URBAN FORESTRY

THOMAS CARUSO

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The United States could benefit from the methods of Urban Forestry and community forestry. The federal government currently does not do enough quickly to help preserve forests and it is difficult to start such systems on a large scale. With an infrastructure that aids people economically, we can see an improvement in the United States economically and environmentally.

Keywords: Infrastructure, production, simplification, community, planning, prevention, optimization, sustainability.

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CHAPTER 1
INTRODUCTION

NARRATIVE

Community forestry is something that can provide economic and environmental impacts to the community. The United States as a nation, could do a lot more to help it's people fight climate change and socioeconomic disadvantages. In recent years climate change has become much more prevalent than many could've estimated. The world is seeing a large increase in carbon put into our atmosphere at a fast rate. Forests have a direct effect on how much oxygen is put back into the air. North America is home to the fourth largest supply of the worlds forests (figure 1) which is currently lacking in proper maintenance. When forests are mismanaged, problems can occur that further contribute to the issue of carbon being put back into the air. Forests are supposed to balance the atmospheres carbon and oxygen, but now that society has advanced the way it has a large chunk of forests are heating up. So how can architecture intervene in this? What does timber construction have to do with such a large issue? Many would argue that simply deforestation is the epicenter for most problems occurring in forests, when in reality it's quite different from that. Traditionally in nature, wildfires occurring at random would actually help the environment. Today what we see in places like California, is when fires last too long, putting too much carbon dioxide into the air, killing too many species of trees and putting too many species of other organisms in nature in danger. But the act of clearing brush that fires originally did in finite areas of forests, actually helped to clear brush build up naturally. The problem comes when you put this in the context of our world which has put forests in the unfortunate position of being hotter overall. So

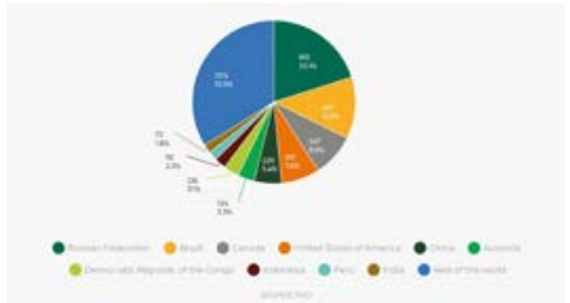

Figure 1: Largest Forest reserves by country

Figure 2: *Timber Processing In Oregon* Le Page, 2020

how do we bring a maintenance to our forests that is needed for the prevention of disaster in American forests? The answer just could be the methods of Timber construction.

THE U.S. AND ITS FORESTS

Deforestation is an issue that many see universally as bad but as mentioned, some natural deforestation from wildfires is actually good. If wildfires aren't doing their job as they once did however, it is our job to takeover. In no shape or form is this an advocation for complete takeover and harvesting of forests for financial gain, but it is an advocation for harvesting timber. The United States has many federally owned forests as well

Figure 3:Dillon, G. *Wildlife Hazard Potential* from https://www.firelab.org/project/wildfire-hazard-potential accessed 2020

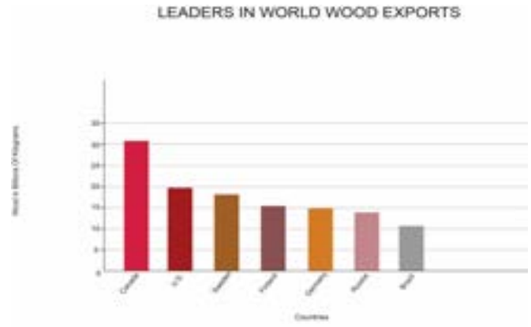

Figure 4: Top countries for wood exports 2020

as a plethora of privately owned forests. A major cause for the forest fires that are ravaging California (other than climate change), is the lack of maintenance in federally rain forests which people like Kathryn Fernholz,[1] say is less involved with contributing to the temperature of the forest fires but is directly involved with the easy spread of these fires. Currently however, 11.6% of US greenhouse gas emissions are because of the United States' high exportation of wood product (figure 4). Countries like Canada, Austria and Mexico provide us with some examples of good forest maintenance that coincide with Ms. Fernholz and the Dovetail Partners Incorporated's claims, on how important it is to maintain forests here in the United States.

Even so we still must investigate further on how we can even begin. If the beginning to solving a major issue lies in maintenance and maintenance isn't being done sufficiently in the United States then how do we ensure that it is done to an appropriate degree?

Community Forestry can potentially ensure an environemental push by promoting forest maintenance as a side effect of its prescence. Countries who benefit from forest maintenance are countries who have created things and made progress off their use of the forests. In Austria for example, Illwerke Zentrum Montafon in Vorarlberg[2], was developed using materials from the local forest. This design process ushered by inspiration of the local species of trees as well as inspiration from the local architecture, helped put forward a project that influenced the local forests in a positive manor. Being that Vorarlberg is at the center of a valley, the select harvesting of the forest by the workers helped clear dead brush which often causes avalanches in the valley. This project's use of local wood was also a lot more beneficial for local contractors and cost relatively similar to wood that would be imported from a farther location. This simple choice to use locally harvested timber is a core value of community forestry as a whole. Timber construction goes up quicker in assembly as compared to steel and concrete construction due to its prefabricated nature. Timber construction also can address the over use of petroluem based products in our economy (seen in figure 6). For these reasons, it is economically feasible to start Timber Farming and begin a conversation to promote locally harvested materials in order to push for environemntal and economic chnage in the US. What we must do now, is go forward and use design to push timber construction over the edge to give more people a reason to join a growing industry.

Figure 5: Loggers harvesting wood, Pike, 2019

Figure 6: Use of Petroluem products in the US, 1950-2015

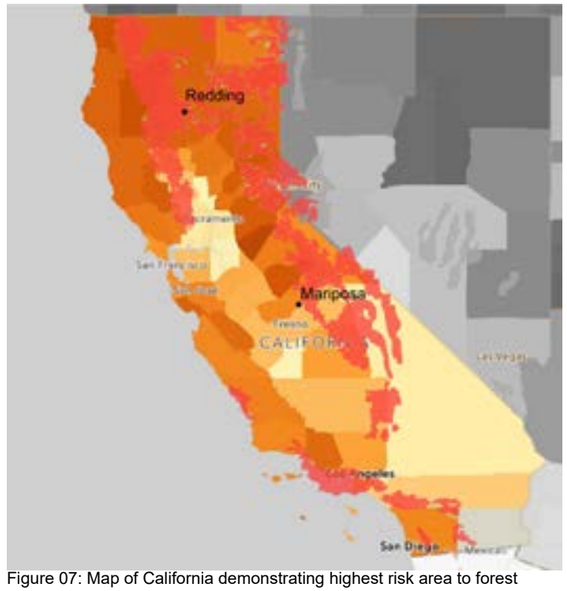

Figure 07: Map of California demonstrating highest risk area to forest fires in comparison to National Forest locations.

Figure 08: Fire jumping a fire line during a wildfire in Sierra National Forest in California

Figure 09: Firefighter in California Wine Country working amidst large fire. Photo by Josh Edelson

A CLIMATE CRISIS

The last two decades have seen an increasing need of environmental attention. From scientists telling us we're reaching times of crisis, to noticeably changing weather patterns our world is changing around us as we continue to do what humans do. What humans have been doing, especially in the United States is focus on economic gain. Sadly, too often economic gain is seen with blinders up to the consequences. The United States has to address the problems its economy influences since it hasn't successfully lowered emissions in a long time (figure 10). The sea level is slowly rising, red tide stands as a major issue in the Gulf of Mexico and on land we're seeing varieties of species of animal's struggle to keep their species in existence. Each issue in its own right, must be paid attention too and addressed if we want to our planet to be clean and entirely beneficial for every living organism. Often times humans don't address major issues until its knocking at their front door. What they might not be realizing is for many people, there is a natural crisis doing just that and for many it's on

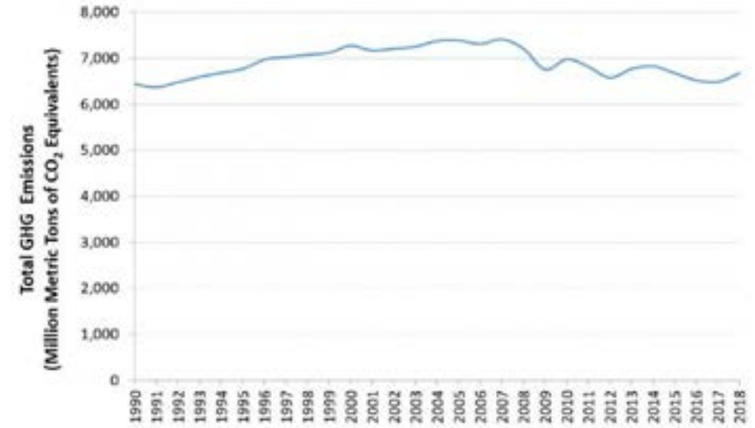

Figure 10: Greenhouse gas emissions in the US since 1990

their block and they don't even realize it.

Enter California, the epicenter for wildfires from 2019-2020. The extent of these fires might seem inherently limited to most. These wildfires are just on the West coast, so the assumption is they'll never reach other areas of the United States. Some might also point out that yes, there are wildfires on the east coast and even the southeast, but they're far smaller due to the varying climate, it would never get as bad as California. These misconceptions are just that, misleading and not entirely true. As the atmosphere warms, we see the worsening conditions in California but that doesn't mean that they're the only ones seeing their warm. Climate change is affecting the Earth's varying climates in different ways and the East Coast of the United States for example, is seeing something very interesting occur. As the climate warms the East Coast is seeing more dry air. A few key things that cause large wildfires are dry arid days and rapidly changing air pressure. With rapidly changing air pressure you get wind and when its strong enough it can start spreading originally small fires into larger more massive fires. Firefighters will start off trying to fight the fire by trying to create a fire-line; an area of primarily dirt on the ground, where no fuels are present. This strategy is supposed to help isolate the fire in the select area it is currently burning in order for firefighters to surround it and drown it with water. Often times however, these fires can be large, so firefighters will be forced to spread out around the area of the fire in order to fight it. What can happen, is fire can actually, "jump," the fire-line that the firefighters created, continuing its spread causing firefighters to reset their positions and try again. With climate change, such a strategy might not even be possible. Forest Fires are often considered out of control by the time they reach the treetops. Often times this is when fire-jumpers (firefighters who jump out of planes) and large-scale dumps will occur on the forests in order to try and drown out the spread of large fires. Today, even after all of these attempts, firefighters will still struggle to put out these fires.

As mentioned problems often get out of hand when they're left unattended for so long. California has an abundance of National Forests as well as they do the natural occurrence of forest fires. There is something else besides the climate of California that has changed that influences these large fires, however. Forests today, are seeing an uncharacteristically low amount of care, in both the public and private sectors. In California, this is specifically an issue of the public sector. As mentioned earlier, California has an abundance of National Forests, therefore the federal government is supposed to maintain these forests. The US Forest system however is understaffed. In the last 10 years, they've campaigned for help from the public to help maintain certain forests. This effort was sadly ineffective as evidenced by the record number of wildfires in California from 2019-2020, indicating the poor maintenance and intervention of the people. The lack of maintenance in forests has

Figure 11: Community Forestry workers in Mexico, David Barton Bray, Leticia Merino-Perez and Deborah Barry, *The Community Forests Of Mexico,* 2009, University Of Texas Press.

caused a fuels-buildup; dead brush or just plain dry brush, that is left sitting in large abundance in areas of a forest. A fuels-buildup is extremely devastating especially in a time when climate change is a major issue. On large mountains, dead brush can cause avalanches from their presence in large quantity and in fires dead brush is what makes these fires worse.

As we hear of these travesties taking a firm grip over the lives of many Californians, we must remember that this is not just their problem. Issues in forests are present across America and with the changing climate these problems can start affecting Americans everywhere any day now. Such a large issue might be intimidating, after all we're all not trained maintain forests. Having a community forest system in place can change the way we handle our forests as a country and can stand to benefit a lot of people. Cleaning the forests is a task that is within reach for many Americans, and it is worth it for them in keeping their families safe in the future. This is written for my Mother Joanie and my Father Mike for always believing in me even when I never believe in myself.

FRAMING NARRATIVE

From the time I was a small child I've had a hard time staying still. Traditional school was therefore never my friend. Sitting and retaining information when I could be running my endless motor seemed like it was becoming somewhat of an issue in my life for a while. Teachers complained to my parents that I wasn't attentive, and it was

Figure 12: Mahopac High School Cross-Country at the New York State, section 1 race in 2016, self-provided

Figure 13: Engine Company 3 of Mahopac Volunteer Fire Department at the 2018 Mahoapc Installation Dinner, Self-Provided

hard to get me involved. My parents began their pursuit to have me try every single sport possible in the hopes that it would wear me out enough that I could sit down and do homework. Things started to change however in 2010 when I started running cross-country for a middle school team. The never-ending burning energy that would keep me active in elementary school was suddenly tamed to a degree. But with this newfound sport was still a lack of excitement among me to really compete. I was the fastest on my team and cross-country didn't seem to matter. It wasn't until High School in 2011 that I had a major wake-up call.

The shift to high school was perhaps a little more than I could handle. Classes were hard and I still wasn't a terrific student by any means. On top of this I was no longer the fastest on my cross-country team. The difficult transition fueled somewhat of an anger for me, and a need to adjust. I started forcing myself to keep up with the seniors on the team. Within three races I was top three on the team. There was something rewarding about seeing my work pay off, getting better as every practice went by and race was finished was a great feeling. Within a few years it appeared my only shot to college was riding my Division One offers


Figure 14: Thomas Caruso (the author) running in Somers NY, 2014

into the sunset. This didn't seem good enough to me though. A division one scholarship in running is great, but it doesn't exactly have a great exit plan. One day I was introduced to a course offered by the technology division in my high school; Architectural Design. The course wasn't what I expected but it opened my eyes; I can do a lot more in my life to help myself and help others than I realize, and I really like that knowledge. The possibilities of life are endless, why should I settle on doing the same thing all the time? Running my whole life won't break me out of my shell and I won't be able to find out more about myself. With this architectural design course, I was figuring out that there are many benefits with being creative and you can do amazing things with a creative skill set.

While I continued the second-year class of my schools Architecture course, I found myself joining Mahopac Volunteer Fire Department in the summer of 2015. This was a bit of a shock to my parents and to myself. I originally did it as a community service opportunity for my school but found my love for helping people kept me in it. After my senior year of high school ended, I enrolled in the New York State Firefighter One Course. After completion of this course I became a certified Interior firefighter for the State of New York. The rest of the summer and years after I participated in many different tasks and learned many unusual skills. It became something of pride for me, but it was missing something. While the years went by I wasn't just firefighting, I was going to school. Against all odds I somehow found myself going from nearly loosing my scholarship in the Wentworth Undergraduate Program, to finishing my Senior year on the deans list for the first time ever. With this, I of course also found myself with an Undergraduate degree that now seemingly lay as a signification of the sec-


Figure 15: *TImber Bridge in Connecticut,* Self provided, 2020

ond passion of my life. With an Interior Firefighter Certification and a Bachelors in the Science of Architecture, I found myself wanting to pursue architecture more but didn't want to leave my knowledge of firefighting behind. With my initial plan to study how architecture could influence emergency services I eventually came to the California Wildfires and the devastating impact that they were having over the west coast of the United States. I discovered that upon researching this that I was becoming more enamored with wood working and forests the farther I got. I realized that I would enjoy this, and it is more than necessary to address problems within forests. So going forward, I am excited to discover what my research might lead me too in terms of fighting the world issue of climate change and keep my path of trying to help people as much


Figure 16: Community Forestry workers in Mexico, David Barton Bray, Leticia Merino-Perez and Deborah Barry, *The Community Forests Of Mexico,* 2009, University Of Texas Press.


