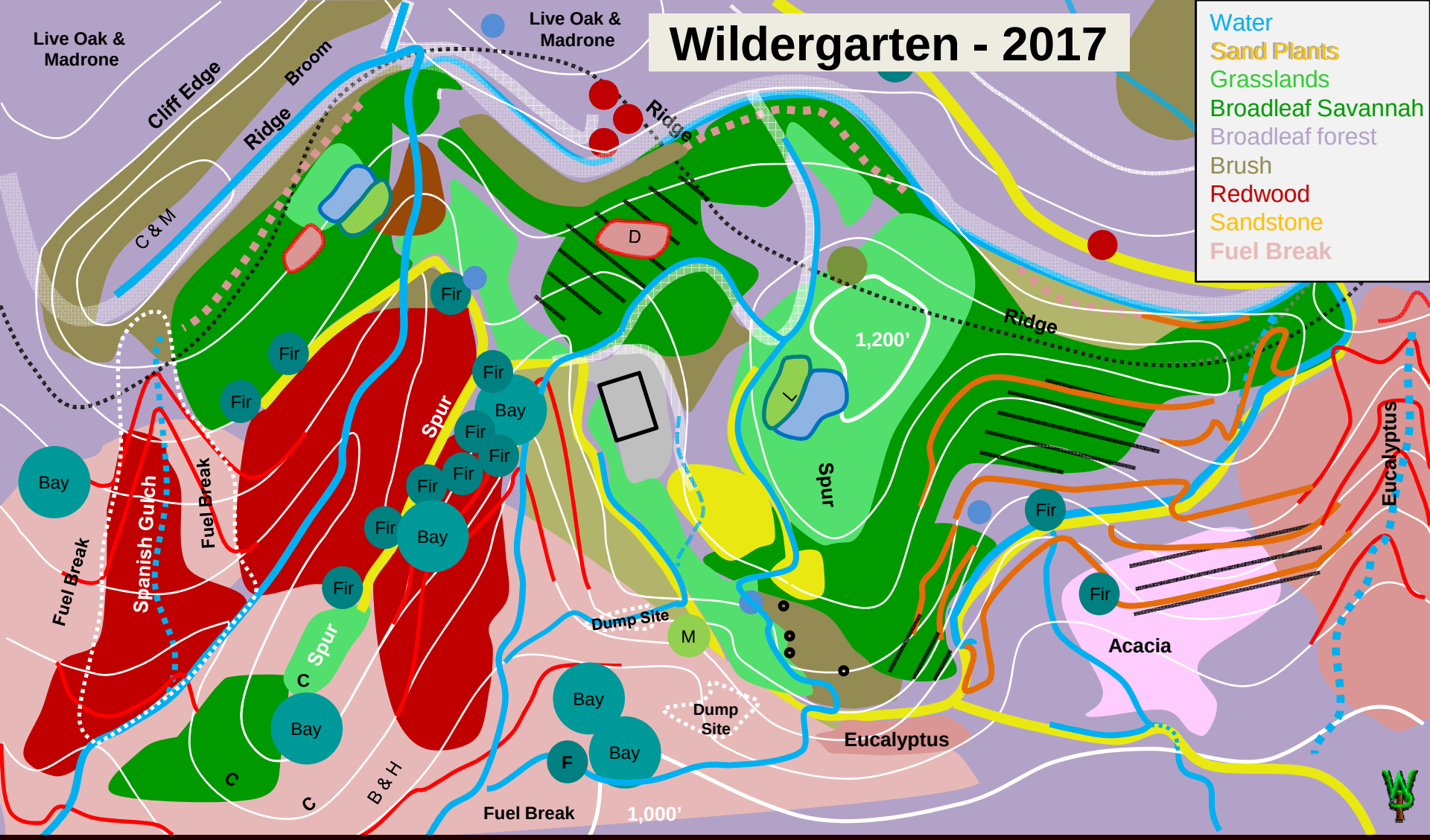
Sayante Tribal Land Use - 1750



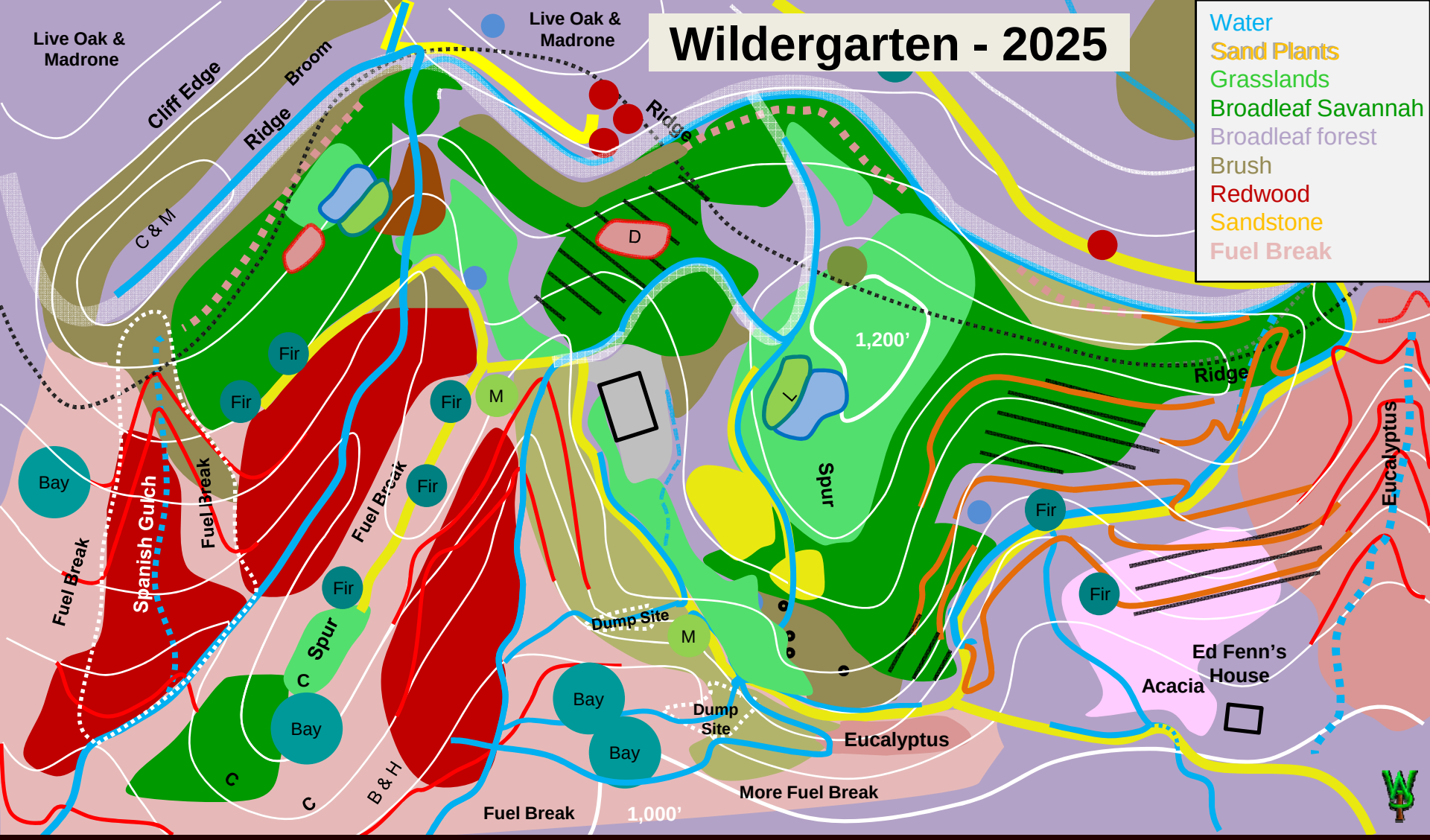
I thought I'd close with a "before and after" set of maps to encapsulate what "restoration" means here. This slide is the first "before." Again, I want to emphasize**:** I am not trying to "restore" to these original conditions. First, with current technology it is humanly and financially impossible**:** grasslands require so much labor, there is so much deeply buried seed, and the seed barrage from outside the property is so constant, there is just no way to do that. Nor do we have the elk, antelope, and people to eat much of what those grasslands would produce nor grizzly bears to eat them. Such fantasy goals are functionally insane, nor do I think them ideal for today. I am doing what I can to produce a landscape at all stages of succession that fully expresses the botanical, fungal, and insect variety long habituated to this area while configured for efficient labor inputs. I want it to produce food for us and for wildlife, materials to support our continuance here including redwood and hardwoods, heating fuel, herbs, flowers, and other pleasantries.



