MULCH/TERRACE/LIVE

EXPERIMENTAL TERRACING AND SOIL REMEDIATION IN CLEARCUTS

This manual is dedicated to the memory of Manuel "Tortuguita" Esteban Paez Terán, shot 57 times by Georgia State Troopers while defending the Weelaunee Forest from destruction. May their memory be a blessing and an inspiration for all who protect the forest and the soil.

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This is a living document, last updated May 2023. Reach us at planetarygardencare@gmail.com.
We'd love to hear from you!

INTRODUCTION

This manual describes techniques for clearing invasive species, remediating soil on a clearcut slope, and encouraging the development of food-bearing terraces through slow processes of observing, mulching, planting, and observing again. At its simplest, it is a technical manual for developing food forests in a degraded clearcut slope in the Pacific Northwest, and the techniques described are site-based and specific. In that sense, it may be most helpful for people working in similar conditions: sloping clearcuts dominated by invasive blackberries, with soil degraded by a century of monoculture timber production. In another sense, though, we think the methodology in this manual is transferable to many different contexts. At the heart of our methodology is a commitment to slow observation and to learning the geologic and cultural history of a place, to minimally disruptive techniques that respect the native flora and fauna living in the interstitial spaces between invasive species, and to participating in the long-term metabolism of a place, on the scale of decades to centuries. We believe in inhabiting this place we are tending, in turning it into a landscape in which humans are active participants in relation with the other creatures here. We hope that our approach is useful to others.

This document proceeds in six parts. The first part is a step-by-step overview of the methodology we used, complete with tool lists, techniques, and resources. The second includes the project outline for our project, which we submitted to Practice Landscapes as part of our grant application. The third includes site maps and geological / cultural history: context that we found crucial to learn in order to think about how to live and garden here. The fourth is a summary of our project, with lessons learned, illustrations, and photographs of our process. The fifth is a series of appendices with technical information for our site; we hope that these will be useful to other people trying to research similar information in their sites. Finally, a bibliography that includes both the technical and research resources we used, and the philosophical and political texts that inform our methodology. Living and gardening in place always has political and ontological consequences, and we prefer to examine those and shape our practices accordingly.

This manual, and this project, came about as a result of a generous grant and in-kind support from Practice Landscapes. We have been excited to collaborate over the past year, and hope that the information and processes within are useful for other people developing long-term planting, remediation, and soil-building plans.

TOOLS AND METHODOLOGY

TOOLS

Other than a woodchipper, this process can be done with a smattering of common landscaping and garden tools. The most important equipment for working with blackberry canes are heavy gloves and sharp pruners/loppers. It helps to also dress in durable clothing and use knee pads to minimize injury from thorns. We found a broadfork to be invaluable for loosening and prepping soil by hand.

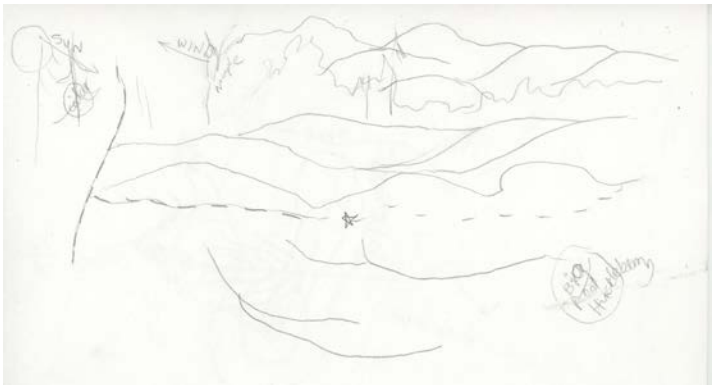
Complete list of equipment:

- hand pruners
- loppers
- digging fork, shovels
- machete and/or weed whacker (we mostly used a gas-powered weed whacker with metal blade attachment)
- heavy work gloves, heavy-duty clothing
- hori hori and/or trowel
- hard rake
- bunyip
- notebook and pens
- 100-ft tape measure
- compass/sun arc reader
- soil test materials (jars, water, shovel...)
- broad fork
- woodchipper
- gravity fed rainwater irrigation set-up
- camera

METHODOLOGY: So you want to plant some perennial food on a degraded, sloping piece of land dominated by invasive species...

Step one: Observe

Any gardening or permaculture book will tell you that the first step in any landscaping project is observation, and we agree. Spend time walking your site. Watch the plants over a year, or two, or three. See who comes up when. That slope might look like it's dominated by blackberry and ragweed tansy and thistle, but if you crawl under the tangles of thorny vines in the early spring you might just see tender bleeding heart and nettles coming up underneath. Maybe there's an old-growth red huckleberry or a healthy stand of Oregon grape in the middle of that mountain of blackberries. ... Get to know the place, and all the creatures and plants that are there, before you start thinking about mass clearing. Daydream about what you'd like to see. Draw sloppy maps on the back of napkins. The point early on isn't to make a perfect plan, it's to to stretch your brain, to learn to see the landscape for what it was, what it is, and what it could be. Think about where you walk, and where you spend your time. Gardening is about making places, and gardens need to be tended. Stake out some rough contour lines with a water level (https://www.vegetariat.com/2014/01/bunyips-fun-say-easy/ https://www.youtube.com/watch?v=pRjNA0DZZb4). You're still playing now, don 't get too attached. What you learn about contour lines might surprise you! Some key points to observe:



An early site map. Doodles are good, don't be a perfectionist...

-Existing plants
-Water drainage patterns
-Site traffic (foot and vehicle)
-Topography

Step Two: Research

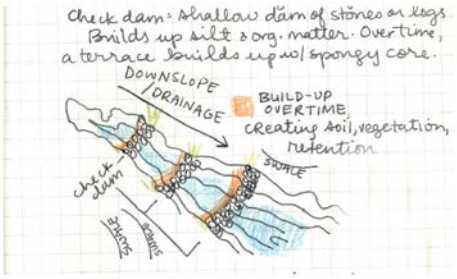
Learn the natural & cultural history of your area. You are intervening in a landscape that has been shaped by natural forces over tens of millions of years, and that has been shaped by humans for tens of thousands of years. What you do to the plants, the soil, and the creatures will have an impact that far exceeds your lifetime. Read up on the geology of your region, including the history of glaciation. In addition to understanding the landforms that define your site, this will also help you understand the soil you're dealing with. Search for USGS geological maps of your region. Look at topographical maps. Look at soil maps of your site (https://websoilsurvey.nrcs.usda.gov). Read about the human history of your site. What have humans been doing here since there were humans? How have they shaped the ecosystem and the landscape? How did colonization affect the Indigenous people and the ecosystem that you're working in? Try to understand the history of your specific site, and how it's changed. Wherever you are, you're almost certainly benefitting from the learned wisdom and land tending of hundreds of generations of humans. Be grateful, and find a way to express that gratitude in

material ways. Being in good relation with the land is impossible while active genocide continues (https://www.researchgate.net/publication/277992187_Decolonization_Is_Not_a_Metaphor)

This is also an opportunity to familiarize yourself with other literature on site and planting design. We highly recommend both *A Pattern Language*, by Christopher Alexander, Sara Ishikawa, and Murray Silverstein, and *Edible Forest Gardens,* by Dave Jacke & Eric Toensmeier. *Edible Forest Garden*s is an incredible resource, and an intimidating multi-volume tome. We primarily used *Volume Two: Design & Practice*; it's easy to browse and use as a reference guide and for inspiration without needing to read the entire book cover to cover.

Step 3: Understand the limits of your site

There are many possible limits: hardiness zones (https://planthardiness.ars.usda.gov); soil pH, fertility, and water retention; changing climatic regimes; irrigation; vehicle, wheelbarrow, and foot access; solar exposure; presence of invasive plants, topography, and so on. Some limits you may be able to change; others are immovable. Decide which limits you can push, and what you need to do so.



For us, planting on a steep slope without road access and without irrigation, we discovered that our biggest limits were mulch, water, and soil conditions. This led us to our plan to use a woodchipper to generate on-site mulch from cleared brush, to establish a rain-catchment system that could gravity feed an irrigation system, and to build check dams and terraces on contour to retain soil while planting fast growing soil improving plants. Your limits may vary.