Figure 17: *Man working in Lumber factory* Albina Yard, "Mass Timber In North America," *AWC,* March 15, 2016, Accessed November 12, 2020, https://www.awc.org/pdf/education/des/ReThinkMag-DES610A-MassTimberinNorthAmerica-161031.pdf.

as I can through my research within this writing.

AUDIENCE

Architecture acts as more of the art of planning how ideas should be laid out and put together. That act in itself, stands helpless without the people who help create the vision that Architects formulate, sketch and draft. This work is meant to pick at the interests of designers and get their thoughts moving on how impactful their planning truly is. A design might seem simple, but even the simplest designs can have some of the biggest impacts. Design isn't something reflected in a set list of objects or types of creations, its something that breaks boundaries. With this writing, the hope is that designers will realize that design can be tied back to things once looked at as things of the past and that even things in nature can be considered. This theme of considerate design can make big impacts and these large

Figure 18: *Produced Wood In Vermont,* Self provided, 2020

impacts can potentially change the way the world functions for the better. An idea in architecture can be looked at as simply just a plan, but it is what that plan influences that determines the truth of how effective your design choice is.

This work is meant to give people resources. People of low-income communities might feel like there aren't too many options for them. There might be a connotation that average people cannot make a large impact. To these people this writing is to show them the possibilities of a bright future and how they can be directly involved in the process. Independent contractors or trade workers alike, will find this reading helpful in optimizing their efficiency. By targeting people involved in wood working and construction, the hope is that this will give people more insight and with that insight economic capability.

DESCRIPTION

Chapter two will lay out how the ideas of Architecture and planning may have any relative impact towards the conditions of forests. Defining how design is even involved by taking an organization of sources and tiering them into phases. By connecting data provided by the government and displaying the works Architects and developers directly involved in construction and Mass-Timber specifically there we will begin an in depth look at how Mass-Timber is connected to many of the issues plaguing forests. A comparison of projects which are up and coming in the Mass-Timber world will be examined and their overall impacts and strategies will be examined. These sources will inform us on where to go when conducting tests in the future.

Design Research or the third chapter, invites a look into perspectives based off the findings in chapter two. Looking at how wood construction and design with mass-timber can be put to the best use in architecture and how this impacts the maintenance of forests. Weighing of the ideas that come forth from certain design strategies and analyzing what works in timber construction and what materials or harvesting techniques based on a per product bases, are more harmful or helpful. Insight will be provided as to what might be the best outlook on all of this in order to further the discussion of Timber construction in architecture and the affect it has on forests in the United States. Studies will be conducted in sites most closely related to a large forest presence and will be analyzed to best

Figure 19: *Processing in Vermont,* Self provided, 2020

determine the overall logistics of implementing new design using timber construction methods.

The fourth chapter will further some design strategies discussed in the previous chapter. However, it will be building off the successful design strategies and creating a direction that is geared towards progress. It will present ideas that are even more forward thinking and new in the field of timber construction. Displaying how we can optimize the use of such an old style of design method in such a new and modern way. It will design more in depth than the previous section, and fully encapsulate the full scope of the design tests conducted, in every scale.

In the final chapter, a slight look back on the work as presented will be conducted. A look at every single idea, and design applied to that idea, will be evaluated and examined on the basis of what works and what doesn't. The final look at what can be improved, how other might be advised to go forward and other lessons that can be learned from the rigorous processes conducted in each design test. A bringing forth of how one might consider these two seemingly different ideas in a different matter as compared to how it was discussed in this writing.

Bringing forth new concepts in design is never an easy task. Often times in from a first glance, two ideas might seem inherently separate. This independence from the other idea, is often an illusion. An instinct by our brains, to fill the gap in a way that it believes is true. The ideas presented in this writing might seem like they're also somewhat standing alone from a first glance. The enlightenment of how they come together is not only how we get to new ideas but it, in itself can become a new idea at times. This writing hopefully, will successfully get you to look at your surroundings differently and consider the impact you as an individual have on the world. With timber construction and perhaps even the help of a community, we can see the change we want to see in prevention of Forest issues across the United States.

CHAPTER 2
LITERATURE REVIEW

Figure 21: Cut Logs in Russell Massachusetts, Caruso 2020

Figure 22: De-barking machine, Russell, Massachussetts, Caruso 2020

INTRODUCTION

Use of wood has been haphazard, based solely on immediate profit. This does not have to be. We can develop reliable systems that provide the needed raw materials while assuring sustainability of these resources. The production and use of wood in construction creates a framework for a future of sustainability and design efficiency. The fact that it is not widely accepted is due partially to the misconception and partially to lack of awareness on the capabilities and impact of the wide varieties of timber construction that are available, some being all lumber as visualized in figure 25, and some being hybrids. Tackling the resistant nature of man and allowing him to embrace a world of forward-thinking ideas regarding timber construction must begin by addressing basic topics regarding the matter. What do the extents of timber construction look like? How many industries and communities can potentially be impacted for the better and in what ways is it worth it for everyone to embrace a new culture of wood creation? What is the climate impact and how do we optimize the sustainability of wood? Examining how we as people can change the overall

Figure 23: Area farmed for lumber production in Australia, Pike, F., 2020

Figure 24: *Logs in Russell Massachessetts,* Caruso, 2020

Figure 25: Re-designing how we define a new age of timber construction begins when we understand the full extents of Timber Construction in the present day, this early 1900's covered bridge displays multiple uses for Timber in one project. *Early 20th Century Bridge.,* Caruso, 2020

outlook and use of wood is what we must do. This writing aims to explore what we currently know about timber construction and community involvement within it. This serves as an exploration of key factors in potentially improving the timber industry, in phases; understanding climate change experts, understanding embodied energy of wood as compared to other construction methods, and understanding what we can do to get communities involved and aware of the practices of timber construction.

Figure 26: With the right amount of cooperation and interaction between the community, government and private entities you can see forests that are maintained properly allowing them to have healthy growth and produce tons of oxygen in turn.

LOGGING; THE RIGHT WAY

North America is home to many different species of trees and wildlife in the Western hemisphere. While dealing with climate change, these forests are extremely vulnerable to natural disasters. Sean Mahoney, an environmental conservationist from Massachusetts in an interview in Kiel Moe's *Branches, Knots and Cut-offs,* discusses how realizing what is in a forest can help us envision how we might use it for design opportunities. But while

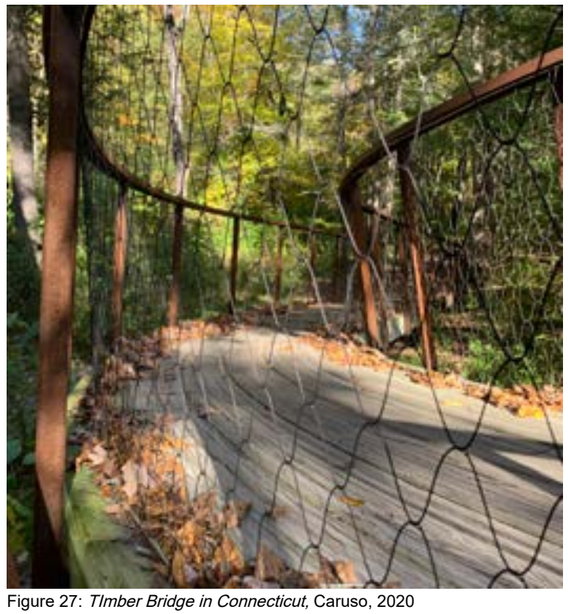

Figure 27: *TImber Bridge in Connecticut,* Caruso, 2020

Mahoney speaks of the usability of Forests, environmental advocates like Francis Pike in the article by Independent Australia; *Forests Logging and Climate Change*. might say that the usability includes logging and logging for straight profit is a negative. Pike might argue that the label of the timber industry as a sustainable practice is dangerous, because it allows companies who are using the forests for things besides wood construction (As seen in figure 28), to take advantage and reap major profits. But Mahoney's indication of sustainability in logging and use of timber construction is rooted in things that Francis Pike might not consider, (Results of community forestry; figure 26) so we will be aware of the concerns of those like Pike, but we will continue to explore why Sean Mahoney believes that design can open new doors to possibilities to improve the use of forests. The US Forest Service identifies a list of top ten tree species by volume within a specific area, as shown in *Wood* Urbanism, by Daniel Ibanez, Jane Hutton and Kiel Moe. They also identify the top ten tree

species most commonly found in the country overall[3]. By looking into aspects like this, we might be able to tap into the thought process of Mahoney and open doors to people like Pike, in order to clarify how we might move forward.

Timber suppliers are often thought to have considered by environmentalists, as the bad guys. The perception is that the ones cutting down the trees are the ones causing all of the problems for forests. This is believed without considering that every legal timber supplier must be Forest Stewardship Council certified, as discussed in Kelcey McLung's article; *4 Mass Timber Projects Changing Real Estate*.[4] What this means, is that each supplier is actively proving that they are planting as much as they're taking away from a forest. This is where people like Sean Mahoney can be persuasive about the benefits of Timber harvesting.[5] But Francis Pike, may dispute this and say that the argument of a simple guarantee that trees will be replanted thus helping a forest out is far too without context[6]. Pike may express the concern that trees take up to 100 years to re-sequester the carbon put in the air by those harvesting trees for biomass fuel burning[7]. In *The Community Forests of Mexico* by Michael Barton Bray, Leticia Merino-Perez and Deborah Barry, we might see part of the puzzle that Pike is missing. The Mexican people have gone far beyond the regulations of the Forest Stewardship certification through their FSC system.[8] This system includes regulations for the use of the Timber harvested, marketing timber through the citizens and specific private companies negotiated by the

Figure 29: Stacks of lumber outside of a Mexican community Saw-Mill, Hodgedon, 2015

Figure 28: Plantation style farming not only takes away large chunks of trees at a time, allowing slow deforestation but it also makes for repetitive planting which is also extremely unhealthy for forests. By creating more of a natural forest and planting diversly as opposed to for profit, we can potentially see a really sustainable use of harvesting wood and not harm forests at all. Rachel, 2019

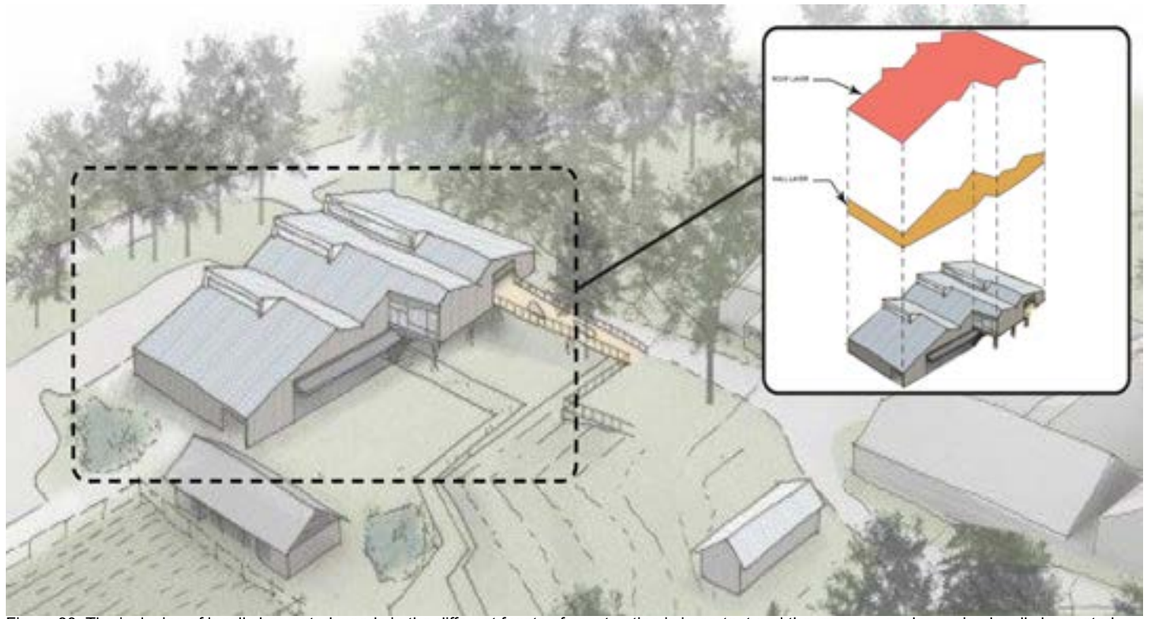

Figure 30: The inclusion of locally harvested woods in the different facets of construction is important and the more we explore using locally harvested materials in the wall and roof layers could make or break the way we use wood in construction, as demonstrated in Common Ground High school in New Haven, Brandon, 2013

government. Perhaps Pike would be a lot less critical of mass logging if a system such as this was implemented worldwide. It is here that you can see the opinions of Mahoney, stripped down to their current outlook which is what this literature review is attempting to do. Taking into consideration the issues of the Mass Timber industry involves some ingredients to be added to the process that make it more environmentally beneficial. Community forestry is one ingredient of that.

EMBODIED ENERGY AND THE TIMBER INDUSTRY

The embodied energy of production has affects that are not visible to the user of a single space. Many designers in the modern world are educated in the impact of Climate change and how we might address it in the years to come. Paul Downton, an Australian author with knowledge of building construction, might argue that no sustainable practice is perfect, but some are better than others. Downton talks heavily of rammed Earth as a sustainable material in his informational piece

Figure 31: Exterior View Of Ascent MKE, Peronto, 2020

Rammed Earth.[9] Rammed Earth construction is the packing of soils and clays into a mixture that creates a sort of concrete substance. But he cites the method of construction as inherently inflexible as a means of construction for varying climates and also argues that ramming earth has a long expensive process of manufacturing which can limit it.[10] Developers such as Tim Gokham, the lead developer on Americas tallest timber structure, Ascent MKE (seen in figure 31), explains the processes of timber construction quite the contrary to Downton's description of rammed Earth. Gokham makes it clear that the main avenue of appeal with timber, is that on top of its high sustainability in relation to forests it also holds an inherent quality of low embodied energy, since it is very easy to construct and requires the least amount of labor time.[11] It is our job as architects to consider sustainable materials and their benefits while resolving issues in the timber industry. The environmental impact of the timber industry is based on every decision made along the way.