This is the second "before." In an odd sense, Mr. Fenn's goals were similar to mine, in that he wanted the land to produce something. Failing that economically, abandoning his orchard business allowed a choking mess to ensue, to the point that there was virtually no groundcover, native or exotic. Eighty percent of the property was dominated by exotic plants and the rest was a redwood monoculture (still is). Eighty percent of the original native plant species were either dormant, extinct, or relegated to a very few individuals. Everything was either conifer forest, exotic forest of eucalyptus (some of them huge) and acacia, choking oak madrone woodland, or broom (some of it dead in massive piles made by a bulldozer) with virtually no groundcover. Much of the oak woodland was going decadent with conifers (particularly Douglas fir) invading and shading out the hardwood, with poison oak and honeysuckle vines climbing into the canopy and girdling the trunks. Some madrones were standing dead. It was a fuel bomb.



So, from a macroscopic perspective, first came broom and clearing for a house, then exotic trees and conifers on the main ridge. I thinned the oak woodland for fire. Then I got the grasslands under control and made an area for sand hill plants. I thinned about half the main redwood stand. Then I went back to whacking oak woodland into a savannah that could express forage plants and sustain a varietal and mostly perennial groundcover. Then came a fuel break below the house and the conifers Beyond making forestry here less laborious but still successionally diverse and aesthetically pleasant, the goal is to fund and construct the first research laboratory of its kind in the world to integrate early successional native systems, how they work, and how they might be managed at reduced cost (see Project Orientation for details). It may seem an obvious thing to do, but nobody else has the native test environment that allows researchers to instigate and investigate the kind of disturbance that has become frequent here.



After replacing the house siding and trim comes logging the conifer stands with the goal of an eventual and varietal understory, meaning I'm going to deal with redwood sprouts. Other science projects will continue, especially toward processes dedicated to cleansing the weed seed bank, stabilizing steep slopes with low fuel-value plants, using fire to manage succession, charcoal soil amendment to improve mineral and water retention and increase forage productivity, possibly reintroduce grazing, characterize novel nitrogen cycles, study fungal and insect relationships including a few introduced as native biocontrols, learn to regulate predation, and continue to reduce the labor input necessary to maintain that forest and grassland cover while making it ever more beautiful with minimal requirements for harvesting (not as easy as one might think). Research and development have always been part of this job; else we never would have got this far, as you will learn in the coming chapters on grasslands. Enjoy!

Forestry Overview

If the conifer forestry chapter seemed limited in scope, that is because I have not done much of it (see timeline on the next page), certainly not nearly as much as is needed. The reasons are very simple:

1. It's expensive; heavy equipment costs a lot just to get it up here.
2. The job is too small to fully defray those setup costs.
3. Until 2015, the State of California and the County of Santa Cruz made it illegal sell logs to offset the cost of thinning, deeming it "commercial logging" (even if it is done exclusively as an improvement at a net loss or with all proceeds going back into the land). Hence, if we want to improve our forest, the money *must* come from our pockets and it's not cheap. Effectively, only big timber landowners are allowed to sell logs while forests grow too dense to be healthy.