Step 4: Decide on your rough site placement

Make your decision based on traffic patterns, topography, and your overall site plan. We chose sites downhill from a house with a roof we could use for water catchment, and built spur trails on contour off the main trail up to the house. There's no need to be overly precise at this stage—the finer contour mapping will come later once you can see the ground.

Step 5: Large scale brush clearing

Work parties go a long way here; half a dozen friends with tools and some good snacks will make the work fly by. We used heavy duty gloves, hand tools including loppers, hand pruners, digging forks, and mattocks, and occasionally a weed whacker with a metal blade attachment. Hand tools are preferable because they allow you to retain desirable plants. Stack your brush uphill of where you're working, if possible, and keep the brush piles organized, with the root ends all facing the same direction, for easy woodchipping.

Step 6: Refined & small-scale clearing.

You should be able to see the shape of the land now. Dig out root-balls and remove smaller plants, while leaving the plants you desire. Root-balls are hard to chip; if you're working on a slope, consider throwing them uphill, as a small gesture of defiance against gravity, entropy, and erosion. It's worth taking the time to selectively clear. Every bare patch of soil is a

wound in the earth, and it will most likely be scabbed over by weeds. If you can leave some ground cover and some desirable shrubs, you'll be that much closer to the multi-story food forest of your dreams.

Step 7: Woodchipping and mulch-making

If you're using a woodchipper, now's the time to turn all those piles of brush into beautiful wood chips, great for retaining moisture, building soil, and supporting mycelium! Get some eye and ear protection, keep your brush piles as organized as possible, and chip away. Try to be strategic about where your piles are.

Step 8: Mark your contours and map your site

Now it's finally time to narrow in on your design. Build a water level / bunyip, get a 100' tape measure, and some surveying flags. Take some rough measurements of the cleared site. How wide is it? How long? What's the total elevation drop?

Mark out the highest contour you plan to plant on, using a water level and flags. By planting larger trees on contour, you can help to retain soil, and gradually build footpaths and terraces in between. There may be some natural benches; consider siting your plantings at the edge of those benches, to benefit from the natural topography and help retain soil.

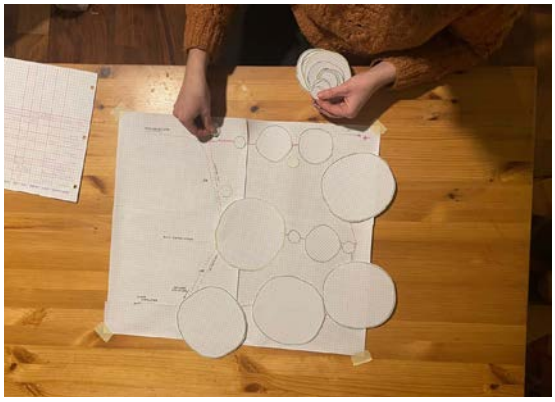
Decide the distance you want between terraces, and then measure down from the highest contour to find the origin point for the next contour. Use the water level again to map your next contour. Based on the solar aspect, the trees we intended to plant, and the traffic patterns, we wanted approximately 30 feet between the major tree contours. This allows space for relatively large trees to reach maturity with their crowns barely touching, and allows for intermediate plantings of shrubs in between the larger contours. Your site may vary.

Eventually, you should have all of your contours flagged, and you should be able to produce a relatively accurate map based on measurements from the ground.

Step 9: Soil testing

You now know roughly where you're going to plant. It's time to learn more about the specific soil characteristics on your contours. Look up soil testing resources in your locale—often available through your county Conservation District. We performed DIY ribbon tests (https://deepgreenpermaculture.com/2020/07/23/three-simple-soil-tests-to-determine-what-type-of-soil-you-have/) in several spots on each contour to get a rough sense of the soil, and then sent samples in for testing to a local soil lab. Check out the appendix on soil testing for an example of what those soil test results look like, and what we learned from them.

Step 10: Site design



You should now have a relatively open site, with contours marked, good piles of mulch, and an accurate map of your site. Now's the time to decide where everything goes! Get a big sheet of graph paper, and transfer your map to it. Keep the scale consistent. Do some solar mapping of your site (https://www.milkwood.net/2015/06/01/design-basics-mapping-the-sun-on-your-site/), to get a sense of where the sun and shade is different times of the year.

Cut circles of graph paper out to represent trees and shrubs with different mature canopy sizes. Make a list of the major trees and shrubs you want, cut circles to represent them, and spend some time playing. There's no one right way to do it. Think about existing soil types, and what might grow well where. Think about shade when the trees are mature, and when they're small. Where are the drainages? Where is the soil rich with decomposing humus, and where is it barren? When you're done moving the puzzle pieces around, tape them down. Now you've got a site plan!

Step 11: Micro-terrace and prepare the soil

Use a broadfork to loosen the soil all along each flagged contour line. This will make digging to remove root balls and smaller weeds easier. Turn the soil over, remove weeds, collect rocks as you go for building small retaining walls, and add soil amendments based on the results of your soil tests.

Depending on the steepness of your slope, you can consider digging small swales and planting your trees on the berms to improve moisture infiltration, but be very careful with this and do your own research. Large swales on steep slopes are prone to failure. Either way, you'll need to create a flat bench in order to plant on, with some small retaining walls built of rocks or woven wattle. The real soil and moisture retention will come with time as the tree roots develop, so don't build an overly ambitious terraces—just large enough to plant your trees in and to retain the soil and mulch around them.

Depending on the time of year, you can now direct seed cover crop, cover the exposed soil with woodchopper mulch, or plant your perennials directly in the terraces. Make a plan, and try not to leave bare ground exposed to the sun and rain for very long.

That's the process! Because our site has no running water, we installed water tank rain catchment system, and 1/2" poly tubing for irrigation. Now observe what you've done, keep tending it, and keep adjusting. Your plan will continue to evolve as you identify problems and mistakes. Built some paths through your terraces so you're encouraged to spend time there, build a bench so you have somewhere to sit and watch, and keep visiting your plants.

PROJECT OUTLINE

By clearing and mulching invasive blackberries and grasses, planting natives & edibles on-contour, and installing rainwater catchment systems for irrigation, we will slow erosion, build soil, hydrate the landscape, and create a human-inhabited subsistence ecosystem.

Our proposed practice includes attention to the terrain and ecology of the site; hand-clearing invasives along contour lines; aerating and cultivating logging-compacted soil; and turning invasive plants into mulch to improve soil health and biodiversity. The terraces will also promote foot traffic, bringing human care and attention to the site. Installing rainwater collection tanks will allow us to water the terraces during increasing summer droughts of the Pacific Northwest, while planting trees on either side of the footpaths will contribute to terrace formation on an ecological timescale.

All of this will prepare the site for winter planting, using native and also climate-migrated trees we raise ourselves or purchase from local nurseries.

Freshly mulched Rubus

Many landscape practices require the use of heavy machinery and unsustainable methods—clearing the landscape into a blank slate, and then importing mulch, soil amendments, and even water. Our alternative approach is primarily observation- and practice-intensive: actively caring for the water, soil, plant, animal, fungal and microbial lives. The latter takes time, attention, and repeated practice. We opt to make smaller, site-specific interventions to shape the landscape in tune with the seasons, the pace of our lives, and the slow growth of forest succession. While this specific grant proposal will be completed within a year, we are measuring the long-term process in a span of decades. Our applied research asks, is it possible to garden in this clear cut with minimal and local materials?

SITE DESCRIPTION

The site is the north end of a 2.2-acre, west facing slope at ~40% grade, which was clearcut by the previous owners in 2014. It was replanted with a monoculture of Douglas fir seedlings, and is being overtaken by invasive blackberries and grasses. Old-growth huckleberries and other native plants are being swallowed. The site is accessible only via a steep footpath, thereby limiting use of off-site materials and machinery. Situated on a collectively-owned piece of land, the slope runs directly uphill from the main community building. Logging this slope increased run-off and erosion down into this building site. The roof of a residence at the top of the slope catches up to 12,000 gallons of rain annually, which will be gravity-fed to terraces for irrigation. The three existing terraces have been planted with native and cultivar trees, but lack a ready supply of mulch and water. Three more terraces have been sited, but need further clearing and extensive mulching and aeration to be prepared for planting.