Michael Le Page argues in his article, *Logging Study Reveals Huge Hidden Emis-*

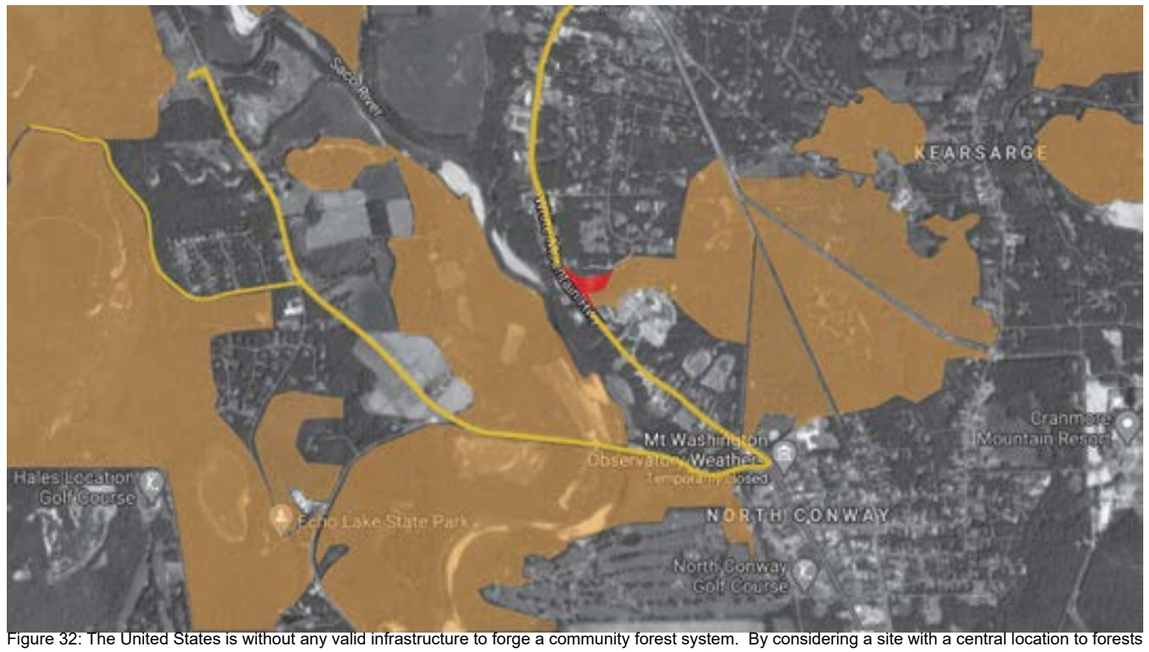

Figure 32: The United States is without any valid infrastructure to forge a community forest system. By considering a site with a central location to forests that maintains a strong link to large roads, we can narrow down where we might consider creating such an infrastructure. Caruso, 2020

Figure 33: Ascent MKE interior of an apartment featuring Glulam and CLT, Ryan, 2020

sions Of The Forestry Industry, that the embodied energy of timber construction being low, is not fully true.[12] Le Page cites that a lot of sustainability statistics in the logging business are recorded in a certain way that actually masks the damages that the logging industry has. Page cites that plantation style loggers in North Carolina actually produce the third most emissions in the state behind electricity generation and transportation.[13] This input is very important when considering how we have to use wood. It puts opinions like Tim Gokham's into perspective and the opinions of Greg Frankenfield as described in Kelcey Mclung's article; *4 Mass Timber Projects Changing Real Estate.*[14] But while their focus on wood might need greater context, their designs do expand on traditional US sustainable design strategies. The United States turn towards the Leadership in Energy and Environmental Design (LEED) standard, reflects a new awareness of environmental consciousness that was not grasped fully by designers in the 20th century. It defines criteria for which we as designers must dive

Figure 34: Illwerke Zentrum Montafon exterior view, Pachnicke, 2020

Figure 35: Illwerke Zentrum Montafon interior atrium view, Pachnicke, 2020

into in order to create things that meet the minimum requirements for good construction in the sustainable world. Gokham and Frankenfield take the stance of just needing to add Timber construction to this formula, for America to begin its process towards total sustainability but conservationists like Mahoney specify details that would not only bring new light to their own arguments but also the arguments of Michael Le Page. Mahoney believes that when using timber, we as designers must eliminate the amount of waste product and wasted energy that is created from using trees that do not meet manufacturing standards[15]. Mahoney believes that we need to create an infrastructure before even beginning this conversation. This infrastructure is currently not available but can potentially solve emissions issues in a big way.[16] In figure 32 we can visualize a scenario where this infrastructure might be placed. This infrastructure discussed serves as another ingredient we need in North America to help improve the factors of sustainability involved in the modern timber industry here in the United

States.

LOCAL MOVEMENT FOR NATIONAL IMPROVEMENT

Mahoney's concept of the promotion of locally harvested materials, is extremely valid. This isn't the first time this thinking has entered the world of design, there's just no infrastructure for it here in North America like Mahoney suggests. In order to think about what this theoretical infrastructure might look like we have to consider ideas that are already being put to work else where in the world. Locally harvested materials display their benefit in a few projects around the world and believe it or not some in the United States.

In Austria, Illwerke Zentrum Montafon (seen in figures 34 & 35) serves as a prime example of the impact that a building with locally sourced materials can have on an area. The project features a Glulam and concrete hybrid structure created from locally sourced spruce in Montafon.[17] Farming the timber for the structure is where we really see the value

Figure 36: Mexican Saw mill producing lumber for sale, Hodgedon, 2015

Figure 37: Modern logging processor in action in Mexico, Garcia, 2020

of its impact. Vorarlberg is an area that features a large forest sitting on top of mountain slopes. When the forests on these slopes are left unmanaged, they begin to see major issues. A dead tree left unattended often falls due to high winds.[18] Pair this with the extreme slopes these trees sit on, and you can see that large dead trees, take out other live trees causing increased erosion and landslides in turn. This made the harvesting of the wood in the Vorarlberg area beneficial to the forests overall makeup because it decreases the potential for natural disaster on the mountain side forests. But while Vorarlberg serves as an example of great locally used sustainable materials and methods in comparison to other projects involving timber construction, the hybrid mode of construction comes into question. Ascent MKE is becoming a major precedent for developers and Architects in North America for timber development and while it furthers wood use when compared to Illwerke Zentrum Montafon by using products such as Glulam and CLT, it is without the locally sourced ma-

Figure 38:Catalyst Spokane interior atrium featuring Glulam and CLT, Darling, 2020

terial that is utilized in Austria. An Educational advertisement by reThink wood titled *Mass Timber In North America,* claims that there are several suppliers for both Glulam and CLT in North America and therefore the embodied energy is still relatively low.[19] But the insight by Michael Le Page from earlier states that a lot of wood purchased might still just be Forest Stewardship Certified without any indication of its true environmental legal impact.[20] By combining what we know from Le Page and applying some of the insight from Sean Mahoney and the designers of Illwereke Zentrum Montafon, we can re-envision how timber construction should be conducted in the United States with a perception that is much wider than that of developers such as Tim Gokham.

A current example of the potential impact locally sourced materials can have on an area can actually be found in the United States. The Catalyst building and Scott Morris Center for Energy Innovation (figure 38) in the South Landing of Spokane's University District is a project which holds its focus on locally

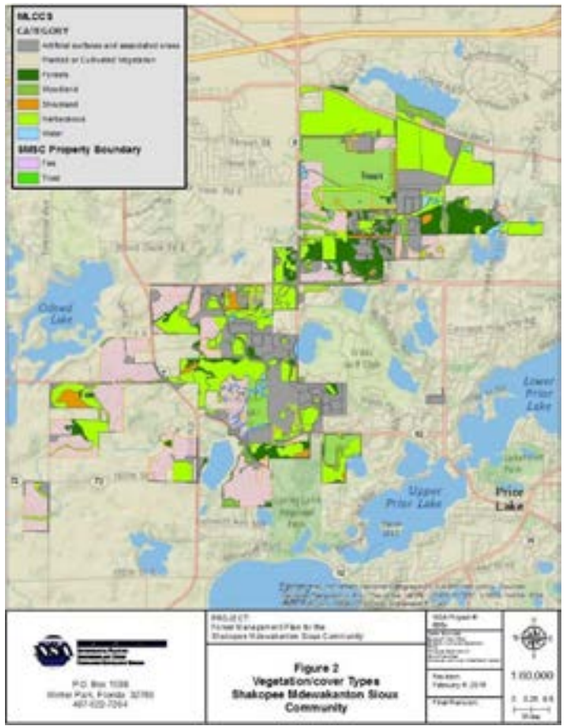

Figure 39: Shakopee Mdewakanton vegetation/cover diagram, Corporation, 2015

sourced materials. Craig Curtis of Katerra, speaks about how the wood produced for the project is primarily from the new CLT factory that they developed in Spokane as well.[21] The materials are sourced from forests around Spokane and while Craig doesn't get into detail on the exact site around Spokane that the wood is coming from, his strong implication is that it is not too far. Spokane being not to far from the current California wildfires is a focal point for his argument; "The carbon storage of the wood that's produced can completely offset the carbon put out by the production of the wood columns themselves……this can do things like improve the health of our forests and bring jobs back to our rural communities."[22] When considering this information, we cannot just take it at face value however. Again, we must cross examine our current actions occurring with timber in the United States and consider that while we need locally sourced materials because of the better embodied energy that comes with it, this is not enough. Le Pages argument must be brought back into focus in order for us to create an outlook that while local materials are good, we still need to eliminate Plantation style harvesting within these forests and assure that these locally sourced materials are truly being beneficial to an area.[23] This can be accomplished by recognizing the truth of the total carbon impact that lumber production has on the world, and allows us to make decisions moving forward such as doing more to prioritize locally sourced materials within buildings both large and small, in turn putting forth projects that make sense for the environment.

A Tribe of Maintenance

Figure 40: Mexican community forest workers running a de-bark machine, Garcia 2015

Figure 41: View of final prototypes made for *The Littleton Trials*, Kennedy & Mans, 2016

Based off the sources gathered thus far, we know there's a direction that needs to be taken towards locally produced lumber that is directly aimed towards the construction industry in order make timber harvesting sustainable. The United States lacks the ability to be flexible in allowing everyone to be involved in such an industry and it holds the creation of mass timber back. Most timber production on a local scale, is seen through the fabrication of studs for residential homes.[24] As mentioned before, most North American Timber producers must be Forest Stewardship Council certified,[25] but as we now know through the insight of Michael Le Page, the international standard that's being used in the United States is not sufficient in guaranteeing maximum sustainability. How we might consider doing more for sustainable production is look towards the Stewardship programs predecessor; Mexico's Forest Certification Concept (the FSC).[26] By looking into this system we can see that

Figure 42: Lumber being cut for *The Littleton Trials*, Kennedy & Mans 2016

Figure 43: Mexican Saw mill receiving lumber, Godoy, 2019

there are actually steps taken by the Mexican government to ensure that the local products are being sold for construction materials through a partial government intervention. It also ensures that every forest will maintain its original biodiversity before and after it is used for production purposes. The FSC even goes as deep as to require a thirty to seventy foot range between trees upon planting, depending on the species.[27] The main thing that authors David Barton Bray, Leticia Merino-Perez and Deborah Barry claim in the book *Community Forests Of Mexico* that really sells the whole system for the entire country, is the aid it provides in small-scale production.[28] The government first works to establish a community saw-mill within an area where people meet a fixed demographic of holding skills in trades of stumpage, harvesting, technical documenting skills and processing skills.[29] The funding to these communities creates an initial footing for them, that gives them resources in order to prosper in the timber industry. These practices are also comparable to the Shakopee Mdewakanton Sioux Community in Minnesota which proposed their intended forest management plan (geographic conditions visualized in figure 38) to the state of Minnesota in 2015[30]. Their management plan serves to maintain the forest with precautions set up to ensure that there are standards set in regard to bug infestations and other potential emergency ecological problems. They also provided a plan of minimum maintenance to be conducted, where the tribe would maintain the current ecosystem while also creating economic benefits for its people, by allowing maple syrup production as well as an annual allowable cut schedule for its people to harvest and sell wood. What their plan doesn't include is restrictions of sale on the wood like the *Community Forests of Mexico* talks about.[31] Therefore, looking towards our Southern neighbor Mexico and to some extent tribes like Shakopee Mdewakanton Sioux Community, we may be able to learn a thing or two about how we can begin to accomplish getting people involved as well as making sure that the people involved

Figure 44: Loggers in Mexico operating a modern saw mill, Godoy, 2019

are selling lumber for construction materials. Knowing of these examples provides us with a framework of systems that can accomplish a relationship of the community to the forests. From here we must go forward and recognize where designers might fit into the picture of a United States Forest maintenance system. We as designers must find a way to educate people of the need for systems like these and have program that would get them involved as well as give them the foundation for beginning such a large practice.

The Grain of Space

In *The Community Forests Of Mexico,* the main piece of program that is initially given to an area is a saw mill (figure 44), which serves as a piece of infrastructure that gives the Mexican people of different specific communities, the primary ability to produce wood for sale.[32] The problem with United States as stated by Sean Mahoney however, is also the lack of awareness of the timber industry as a good option for construction at all[33]. This is reinforced by Tim Gokham in *4 Mass Timber Projects Changing Real Estate* when Gokham discusses the reasoning behind why people often don't think of choosing Timber construction for a lot of projects in America today[34]. In order to get people into the ideas of Timber Construction we might look into educational programs as well. An example of this type of program is the Maine Boat school in Brooklin Maine, we can see an educational program that sets the stage for boat making.[35] By looking at their curriculum we might get into the ideas of an educational program similar, but with more emphasize of Timber aspects as opposed to boat making aspects. But this idea is only dependent on the success of a building to bring people in to freely gain interest in partaking in a subject based trade school. In Israa Hanafi's; Human *Social Behavior in Public Urban Spaces Towards Higher Quality Spaces,* there is a discussion of what makes people interested in coming to public areas[36]. By using her information, we might also need to consider that a site of choice within an area needs to be inviting and welcoming to people

Figure 45: View of a developed prototype made for *The Littleton Trials*, Kennedy & Mans, 2016

in order for there to be an interest sparked over the educational aspect of Timber Farming. The building itself might also benefit from serving as inviting as possible. For this we might consult the psychology of man and his surroundings through the help of Harry Francis Mallgrave's; *Cognition in The Flesh, The Human in Design*.[37] Making sure that the site and program are successful and bringing people in and informing people about how timber construction can be beneficial in the correct way is what we should be exploring and accomplishing. By considering a hands-on program like the Maine Boat School[38], we can also get into doing programs that operate like a study conducted in Massachusetts by three men; David Kennedy, Jacob Mans and Benjamin Peek known as *The Littleton Trials.* (Prototype seen in figure 45) [39] This study can inform us on how might go about how we can go about creating a curriculum or museum of some sort to help us display information that can intrigue people to become involved in timber construction. If we are to consider a functioning system of Forest maintenance, we also must consider what program will aid us in the making of this system. By using these references, we can begin to shape what our designs might actually be doing, and what they will be sustaining. Our program must educate people, and give them the tools to be involved, but before it can do that it also must be available and open to the public allowing them to freely gain interest themselves and partake in community forest management because it is necessary for them.

CONCLUSION

Timber construction is a very intriguing construction style that could potentially stand to help American forests and climate change. North American forests are vulnerable and ripe for disaster. Mass timber is an up and coming construction material which has obvious benefits but is not currently being used to its full potential. Knowing the potential and how we can use it may benefit us in the future. Through experimentation of ideas we might be able to envision a world that uses timber in a way which benefits us all. In order to do this we must take what we know about Timber construction, and comb through all the issues and current standards that hold the industry from advancing and make changes that ensure that timber is not only doing the minimum to help, but the maximum. By understanding what is currently being done in the world, we can see the appropriate measures that we must take in order to design for efficiency in the use of wood products.

Figure 46: It Is important to recognize the possibilities of wood, in order to further ours and other peoples knowledge of its capabilities and by exposing people to different forms of wood creation we potentially give them an avenue to start a conversation on wood construction, Robarts, 2020

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CHAPTER 3
DESIGN RESEARCH

THE TIMBER INDUSTRY NOW

Upon reviewing the main takeaways from our last chapter, we can go forward and attempt to address the main key issues with the Timber industry and get a better grasp on developing design decisions that make sense. It is clear the United States citizens are divorced from their resources. Production of cross-laminated timber and other large lumber factories are spread out across the country (figure 47)[1]. This means that the embodied energy of transportation is often considered from the point of harvest to one of these locations, to the site of where its produced. This serves a unique issue of how we can better balance the embodied energy of lumber production with the output of energy within a building developed using mass timber. To properly address this, we must first analyze how we might create details which express the highest energy efficiency, in order to gauge how we might develop the best solution on a project scale. From the project scale we then might be able to address how architecture is bridging the gap for the citizens of the United States with the resources around them.