If I don't cut the trees, they'll eventually fall or burn (if they make it to the ground without tangling up in their relatives). If they fall, they will *definitely* make a substantial hole in the side of the hill. Unfortunately, timber operations are expensive, not so much in the cost of cutting trees but in getting the logs out, particularly in a benign manner. The better a job I want to do, the more unaffordable it becomes. For example, I would love to grind out the stumps to make more room for the groundcovers and shrubs characteristic of a primeval forest. It might also reduce the regeneration of so blasted many trees. I have experiments in mind there too. We do have potential uses for wood I cannot afford that would benefit the land and advance the science of native landscape management. For example, if I wanted to do experiments grazing grasses or browsing brush while weeding what comes up after them, I would need a small barn, and a corral to protect my goats or sheep from the government's overpopulated predators. We have many more trees that need removal to give room for the others to grow into the monster redwoods everybody loves (including me). Thinning the trees could fund that construction.

So, the trees sit there, too thick for their own good and definitely bad for the forest understory species I would like to reestablish. According to US Forest Service measurements, this county is growing five times, by volume, what is being harvested; it is unsustainably "sustainable." Worse, succession is starting to threaten even oak madrone woodland, as Douglas fir precedes redwood into colonizing what only 90 years ago were grasslands and forbs 120 years before that. Meanwhile, the regulatory process disinvests land ownership, eventually forcing the owner to sell, usually to a developer or to subsidize urban infill, an economic process discussed at length in *Natural Process*.

These laws are exemplary of an insanity advocates of regulatory government have sold as beneficent. The system benefits large corporations, developers, and their dependent cadres of bureaucrats, activists, academics, and consultants. Please, help make it stop. If nothing else and as a temporary measure (until risk management markets can displace the regulatory juggernaut), there should be a minimum size of harvest for job to require a permit. That way, enough more people could afford to do projects such that we might all actually learn more than we do now by observing their results.

Forestry Overview

The arrangement of our place today in no way represents what it once was at any time since the last ice age. There is obviously a major disparity between the preponderance of grasslands under aboriginal management versus the amount of forest cover I maintain here today. So this project is a “native plant restoration,” not a “habitat restoration” per se as was intended when it began.

One reason for this choice is that grasslands require four to ten times more weeding labor per acre than forests. I simply cannot manage that much grassland at the necessary level of detail to accomplish nativity. It is not physically possible with current technology. Because of historic erosion, many of our slopes have become too steep for a grassland here anyway; gophers would just tear it up and induce continuing subsequent landslides. Nor do we have a way to manager herbivory.