Following contours on slope, we will clear vegetation with hand tools, and use a wood chipper to mulch cleared debris. We will use broadforks to break up and aerate soil, preparing terraces for planting next winter. We will install water tanks near uphill residence and run irrigation lines to the terraces. Construction of a small (8x12) storage shed at the top of the lowest terrace will provide storage for the wood chipper, broadforks, and other tools, and supply additional water catchment. Aside from the roofing, we will construct the shed with alder and douglas fir saplings that are being cleared on the terraces.

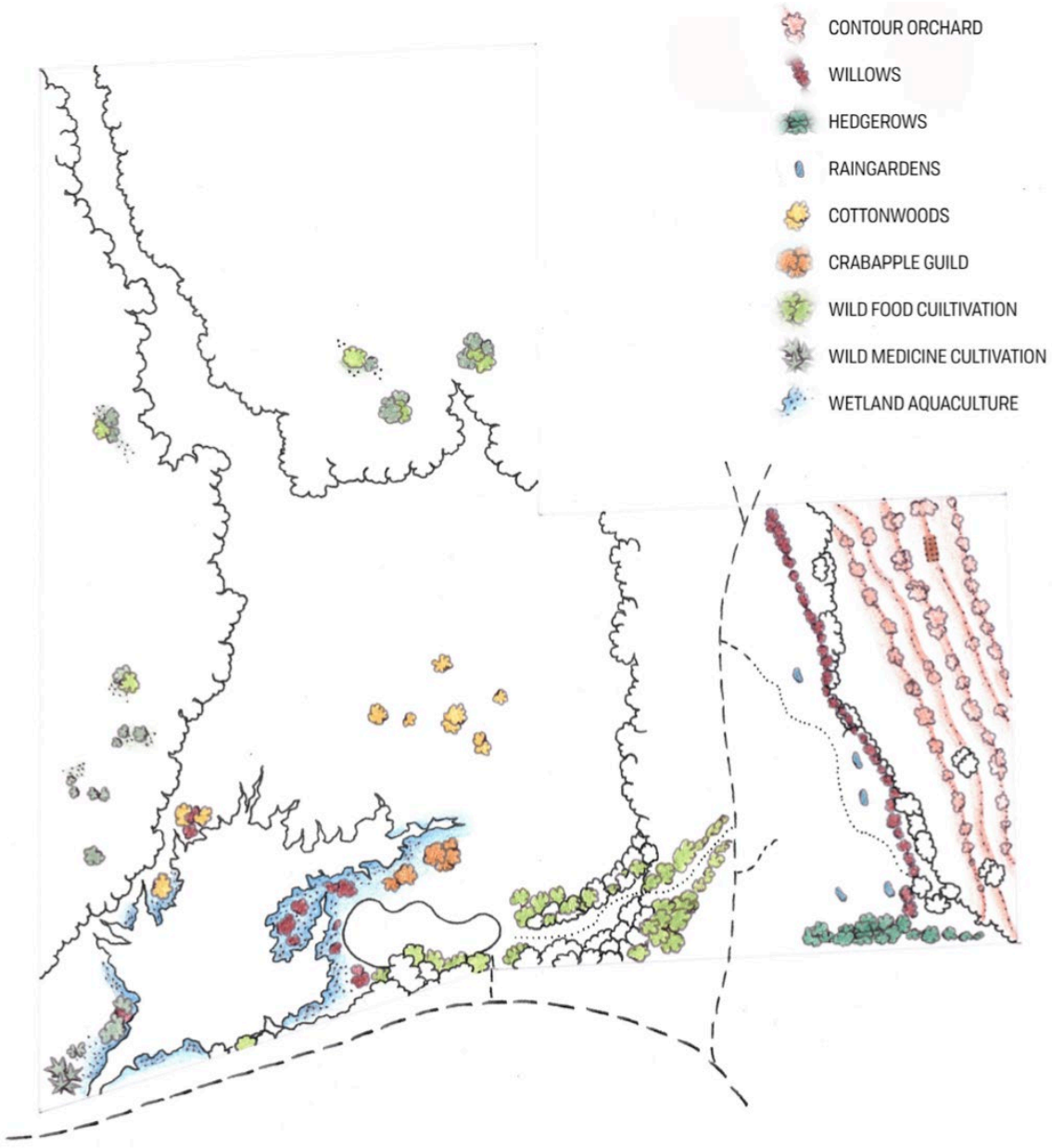
We don't decide our terraces solely from a topographic map; it is a situated, handmade process of measuring contours, assessing indicator plants and soil structures, and protecting the particular ecology of the place from indiscriminate clearing. We seek to avoid confusing the map for the territory. Further, we assert that subsistence and cultivation are not mutually exclusive with ecological restoration. We're deliberately choosing to grow food in the clear cut as a process of remediation, using minimally disruptive tools that work with time, rainfall, local materials, our footsteps, daily rhythms, and our human cultures. This land-based practice looks like living here, walking here, feeding ourselves and our families from the land. Inhabiting this place is a practiced method of observing, remediating, and tending.

ANTICIPATED OUTCOMES

This project will create walkable paths along heavily mulched terraces, creating fertile and accessible forest garden space, supplied with water from gravity-directed rain catchment systems. This will allow us to proceed to the next phase of our site plan by 2023, planting the trees and shrubs that we have been raising in the newly accessible and improved terraces. By expanding the footpaths and resting spaces, we will encourage inhabitation of the site. Adapting to a changing climate requires deep attention, observation, and care; we aim to construct a landscape which encourages these practices, enmeshing the human habitants with the metabolism of the land. The application of mulch and infiltration of water into the soil will directly benefit soil health and hydration in the landscape, helping to drought-proof it as the climate warms and dries. Storing water in the landscape and selective clearing of the slope doubles as a fire barrier between our residences and the commercial timber plantation on the eastern border of the project site. Building soil sequesters and retains carbon and other essential nutrients, while creating conditions amenable to perennial food systems. As the fruit terraces develop, they will attract more foot traffic, yielding more attention and care, while increasing biodiversity. Social benefits include walking trails, sitting space for contemplation and observation, integrating daily habits with food harvesting and plant care; long-term social benefits include local, perennial food sources, increasing local food autonomy and surplus for sharing.

