*This project is dedicated to the Northern Paiute, the native custodians of the land on which Fly Ranch sits. We offer this proposal in their honor, and we thank them for their hospitality and inspiration*

**Inspiration & Intention**

The sound of the wind blowing through the saltbush. The dark rocks of the Granite Peak Range. Steam rising from the geyser and the smell of rain in the desert. Jackrabbits running through the brush. The long history of humans who have lived and continue to live here. This is the landscape of Fly Ranch. How do we honor it?

Our visit to Fly Ranch made one thing eminently clear: beauty is already inherent in the landscape and ecology of Fly Ranch. As designers, our role becomes less what to “do” with this landscape, but instead how to give it a voice. Can we make unique qualities of the land more legible? We decided to use locally available resources - sunlight, water, soil, and gravel - to create a space that invites visitors to connect with the environment. Our proposal, *Weeping Desert Lab* is a passive geothermal greenhouse that acts as a sheltered space to contemplate the landscape and an edible plant laboratory.

The traditional willow-frame houses of the Northern Paiute inspire the structure of this project. The Paiutes built no permanent structures, and instead crafted temporary shelters using willow branches and mats of cattail, bending these endemic materials into position. The simplicity, sustainability, and scalability of this practice by the traditional inhabitants of this land are the starting points of our proposal.

*Weeping Desert Lab* combines three functions: geothermal greenhouse, solar still, and contemplative space. The system is entirely passive - relying only on sunlight and the evaporation of water. It “weeps” potable water and bears edible harvests, allowing visitors to viscerally feel the power of the hot springs, the sunlight, and soil. The greenhouse is both a shelter from the landscape and a way to understand its qualities of light, water, and ground. Finally, *Weeping Desert Lab* is simple and scalable. Maintained, it can last for decades. Alternatively, it can be easily dismantled and removed.

**The Experience**

Standing at the Fly Geyser, you notice the greenhouse tucked into the ground less than 100 meters away. You approach and see its entrance deliberately framed by recycled tiles and bricks. You remove your shoes before the door and prepare to transition. Opening the door, you feel a warm wave of moist air across your face. Closing the door behind you, your vision is overwhelmed with the eclectic texture of the walls and plants. Your entire body relaxes as you take your first step onto the floor of the greenhouse and the water warms your feet.

You move forward, past a moringa tree, climbing peas, cherry tomatoes, and a banana seedling, all edible plants adapted to the heat and humidity of the space. Your footsteps create ripples in the water and feel the ripples from others sharing the space. You grab a cherry tomato and eat it. At the southern side of the space, the evaporated water that has condensed on the greenhouse membrane condensates and gathers into a reflection basin. You stand there and peer outside at the immense beauty of Fly Ranch. The greenhouse, although enclosed, feels like part of the land, energized by sun and water, and protected by the ground.

**Activities**

The greenhouse is first and foremost a space to experiment with edible horticulture in the high desert environment. Which plants will thrive in this unique high-altitude moisture? Which will produce reliable harvests? This will take time to find out. Temperature and humidity will be measured, outdoors and indoors. Plants, soil quality, insect presence, and watering regimes will be monitored carefully. This will be an ongoing process, where the emphasis is not simply on maximizing yields, but also on the observation of and care for plant life.

 The greenhouse is also a therapeutic space of contemplation. The sensory experience of walking on gravel in warm water creates a visceral connection with the geothermal energy that animates this part of Fly Ranch. The rippling water on the ground connects us to others moving in the space. The abundance of plants in the desert invites us to meditate on the acts of caring for and designing with our environments.

**Technologies**

*Weeping Desert Lab* is primarily a greenhouse - an enclosed environment heated by sunlight. Five passive technological systems augment it:

1. Geothermal — a PVC pipe diverts brackish water from the main hot spring onto the floor of the greenhouse.
2. Solar still — sunlight evaporates brackish water, which condensates onto the above membrane and collects into a pool, where it can be used to water the plants. The gravel floor and the rippling of water by footsteps increases the water’s surface area, thereby accelerating the rate of evaporation.[[1]](#footnote-0)
3. Thermal mass regulation — the structure is surrounded on three sides by a berm that acts as a thermal mass, cooling the space when the outside air is hot, and warming it when it is cold.
4. The membrane of the greenhouse is supported by a bespoke “bending-active” bamboo lattice.
5. Ethylene tetrafluoroethylene (ETFE) architectural film is tensioned into place between the oculi (air vents) of the bamboo lattice and the perimeter retaining walls, thereby sealing the greenhouse from the surrounding environment.

**Inputs/Outputs**

The greenhouse is entirely passive. The main inputs are provided by the environment itself: water and sunlight. However, active maintenance (a minimum of once a week) is necessary and will include watering and pruning plants, testing soil quality, opening and closing the vents, and monitoring insect populations.

