Nothing Short of a Miracle

James Michael Tate in Conversation with Aaron Stottlemyer

For the past two years, James Michael Tate has taught design studios at Texas A&M that investigate mass timber. As a part of this effort, he has collaborated with Dr. Aaron Stottlemyer, Forest Resource Analyst at Texas A&M Forest Service. The overlap of their interests—Tate is a designer and educator, while Aaron works to create economic opportunities for Texas timberland—suggests a productive space for further collaboration between the fields of architecture and forestry. They spoke after the completion by Tate and his students of a cross-laminated timber (CLT) construct (seen in the accompanying images) for the Texas Forestry Association's annual meeting last year.

JMT What is the Texas A&M Forest Service? What are its responsibilities?

AS As the state forestry agency, the mission of Texas A&M Forest Service is to ensure that trees, forests, and related natural resources are protected and sustained for the benefit of all Texans. As part of the service component of a land-grant university system, we are called to protect and conserve the natural resources in this state. We deliver science-based information about natural resource conservation through technical assistance and program delivery. One of my roles is economic development, so I support existing markets for timber in Texas and promote new ones.

JMT While forests are widely understood as natural environments, it's also important to understand them as industrial farms, in a way. How might ideas of organization, design, and maintenance relate to forestry?

AS Forests are unique among environments where agricultural commodities are produced. In the South, we mostly practice plantation forestry where trees (primarily pines) are planted in rows, much like other crops, and intensively managed to grow them to a merchantable size as quickly as possible.

Initially, trees are planted at a high density, which serves a couple of purposes. First, planting more trees will ultimately ensure adequate stocking after some of the trees inevitably die in early stand development. Next, and of great importance to lumber production, is that close spacing through the first ten years or so of stand development forces the trees to put their energy into vertical growth. This makes straighter logs with minimal taper and fewer branches (which is where knots come from when the logs are sawn into lumber). In a typical scenario, the stand of trees would be thinned after about twelve years to lower the density by as much as 66 percent. Trees removed at this stage are often used for making paper or panel products such as plywood or oriented strand board (OSB). With more room to grow, the crowns of the remaining trees will expand to fill in the gaps, and the trees grow at a faster rate, adding more wood to the main stem, which we call the "bole." Typically, one

Photo by Leonid Furmansky.

or two thinnings are conducted before the stand is harvested after about twenty-five to thirty years.

In the South, this final harvest is often a clear-cut where all trees are removed. The harvested trees become a variety of primary and secondary products: lumber, shavings for animal bedding, and chips for paper. Even the bark and sawdust are utilized. No part of the tree is wasted. The cleared area facilitates reforestation activities where new seedlings replace the harvested trees and the process starts all over again. While plantation stands look different than naturally regenerated forests, they still have tremendous value beyond timber production. They produce oxygen, provide wildlife habitat, clean water, and offer recreational opportunities.

JMT What are the different kinds of forests in Texas?

AS We have about 12 million acres of forestland in East Texas. This is where the large majority of commercial forest products are grown, managed, harvested, and processed in the state. Pine is the most abundant forest type, with loblolly pine as the most common species, but we also have longleaf, slash, and shortleaf pines. Oak-hickory is the second-most abundant forest type followed by oak-pine, oak-gum-cypress, and elm-ash-cottonwood forest types.

JMT What is the breakdown of publicly owned versus privately owned forestland in Texas? What are the implications of this division?

AS Privately owned forestland is the backbone of a strong forest economy. Over 85 percent of forestland in the South is privately owned, which is why it has come to be known as the "wood basket of the nation." Texas is no different. Ninety-two percent of forestland is privately owned; the remainder is in public ownership.

Family forest landowners are by far the largest group of private owners. There are numerous reasons to own forestland. Landowners cite scenic beauty, family legacy, protecting nature, wildlife habitat, and privacy as the top reasons. But this doesn't mean they don't harvest timber. In fact, many owners do, which helps to cover costs associated with owning and managing the land. As long as strong timber markets exist, owners are more likely to keep their forestland and invest in good stewardship. This keeps forest as forest instead of the land being sold for nonforest use.

Timber investment management organizations (TIMOs) and real estate investment trusts (REITs) are the other primary groups of private owners. In contrast to family forest landowners, these organizations buy, manage, and sell timber land on behalf of insurance companies, foundations, pension funds, and private investors, so maximizing return on investment is the primary motivator. Other groups of private owners include Native American tribes and nongovernmental organizations.

JMT What happens if the trees produced by these various entities aren't harvested?

AS There are a number of important considerations related to this question. First, it's worthwhile to consider what happened during the 2008 housing market crash and following recession. The housing sector—the construction and remodeling of homes—is the primary driver of demand for forest products in the South. When housing is strong, high demand for lumber and panel products leads to good prices paid to landowners for their timber. The 2008 recession led to a housing collapse; demand for timber decreased greatly; and prices paid to landowners dropped significantly, so many of them decided to take their timber off the market and wait for better pricing to return.