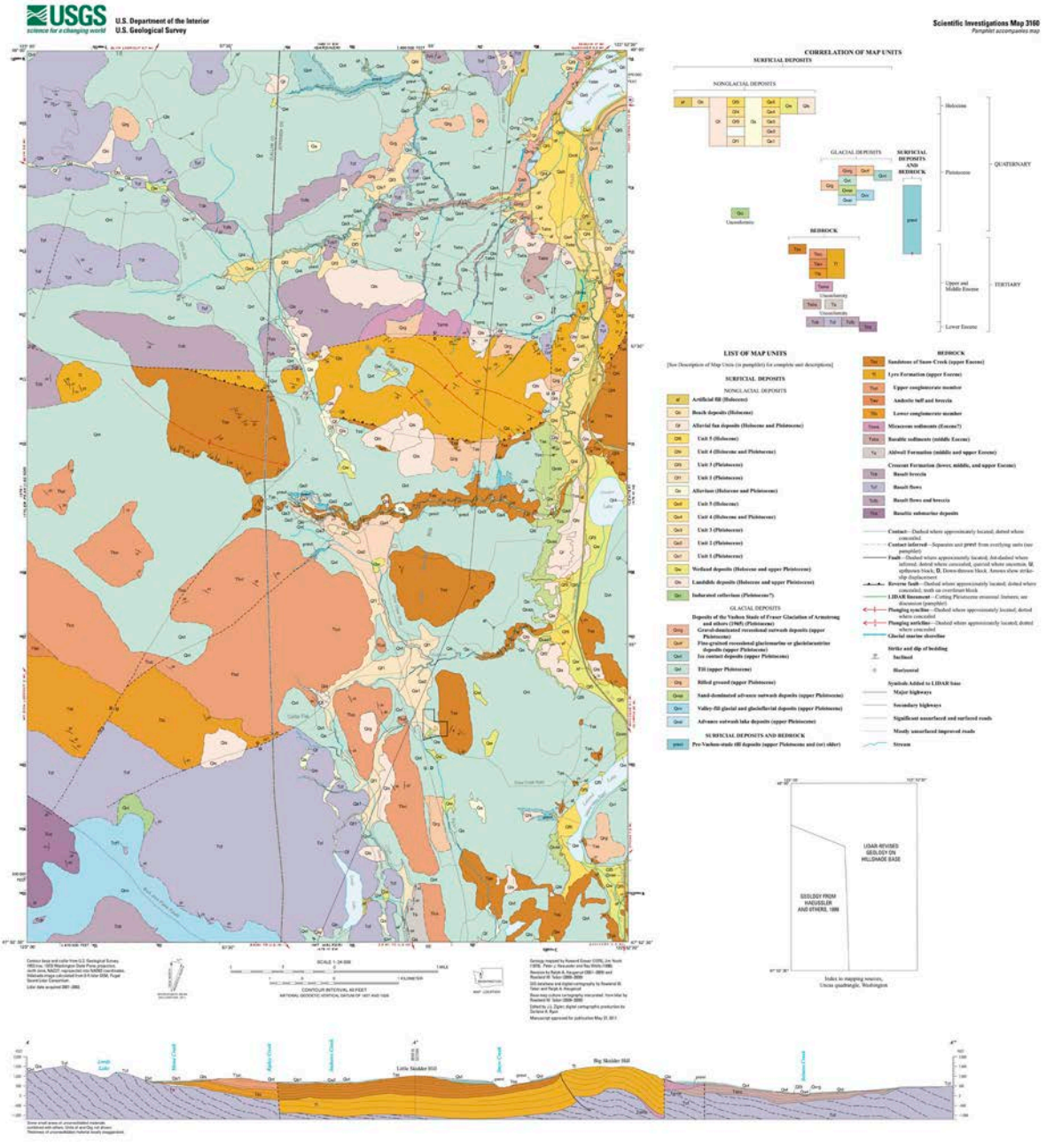
We are investigating techniques for low-input soil building and invasive plant removal, and combining the need for subsistence with the desire to rehabilitate a landscape damaged by over a century of logging. Through clearing with hand tools, we will also be able to perform a more detailed plant inventory, and support the native species that we want to continue living and thriving here. We do not work professionally in the field of landscape architecture, but we are dedicated to caring for this land in a changing climate while supporting a complex subsistence ecology and communal longevity. This proposal is a proof-of-concept for tending and improving a damaged landscape through inhabitation, combining our need for food, beauty, and care with the needs of the land, its creatures, and its metabolism.

Roughly 79% of forested lands in Washington state are managed for commercial timber extraction. Since 2018, we have witnessed much of the neighboring forests get cleared to the ground and almost immediately replaced with invasive species, which the timber companies then saturate with glyphosate and other toxic herbicides. As we continue our long-term relationship with this land, it is becoming clearer that to learn to live here is to learn to regenerate the land as a strategy toward protecting regional and hyper-local biodiversity which is severely compounded by widespread logging malpractice.



An early site design for the entire site. The current terracing project is part of developing the contour orchards.

GEOLOGY, HISTORY, FUTURE



The terraces we are gardening sit on a small ridge formed by an outcropping of Snow Creek Sandstone, a sedimentary formation deposited between 48 and 35 million years ago off the Pacific coast and uplifted into what are now the Olympic Mountains 18 million years ago. Immediately below the terracing site is a lower bench of "cobble gravel, pebbly sand, and sandy silt" deposited on the margins of Fraser Glaciation ice between 25,000 and 10,000 years ago. These deposits were transported through glaciation and erosion down from the higher bedrock in the Olympic Mountains. In the valley below, wetland deposits of peat with intermixed sand, silt, and clay were deposited roughly 10-12,000 years ago. To the south, northeast, and on the eastern side of the sandstone outcropping that forms the slope where we work, glacial till composed of granitic clasts illustrates where glaciers used to sit.

Forest succession unfolded after the retreat of the glaciers, likely following the same progression we are familiar with today: alder and willow growing in the mineral rich but nutrient poor soils, followed by Douglas fir and bracken fern during a warmer, drier period. A cooler and moist period from 8,000 to 3,000 years ago created perfect conditions for hemlock, spruce, and western red cedar to become the apex trees of the region. This valley, and this entire region, was occupied by the Twana people for millennia, and likely tended by both humans and beavers through fire, harvesting, forest gardening, and dam building. We are unsure when the first logging operations began here, but know that the first European settler to reside in this valley was Ernest Ripley, a dairy farmer born in Massachusetts who came west in at the turn of the 20th century. His primary legacy today appears to be the conversion of a rich wetland into dairy pasture, and the introduction of reed canary grass (Phalaris arundinacea) as a fodder crop. Reed canary grass continues to strangle out native plants and dominate the wetland, as well as spreading easily to any cleared areas on the slope.

That is one history of this place. Another history comes from a Skokomish elder, Frank Allen, recorded in the 1930s:

"The Skokomish people had a flood. My grandfather said about eight or nine generations before his time. The Skokomish all put food and their belongings in canoes and then the rains and the waters began to rise. They rose and rose until the mountains were covered. All except one back of e'lo'aA, called duxwxwe'kw [Where you Tie yourself]. Just the top of this mountain was showing." (Wray, 71-72).

e'lo'aA is known today as Mount Elinor, a prominent peak just slightly to our south. In 1855, the Treaty of Point No Point established a small reservation on the mouth of the Skokomish River, and subsequent decades of pressure from the state and federal governments and white settlers forced most Twana inhabitants of this area off their land and far to the south.

All of this is to say, this place is composed of ancient elements and relations but has existed in its current shape and landform for only the past 10-12,000 years. The sandy, gravelly soil we are clearing and trying to grow food in was once a sandstone promontory sitting above a narrow lobe of glacier, with meltwater streams running along the margins. Waves of forest succession and heavy rains built up acidic but high organic matter soil in the forest forest floor, while a vast web of human and non-human actors formed a cultural ecosystem that supported many different forms of life. Cultural genocide of the Twana people, beavers, and forests have helped to turn the soil of the slope into a compacted and nutrient poor Douglas fir plantation, but in the understory there persist culturally and ecologically important plants, including healthy populations of Mahonia nervosa and red huckleberry.

It is in this context, both in the deep time of geological history and the recent history of European settlement and devastation, that our work is situated.

RECENT HISTORY

We purchased this land with a collective of friends in 2018. Since then, on the site of this specific terracing project, we have cleared blackberries, planted serviceberry, aronia, apple, hazelnut, red flowering currant, honeyberry, Siberian pea shrub, and sea buckthorn, among others. We have observed the Douglas fir plantation, planted after the last clearcut in 2014, grow from knee high seedlings to 15' tall saplings, and the cut-leaf blackberries grow from small patches to impenetrable brambles. We have begun to understand the flow of water, and continue to be surprised by the unpredictable weather patterns and climatic shifts–including a dramatic swing this year from a dry October with temperatures persisting in the 60s and 70s to a freak blizzard in early November which dumped 5 inches of snow on trees still bearing all of their leaves.

NEXT 10 YEARS

In 2023, we will plant trees, shrubs, and groundcover in the cleared terraces, mulching them with woodchipped material from on site. Prior to planting, we plan to amend the soil as needed to improve the deficiencies we discovered through observations and soil tests. We anticipate a large quantity of calcium, wood ash, kelp, and compost in our near future. We will also connect the 1,350 gallon water tank to gravity-fed irrigation lines running down to each terrace. Following years will require deer fencing, ongoing blackberry and tansy control, and eventual cutting or coppicing of the alders, bitter cherries, and maples we are currently leaving. We also intend to plant a hedgerow of willows on the downslope side of the lowest terraces, for erosion & run-off control and to coppice for withies and polewood for garden architecture (trellises, fences, wattle retaining walls, etc.). We anticipate needing to replace some trees that will die, and learning an appropriate cycle of woodchipping/mulching/soil amendments. As the terraces take shape we anticipate further understory plantings, as well as building pleasant and habitable garden architecture: benches for sitting, small sheds for tool storage, more small rain catchment systems, and more.

