

SUS 599 Intro to Permaculture Final Project
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Preliminary Site Design – Refugia Gardens, Flagstaff



As we take on the obligations of kinship with the land, so too does the land take care of us.

Introduction

Refugia Gardens is a project started to address a sense of uprootedness and paralysis stemming from the contradiction of inaction in the face of existential urgency. A burgeoning small-scale farm, the mission is one of tending kinship between land and people by growing and gathering bioregional crops and by creating thriving refuges for human and other-than-human communities. In observing and experiencing the social and ecological inequities pervasive in this area (i.e. food access, food sovereignty, land exploitation, settler-colonialism, etc.) the question of taking action then became one of how to address these detrimental and violent inequities in the name of kinship and care, while tending to our own individual soul-sicknesses born of wanting connection and deep relationship with Place and Other that dominant Western society does not support. In a sense, Refugia was born out of great Grief for our world and everyone held within facing climate change, and so born out of great Love for our world and everyone held within.

Refugia are unique places of relative stability where species can flourish during immense ecological change. Amid upheavals in the social, ecological, political, and economic realities of our time, the word *refugia* informs the praxis: together, making refuge and taking refuge—for humans and

others. As such, those with the gardens are dedicated to cultivating food-focused refuges that thrive through the present and coming storms of climate change, capitalism, colonialism, and ecological devastation.

The gardens operate on the following set of principles and practices, which inform the motivations and developments of the gardens and so inform this plan analysis:

- Grow healthy, bioregional crops—for the people, by the people
 - Sustenance for the body and spirit comes from the land. Our regenerative growing practices are informed by the call and response arising from conversation with the land, water, plants, and animals.
- Tend respectful, non-exploitative relationships with land, water, & human communities
 - We believe our relationships with each other are deeply connected to our relationships with the land and with ourselves. Conversing with human and other-than-human life cultivates kinships that inform our co-creative, interdependent existence in the world.
- Support Indigenous food sovereignty and land stewardship
 - Settler colonialism—a land-based project which seeks to eliminate Indigenous peoples and replace them with settler society—is not a past event but an ongoing process on the Colorado Plateau, entwined with dominant economic, social, and political systems that continue to devastate land and people. We believe that those of us non-Indigenous settlers have particular obligations to practice anti-colonial relationships with the land and Indigenous peoples who have long inhabited this region. Our work is not to re-settle the land; it is to un-settle oppressive structures within and beyond ourselves, while practicing thriving otherwise.
- Increase land access for the landless

- Lack of land access among poor, people of color, Indigenous, and young people is a historical symptom of the structures of domination. Land access issues prevail among peasant farmers across the world. Not having access to land or knowledge of gardening, farming, and gathering can make land-based work seem non-viable as lifework. Working together strategically for land access is necessary to build a just and resilient local food community.
- Redistribute surplus equitably—in solidarity not charity
 - While dominant economic systems promote self-oriented accumulation, we believe that equitable redistribution is fundamental for a healthy and vibrant community that supports all of its members. In redistributing surplus food, seeds, knowledge, and otherwise, we engage in solidarity, not charity—struggling together in the practice of mutual aid.
- Respond to the present crises (ecological, economic, and social) and build regional resiliency
 - Mutual aid and reciprocity are crucial components of community resiliency in times of crisis. Crises, like illnesses, can be chronic (long-term) and acute (short-term), and sometimes can be both. In cultivating grassroots resiliency, we work collaboratively to build regional food sovereignty.

(Eckert, White, & Schierl, 2018)

Vision and Mission

With these principles and positionings in mind, the mission of this design project is to revitalize the soil and ecosystems of the land to foster bioregional and regionally adapted food crops that contribute to the resilience of our human and non-human communities. In particular, we look at regenerative, non-exploitative growing practices to work in deep relationship with the land whereby we

are able to provide healthy regionally-appropriate food for our communities amid the current and compounding climate crisis.

