Circular Chromatics: Biomaterial Invention through Research-Build

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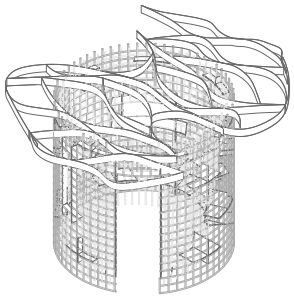
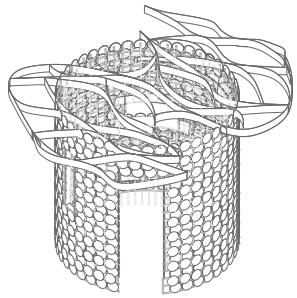
Award Category
Students & Emerging Architects

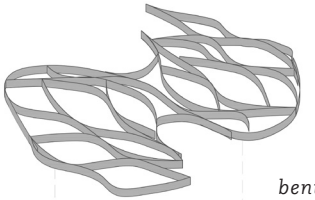
Project Description
As the scale and immediacy of the climate crisis becomes ever more apparent, so does the need to develop sustainable building systems that radically rethink the materials with which the built environment is constructed. This project, developed by 14 students over a single semester, shifts the emphasis of a traditional design-build course from program and client to material invention and experimental fabrication: a new research-build model. Students design and construct an experimental biomaterial pavilion piloting three novel building systems: a double-layered woven bamboo wall with CNC-milled joinery and a bent greenwood canopy, both sourced from campus landscaping waste, and a façade of custom paper pulp shingles made with campus paper and wood waste.

The project responds to, frames, and choreographs a specific experience on site, but its primary goal is to empower students to develop and pilot carbon-sequestering circular construction techniques by working with local material streams. Nearly the entire structure is biodegradable, and is disassembled and composted at end of life.

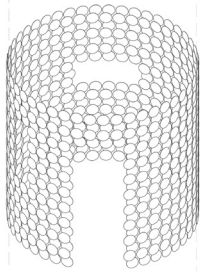




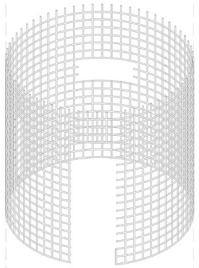
completed pavilion on site; axonometric drawings



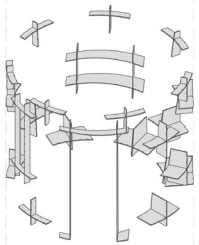
bent greenwood canopy



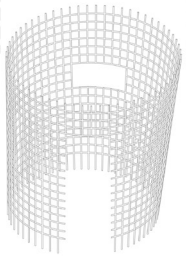
paper pulp shingles



woven bamboo wall
(exterior cylinder)



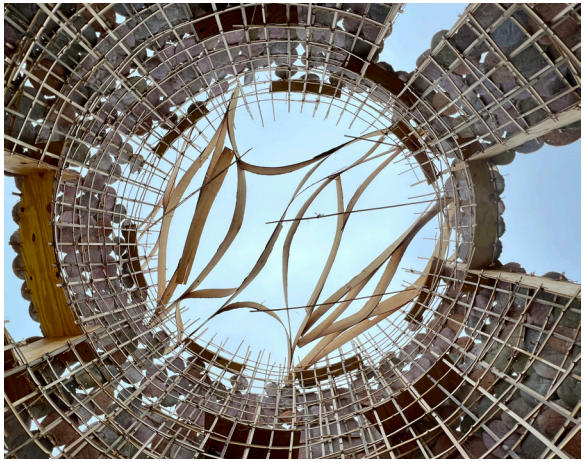
woven bamboo wall
(milled plywood joints)



woven bamboo wall
(interior cone)

exploded axonometric describing various material systems

completed pavilion on site; details of disassembly and composting of material systems



Double-Layer Woven Bamboo Wall

The system provides the overall form and structure. Digitally designed and fabricated plywood joints serve several functions: connecting inner/outer surfaces, providing shear resistance, delineating door/window openings, and determining form/thickness. Joints are strategically deployed to eliminate formwork: the wall is self-forming during assembly. Students source material from a bamboo grove on site, split poles into thin strips, and weave large flat panels that are then brought to site for assembly.

assembling woven panels; completed wall on site

Paper Pulp Shingle Façade

The structure is clad in custom shingles that produce visual weight, drawing visitors and creating a sense of interiority. Students developed a method for casting waste paper and woodchips generated on campus without adhesives using a paper making technique: paper, woodchips, flour, milk paint and water are blended into a homogeneous pulp. The pulp is spread onto canvas, pressed with a 3D printed mold to create texture, and hung to dry. Shingles are coated in soy wax to improve weather resistance.

paper pulp shingle production; completed façade detail

Bent Greenwood Canopy

A thin bent greenwood canopy tops off the pavilion, made of undulating strips standing on edge that provide shade and patterned light within. A bandsaw sawmill is used to cut 1/4" thick pine boards. A 1:1 template is printed to ensure accurate curving. The wet greenwood has enough flexibility that steaming proved unnecessary. The pine strips are curved over the templates with CMU weights. The wood is dried in the sun for several days, at which point it holds its shape and is assembled with pop rivets.

bending greenwood strips; view upward through canopy

view into pavilion; interior elevation view through bamboo wall to backside of shingles

horizontal framing of distant mountains;
vertical framing of nearby historic house

pavilion framed by landscape on approach from nearby historic house