We don't know what will happen with the climate and plant life here in the long term. We hope that building soil, planting trees, and holding water in the landscape will make it more resilient, viable, and food-giving for creatures of all sorts in the difficult centuries ahead.

SUMMARY AND REFLECTIONS

We sited our terraces after a few years of getting to know the place and observing the landscape trends. Previous logging grades left a set of more obvious, nearly-flat areas that we are retrofitting into orchard terraces. Prior to receiving the Practice Landscapes Grant, we identified, cleared, and planted three terraces. From top to bottom, we refer to them as Buckthorn Wilderness (where we planted 10 Sea Buckthorn shrubs), Malus Palace (the home of our apple trees, among others), and Hazelberry (home to hazelnuts and honeyberries). Since receiving the grant we have identified three more terrace sites, which have seen the bulk of the work of the grant.

Every step of this process has been iterative and recursive: we began with a broad vision of transforming the clearcut into a food forest, and knew that terracing would be important for long term soil retention. We planted our first two terraces early on, with low-cost bare-root trees that we selected for low maintenance hardiness. Our initial goal was to introduce a shrub layer among the rapidly growing replanted Douglas fir, begin creating organic matter for mulching later on, and establish some plant diversity among an otherwise monocultural plantation. Each of the terraces we have established since have come about through walking up and down the paths, observing the land, and beginning to understand our habitual movement through space. The conventional "zones" of permaculture design are challenging on this land, as we have distributed dwellings and the primary building sites are not conducive to intensive food production. As a result, we have prioritized planting and cultivating along trails, with the hopes that regular foot traffic will lead to the kinds of observation and tending needed to cultivate these budding orchards.

Our initial plantings also informed us of the need for site-generated mulch. Without vehicle access, carrying up sufficient wood chips to deeply mulch all of our trees has proven unrealistic, and so we identified a wood chipper as a primary tool necessary to scale up our planting.

Equipment needs safe storage, and so we constructed a shed for the wood chipper to protect it from the elements–a shed which can also provide storage and a central location for other tools.

Planting terraces in 2019

Broadforking a newly cleared terrace

Fresh mulch

Steep footpath to terraces

3 Inch Woodchipper

Woodchipper Shed

Our next step was physical clearing of the terraces. We used loppers, hand pruners, and a weed whacker with metal blade to clear blackberries, salmonberries, and elderberries, making sure to leave the stems on blackberry crowns long enough to easily identify them for later removal. Heavy duty gloves and a lot of volunteers were both critical for this phase. Organizing material for easy woodchipping is important here: we build brush piles with the debris all oriented on the same axis, and with rootballs all pointing the same direction. Clearing with primarily hand tools allowed us to observe the existing plants and leave healthy stands of native understory, including Mahonia, some impressive old growth red huckleberries, bitter cherry, and more.

Woodchipping is a noisy and arduous affair. Good gloves, good ear and eye protection, and a good attitude go a long way. We prioritized depositing woodchips to the uphill side, and found that 2-3 people was a good number for organizing, transporting, and feeding debris. Woodchipping is also an interesting tactile way to learn about plant architecture–the many rigid lateral branches on blackberry canes made them particularly hard to feed into the woodchipper, while the upright growth habits of salmonberries funneled easily.

The brush that we did not chip was reserved and stacked into check dams on the downhill contours to help retain soil and slow water runoff.

Once the site was cleared of the dense *Rubus* brush, with primarily alder, fir, maple, and bitter cherry saplings remaining, we began removing *Rubus* rootballs by hand (and mattock, and shovel, and saw!). We could see enough to accurately survey contours and measure planting rows. We used a water level (bunyip) and surveying flags to mark three contours roughly 30' apart, thus establishing the primary planting rows for our biggest trees. A 100' measuring tape was useful to accurately map the planting area.

We converted the measurements we took to a scaled map of the project, and created paper cut-outs of different tree diameters to help develop a planting plan.

Blackberry Rootball

Stacking brush for chipping

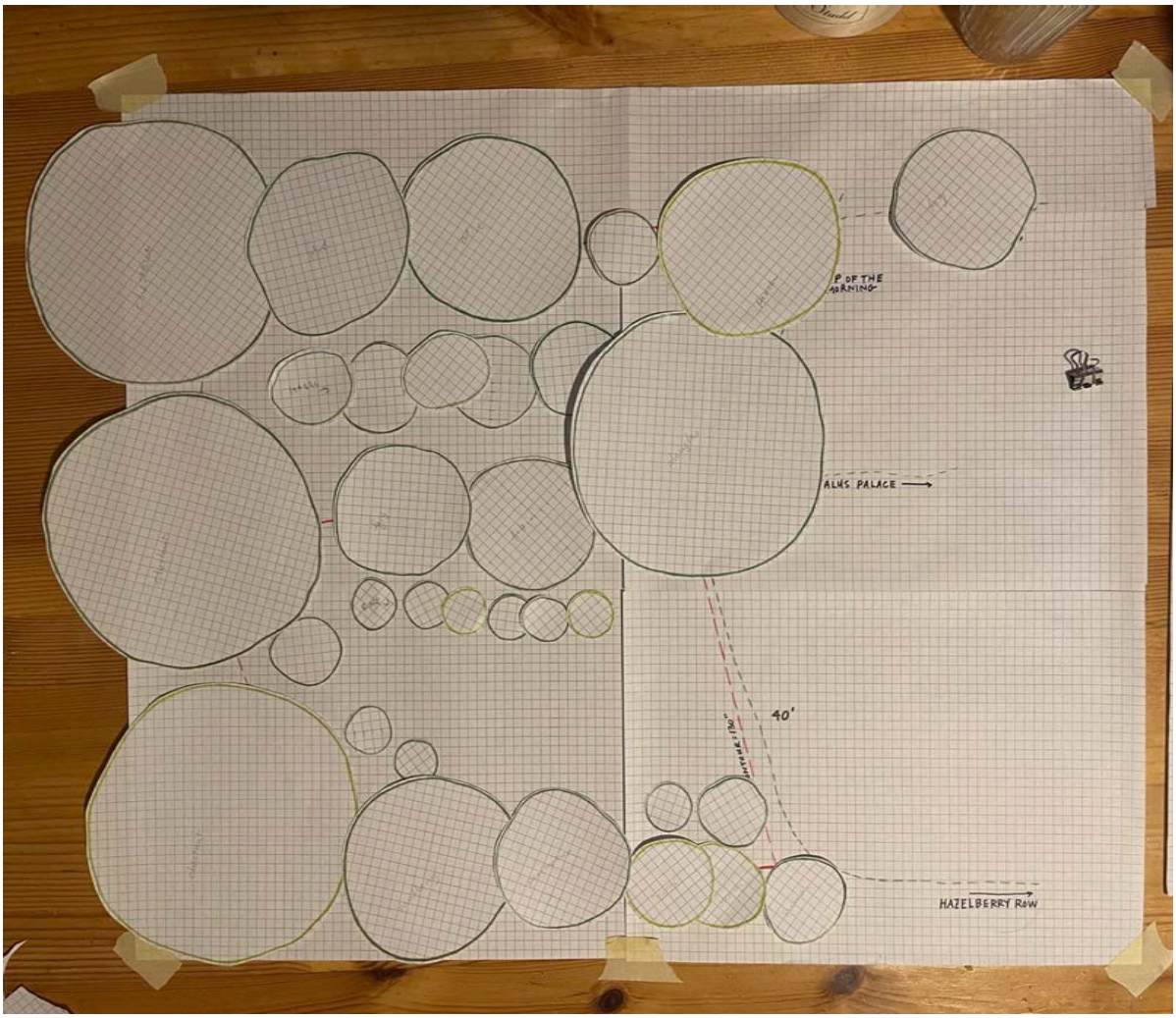
Blackberry, meet woodchipper

We also benefited from a big volunteer push from friends to help transport a 1,350 gallon water tank up a narrow foot-path by hand. We are still in awe at how quickly and seamlessly it happened.