The United States has the fourth greatest reserve for forests in the entire world. Containing about roughly 8 percent of the all of the worlds forests, with roughly 304 million hectares.[2](figure 48) Currently access to this reserve is dominated by larger wealthy corporations, due to their access to larger funds.[3] While some are timber manufacturers, within the group of people who are forest stewardship certified there are also those who sell the wood for fuel which in turn causes a greater production of plantation style operations which serve as harmful to the environment.[4] If we can change the main economic use of land being harvested for fuel, and create an infrastructure that connects those who are currently economically incapable of harvesting resources from United States forests we might be able to push out the large amount of carbon being put into the air by these large corporations and replace it with a solution that is inherently sustainable.[5]

Furthermore, in making things sustainable we also have to reconsider how we develop common construction in the United States. Crude oil-based products make up for over 6000 different materials used in the United States. In common building construction methods, crude-oils are used in the making of insulation, roofing and in some cases flooring.[6] The United States produces 19.25 million barrels of crude oil a year, but we consume

Figure 47: Locations of North American CLT factories

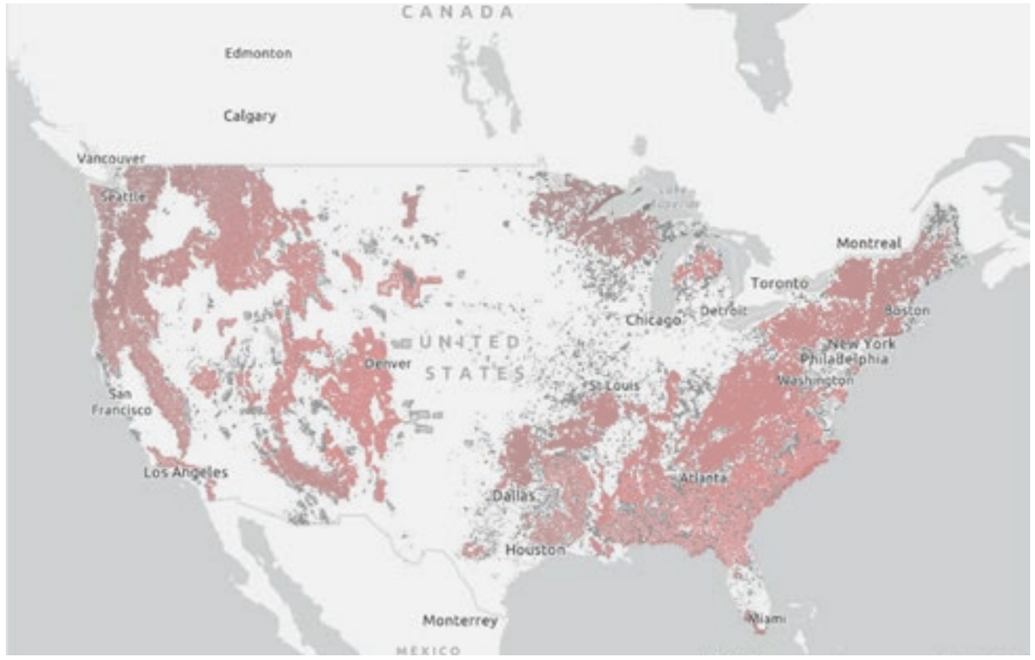


Figure 48: Locations of US Forests

94% of it, here in the United States[7] (Figure 49). The United states consumes 2.4 times the amount it exports to the rest of the world[8] (figure 50). Clearly, we over consume and overuse materials which are not sustainable. Going forward we need to address this overuse of petroleum and sustainable materials such as mass timber in new ways not commonly thought of as practical in today's society.

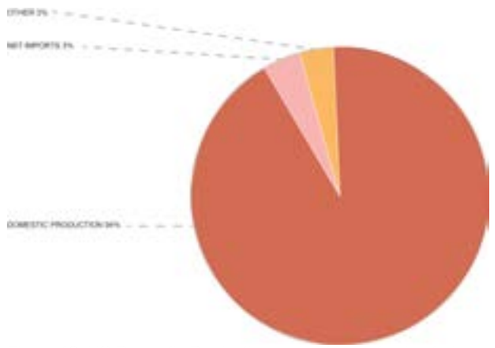


Figure 49: US Domestic Production and net imports of petroleum as shares of Petroleum consumption, 2019

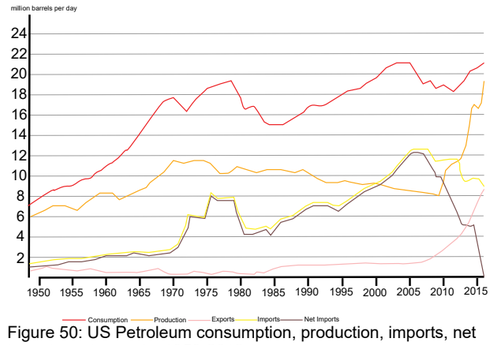


Figure 50: US Petroleum consumption, production, imports, net imports and exports, 1950-2019

WOOD IN DETAIL

Before we can provide a sense of a connection for communities to their resources in the sense of a project, we must understand what wood

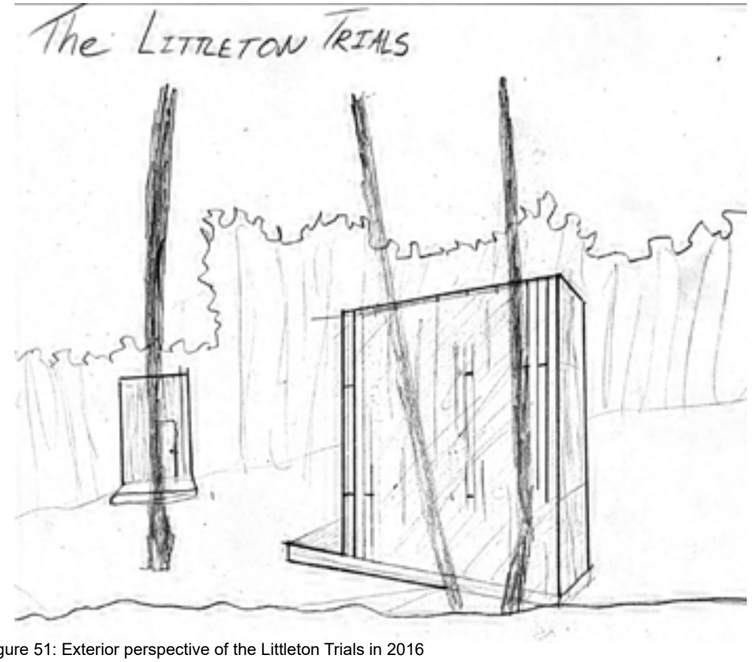


Figure 51: Exterior perspective of the Littleton Trials in 2016

construction might need to be doing when working within a building. When looking back at "The Littleton Trials," in Massachusetts, we can clearly see that species of tree is highly important in regard to wood production.[9] The thermal properties of wood are codependent on the species and their relative density and thermal conductivity.[10] As seen in figures 51 and 52; "The Littleton Trials," concluded there were differences of heat transfer occurring through the different species of wood they used, and each one of their huts they developed mimicked the thermal properties of the most dominate species used in each hut.[11] They also compared having pockets of air within a wall assembly of pure wood with that of solid construction. As seen in

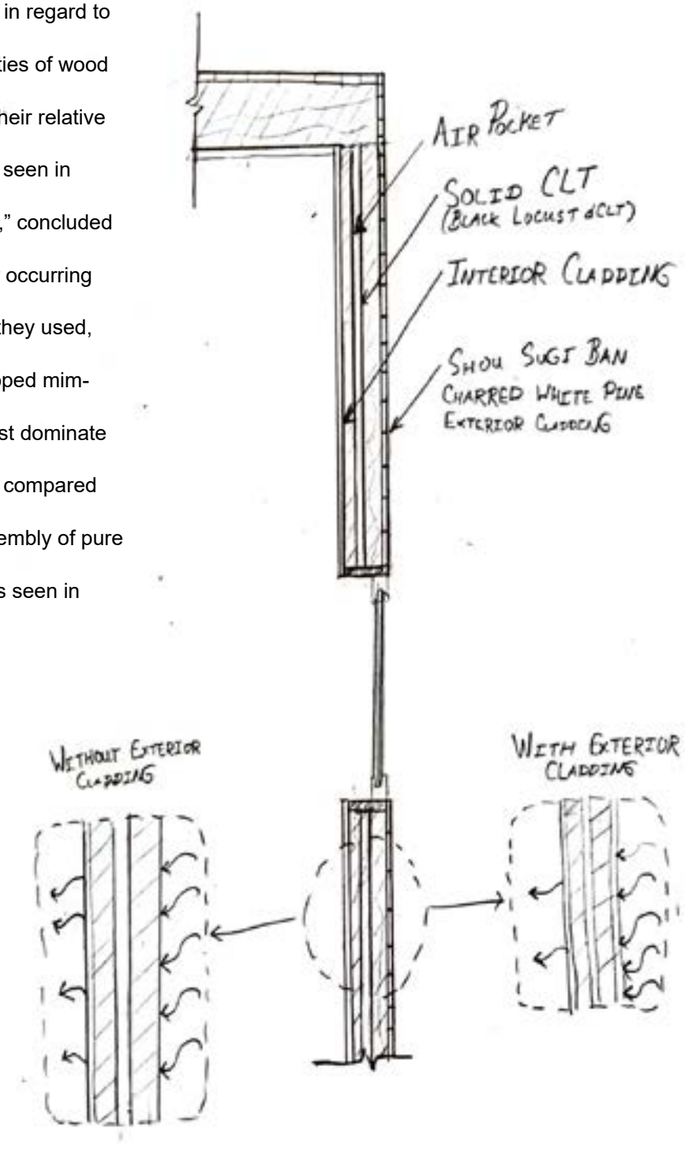


Figure 52: Wall detail and heat transfer reaults from the experiments on monolithic wood construction in "The Littleton Trials."

figure 53, there are many species of Trees in the United States but going forward it is crucial that we look at them in terms of quantity in a specific area and also in overall numbers across the country.[12] By taking what we learned from the study by Mans, Peek and Kennedy, we can better understand what species are available and gauge what wood we might use and how we might use it. While lowering the overall carbon impact of buildings is important when being environmentally conscious, there is still not enough being done to take carbon out of our atmosphere. Using as much of an area of a forest given as possible, is important because it assures that there is no need to cut too much or that wood trusted to the harvesters isn't being completely wasted. As a result, production methods are important to consider with the fact that we must understand the properties and diversity of different species within a forest. When looking at the different methods of lumber production we can see that the methods of producing Laminated Veneer Lumber and Mass Plywood Panel (shown in figure 54) actually produce 30% less waste product than other methods.[13] Potentially, developing a system to be used in a building envelope that considers all of these things could be extremely helpful. In figure 55, the image depicts an interlocking LVL system. This can serve as a base for a structure for a wall

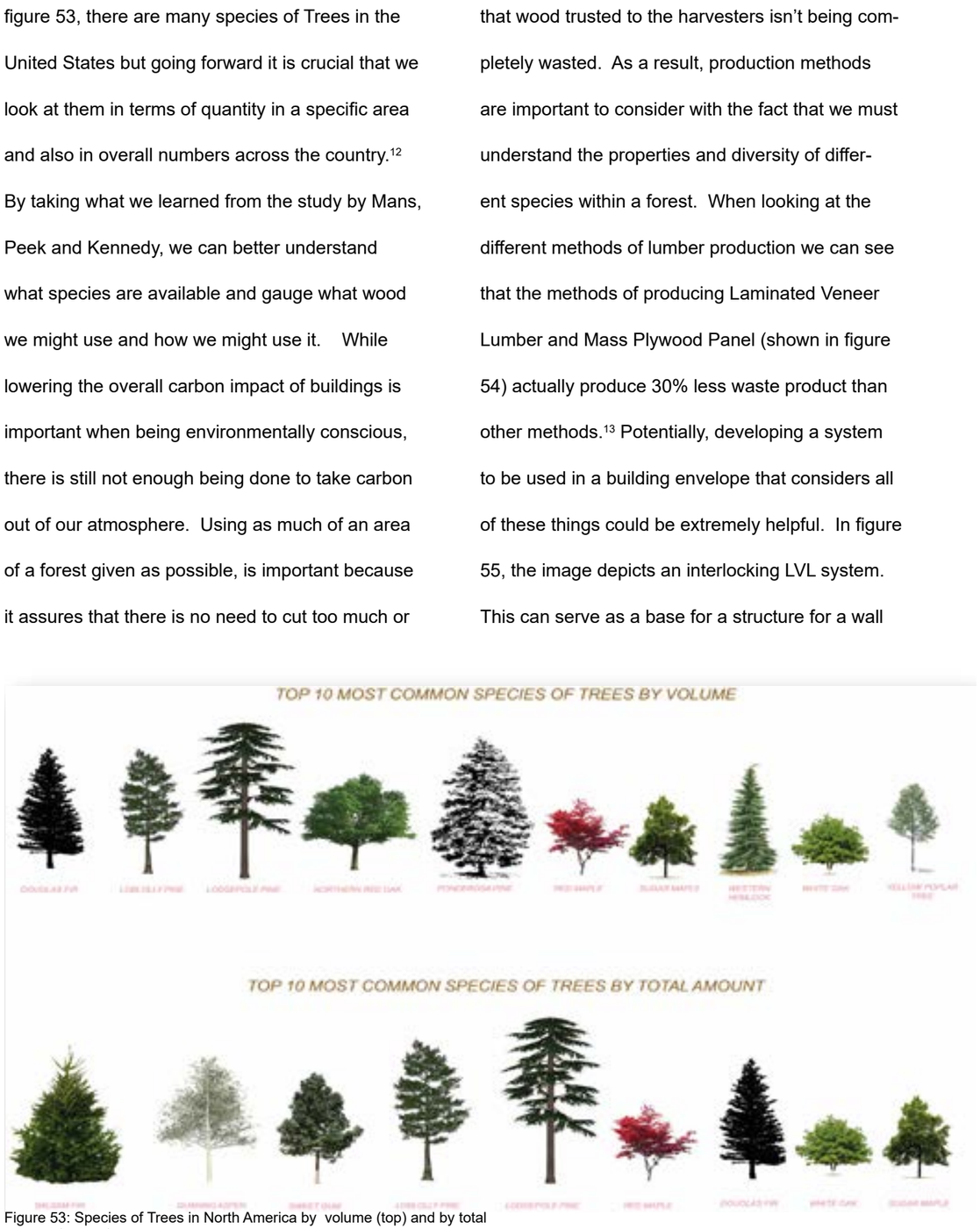


Figure 53: Species of Trees in North America by volume (top) and by total amount (bottom)