Photo by Leonid Furmansky.

As we know, housing rebounded, but there were a couple of problems that we're still dealing with today. First, there's currently an oversupply of timber after harvesting was postponed in the early 2010s, and many other stands that were approaching merchantable size at that time are now ready to be harvested. So even though housing has rebounded, sawtimber prices have remained largely suppressed due to high sawtimber supply. This was also an issue during the pandemic; lumber prices skyrocketed while the price of timber remained constant. Second, sawmills are equipped to be able to process logs with both a minimum and a maximum diameter. Some of the stands where harvesting was postponed have outgrown the capacity of many sawmills to be able to process the logs. I suspect that many mid-rotational thinnings were probably also postponed during that time, or, in some cases, never conducted. In those scenarios, trees would not have grown as fast as they could have, due to overcrowding.

Not only do managed stands reach merchantable size faster, leading to quicker returns on investment, but trees are also at lower risk of mortality in the event of fire. The unfortunate reality of forests in the American West is that thinnings, timber harvesting, and other management that would otherwise make these forests more resilient to drought, insects, and fire doesn't happen for the most part. We see the consequences of this lack of management every year when catastrophic fires occur across the region. Even though we have fires in the South, they aren't nearly as devastating. One big reason is because our forests are managed.

JMT How did you become familiar with mass timber and start to be in conversation about it with architects, contractors, and developers?

AS At Texas A&M Forest Service, we're always looking at what we can do to help expand existing markets and promote new ones. Of the various mass timber products, CLT seems to have the greatest potential to increase demand for Texas-grown timber. This is aided by the fact that seven of the fifteen fastest-growing cities in the nation are in Texas and are fairly close to East Texas timberland operations. As an architect friend suggested recently, in Texas we have the capacity to grow our own buildings.

JMT In architecture, an interest in CLT comes from its ability for offsite prefabrication, but also due to its capacity for carbon sequestration. It's important to keep in mind that prevailing structural materials—steel and concrete—are energy intensive to produce and aren't renewable in the way wood is. Also, typical construction methods tend to produce excessive amounts of waste, whereas factory-built components are perceived to eliminate some waste. Many would suggest it's possible to build higher-quality components in a controlled factory environment instead of on a construction site. And of course, wood products store carbon. I know you're not an architect, but I'm interested to hear your perspective about carbon sequestration as your work is located at the moment when natural matter becomes a building material and enters the "built" environment.

AS There is unprecedented interest in forests and forestry as both natural climate solutions and a means of producing building materials with low embodied carbon. Steel and concrete will always have a place in construction, but if the goal is to reduce embodied carbon—that is, carbon emissions associated with resource extraction, processing and manufacturing, transport, and installation—no building material can compare to wood.

Forestry and forest products manufacturing are inherently "green" industries. Wood is a pretty simple material in its composition, but the process by which it is produced in trees is nothing short of a miracle. Concrete and steel manufacturing, on the other hand, requires the extraction of nonrenewable resources and a massive energy input, typically from the burning of fossil fuels. When you build with wood, the carbon absorbed from the atmosphere during the process of photosynthesis is locked up for the life of the building, or even longer if the wood is repurposed after the building is taken out of service.

JMT By now, mass timber is generally known in architecture schools, but there are only a few success stories about its commercial use in Texas. While projects might favor this material early on, some have only partially integrated mass timber systems, and many do not go forward. What are the challenges and limitations of CLT or similar wood products in the context of Texas?

AS There are a number of challenges to be overcome before we might expect to see more widespread adoption, not just in Texas but across the US. First, there's still a general lack of awareness about CLT and mass timber's numerous advantages over conventional construction types among the various stakeholders who make decisions or who have influence over the decision makers—I'm thinking of building owners and their representatives, facility and project managers, real estate developers, city planners, code officials, and others. There's also been instances of certain trade organizations disseminating misinformation about the sustainability of wood and the strength, durability, and fire performance of CLT compared to conventional building materials produced by the industries they represent.

This might be related to awareness among the professionals who design and specify buildings for approval by decision makers: architects and engineers. You're teaching about it at Texas A&M, Tate, but CLT is a novel technology, particularly

in the South. As such, it probably wasn't part of most architects' formal educations. And if architects aren't familiar with it, the construction, mechanical, electrical, and plumbing professionals surely don't have experience with it, either. This points to the need for outreach and education efforts targeted at these various stakeholders. I think it's important to not only educate young designers but also provide hands-on, experimental opportunities to imagine how the material can be used.

The creation of three new mass timber construction types in the 2021 International Building Code was a step in the right direction, but cities must adopt the updated code. Otherwise, the time and cost of alternative means and methods approvals alone might be enough to prevent a project from using mass timber.