NEXT STEPS

The next few years will be challenging. We need to establish our trees and an appropriate groundcover to improve the soil, continue controlling blackberry growth, and protect young and tender plants from deer. In the spring of 2023 we broadforked and shaped the terraces and plante trees, cover crops, and shrubs. We will also install a gravity-fed irrigation system from the water tank at the top of the hill. We have left the majority of the non-coniferous trees in place for now– alder for its nitrogen-fixing and soil improving abilities, bigleaf maple for its generous production of leaf mulch and its propensity for coppicing, and bitter cherry to feed native birds. We hope that the combined leaf litter of these deciduous trees, plus the shade they create as they grow, will help to improve the soil until they begin actively competing with the cultivars we are planting.

Stacked brush piles after a large work party



Planting plan for the three new terraces

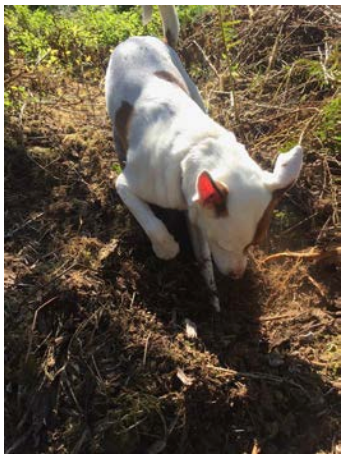
Soil ribbon tests

Collecting soil samples

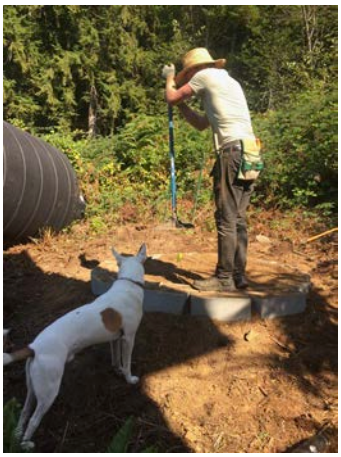
Soil samples ready to ship

Fresh mulch

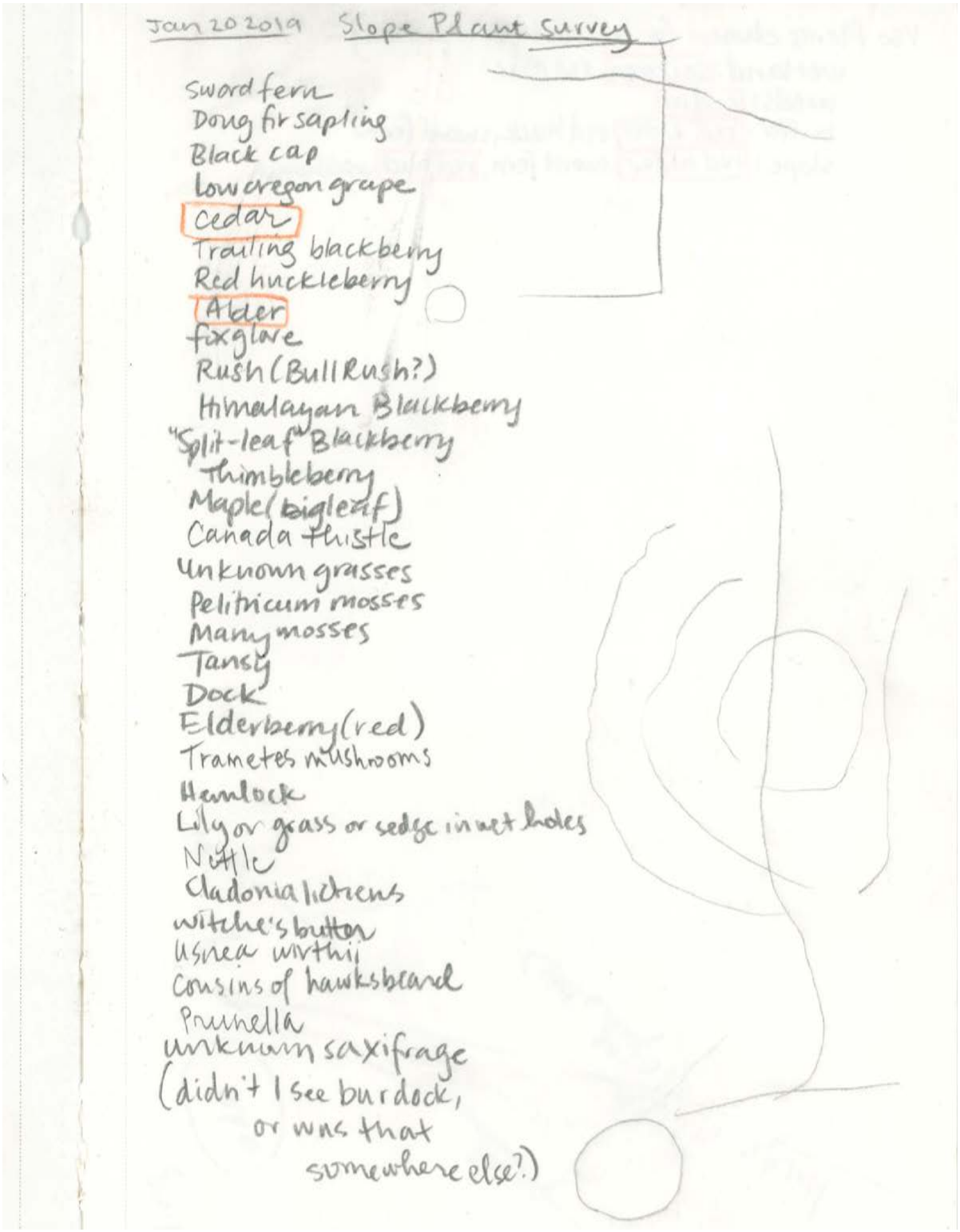
Mind the newts



Our loyal digging helper



The water tank saga



An early plant inventory

APPENDIX 1: PLANT INVENTORY

N = native
I = introduced/invasive; unintentional
G = gardened; introduced by us intentionally

PLANTS THAT EXIST ACROSS THE SLOPE

Western Red Cedar, Thuja plicata [N]
Douglas fir, Pseudotsuga menziesii [N]
Western Hemlock, Tsuga heterophylla [N]
Big leaf maple, Acer macrophyllum [N]
Bitter cherry, Prunus emarginata [N]
Red Alder, Alnus rubra [N]
Cascara sagrada/chittern stick, Frangula purshiana [N]
Salmonberry, Rubus spectabilis[N]
Black cap, Rubus leucodermis [N]
Trailing blackberry, Rubus ursinus [N]
Thimbleberry, Rubus parviflorus [N]
Himalayan blackberry, Rubus arwwmeniacus [I]
Cut-leaf blackberry, Rubus lacianatus [I]
Red elderberry, Sambucus racemosa [N]
Spirea, Spirea douglasii [N]
Low oregon grape, Mahonia nervosa [N]
Tall oregon grape, Mahonia aquifolium [N]
Red huckleberry, Vaccinium parvifolium [N]
Sword fern, Polystichum minutum [N]
Mosses [N]
Lichens [N]
Lungwort lichen, Lobaria pulmonaria [N]
Sedges [N]
Tule/Hardstem Bulrush, Schoenoplectus acutus [N]
Reed Canary grass, Phalaris arundinacea [I]
Sulfur tuft and other saprophytic basidiomycetes [N]
Tansy ragwort, Senecio jacobaea [I]
Pearly everlasting, Anaphalus margartiacea [N]
(maybe a cudweed?) [N]
Nipplewort, Lapsana communis [I]
Foxglove, Digitalis pupurea [I]
Canada thistle, Cirsium arvense [I]