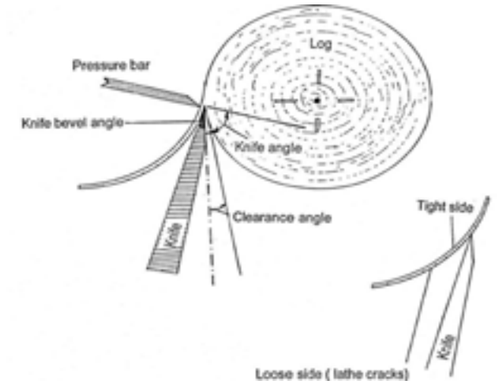
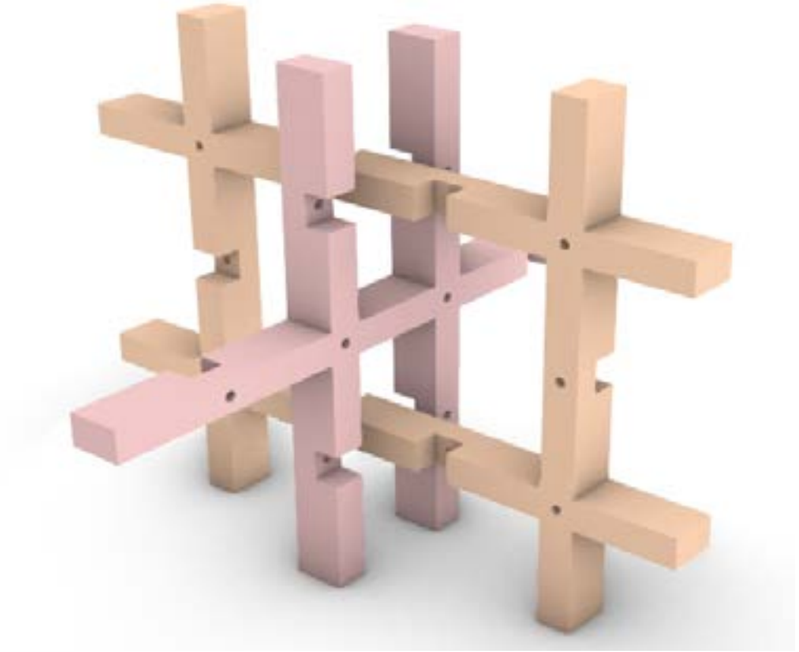


Figure 54: Process of creating Mass Plywood Panel, and Laminated Veneer Lumber

roof. While this is structurally efficient, we still need to consider layering it to accomplish the result as experimented with in "The Littleton Trials." Creating a pocket of air in between each panel allows the wall assembly to insulate itself further according to the experiment, therefore to use wood more efficiently we can put MPP panels between the grid of the LVL system and create a wall assembly that uses wood in the most efficient manner (figure 56). What this wall assembly potentially accomplishes, is the closest resemblance to the makeup of a living tree using the most efficient wood products possible. Potentially, we could accomplish something similar with a roof system. By using the interlocking method on a by panel basis, we can begin to generate a panel which uses layers of wood to generate a specific thermal property. This is depicted in figure 57. Essentially, the LVLs act as a sort of waffle slab system, and plywood is layered as normal. But these layers are accompanied by an interior layer of Western Hemlock, which serves as a finishing layer, but also holds a higher diffusivity value, making it something that exchanges thermal properties much slower.[14]

While the design tests conducted explore interesting possibilities, they do not consider the study conducted by Kiel Moe's Stackhouse. The



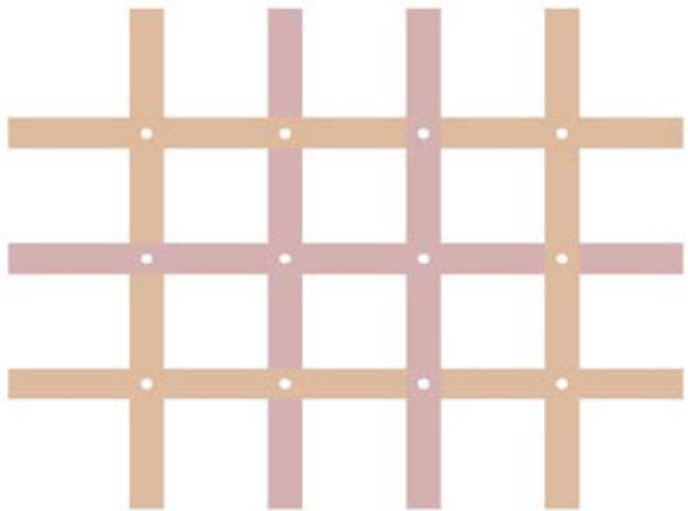


Figure 55:Assembly of an interlocking LVL system, shown by itself

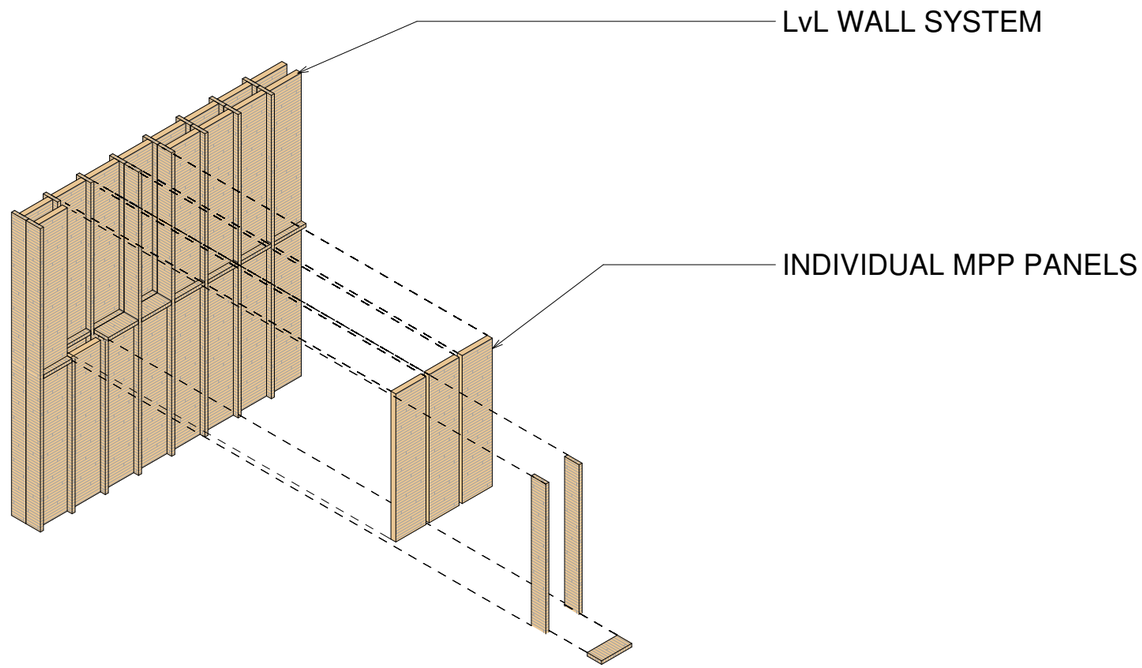


Figure 56: Wall Assembly of an interlocking LvL Mullion system with MPP panels installed between each void; Exploded Axon

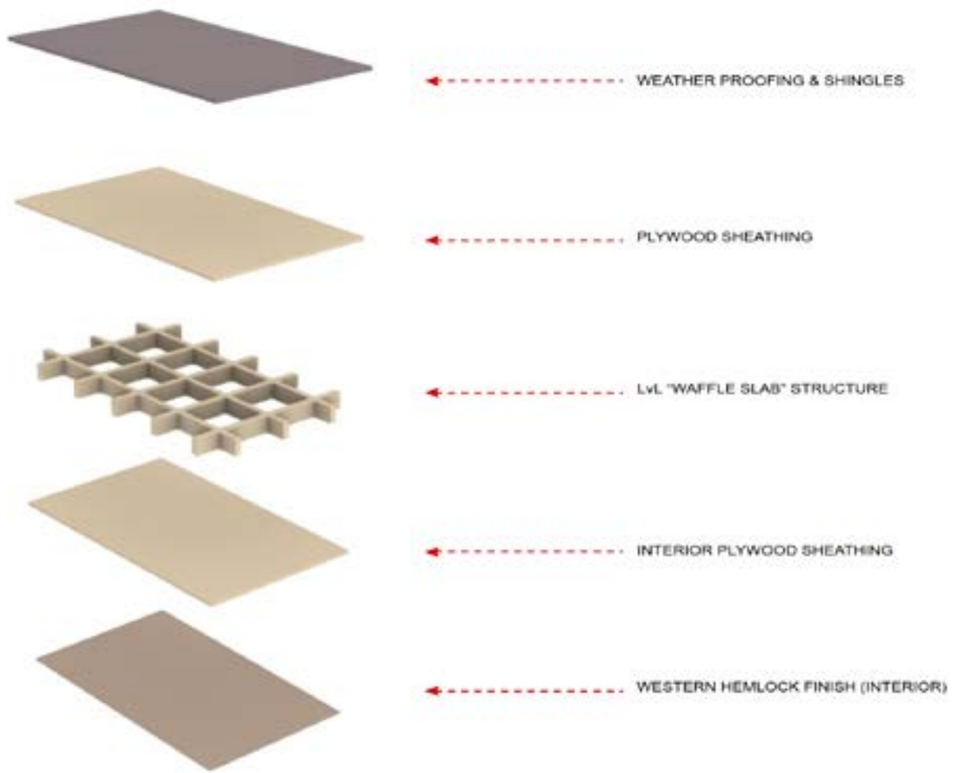


Figure 57: Roof Assembly of an interlocking LvL Mullion system with Western Hemlock interior finish to test thermal qualities; Exploded Axon.

Stackhouse studies idea that too often the accounts of carbon associated with timber buildings are focused on the carbon sink impact of potential primary building material substitution.[15] In order to study the total account of carbon within a timber building, Moe considers multiple factors such as; carbon cycles, total production energy, carbon storage and carbon equivalence, as well as the associated energy dynamics of various wood construction systems.[16] The Stackhouse depicted in figure 58, was built in Colorado along the Arkansas River Valley. Moe wanted to open up the idea that the aim to accomplish ecological and architectural potential of a design and material specification is much greater than just specifying a material that sequesters carbon or has a lower carbon impact.[17] Moe asses the building construction assembly that is commonly used in residential construction, and infers that in every step of the way for each material included in a general wall assembly, there is much more process and development going into manufacturing each of the parts. Even the manufacturing of a basic wood stud involves multiple steps, and each step has an embodied energy associated

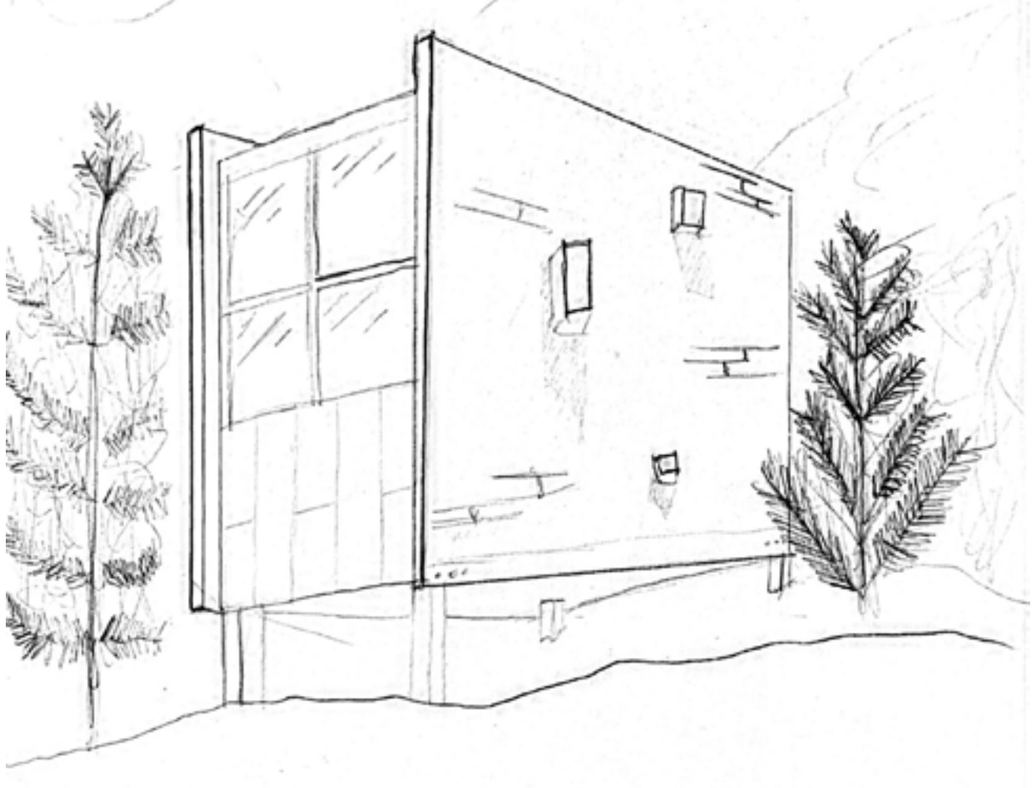


Figure 58: Stackhouse drawing, front perspective

with its development. Moe studied the difference of this standard stud wall construction with what he refers to as a stack of 6x8 Spruce timbers. This stick vs stack concept illustrated in figure 59, displays how there are more parts involved in standard residential construction and as mentioned each part undergoes a process of development. Moe then uses the crate-to-gate analysis by the Consortium for Research on Renewable Industrial Materials (CORRIUM), to conduct a multi-year comparison of process of manufacturing for each in relation to the location of the Stack House in Colorado. This analysis takes into account the transportation, specific species properties upon harvest (like moisture content) and the composition of fuel sources in the electric grid.[18] In the end the, the study concluded that the use of monolithic architecture in terms of the use of the solid 6 inch timber walls, were more efficient in a thermal capacity than traditional stick built. The design being just two sides with main windows and an entry, with another two sides of thick timber construction makes it so the building doesn't actually need a heating system, while also allowing cross-ventilation to occur cooling the building in the summer months (figure 59.1 & 59.2).[19] Moe also uses this project to extend his construction system analysis to forestry cycles more directly. By adjusting the intensity of harvesting in a

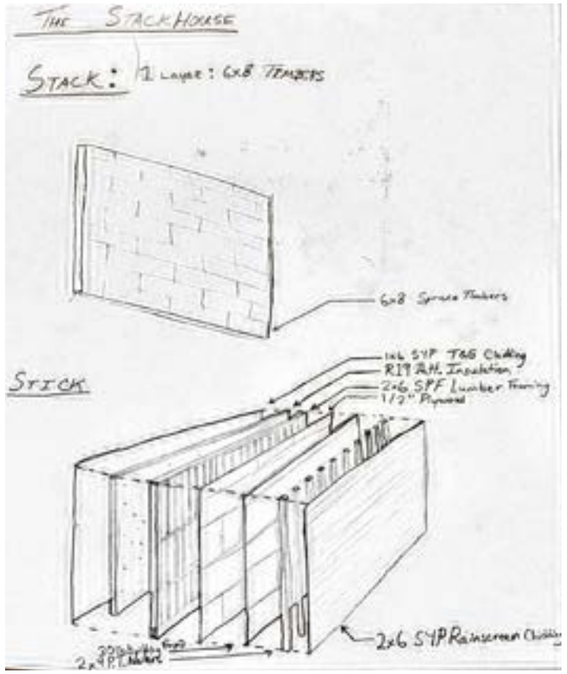


Figure 59: Stick vs stack concept in sketch.