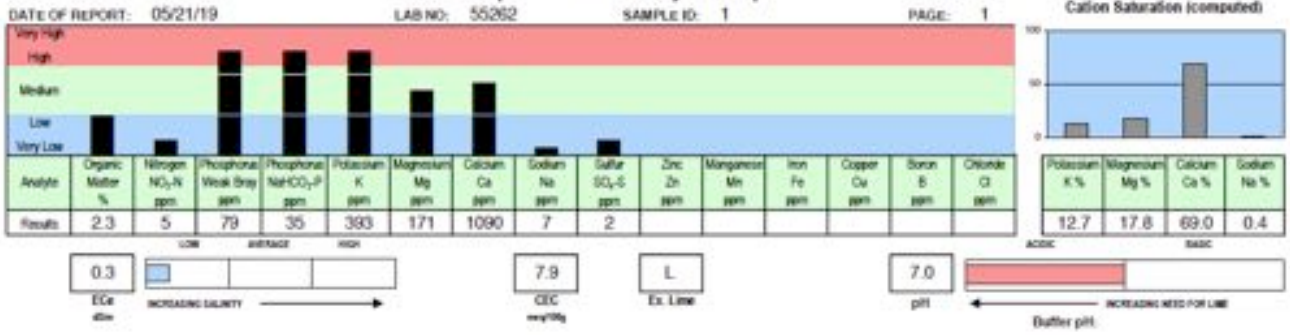
We envision a space where folks can be directly involved in growing, harvesting, and using their own food and medicines in relationship with the non-human peoples of this place. We want the site to encourage the application of, and experimentation with, Permaculture principles and practices such that they are seen as a tool and less of a dogma. Our priorities include instituting efficient energy harnessing systems (including active and passive rainwater harvesting and storage), creating windbreaks of native and perennial edible plants, and beginning a regionally-appropriate orchard with perennial inter-cropping. We would like the following elements to be a part of the system: mushroom cultivation, native wildflowers and grasses that attract an array of pollinators, a robust assortment of bioregional herbs (medicinal and culinary), integrated composting systems, animal husbandry (i.e. chickens and bees), habitat for existing fauna, and a goal toward the removal of dependency on dominant energy utilities (i.e. Doney Park Water Utility, Arizona Public Service electric utility, etc.).

Description of Challenges and Constraints

The primary site of cultivation currently sits on a 2.5 acre plot of land to the east of the so-called San Francisco Peaks, in the Timberline neighborhood. The land is entering its second year of full-time cultivation with a group of three regularly attending to it. The major constraints and challenges of the area are regarding: soil, water, wind, heavy restriction to funds.

Due to a long history of dry farming (with tillage) by the Mormon Church, soil compaction from livestock, and devastating flooding, the soil on which the garden sits is nitrogen deficient and heavily devoid of organic matter. (see Fig. 1) Additionally, the soil has such a texture that when allowed to completely dry, the exposed top layer of soil (note that this is not a “topsoil”) becomes largely hydrophobic, making water saturation and storage difficult. The challenge presented is one of soil regeneration—building soil without the use of artificial fertilizers and additives.

Graphical Soil Analysis Report



Soil Fertility Guidelines

CROP: ORGANIC RATE: lb/1000 sq ft NOTES:

| Colman (70 score) | Line (70 score) | Opium | Elemental Sulfur | Nitrogen N | Phosphate P ₂ O ₅ | Potash K ₂ O | Magnesium Mg | Sulfur SO ₄ -S | Zinc Zn | Manganese Mn | Iron Fe | Copper Cu | Boron B |
|-------------------|-----------------|-------|------------------|------------|---|-------------------------|--------------|---------------------------|---------|--------------|---------|-----------|---------|
| | | | | 3.4 | 1.0 | | | 0.7 | | | | | |

- C** NITROGEN sources include composts and legumes as well as blood meal, cottonseed or alfalfa meal, hoof & horn, fish or chicken feather meal. Sodium nitrate is not recommended. Monitor brix levels.
- M** PHOSPHATE: Availability varies with product. However, poultry-based products are a good source.
- M** Otherwise, consider bone meal or soft rock phosphate. Blood & bone meal will also provide nitrogen.
- E** MINED GYPSUM is a good source of sulfate-sulfur (10 lb provides about 1.5 lb S). Certain natural sources
- N** of sulfate of potash may also be used (10 lb provides about 1.8 lb S as well as 5 lb K₂O).
- T** IF growth is not satisfactory, consider causes such as compaction, moisture, root or stem damage, herbicide
- S** residues, micronutrients, contaminants or other pests, and disease - and climate.

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Fig. 1: Results of soil analysis for site conducted in May 2019

The site sits on the east side of the San Francisco Peaks, which is the leeward side, in the rainshadow. As a result, Refugia receives on average approximately eight inches less precipitation annually than areas west of the Peaks. (NOAA, 2010) This is compounded with the reality that climate change is already having unprecedented effects on the reliability of annual weather patterns (i.e. little to no Monsoon activity in the 2019 season), reminding us of the high potential for aridification. In an area that is already considered a high-desert environment, every drop of water is precious. Right now, the gardens are relying on a local water utility to meet irrigation needs. The challenge presented is how to make use of every drop of water that falls in the area to reduce the financial and environmental burden of relying on a water utility.

Refugia sits in the path of the wind-tunnel created by the valley between Mount Elden and the San Francisco Peaks/Dry Lake Hills to the southwest. The prevailing winds of the region are already

southwesterly; this tunneling effect intensifies and directs the winds to the point that often we face sustained winds of 25-30mph with gusts of 60mph. This not only intensifies the drying effect of the rainshadow, but also informs our infrastructure and viable species availability. The challenge presented is one of creatively instituting windbreaks to disperse the energy of the winds and create viable microclimates for vulnerable species.

