FOREST-TO-CITY | Architecture as Open System

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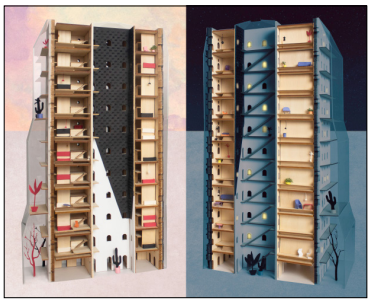
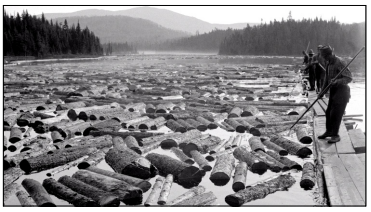
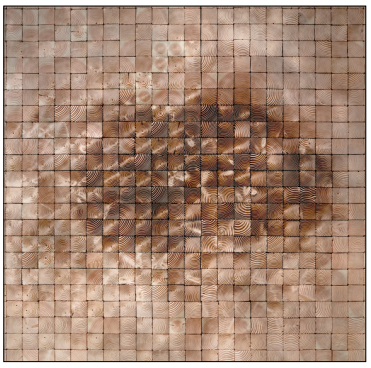






OVERVIEW

By 2050, global population will grow from 7 billion to 10 billion. This will require the construction of 13,000 buildings every day for the next 30 years. And of the 20 largest cities in 2050, 15 of them have yet to be built.

Buildings contribute about 40% of global carbon emissions, and concrete alone makes up about 8%. Yet by many accounts, there is not enough sand of the right type to make even the concrete foundations for all of the buildings of the next 30 years.

In other words, it is impossible to think about the climate crisis without thinking about architecture, without thinking about materials, and without thinking about scale.

It's tempting to look to single changes to fix the problem (technologies like carbon capture, or new ways of making concrete, or low cost solar and wind power, or even lifestyle shifts). But science indicates that a single fix is impossible. Instead we need a range of different climate stabilization wedges. And more fundamentally, single technology fixes and climate stabilization wedges should not be developed in isolation, because they may have unintended consequences.

So instead of designing single technology fixes, what is more likely to address the problem is designing new systems. In other words, the design of single solitary buildings is insufficient in the context of the climate crisis. But there may be new possibilities in designing architecture as an open system.

In this studio, we will address the massive global construction and rapid urbanization that will occur in the exact same ten years in which it is critical to drastically cut carbon emissions. We will explore a new type of design. We will simultaneously design materials, typologies, prototype buildings, forests, and supply chains. We will explore architecture as an open system.

1: MASS TIMBER

Mass timber is a system. While wood is a material that has been utilized in architecture for centuries, there may be new possibilities in conceptualizing and designing with timber not as a material choice but as an open system.

Wood is lightweight, renewable, and versatile. It sequesters carbon (about half a ton of CO2 is sequestered for every ton of timber). Compared to traditional materials like steel, concrete, and plastic, it often leads to better work conditions, less pollution during extraction and production, and quieter and safer construction sites. And wood may have a positive impact on human health. As architect and timber researcher Alan Organschi cites, a study in Austria found that wood-lined classrooms produce lower cortisol rates and lower heart rates than sheetrock-lined classrooms.

This studio will explore the use of engineered wood in buildings and the idea of mass timber as a system. Engineered wood—such as glued-laminated timber

Images (top to bottom): Rapid urbanization in China; Physical model of sustainable housing prototype in Phoenix, Arizona (Benjamin Studio 5, Julia Pyszkowski); Traditional logging techniques (via Alan Organschi); Mixed-use development in Corktown by Jesús Vassallo and Albert Pope; Timber facade of Subculture by The Living; Albina Yard by Lever Architecture.

(glulam), cross-laminated timber (CLT), dowel-laminated timber (DLT), and laminated veneer lumber (LVL)—creates new opportunities for building structures. In recent years, advances in engineering and manufacturing have led to new types of performance and new applications for timber buildings. The wood industry has developed techniques for using different species, different layups, and targeted distribution of wood pieces of different fiber properties to create new architectural elements. There are options to replace the glue in mass timber with bolts, plates, and event wood dowels and stronger laminated wood. Making use of these new material possibilities, many new timber buildings have been constructed in the past few years in many parts of the world.