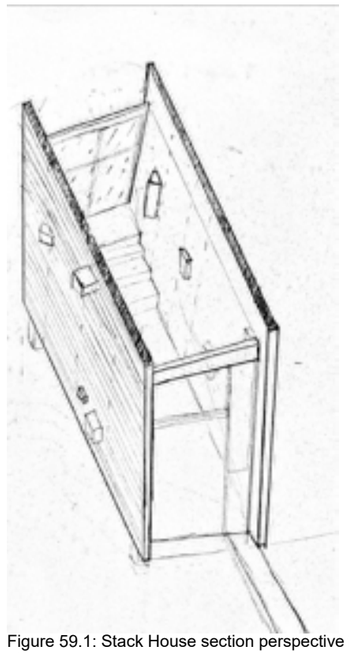


Figure 59.1: Stack House section perspective from above

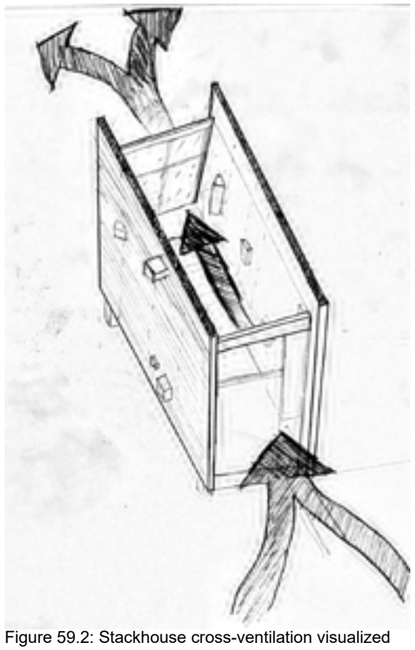


Figure 59.2: Stackhouse cross-ventilation visualized

specific place, could have a carbon increase over time allowing us to be able to tend our forests as their composition changes through climate change in the coming decades.[20]

Being aware of Moe's study allows us to conclude that a solid wall assembly of Timber, may possibly be something that is even further developed in terms of energy efficiency of a building than some of the conclusions drawn in "The Littleton Trials." Moe's study stresses the efficiency of wood as a thermal conductor is very high and proves that solid wood when used properly in design can potentially be a benefactor to the overall performance of a building itself, by lowering its carbon footprint in operation. This knowledge of detail is important going forward because in order to continue to spread the knowledge of the efficiency of wood construction we must know what strategies are good to keep in mind when defining how we can educate others on preserving forest land by using materials in the most sustainable way.

SITE; RUSSELL MASSAHCUSSETTS

While the fires in the west are an example of forests in crisis in present day, it could be more helpful to also consider a place without chaos knocking at the front door. The east coast is also vulnerable to issues that are plaguing the west. Thanks to climate change, the East coast is seeing dryer and windier seasons. For these reasons its potentially helpful to look into how we might begin to establish an infrastructure of awareness for timber construction and evaluate how we might learn from some of the community systems mentioned in the previous chapter and apply them to real life communities.

Currently the west actually has a majority of the Cross Laminated Timber Factories in North America. The lack of infrastructure for lumber production as discussed in Kiel Moe and Oliver Curtis' *Specific Carbon* is a major key in lowering embodied energy.[21] The northeast specifically having its nearest development being in Quebec is specifically harmful for Americans environmentally but also economically. In order to make timber production in the United States truly sustainable we must be able to supply more of an infrastructure to the people of the United States for production. Russell

Figure 60: Russell Massahcusetts in relation to most of the Northeastern United States

Massachusetts is in a central location to most of the Northeast, as shown in figure 60. According to Sean Mahoney in *Branches, Knots And Cut-Offs*, 80% of forests in New England are privately owned and there is nothing in place for owners to utilize in order to sell patches of lumber, turn a profit and more importantly allow them to maintain their forests properly as a result.[22] Being that Russell Massachusetts is an area that is above average on unemployment from the rest of the United States average, at 4.2% of its population unemployed and on average the income per capital is less than the United States average. As visualized in figure 61, the area is actually relatively close to a forest and

Figure 62; Site in Russell

the site next to a large forest partially visualized in figure 62 is potentially a perfect area for new development on the infrastructure discussed by Mahoney, Moe and Curtis.

The area for the site proposed is actually currently being used for Timber related activity already. Currently logs harvested from the near-by area, are brought back to the site to be de-barked and prepped for shipping to whoever has purchased the logs. As visualized in figure 63, the area currently has plenty of lumber ready for evaluation and sale to a prospective buyer. The site has potential to do so much more than that though. The location and context for the site is perfect for the development of a Cross-Laminated Timber factory. The building visualized in figure 64, is a building which serves as a factory and trade school for timber related work. The reasoning for the combination of the trade school and factory is because though Russell statistically has people living within the community who could stand to gain from working in a cross-laminated timber factory, there's a lot of processes that go into harvesting and using the lumber which have skills that the citizens of Russell could also stand to gain from. Only 1.3% of the United States has Forestry related occupations and though Russell has the current

Figure 63; Lumber prepared for shipment, Russell MA

Figure 64; Potential Wood Shop space with visual connection to the factory floor

lumber activity occurring in the town itself, none of the people working on the land are currently from Russell. Out of the entire population of Russell, 0% of Russell's inhabitants have Forestry or Agriculture jobs, a majority are in retail and transportation jobs. By supplying the town with a combination Timber factory and Trade School, we can provide a straightforward route for the people of Russell to be closer connected with the forests within the area and within the greater Northeastern United States.

The Trade school includes program such as a horticulture class depicted in figure 65, a carpentry class with wood shop depicted in figure 66 and a house framing class which would educate people on wood construction and the types involved who would be provided a studio style space as depicted in figure 67. The building sits adjacent to the community of Russell across the River at the end of the main street which goes right through the center of the community. As visualized in figure 68, the building is not too far from the community, furthering the relevancy of the project in its location in Russell. The site also has access to alternative traffic besides easy access for large scale trucks which might be transporting wood. As depicted in figure 69, there is also direct access to the site potentially through a train spur. This accessibility is

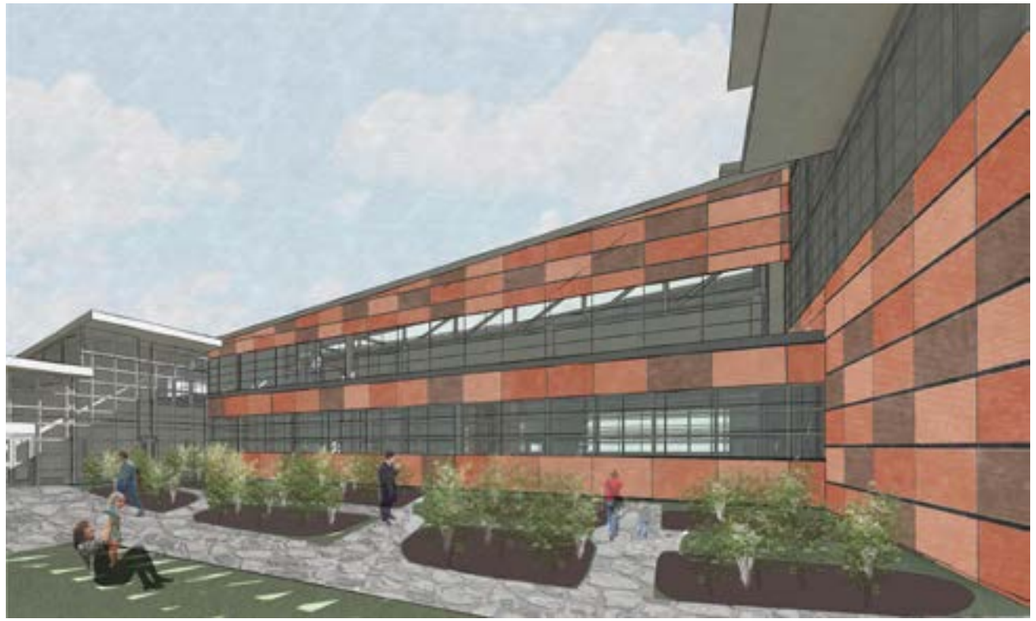


Figure 65; Potential Garden for a Horticulture Class

Figure 66; Potential Wood Shop space with visual connection to the factory floor

Figure 67; Potential Wood Shop space with visual connection to the factory floor

Figure 68; Site section of the factory through the river, across to Russell’s main street.

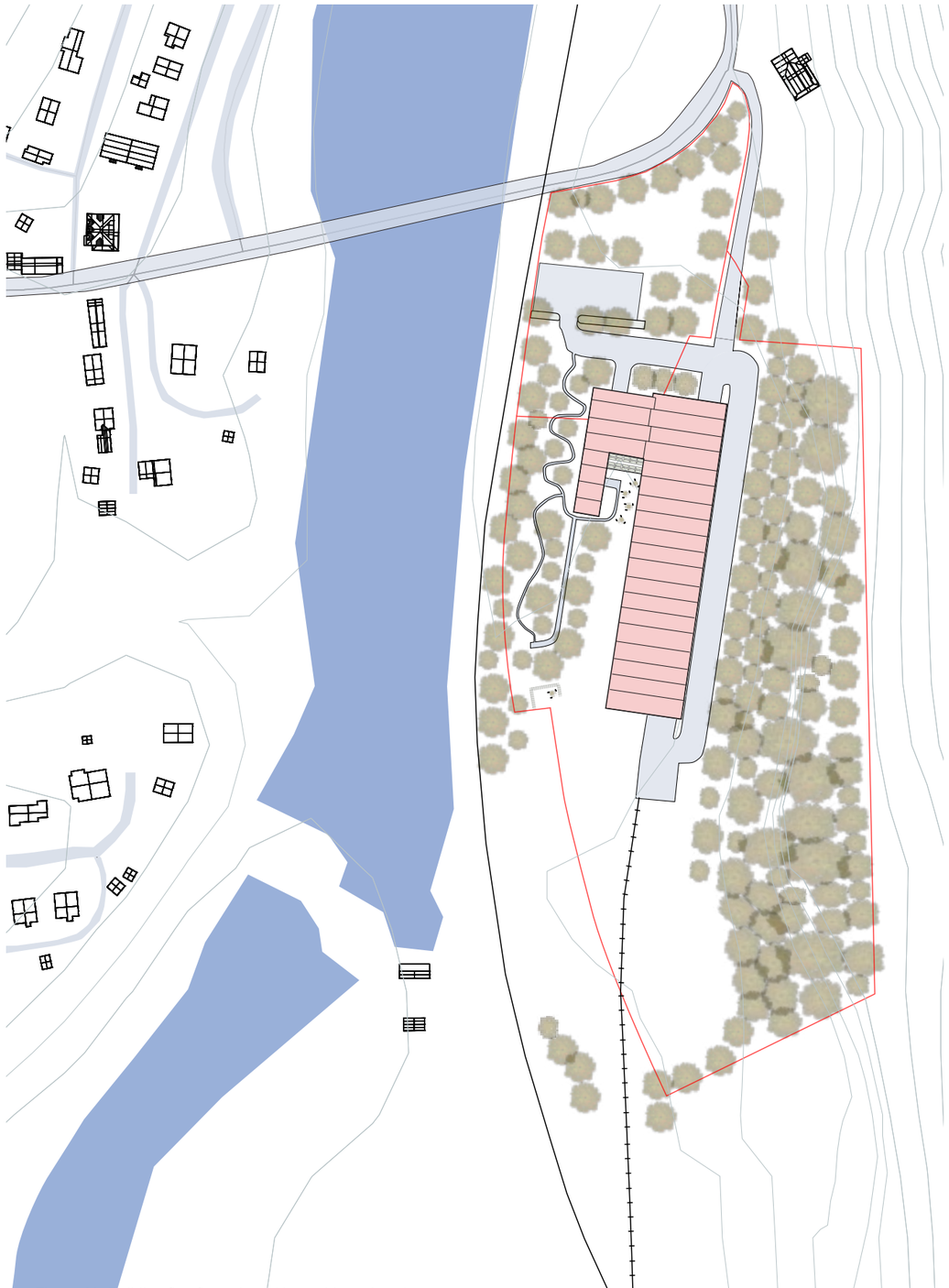


Figure 69; Building first floor plan with machinery locations

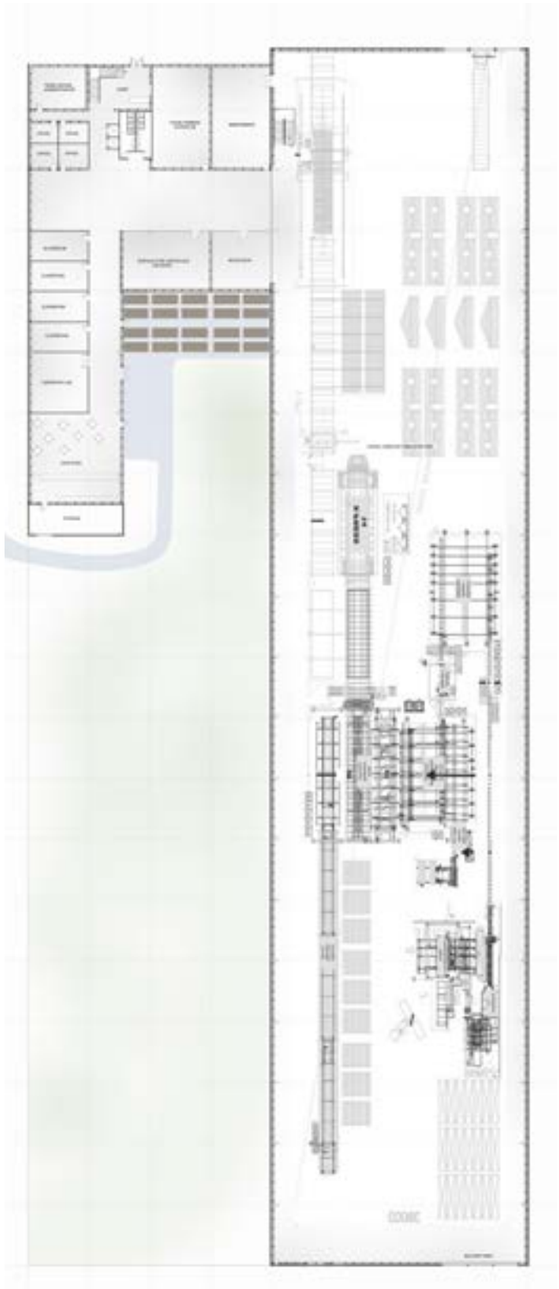


Figure 70; Building first floor plan with machinery locations

potentially even more helpful in transporting lumber to different regions of the country by using more train travel in the process of shipping.