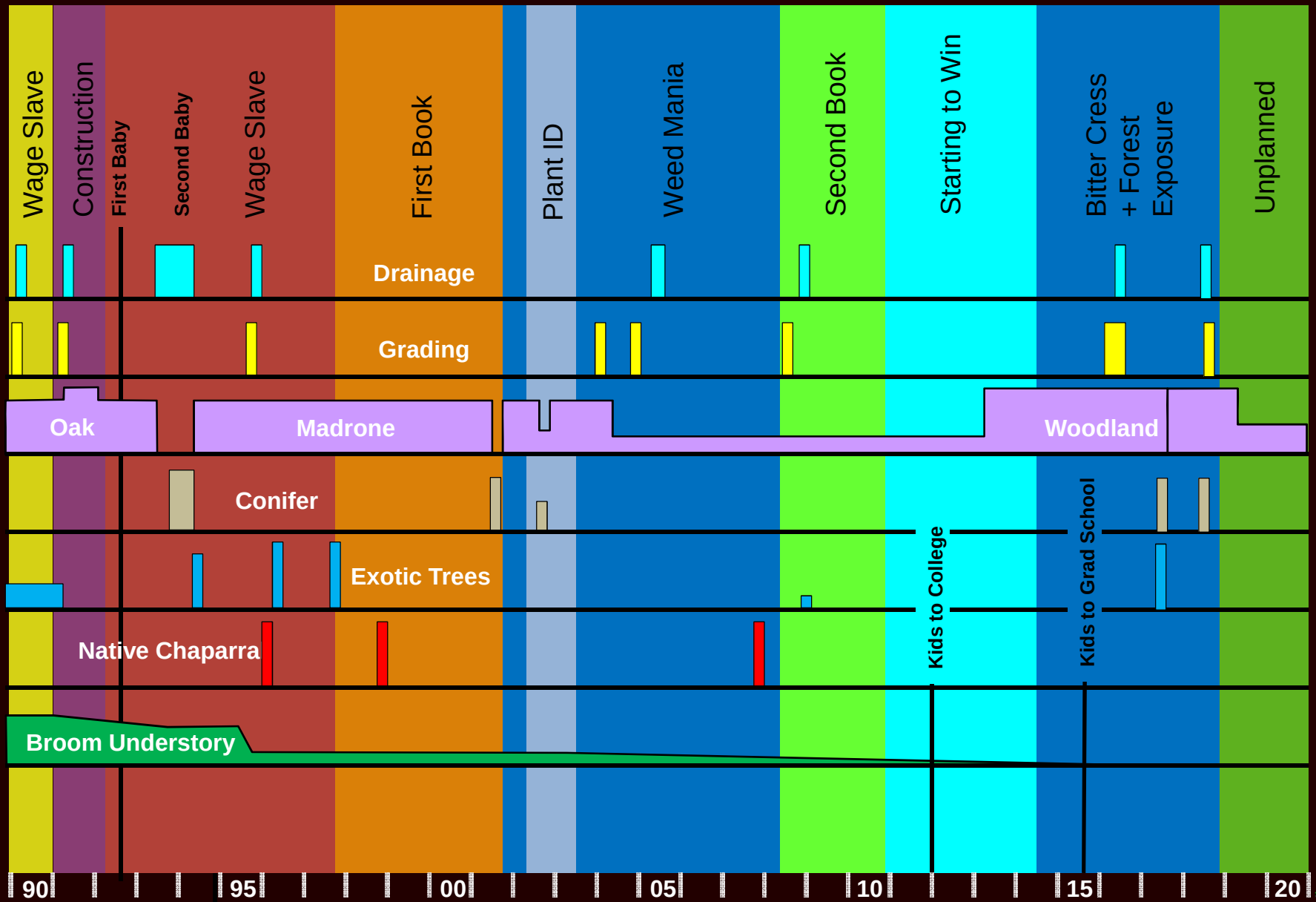
We are not using the land the way the Indians did. We don’t eat acorns. We don’t dig blue dicks as a starch or for safe water. We do use redwood. We don’t use sedge roots for baskets. We do need roads for wheeled vehicles. We don’t harvest grasses, small seeds, or hazelnuts. We leave those for wildlife, which is finally starting to appreciate the condition of things here. I don’t hunt much. I just don’t have the time and patience for it.

In terms of time and effort and despite their relative scale, grasslands and sand hills have absorbed WAY more emphasis than forests here since about 2003. Yet the reality when we started was that the place was either totally forested (both native and exotic) or covered with broom. Only once broom was removed and overstocking was under control were even exotic grasslands possible (which is what we got). So, removing that woody vegetation came first, which is why it was first in the book. In effect, the need for functional infrastructure and a place for grassland systems to express is why forestry as a topic was covered before the chapters on grasslands to come. I was just lucky that there weren’t many tree stumps in the brush-lands that were covered with broom, although I’m sure making more of those now.

So, what then is the goal? There are many (see the Project Overview chapter at the end of Part I). Bottom line**:** we are learning how to maintain and observe relationships among all the constituents of the successional system, its symbiotes and dependants as living and reproducing, if only to keep them from going extinct. In order to learn how to keep these systems alive, we must first clean them up and learn how they work and and then learn how to do that in a cost-effective manner. That way, others can repeat the work and increase its effective scale. I suspect there are a series of ‘critical masses’ with which to sustain the animals that depend upon these systems in adequate numbers to prevent them from going extinct too but I don’t think anybody knows what those scales might be for each and every animal species. Bugs are particularly in trouble. One thing at a time.

So if you are still with me in this monster of a “book,” it’s on to grasslands and all they bring. This is where things get technical, and not just aesthetic, although their beauty is undeniable.

Forestry Overview



This image presumes you have read the Project Overview chapter

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