The architectural results of wood are appealing, but its climate impact is even more important. By some analyses, it is more important to decarbonize industrial applications such as cement and steel than to rapidly shift the electrical grid to solar and wind power. In this context, mass timber has the potential to replace steel and possibly even cement.

2. FORESTS

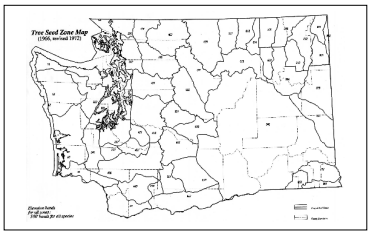
In addition to exploring the relationship between mass timber and buildings, we will explore the relationship between mass timber and forests. It will not be possible to address the scale of construction in the next ten years without thinking about the source of materials for all of the buildings. While mass timber involves many benefits, its widespread use will only be possible in combination with sustainable forestry.

This studio will investigate the wood industry and its connection to sustainable forests. We will expand the site of architecture from the location of the building to the location of the raw materials, and beyond. We will study how working forests provide a range of environmental services in addition to wood products—including clean water, wildlife habitat, carbon sequestration. We will look at current and past management of forests, including tribal ownership and indigenous practices. We will look at the labor involved in forestry, and the scalability of all aspects of the use of mass timber. We will look at both distributed and centralized mass timber systems. We will think holistically and design systems that include forests, factories, buildings, and cities.

This kind of thinking about systems has been advanced more recently in other areas, such as food. The farm-to-table movement was the start of an idea about open systems. Yet the chef and writer Dan Barber explains how the initial framing of the farm-to-table movement turned out to be wrong.

He writes: “Science teaches us that the answer to understanding the complexity of something is to break it into component parts. It insists that things need to be precisely measured and weighed. But interactions and relationships…cannot be measured or weighed… Our belief that we can create a sustainable diet for ourselves by cherry-picking great ingredients is wrong. Because it’s too narrow-minded. We can’t think about changing parts of our system. We need to think about redesigning the system.”




Images (top to bottom): Timber facade prototype for Subculture by The Living; Laminated veneer lumber (LVL); Traditional logging practices (via Alan Organschi); Tree Seed Zone Map of Washington state; Example of unsustainable forestry in Brazil; Custom fabrication for timber facade for Embodied Computation Lab by The Living; Same.

Barber picks wheat as an example and describes how a New York farmer named Klaas Martens grows sustainable emmer wheat and has resurrected a lost flavor that has contributed to Barber's own award-winning cuisine. Then Barber notes: "The secret to great-tasting wheat… is that it's not about the wheat. It's about the soil." Martens designs the soil, not the wheat, and he does this through rotation farming and working with the larger system. By extension we could say it's important to simultaneously design the grain, the soil, the food plate, and even new flavors. And perhaps for architecture, we could say it's important to design the material, the factory, the building, and even new building typologies at the same time. In this sense, architectural materials should no longer be considered static and permanent, but instead dynamic and continually transforming. And architects should take the initiative to actively design these transformations.

In this context, the studio will explore the possibilities for forest-to-city architecture. We will take a critical look at the farm-to-table movement—as well as at some of the past models of architecture as system—and we will develop new kinds of open systems for architecture.

3. CHINA AND CHILE

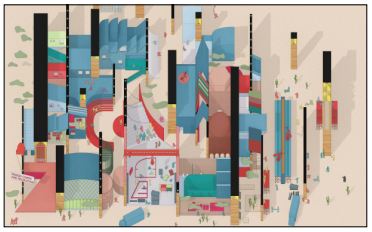
Of the 13,000 buildings that will be constructed every day for the next 30 years, more than a quarter of them will be in China. And many more will be in the Global South. But if mass timber architecture has been developed as a system of renewable materials for the Global North, what might a version look like for the Global South?

