# Sage Hill : A Post-Natural Geoform for Multi-Species Restoration

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## ABSTRACT

As humans continue to develop, build, and rebuild on areas around the globe, the integrity of the soils that are built on continue to be compromised through this distribution and environmental conditions. With the accelerating damage and effects of climate change, the technologies employed in environmental engineering are expected to provide protection, as well as an ecologically sensitive application. The clearing and replacement of existing landscape is inherently human centric, as it disregards the other cyclical relationship at play between the vertical elements of a root stabilizing tree stands and their surrounding biodiversity. Joyce Hwang in her essay, Living Among Pests, has suggested that the needed reconnection of biodiversity with our urban buildings will force a re-examination of "articulation [of our built surfaces] to take on more responsibilities. Ornament will become performative.[1]" The project, Sage Hill, re-imagined the practice of soil-stabilized geotextiles, through new material and technical investigations towards a post-natural condition. A small hill was designed and composed of a series of 3d printed earthenware geo-textiles that wove together, informing a topographic chain, providing both soil stabilization as well as habitat establishment for both flora and fauna.

## HISTORY

Geoenvironmental engineering is a discipline that studies engineered conditions with a focus on environmental issues. Under that umbrella is the development and application of geosynthetic materials. These products are made from natural or synthetic polymer materials. There are still many outstanding questions surrounding their longevity tied to their performance.[2] The invention of the geotextile began in the 1970's, when the Army Corps of Engineers contacted a private manufacturing company, Presto Products, to create a honeycomb confinement system that could be applied on roadways for heavy vehicle loads. They worked with consultants Waterways Experimentation Station, to develop welded polyethylene strips that would be able to be used on sand for heavy military vehicles driving through the desert.[3]

Geotextiles utilize this material makeup, and are stabilizing solutions which reinforce slopes, walls, roadways, and other structural applications. They maintain static pressure and increase load resistance through the subsurface, mimicking plant roots and retaining soil elasticity. Their porous mat like structure allows for water filtration in most cases, preventing the soil from moving during weather changes. Their materiality is typically associated with polyester, high-density polypropylenes, or high-density polyethylene through a knitting, weaving, extrusion, or welding manufacturing process.[4]

## RESEARCH

The project, Sage Hill, began with an investigation on how the materiality of soil stabilization structures could be expanded. Explorations of the vertical expression of the textile itself, opportunities for more volumetric porosity for soil and roots, as well as using more sustainable material.

In Gottfried Semper's, - Four Elements of Architecture, he speaks to the early tribal practices which wove materials together for various forms of cover.[5] The process of weaving was integral to the design of a serious of modules, that interlocking of each of the cells creating the overall mat [Figure 1&4]. The fabrication of the modules was devolved in way that the porosity would allow for more water filtration and root stabilization post installation [Figure 2&3]. The interlocking design also provided various scaled planting areas, planted with sedum and sage species. The towers incorporated seed pockets for bird feeders, to support the local flyway [Figure 5&6]. The feeders and the plantings attracted pollinators to re-invigorate the sweeping lawns of this human centric space with flora that support micro-fauna biodiversity [Figure 7&8].

The hill was printed from two-tone ceramic clay, interlocking to retain soil across a slope. The modules were developed to