In order to allow an interactive experience for the trade school, increasing the tie of the building to the production aspect as part of its educational value there is a visual connection to the processes occurring in the CLT factory area. As seen in figure 70, the factory floor is about 120 feet wide and 600 feet wide to accommodate the large equipment used in the manufacturing processes. The interior of the factory is dominated using details familiar to use from the section earlier. The wall uses solid CLT in a manner similar to Kiel Moe, using solid timber for his Stackhouse in Colorado. In the detail depicted in figure 71 however, also shows the use of the LVL structure discussed earlier. This is partially for an aesthetic purpose, and partially to cut down on the amount of CLT needed for structural purposes. The building's roof system is made of pure CLT as well. As depicted in the axon in figure 72, to allow an easy assembly for the roof, essentially lowering the embodied energy of its production, the design of the roof is based solely around the standard dimensions of produced CLT. The largest size standard panel produced is 10 by 60 feet.[23] For this factories bays, each bay is 30

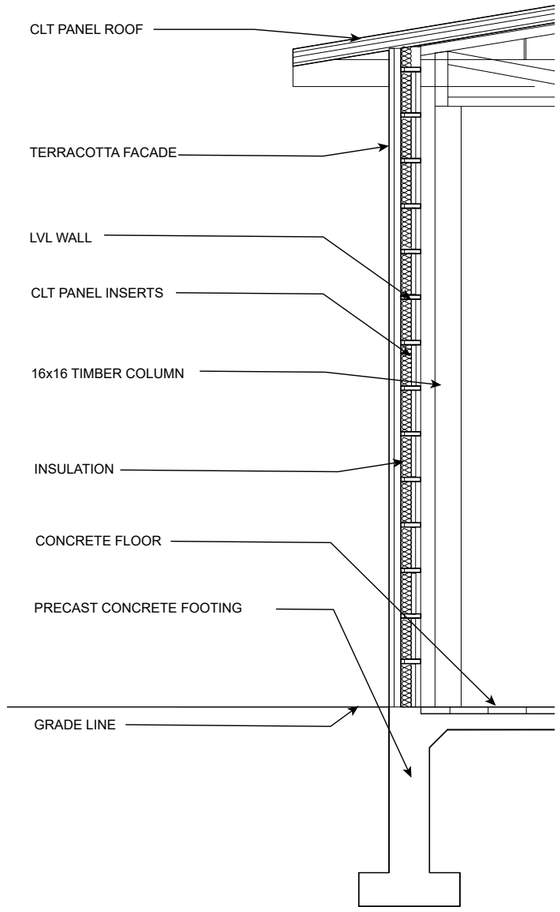


Figure 71; Factory Detail Section

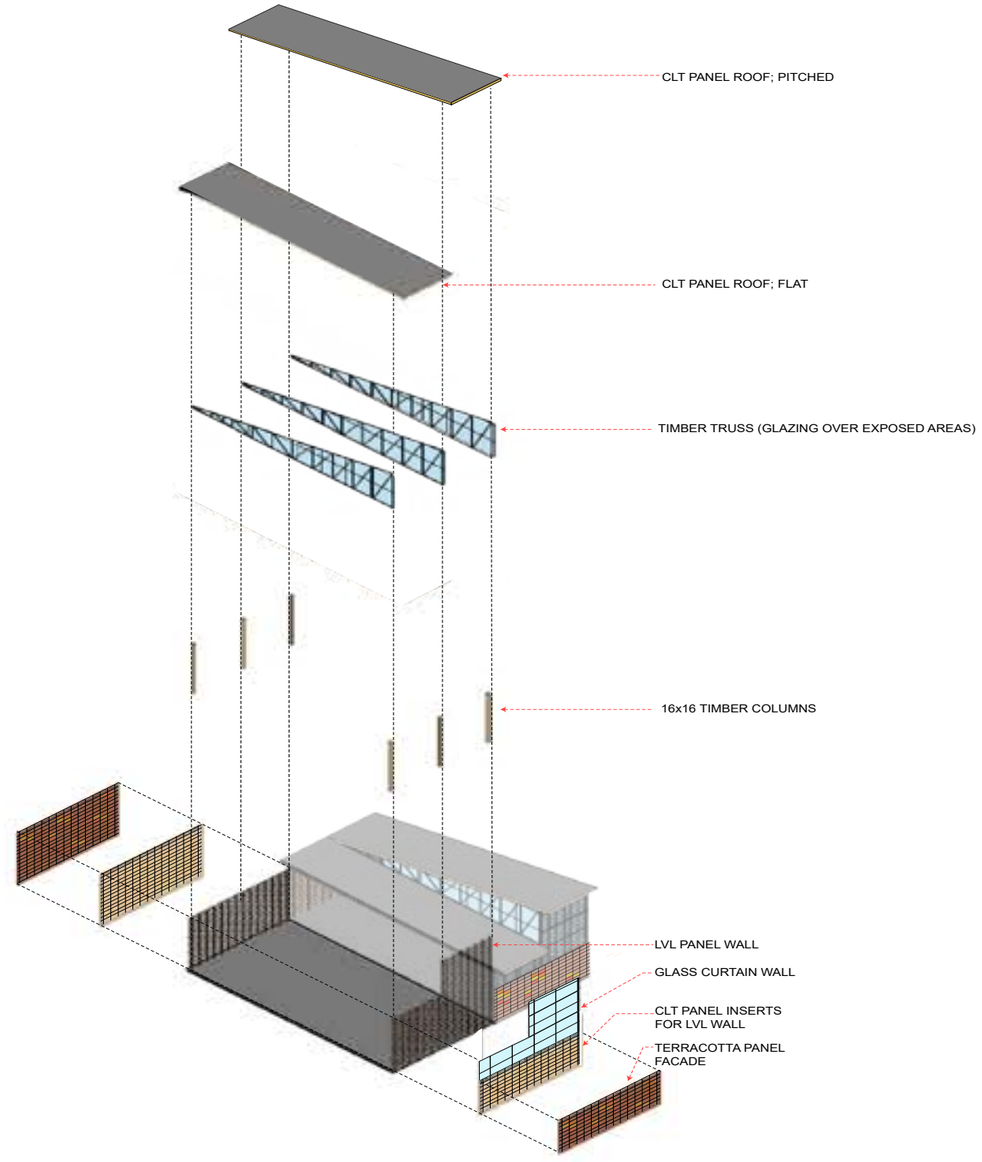


Figure 72; Factory Axon

feet wide, meaning for two bays worth of roof production, you will only need 12 panels, cut directly in half, making the embodied energy for the production of the roof of the factory fairly simple and easy to produce.

While this factory serves as a great piece of infrastructure that includes appropriate wood details, its connection aspect of linking the trade school with the factory design serves potential for weakness. While this building may serve as a necessary piece for the site and area of Russell, it could stand to do better in bringing people in and serving as more of a community hub. The sustainability aspect of the building is also done decently, but it does not consider some of the thermal properties that Kiel Moe addresses in his Stackhouse. While timber is clearly the highlight of the building as visualized in the main entry in figure 73, the building could do better to explore having an exterior cladding of being more timber much like the Stackhouse.

Figure 73; Entrance perspective

SITE; NORTH CONWAY

Another area of potential interest in the East coast is North Conway New Hampshire. Upon reviewing the forest system of the Sioux Tribe in Minnesota and the Community Forests of Mexico, we can gather that in order for a forest management system to truly work, it must benefit a community economically enough that it is feasible. North Conway serves as a location ripe for a forest management system to work, because of its overall demographic. Timber forest management can possibly bridge the gap between local workers and the forests, it's important to note that North Conway is an area of many potential local workers. 40.3% of the population of North Conway lives below the poverty line. Most of these occupations within that demographic are primarily found in retail jobs and food service employment. With this said North Conway lacks severely in the professions involving construction. Though the community is relatively close to a National Forest and is surrounded by United States forest lands as visualized in figure 74, the community sits within a state that only produces 2.43% of wood product a year. The site chosen sits central to the community of North Conway on a major road, and thought the site is only connected to the forest land via a small

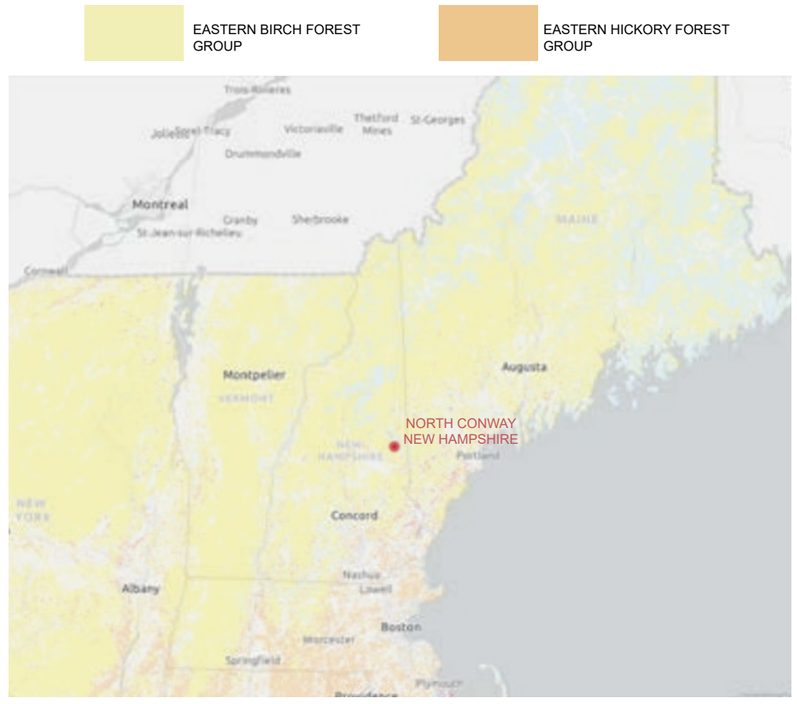
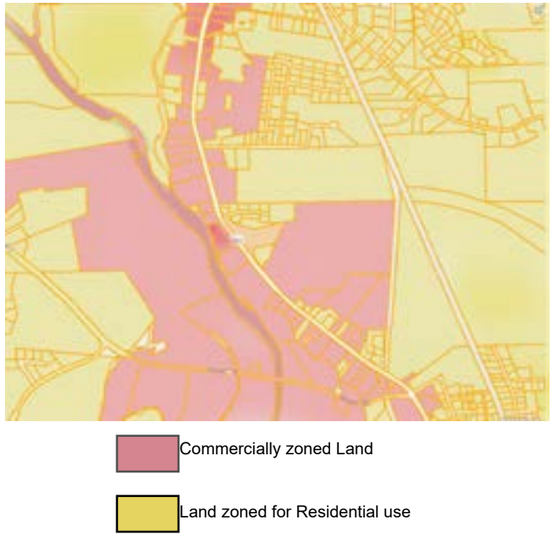
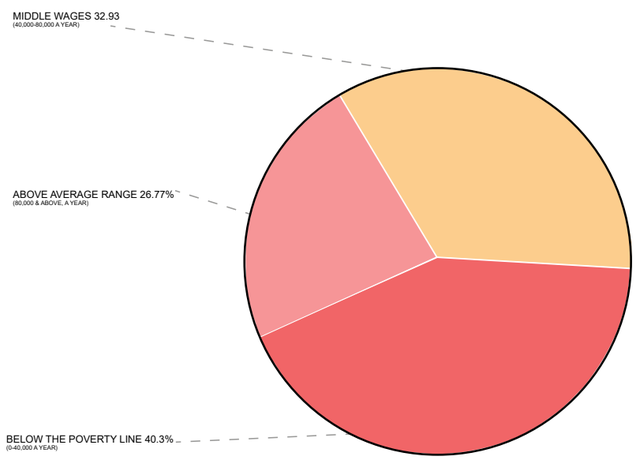


Figure 74; Forests around New Hampshire

amount of trees in comparison to the forest around it, the site is central to residential and commercial activity in the community as visualized in figure 75. Being that 40.3% of the community lives below the poverty line and work within retail practices in North Conway (also visualized in figure 76), it might be potentially beneficial to place a community center central to this activity within North Conway that works with the context of area to further promote timber construction and timber construction details.



It is common practice within the United States to propose options based around Glulam and CLT based options. In Ascent MKE in Milwaukee, the building also displays Glulam and CLT. Hierarchically the building does a pretty good job displaying its wood components in plan drawing awareness to the large timber members as seen in the diagrams provided in figure 77. This design strategy helps put the timber construction aspect at the forefront of the design, but its talk of sustainability is somewhat undercut by what we have learned from Kiel Moe in the Stackhouse. As shown in figure 78, the floors are made of CLT and are join using steel joints. The drawings of platte fifteen displayed in figure 79, show a similar method of hierarchy being used in this larger building, and use of wood lattice dividers (figure 80) actually help



diversify the use of wood within the building to a degree, but the construction of the building remains similar to that of Ascent MKE, in the sense that metal pins and plates are manufactured to join the large wood members together. While these large buildings might be inherently more sustainable than most other large commercial buildings made from concrete or steel, they lack in the sense that they do not maximize the abilities of wood construction since it requires non sustainable methods to actually manufacture the steel being placed within the structure. What the buildings do successfully however, is display the wood products being used well through an organized hierarchy that puts Timber center stage.

This information and context bring us to a design test. When examining the relativity of the site with the surrounding context of the residential area, we could envision a community area that provides infrastructure for the low-income population that lives amongst it. In figure 81 we can see this relationship working in sectional perspective. The potential of a public space that serves the community of North Conway, needs to begin by educating the community with some sort of education center. Being that the area is limited in construction

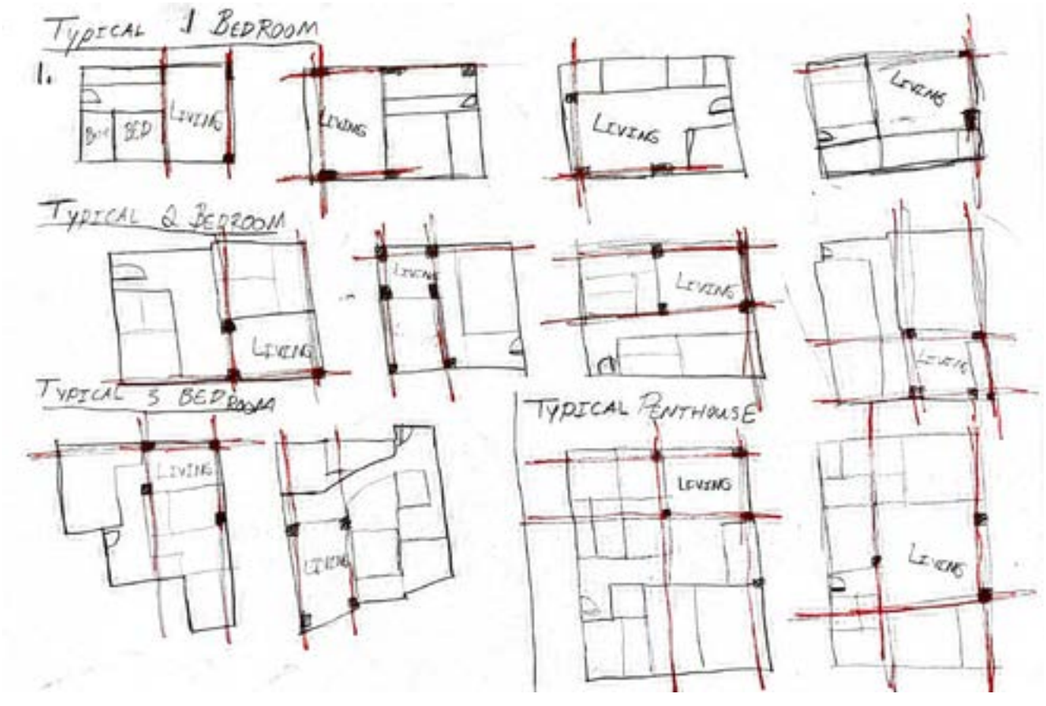


Figure 77; Apartment plan hierarchy diagram of each style apartment available in Ascent MKE.