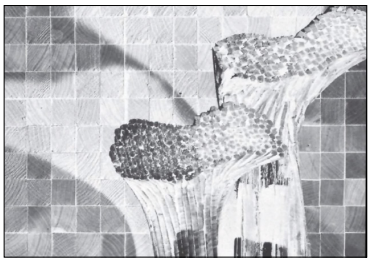
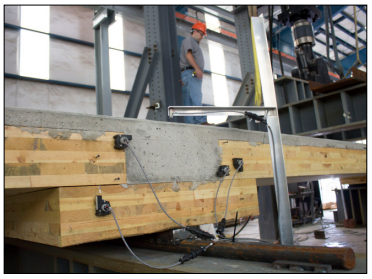
Currently in China, only one percent of new residences are built with timber and most wood based panels are used as finishing material. (By comparison, the timber utilization rate in Canada, the United States and Japan is over 40%.) And a majority of dimensional lumber used for the mass timber in China is imported. But China is at the beginning of what may be a rapid adoption of mass timber buildings. Zoning regulations are changing to allow for taller timber buildings. Universities and industry researchers are developing bamboo-wood composites that allow for high performance and low cost. In 2015, regulation was introduced that would require 30% of prefabricated materials in the Chinese construction industry to utilize wood by 2025.

This studio will explore the possibilities for mass timber to make a significant impact on global construction in the next 10 years. As case studies, we will investigate applications in both China and Chile.

4: TRAVEL

The studio will travel to the Pacific Northwest of the United States, and we will purchase carbon offsets for its flights. (By some accounts this will involve four times less carbon emissions than traveling to Asia or South America.) We will visit the world's largest factory for cross-laminated timber recently opened by Katerra in Spokane, Washington. We will also visit a regional lumber company called Freres Lumber that has invented a new timber system called mass plywood in Portland, Oregon. We will meet with the Forestry Department at Oregon State University to discuss sustainable forestry and explore their range of prototype buildings. And

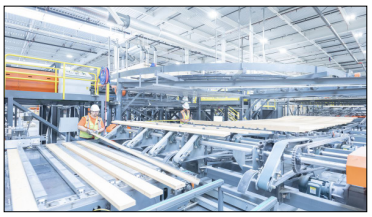



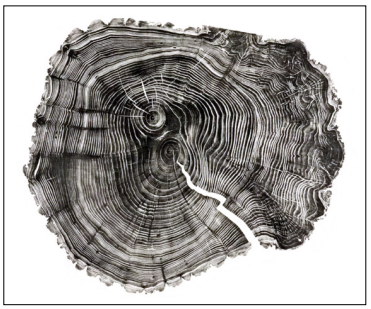
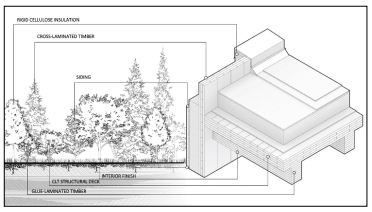
Images (top to bottom): Villa Verde by Alejandro Aravena; Open Source Architecture (Benjamin Studio 5, Qi Yang); Chilean Pavilion at Milan Expo; Glued dowel experiments by Eero Saarinen; Physical testing for SOM Timber Tower Research Project; One of the first mass timber prototypes in Tianjin, China; Traditional timber construction in Chiloe, Chile.

as part of our research and critical analysis, we will visit some of the region's leading timber architecture firms, including Michael Green Architecture and Lever Architecture.

We will contextualize our research and these visits within the possibilities for designing new architectural systems in the United States, China, Chile, and beyond. Teenage activist Greta Thunberg states, "You say you love your children above all else, and yet you are stealing their future in front of their very eyes…Until you start focusing on what needs to be done rather than what is politically possible, there is no hope. If the solutions in this system are so impossible to find, then maybe we should change the system itself."

Building off of the dual needs to construct more buildings and reduce carbon emissions, we will aim to change the system itself. And over the course of the semester, we will apply all of our concepts, experiments, and imagination to the design of innovative and viable proposals for prototype buildings and new ways of living.






Images (top to bottom): Katerra CLT factory in Spokane, Washington; CLT building by Michael Green Architecture; Woodcut by Bryan Nash Gill; Timber City by Alan Organschi; Fire testing of cross laminated timber; Wood facade prototype for Embodied Computation Lab by The Living; Katerra CLT factory; Same.