Perhaps the greatest challenge is one of funding these larger “one-and-done” projects necessary for the initial institution of gardens or farms. We are all young folks with limited access to capital and a deep reluctance to accrue debts in this pursuit. Currently the farm operates with largely volunteer labor, and the funds acquired from our sales at the Flagstaff Community Farmer’s Market, as well as our CSA subscriptions. In expanding our growing area, we will be able to expand our sales to further support these endeavors. The challenge presented is to find creative methods of funding operations and building capacity.

Overview of Master Plan

Broadly, the entire property would see further integration of native grasses, native perennial or self-seeding pollinators, and ground-covers in an effort to increase biomass in the soil as increase the water-retention capacity of the soil. To aid in the robust growth of the soil’s microbial communities, the whole property would see layers of however much compost and manure we are able to produce or acquire from organic, reputable sources. Additionally, mycelial communities would be established in wetter, shadier portions of the property to increase the water storage and microbial association capacity of the soil, as well as engage in the mycoremediation of soils. We would integrate species that have edible fruiting bodies to supplement our food crops. The northern plot of irrigated rows will be extended an additional 50 feet, and low-flow drip irrigation will be introduced to all actively irrigated areas to reduce watering costs. Active and passive rainwater harvesting and storage systems would be introduced in the form of earthworks, storage tanks, and a storage pond.

Note: any prospective plant species listed below are assumed to be a naturalized, regionally-adapted, or native variety. The lists below are considered speculative and by no means exhaustive.

The northeast corner of the property is the highest point on the property, and so all the water that enters the area drains southeast-ward from that point (see Sector Analysis map). That being said, the property overall has a relatively shallow grade; there is not much slope in which significant terracing could be done. However, the desire is to take that northeast corner and implement some earthworks to create a shallow terrace/ditch-and-swale passive catchment system along the contour lines to allow water to slow, spread, and sink in that area to slowly drain to the rest of the property (see Potential Future map). In that area we would plant native grasses with the root systems able to stabilize the soil, as well as perennial bioaccumulators to draw up nutrients and assist in raising the water table. Additionally planted in this area would be food crops that can be traditionally dry-farmed, as the only water the area would be receiving would be from perennial rains and snows. Such a planting would include crops like corn, beans, squash, garlic, onions, bee plant, medicinal herbs like horehound, comfrey, and calendula, as well as culinary herbs such as saltbush, saffron, thyme, and epazote.

The area that is currently used as a dog run (labelled so on the base map) would be reduced for the introduction of an orchard in the northeast corner of the property. Ideally a variety of fruit and nut bearing trees would be introduced, such as apple, pear, apricot, and peach. Additionally, interplanted through the trees would be fruit-bearing shrubs such as raspberry, currant, and wolf-berry. To round out the guilds we would have low-lying nitrogen fixers, likely in the 6:10 ratio of nitrogen-fixing plants to fruit-bearing plants to provide adequate nitrogen supply for the trees. Such species could include milkweed, lupine, and buckthorn. (Rayner, 2013) Dispersed among these would be perennial pollinator attractors that are staggered in their blooming times to provide habitat and sustenance for native pollinators as well as the apiary that would be housed within the orchard. Such species could include bee plant, lemon balm, milkweed, mints, native iris, and clovers.

The area to the west of the main house (“High Desert Food Forest” on the Potential Future map) would be transformed by introducing additional wind-hardy, drought-tolerant tree and shrub species such as ponderosa pine, pinon pine, gambel oak, cliffrose, and rabbit-brush. To add to the guilds in the pursuit of a food forest model, species such as yucca, prickly pear, currant, wolf-berry, yarrow, elderberry, and Navajo tea would be added.

Conclusion

Refugia is still in its young stages, and as such has incredible potential for malleability in its growth. As this iteration of a site design was being developed, discussion turned to the very real possibility of the acquisition of different land, in greater and less developed acreage, and the potentiality of relocating to the wetter side of the mountain. As we develop as a project in our ideologies, there is more and more thought about the necessity of Refugia as being moveable, malleable, and focusing on connectedness in space and place. “Refugia” as an organization and idea of community with a guiding core of folks, with the understanding that refuge is so singular to the place in which it is created – To that end, within the organization (read: community), there need be understanding of the different and equally necessary energies of “*being with*” and “*walking with*” as a cultivated aspect of community. Refugia as a practice of being in and with place, but also a practice of walking through place – an embrace of the inherent impermanence within the perceived permanence of land work, guided by principles upheld and shaped by our continual learning.

In fewer words, this site design could likely be scrapped in the near future. Yet this iteration is still an exercise in the embodiment of our mission, vision, and objective practices and has allowed for an experience of the complexity of designing practical systems for the real world. Refugia in its current and ever-shifting form already represents significant steps toward the development of a resilient, regenerative, and *relational* ecological system. The hope is that the major parts of this design will improve the health and productivity of Refugia Gardens, while also allowing for experimentation, interconnection, and a revitalization of community.

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BASE MAP

REFUGIA GARDENS

As of Spring 2023



Scale 1:200



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SECTOR MAP

REFUGIA GARDENS



POTENTIAL FUTURE MAP REFUGIA GARDENS

