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VAMO — Vegetal, Animal, Mineral, Other

A Circular Vision for Architecture at the Venice Architecture Biennale 2025

ETH Zurich, the Massachusetts Institute of Technology (MIT), and global collaborators present a lightweight, regenerative installation that explores alternatives to architectural permanence.

Venice, Italy — May 2025

VAMO, a collaborative architectural installation developed by ETH Zurich, the Massachusetts Institute of Technology (MIT), and other collaborators, will premiere at the 19th International Architecture Exhibition ***Intelligens. Natural. Artificial. Collective.***, curated by Carlo Ratti and organized by La Biennale di Venezia. The exhibition opens to the public from May 10 to November 23, 2025.

Presented in the Corderie of the Arsenale, VAMO contributes to the Biennale's call for architecture to shift from mitigation to adaptation. As Ratti notes, "the time has come for architecture to embrace adaptation: rethinking how we design for an altered world." In this context, VAMO introduces a biodegradable, modular structure made from reclaimed materials—demonstrating how architecture can become "as flexible and dynamic as the world we are now designing for."

Anchored around a historic brick column, VAMO reimagines the future of architectural practice through circularity. Every component is biodegradable, and most are repurposed: the structure is made of upcycled wood, while cladding and surrounding elements repurpose spent coffee grounds, coconut husks, waste wool and garments, waste Murano glass, leather discards, pineapple peels—all given a second life through unique processes.

"This structure demonstrates the potential of connecting advanced computational techniques in design and fabrication with the intelligence and abundance of the natural world, opening up new material and visual palettes with infinitesimal environmental impact."
— Caitlin Mueller, MIT

"Working with reused and biodegradable materials teaches us to design differently. The art of connecting digital tools, innovative materials, and traditional craft is essential to create a regenerative future. Circular architecture means rethinking how we design and fabricate, including by adapting to each material's story."
— Catherine De Wolf, ETH Zurich

VAMO's hybrid approach—combining computational form-finding, digital fabrication, and artisanal craftsmanship—reflects a commitment to context-sensitive construction and the enduring value of manual skill.

At the structural level, VAMO interlaces wooden tilted compression rings with an anticlastic tensile network of spliced hemp-rope cable net, spanning 6.5 meters in pure tension and compression. The form was developed using Ariadne and Theseus, two custom digital tools created by MIT's Digital Structures research group. These tools allowed the team to model three-dimensional design concepts and automatically adjust their geometries to ensure that all elements in the structure remain in pure tension or compression, while integrating fabrication constraints and material limitations.

ETH Zurich's Circular Engineering for Architecture research group led the fabrication of the wooden rings using salvaged beams and boards from the temporary Huber and Music Pavilions, which were disassembled carefully for the reuse of their materials, in Switzerland. The lower ring's eight scarf joints were crafted through 5-axis CNC milling, enabling the reuse of damaged, non-standard reclaimed components. The upper ring was shaped and assembled by hand by Anku.ch using traditional woodcraft techniques: half-lap joints secured with dovetail wedges and wooden pegs, adapting to the irregularities of the reused wood.

The canopy is clad in several panels made from emerging materials, most of which were developed or accelerated as part of MITdesignX, a program of the MIT Morningside Academy for Design (MAD), and MITdesignX Venice. These include:

- COBI: repurposes coarse, unused wool into breathable panels infused with beeswax—giving new purpose to a fiber typically discarded in industrial wool processing.
- Cortado: compresses spent coffee grounds into a leather-like material with a fraction of the carbon footprint of cowhide.
- Hera Materials (formerly Atacama): developed Woodpack, a recyclable alternative to plastic film made from regional biomass and compatible with paper recycling streams.
- Kokus: combines coconut husks and reclaimed wool into acoustic panels without synthetic binders—completely compostable.
- rehub: reprocesses Murano's non-recyclable glass waste into a terrazzo-like material formed at room temperature; featured in the stool tops (not the canopy).
- Vérabuccia®: creates panels from pineapple peels, preserving the fruit's natural texture as a surface pattern—avoiding petroleum-based finishes.

Other partners joined the project, featuring material research and production aligned with circularity and biodegradability:

- DumoLab Research (DLR), from the University of Pennsylvania's Stuart Weitzman School of Design: uses wood biomass composites and additive manufacturing to create panels that are printable, and designed to break down safely in soil.
- Manteco: produces dense, high-end textile panels from 100% recycled wool, without dyes or added chemicals, using color-sorting techniques.

- ReLea Core, from the Politecnico di Milano — transforms industrial leather dust and collagen into flexible sheets—extending the life of a by-product typically landfilled.

Together, these materials reflect a wide range of low-impact fabrication methods and resource recovery strategies, many developed through iterative experimentation.

Targetti provided the lighting for the installation using VADER spotlights.

After the Biennale, the installation will be relocated to a forest in Switzerland to be reused and then naturally biodegrade. Its slow disappearance highlights architecture's potential for renewal rather than permanence.

Combining digital form-finding, material upcycling, craftsmanship, and experimental materials, VAMO's integrated approach demonstrates how design can adapt to climate realities through regeneration, not extraction.

ABOUT THE PARTICIPANTS

ETH Zurich

ETH Zurich is a public university with a strong focus on science, technology, engineering, and mathematics. It is internationally recognized for its contributions to research and education, particularly in addressing complex societal and environmental challenges through sustainable and practical solutions. Within the Department of Civil, Environmental and Geomatic Engineering (D-BAUG), the Chair of Circular Engineering for Architecture (CEA) conducts interdisciplinary research aimed at enabling circular practices in construction through digital transformation. The group explores how digital technologies—such as artificial intelligence, machine learning, and digital fabrication—can support the identification and reuse of building materials. By facilitating data-driven connections between available reused materials and construction projects, CEA seeks to contribute to a more resource-efficient built environment. The chair aims to enhance collaboration across the construction value chain, with the goal of reducing environmental impact and supporting a transition to circular architecture.

Massachusetts Institute of Technology (MIT)

The Massachusetts Institute of Technology (MIT) is a research university in Cambridge, Massachusetts, USA, known for its focus on science, technology, and interdisciplinary problem-solving. Several entities from the MIT community contributed to the VAMO project. The Digital Structures research group, works at the interface of architecture, structural engineering, and computation, pursuing creative and technical goals in the design and fabrication of buildings, bridges, and other large-scale structures. The Morningside Academy for Design (MAD) brings together students, faculty, and researchers across disciplines to explore how design can address complex challenges through education, experimentation, and entrepreneurship. It is home to MITdesignX, an academic program empowering the creation of new business ventures and forward-thinking solutions designed to address critical challenges

facing the future of cities and the human environment. MITdesignX Venice is a new multi-year initiative bringing the Venture Design program to Venice in collaboration with local partner SerenDPT.

Anku.ch
Anku.ch is a Swiss woodcraft company dedicated to designing and building natural, sustainable spaces. With a focus on local materials and traditional craftsmanship, Anku creates custom structures such as cabins, yurts, domes, and furniture. Besides expertise in woodworking, Anku also offers hands-on workshops that encourage a deeper connection with traditional building skills. Anku supports individuals, communities, and organizations to create living oases to reconnect with nature, oneself, and one another.

Other participants include the University of Pennsylvania's Stuart Weitzman School of Design (DumoLab Research), Politecnico di Milano (ReLea Core), Manteco, and Targetti.

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