Bleeding heart, Dicentra formosa [N]
Cat's Paw, Hypochaeris radicata [I]
Nettles, Urtica dioica [N]
Self-heal, Prunella vulgaris [N]
Violet
Field mint, Mentha arvensis [N]
Chickweed willowherb, Epilobium alsinifolium [I]
Fireweed, Chamerion angustifolium [N]
Large-leaved Avens, Geum macrophyllum [N]

SPECIFIC TO HAZELBERRY

Lemony quince [G]
Goumi, Elaeagnus multiflora [G]
Hazelnut, Corylus avellana [G]
Red flowering currant, Ribes sanguineum [N] [G]
Scouler's willow, Salix scouleriana[G] [N]
Garlic, Allium sativum [G]
Chives, Allium schoenoprasum [G]
Yarrow, Achillea millefolium [G]
Lupine, Lupinus spp. [G]
Crimson clover, Trifolium incarnatum [G]
White clover, Trifolium repens [G]
Honeyberry, Lonicera cerulea [G]
Dandelion, Taraxacum officinale [I] [G]
Fava bean, Vicia faba [G]
Comfrey "Bocking 14" (sterile cultivar), Symphytum officinale [G]
Daylily, Hemerocallis fulva [G]

SPECIFIC TO MALUS PALACE

Apple, "Arkansas Black", Malus domestica [G]
Serviceberry, Amelanchier alnifloia [G]
Hazelnut, Corylus avellana [G]
Black Chokeberry, Aronia melanocarpa [G]
Red flowering currant, Ribes sanguineum [G]
Currant (black or white), Ribes spp. [G]
Siberian pea shrub, Caragana arborescens [G]
Lavender, Lavandula angustifolia [G]
Yarrow, Achillea millefolium [G]
Chocolate mint, Mentha × piperita f. citrata [G]
Comfrey "Bocking 14" (sterile cultivar), Symphytum officinale [G]

Sunchoke, Helianthus tuberosus [G]
Elecampane, Inula helenium [G]

SPECIFIC TO THE BUCKTHORN WILDERNESS

Sea Buckthorn, Hippophae rhamnoides [G]
Red flowering currant, Ribes sanguineum [G]
Black Chokeberry, Aronia melanocarpa [G]

APPENDIX 2: SOIL

DATE OF REPORT: 12/12/22

SOIL ANALYSIS REPORT

PAGE: 1

SAMPLE ID	LAB NUMBER	Organic Matter		Phosphorus		Potassium	Magnesium	Calcium	Sodium	pH		Hydrogen	Cation Exchange Capacity	PERCENT CATION SATURATION (COMPUTED)				
		*	**	P1 (Weak Bray)	$NaHCO_3$-P (OlsenMethod)	K	Mg	Ca	Na	Soil	Buffer	H	C.E.C.	K	Mg	Ca	H	Na
		% Rating	ENR lbs/A	**** * ppm	**** * ppm	***** * ppm	*** * ppm	*** * ppm	*** * ppm	pH	Index	meq/100g	meq/100g	%	%	%	%	%
HAZEL	58473	13.2VH	294	46VH	30**	440M	291L	1346VL	16VL	4.2	5.1	24.6	10.8	3.2	6.9	19.3	70.4	0.2
TERR1	58474	27.6VH	581	66VH	35**	288L	233L	1347VL	31VL	3.8	4.4	28.5	9.9	1.9	5.0	17.7	75.0	0.4
TERR2	58475	19.7VH	425	26M	25**	298M	195L	946VL	23VL	3.6	4.6	21.6	7.6	2.7	5.6	16.4	75.0	0.3
TERR3	58476	22.0VH	469	44VH	29**	401M	265L	1177VL	18VL	3.7	4.2	27.5	9.6	2.8	6.0	16.0	75.0	0.2

** NaHCO3-P unreliable at this soil pH

SAMPLE NUMBER	Nitrogen NO_3-N	Sulfur SO_4-S	Zinc Zn	Manganese Mn	Iron Fe	Copper Cu	Boron B	Excess Lime	Soluble Salts	Chloride Cl		PARTICLE SIZE ANALYSIS			
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	Rating	mmhos/cm	ppm		SAND %	SILT %	CLAY %	SOIL TEXTURE
HAZEL	21M	3VL													
TERR1	37H	4L													
TERR2	35H	3VL													
TERR3	23M	4L													

* CODE TO RATING: VERY LOW (VL), LOW (L), MEDIUM (M), HIGH (H), AND VERY HIGH (VH).
** ENR - ESTIMATED NITROGEN RELEASE
*** MULTIPLY THE RESULTS IN ppm BY 2 TO CONVERT TO LBS. PER ACRE OF THE ELEMENTAL FORM
**** MULTIPLY THE RESULTS IN ppm BY 4.6 TO CONVERT TO LBS. PER ACRE P_2O_5
***** MULTIPLY THE RESULTS IN ppm BY 2.4 TO CONVERT TO LBS. PER ACRE K_2O
MOST SOILS WEIGH TWO (2) MILLION POUNDS (DRY WEIGHT) FOR AN ACRE OF SOIL 6-2/3 INCHES DEEP

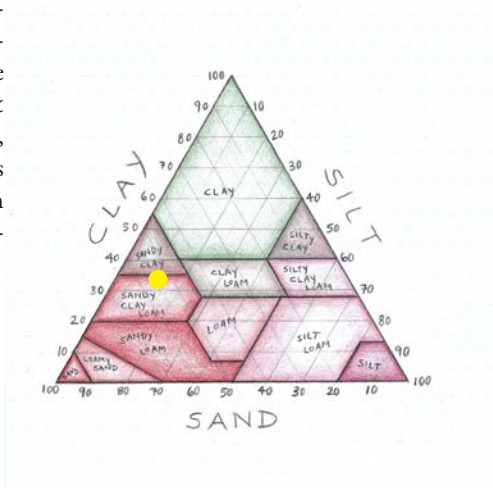
This report applies only to the sample(s) tested. Samples are retained a maximum of thirty days after testing.

Joe O'Brien

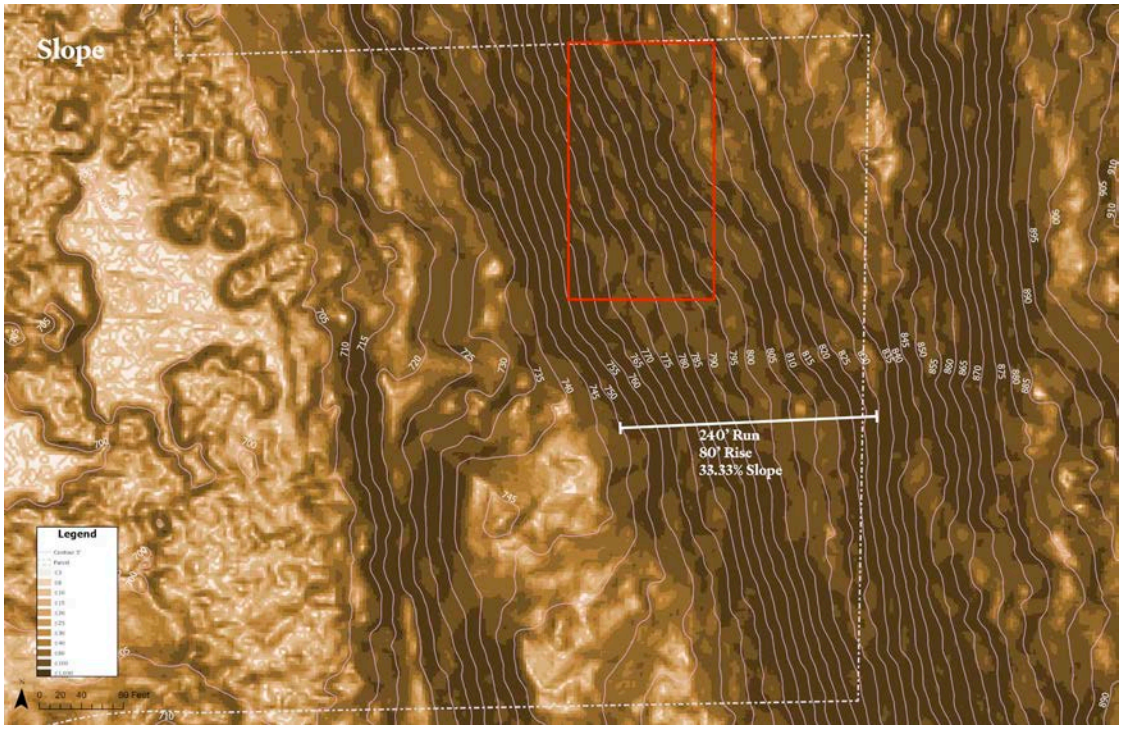
Joe O'Brien, CCA
A & L WESTERN LABORATORIES, INC.