Supply is another issue. There is currently only one manufacturer of southern yellow pine CLT in the South (another expected to come into production soon). Currently, pricing on CLT panels is likely not going to be as competitive as it would be if there were multiple manufacturers competing for orders.

Photo by Leonid Furmansky.

Cost is another factor. There have been many projects where mass timber was eliminated as a structural material after it was flagged as having a high unit cost when compared to the alternatives. With CLT and other types of mass timber panel products, project teams can't evaluate alternative building systems based on the hard cost of the structural system alone. The reality is that currently there is a premium associated with early planning, higher unit-cost materials, and prefabrication. However, there can be considerable cost savings when it comes to construction schedules, labor, excavation, and foundations, finishes, and other factors. This can result in considerable cost savings, getting buildings to market faster, and even demanding higher rent for wood-lined interiors. The challenge is quantifying the potential cost savings and other benefits for the decision makers.

I'd even say that, given the pride associated with using things produced in this state and the importance of forests and forest industries to our economy, if developers can make the numbers make sense, building with southern yellow pine CLT is the Texan thing to do. If demand increases like we anticipate it will, hopefully structural CLT manufacturing will come to East Texas.

JMT How do you think mass timber could transform our imaginations and ways of building in the next couple of decades?

AS I am optimistic about the future of mass timber and southern yellow pine CLT in particular. I spend a lot of time talking to early adopters of mass timber across Texas about their motivation and experience—company presidents, architects, engineers, developers, owner representatives, facility managers, hospitality professionals, building occupants, and others. I've observed universal enthusiasm about how mass timber will transform how we design and construct buildings in the future.

As a forester, it is one of the highlights of my career helping to tell the story of forest resources and manufacturing and their importance to rural economies in Texas. I'm also encouraged that our land-grant university system is challenging its architecture students to experiment with these materials. This recognizes the potential for architects to have positive impacts on the built environment as well as the state's forests through mass timber.

JMT Last summer, I worked with Texas A&M architecture students on a project using three-ply CLT panels made of southern yellow pine. For this initial construct, we created a free-standing wall intersection: through a series of notched cuts, four interlocking pieces could be assembled without using mechanical fasteners. Additionally, we explored subtractive processes

of surface relief. Some of these tested panel-to-panel connections, and others were purely ornamental. The resulting piece was exhibited at the 2021 Texas Forestry Association Annual Meeting in October 2021, held in Nacogdoches. While many attendees had heard of CLT and most are familiar with engineered wood products, it was the first time almost anyone there had the opportunity to interact directly with the material and see it become a piece of architecture.

The construct provided an opportunity for students and faculty who are making speculative design projects to work with physical material at a 1:1 scale. There's a pedagogical ambition to link theoretical exploration to the outputs of practice. I try to take on projects where architecture can push the cultural imagination. The CLT construct we created is intentionally not overly defined or complete. It doesn't say, "Here's exactly how to implement it and repeat the solution." It's suggestive of a way of working with the material so that anyone in the room can understand it. Also, its detailing and assembly both goes with and against its material properties. On one level it's practical, while on another it offers up some unexpected surprises to the audience. Aaron, what did you think about this test construct?

Photo by Leonid Furmansky.

AS The Texas Forestry Association Annual Meeting is one of my favorite gatherings because it brings together all types of forestry stakeholders—growers, consultants, managers, extension professionals, loggers, truckers, processors, realtors, educators, students, and legislators. Several architects were also in attendance. Nearly 400 people participated under the meeting's theme of "Re-imagining Wood: The Sky Is the Limit." We settled on this theme after deciding that topics like CLT and voluntary carbon offset programs would be discussed at the meeting.

One of the things the planning team decided early on was that we wanted to do more than just show our attendees pictures of mass timber on a screen; we wanted them to *experience* it—to touch and smell it and to imagine its possibilities. This meant we needed a physical exhibit. We gave you design freedom to propose a feasible installation and were blown away with what you and your students ultimately came up with—an experiment that combines innovative shapes, panel connections, and ways to achieve different surface aesthetics during the fabrication process.

To my knowledge, there hasn't been anything like this at a forestry meeting before. Imagine being a forest landowner in East Texas who attended this meeting and heard mass timber experts talk about how the timber that they're stewarding is being used to revolutionize construction processes and the built environment—all while encountering a 1:1 model standing in the center of the meeting room! This is what we were able to achieve. The CLT-related exhibits and speakers were well received. I hope attendees left with a renewed sense of pride and purpose in the work they do, as well as optimism about the future of the forest sector in East Texas.

JMT What have we missed in this conversation that you'd like to address?

AS Though it's uncommon now, I think it's smart for architects to talk with forestry professionals to learn about forests. I've listened to a lot of well-intentioned architects over the years try to talk about forestry, only to fan the flames of misinformation because they don't understand or have a full appreciation for how things actually work. Environmental sustainability is something that the teams that realize buildings—architects, contractors, and developers—care more and more about, so it's important for everyone to have the most accurate information when making decisions.