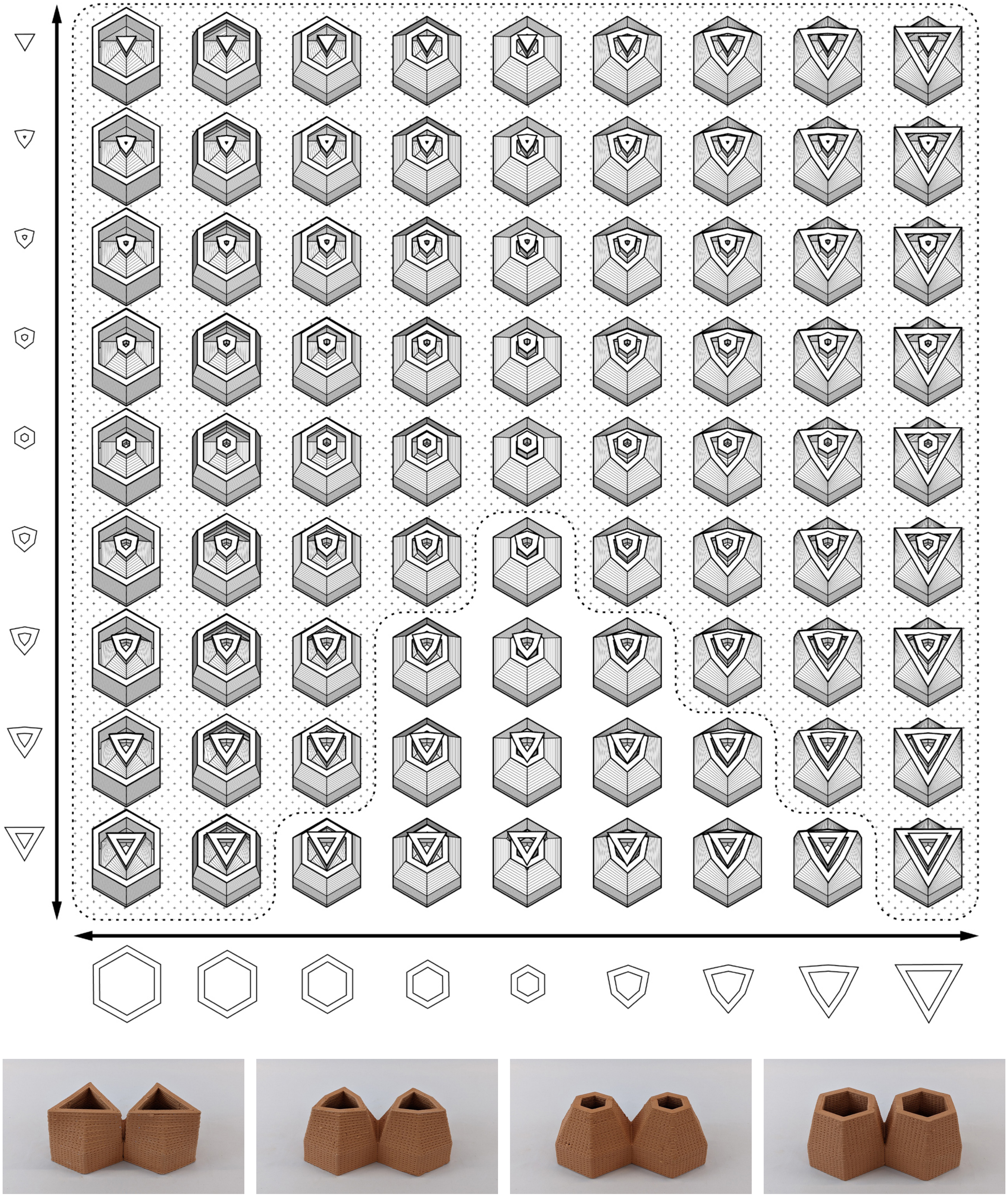

Figure 1. Geotextile typlogy matrix and geometric extrusion.