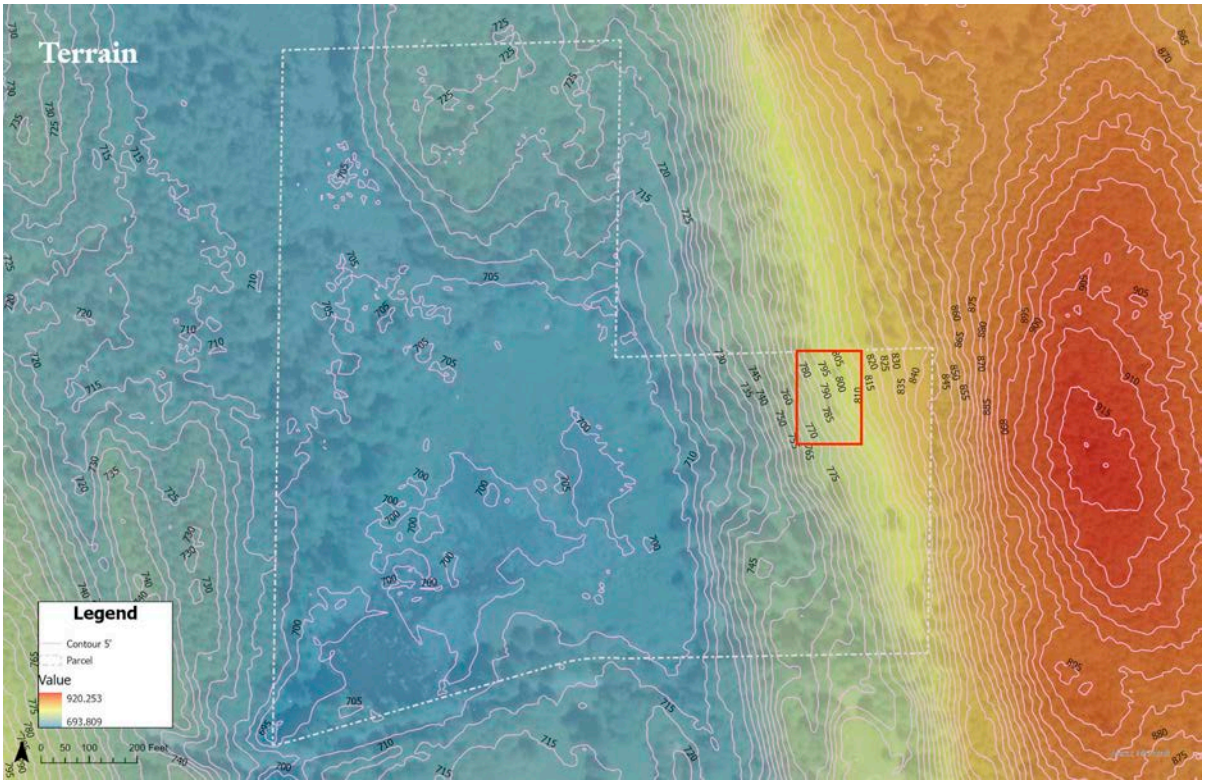
SOIL TEST RESULTS

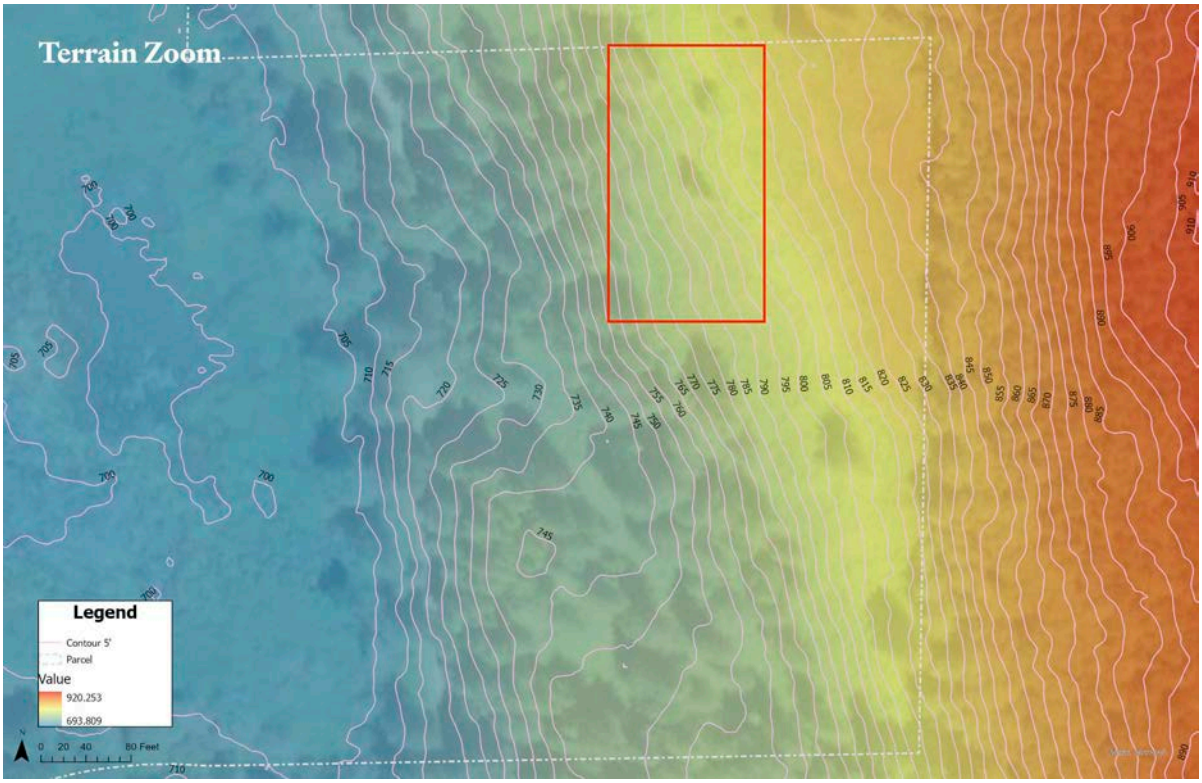
We tested soil on the three new terraces, as well as Hazelberry, with both DIY ribbon tests and a laboratory. We learned that the soil was highly acidic, with relativelt high nitrogren content, high organic matter, and very low cation exchange capacity (CEC). Forested soils in rainy Washington have a reputation for acidity and very low calcium content. We hypothesize that over a century of clearcutting and growing monoculture coniferous trees–adding needles to the soil and removing most organic matter through large harvesting–has not improved the situation. Organic matter will help here, but most importantly if it is non-coniferous. We hope that the abundant *Rubus* woodchips, as well as leaf litter from alders & other deciduous trees we are leaving, might help to create better mulch conducive to healthy soil biomes. We are also investigating the use of wood ash & urine combined as a soil amendment for increasing pH, adding calcium, and increasing fertility. We produce both of these in large quantities through daily life! See the appendix for articles on soil acidification in Washington, clearcutting impacts, and wood ash and urine as amendments.



APPENDIX 3: MAPS COURTESY OF MARK HELLER




Terrain
Legend
Contour 5'
Parcel
Value
920.253
693.809
0 50 100 200 Feet


Terrain Zoom
Legend
Contour 5'
Parcel
Value
920.253
693.809
0 20 40 80 Feet

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