The outputs of the system are potable water, salt minerals, and biomass. This is composed mainly of edible foods in addition to plant parts (leaf litter, branches, and stems) that can be composted back into the soil to maintain its fertility.

With a minimum estimated yield of 1-2 gallons per hour, the greenhouse will produce at least 8,760 to 17,520 gallons of potable water annually. An average edible food yield of 4 kilograms a day will produce 1,460 kilograms of food annually. Below is a non-inclusive list of candidate plants that are ideally suited to the high altitude, humid conditions of the greenhouse.

*Abelmoschus manihot*, edible hibiscus

*Abelmoschus esculentus,* perennial okra

*Basella alba, m*alabar spinach

*Cajanus cajan*, pigeon pea

*Cnidoscolus palmeri*, bull nettle

*Cylindropuntia acanthocarpa,* cholla cactus

*Dolichos lablab*, hyacinth bean

*Mimordica charantica*, bitter gourd

*Moringa oleifera*, moringa tree

*Opuntia ficus-indica*, prickly pear cactus

*Psophocarpus tetragonobolus*, winged bean

*Setaria palmifolia,* Highland pitpit

Solanum melongena, perennial eggplant

*Tylosema esculentum*, mirama bean

**Specifications**

 Material Labor

Treated bamboo rods 580 m $2k 8k

ETFE film 140m2 $6k 6k

Wet-stacked reclaimed masonry 22 m3 $5k 6k

Local quarry gravel 2m3 $1k 1k

Local sand 3m3 $1k 1k

Impervious geotextile 64m2 $3k 4k

Organic bedding soil 45m3 $5k 1k

Materials Total: ~$23k

Total Including Labor and Excavation: ~$70k

**Prototype Development**

The prototype will be developed on site with a significantly scaled-down design, simplifying the complexity in specification and installation without compromising any desired materials or systems. The bamboo shell will consist of a more symmetrical dome, with the rods bent inward and down into a singular oculus/air vent. In this form, it will come closer in resemblance to the traditional Paiute shelter.

The prototype dome will have a diameter of about 7 meters. Accessibility of this space will be enabled through a small doorway, similar to an igloo, as there will not be as much earth to retain to a greater height. There will be enough plant bedding area to experiment with the planting and growth of the various species mentioned in the proposal.

Masonry will be reclaimed from as many local sources as possible before specifying any new masonry. The rock quarry, on County Road 34 in the Calico Hills, is an ideal place to procure the gravel for the greenhouse floor.

**Environmental Impact Summary**

This proposal is designed for minimal environmental impact and for its capacity to be dismantled if necessary.

Approximately 110 m³ of soil will be dug up to create the footprint for the submerged portion of the greenhouse. An additional 30-60 m³ of soil may be lightly impacted in order to lay the PVC piping from the main hot spring to the northwest. Alternatively, a viaduct can be laid to reduce ground disturbance. The soil excavated on site will be redistributed onto 300 m2 of existing earth to build the berm around the greenhouse.

Before construction, a botanical audit will establish what plant species, especially protected and natives species, are present on all disturbed areas. All plants uprooted and disturbed as part of this process will be replanted onto the exterior berm, to prevent soil erosion and further blend the berm into the surrounding landscape.

The planting beds inside the greenhouse will be separated from the surrounding ground to prevent salt from leaching into the planting beds. This will be done with an impermeable geotextile membrane that wraps up and behind the stacked masonry so that it is hidden from sight..

The ETFE membrane that encloses the greenhouse has an approximate lifespan of 20-30 years before it needs to be replaced due to reduced light admission, after which it can be recycled indefinitely as a polymer. [[2]](#footnote-1)

Our project, as designed, calls for the use of 580 meters of bamboo rods. These rods would be treated in a low-toxicity Boron solution to prevent fire, rot, and insect vulnerabilities, dramatically extending their lifespan. Bamboo is extremely sustainable because of its fast growth (3-10cm per day) and high carbon sequestration rate, producing 15 times the volume of wood compared to timber. The circular profile of the rods make bamboo ideal for conforming to the curves of a peculiar shape and younger pieces can be specified to construct tighter bends where needed.

The elemental nature of all other materials (sand, gravel, reclaimed masonry) ensures an almost perpetual lifespan for service and re-use.

1. “Enhancing the solar still yield by increasing the surface area of water,” Journal of [Environmental Progress & Sustainable Energy](https://www.researchgate.net/journal/1944-7450_Environmental_Progress_Sustainable_Energy), December 2015 [↑](#footnote-ref-0)
2. Amy Wilson of the tensile architecture group Architen Landrell says the following about ETFE:

*"The production of ETFE involves the transformation of the monomer TFE into the polymer ETFE using polymerisation; no solvents are used in this water based procedure. The material is then extruded to varying thicknesses depending on application; a process which uses minimal energy. Fabrication of the foil involves welding large sheets of the ETFE; this is relatively quick and again a low energy consumer."* [↑](#footnote-ref-1)