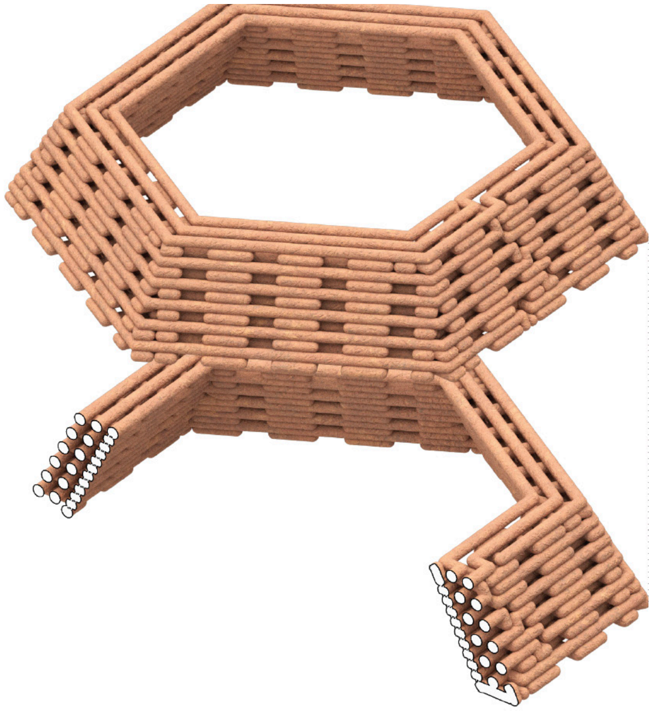

Figure 2. Modeled weaving studies for root aeration.

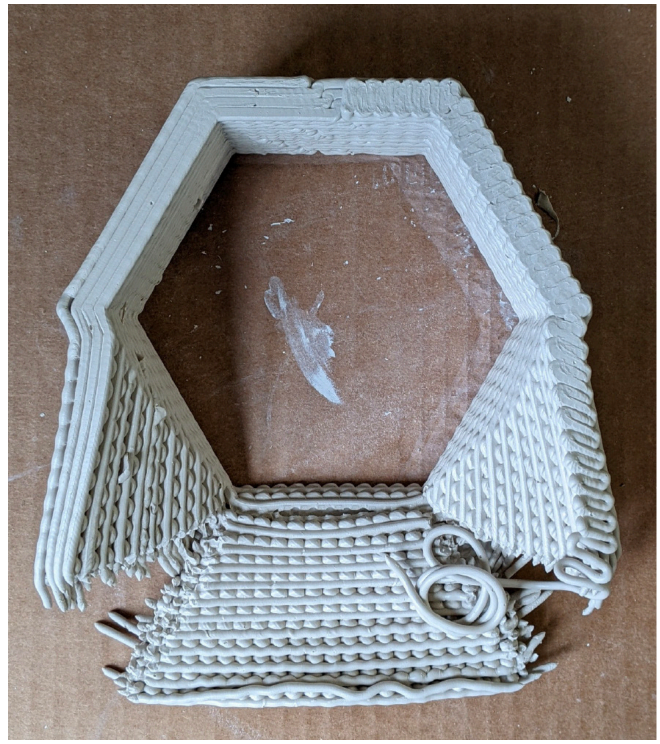

Figure 3. Printed studies testing material weave and strength.

create a circular pattern and interlaced with the two colors [Figure 9]. The color was significant to graphically identify that the project is made up of individual components, as well as a reference to the historic Iranian bird towers.[6] Each piece was 3d printed from a vertical paste extruder with a 3mm nozzle, then fired in a kiln to cone 5. It was decided for this project, the modules would not be glazed, as means to reduce the number of additional materials and chemical compounds interacting with the soil, but in later iterations glazes will be introduced to examine the ability to enhance material strength and longevity.

Sage Hill does not seek to either restore an idyllic lost natural beauty nor create human centric surface level reproduction of an image of green built upon the comfort of pest free condition. Rather, its application supports an existing ecology through the visualization of the geotextile mat, emerging out of the typically invisible infrastructure, through a hyper saturated condition [Figure 10].

## CONCLUSION

The project maintained the slope, provided visibly useful habitat for both the local bird population, educated visitors to the project on the conditions regarding soil stabilization, infrastructure, and the introduced plant species for a fall season. Upon removal it was observed that some of the cells cracked along the angles in the geometry, either from soil contraction or sustained moisture. Otherwise, the interlocking geometry performed as intended, providing aeration for the root structure, and maintaining the soil stabilization with the interlocking system.

## ENDNOTES


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Figure 4. Interlocking system application.

Figure 5.  Vessels for plants and others for water. Sahar Coston-Hardy

Figure 6. Overal view of the project. Sahar Coston-Hardy

Figure 7. A bird captured eating from the feeder.

Figure 8. Evidence of seed being dropped outside of the feeder.

Figure 9. Towers of the site in the distance. Sahar Coston-Hardy

Figure 10. Sedum and sage planted on the hill. Sahar Coston-Hardy