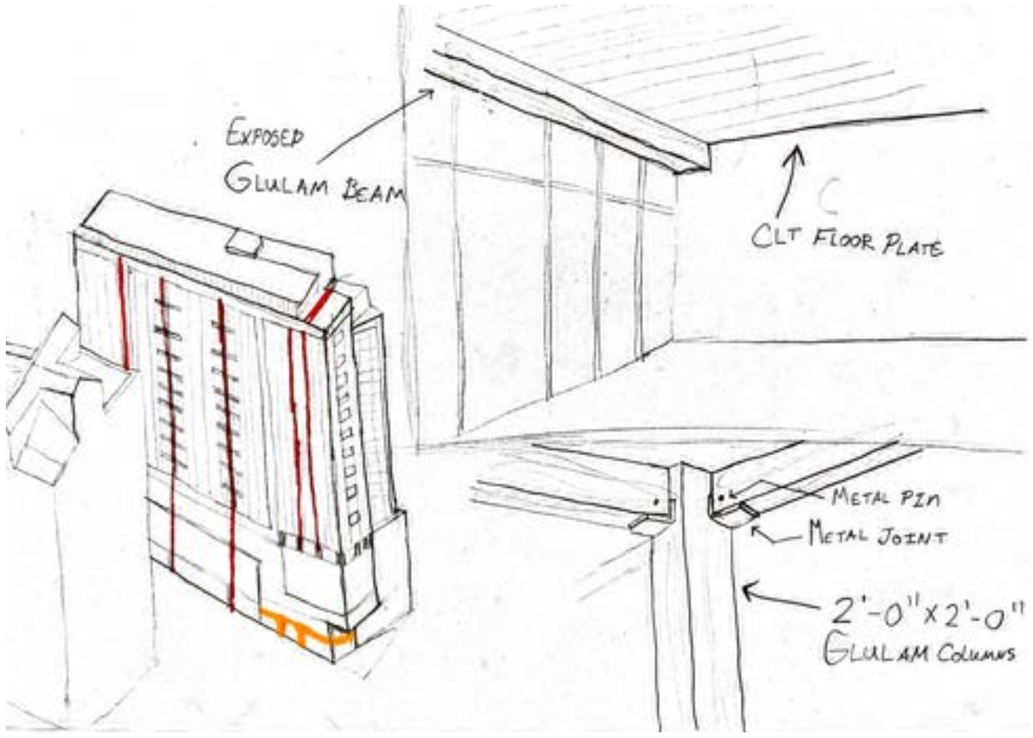


Figure 78; Sketch of Ascent MKE and interior Glulam and CLT inside of a typical apartment.

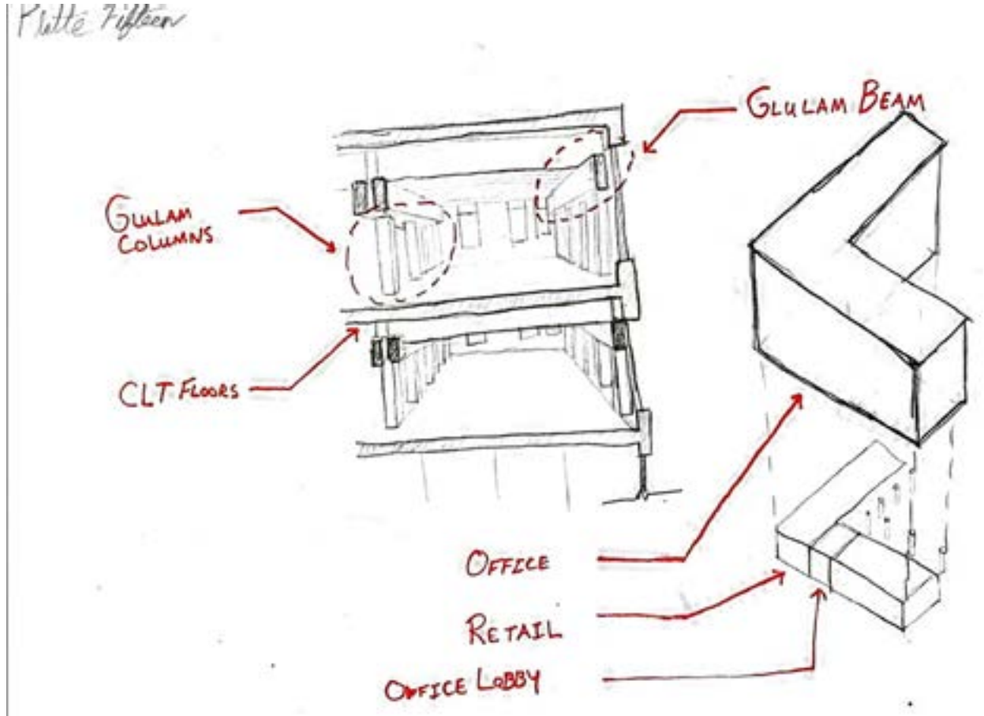


Figure 79: Platte Fifteen section and organization sketch

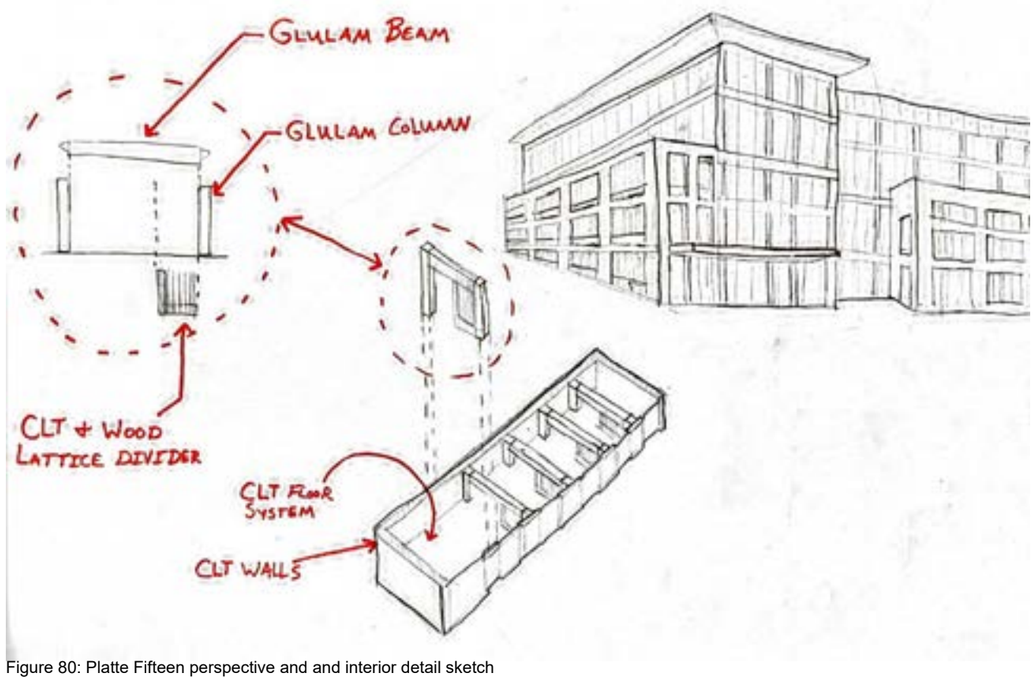


Figure 80: Platte Fifteen perspective and and interior detail sketch

Analytique:
Locally sourced materials, farmed by people within the community of closest proximity potentially harbors the least amount of embodied energy within timber farming and gives economic benefits to the people who work to harvest the timber from forests. As architects, we can design public spaces which connect the community with the processes involved in timber farming, cultivating a new group of people who live off their community resources as best as possible. Introducing program that brings people in, connects them with the industry and gives them first hand education into the processes of milling your own lumber could potentially be the way we connect North America with its plethora of forests

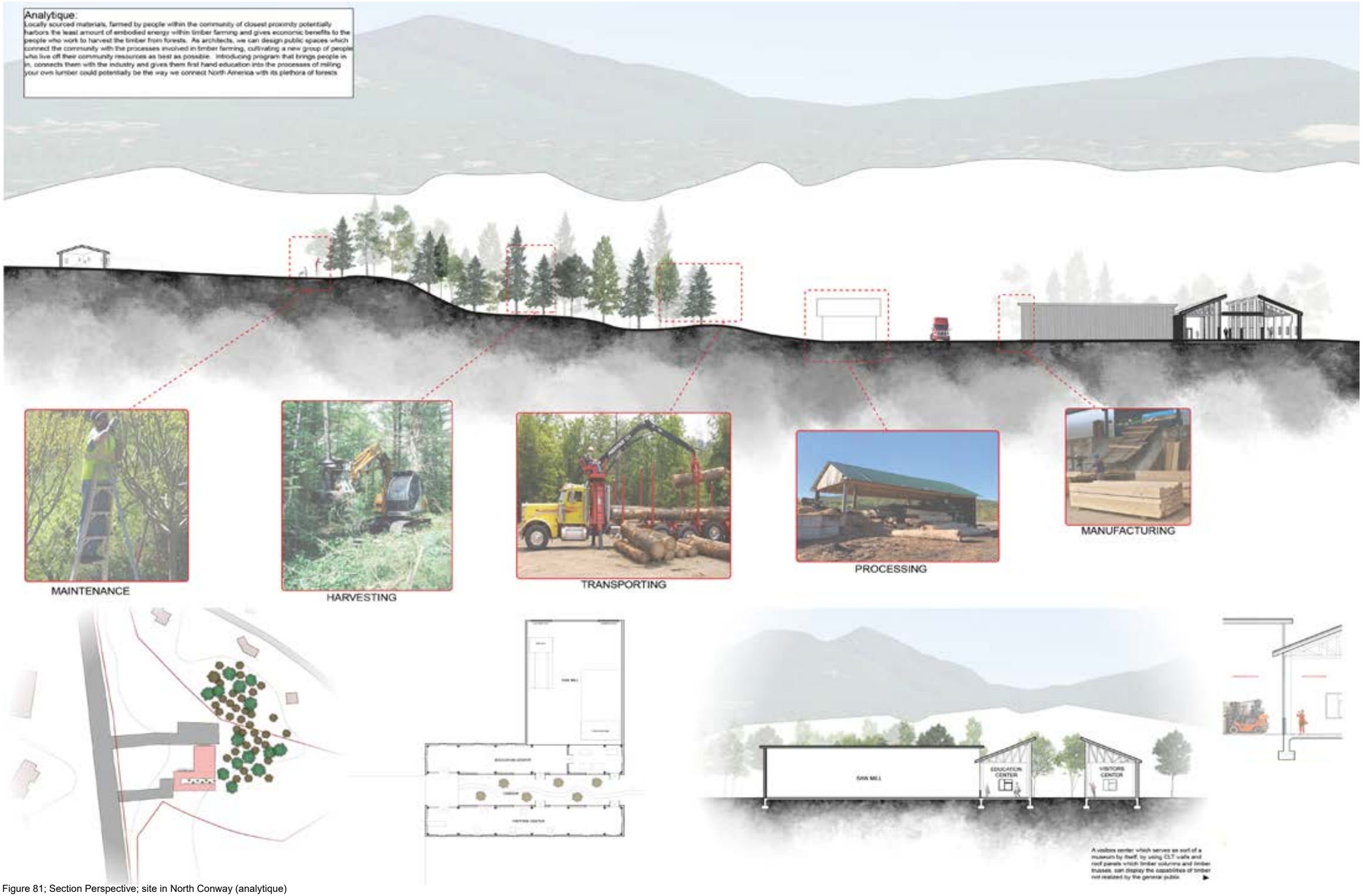


Figure 81; Section Perspective; site in North Conway (analytique)

knowledge, in order to make this plan work it would be safe to assume that program on the site would need to inform the people of basic things involved within crafting their own lumber. This is also going to need to stress the education of how to even begin maintaining the forests in the first place. Within the Community Forests of Mexico, a large key to their success is that the demographics of the areas chosen for aid in forest maintenance and timber production, are largely pre-educated in basic skills like woodworking and logging.[24] That's why not only must we consider the infrastructure provided in North Conway to be a Sawmill like the Community Forest system in Mexico, but we also must include an aspect that brings awareness to the area of the possibilities of involvement. The education provided will need to influence the ability of the community to produce and sell their own wood products. It can also potentially educate them on the species they may use to gain resources from and provide them with context on how best to use them as well as how best to replant these trees and ensure the forest is not losing its ecological makeup. All of this can directly benefit those who live in nearest proximity of the site who also have easy ability to maintain the forest throughout the course of time. The location of the site also provides plenty of

Figure 82; Public and private lands in and around 3145 White Mountain Highway

Figure 83; Interior view of timber structure inside Combination community center building proposed for North Conway

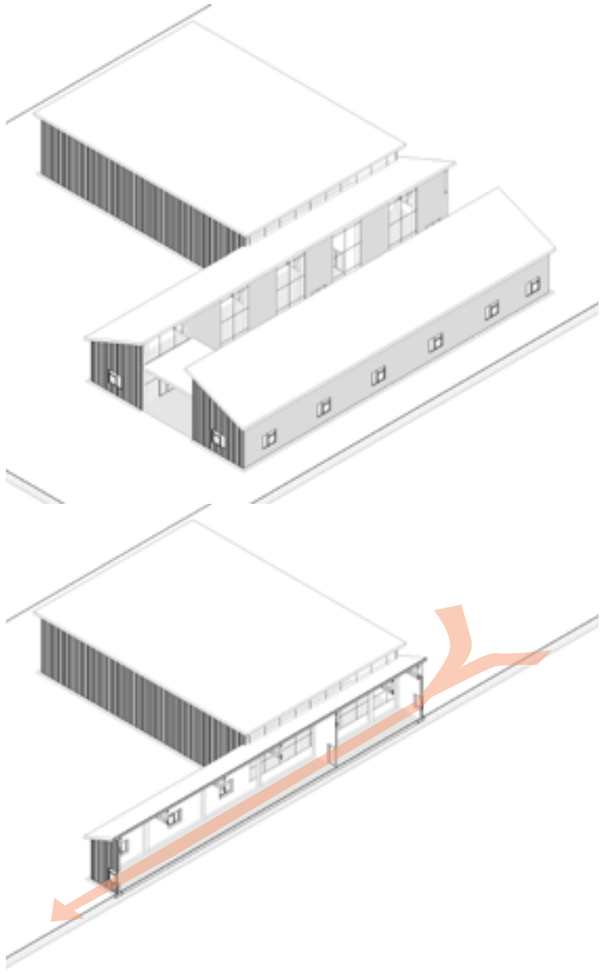


Figure 84; Cross Ventilation of proposed timber community center in North Conway

opportunities for the people being educated on the site to branch out and make use of the high density of forests within the area. Both public and private lands in the area shown in figure 82, can serve as potential economic benefactors, and with the site's proximity off the largest road in North Conway, the access to and from other locations is relatively easy. But before we can even imagine this consideration of education as a success, we have to envision what this kind of education might look like and what specifically it should include.

Much like the buildings seen Milwaukee and Denver we can prominently show the wood structure within the main spaces of the community center as visualized in figure 83. Exposing people to a community center that displays the timber construction while also providing programs to inform the people on the methods being used, can help bring people closer to timber construction within the community of North Conway. Furthermore, the details used within the building could also demonstrate efficient thermal design like the methods used by Kiel Moe in the Stackhouse. The simple use of the windows positioned on either side of the building as shown in figure 84, can help draw through air in the summer, and when shut can still stay insulated in the winter. This aspect of design

can serve as more education in action for the people using the building.

Something I've begin to realize, is that the designs which involve larger changes in how you use timber construction need to be able to ensure the best use of the land in order to make, use and further production of timber products. Therefore, I wanted to tighten these ideas of the site being involved with the processes of timber construction. In the North Conway site I decided to test the idea of the site working to accomplish something which would further the uses of Timber production in the area. In the master plan seen in figure 85, I proposed the first stage to an idea which would involve careful organization of the community saw mill/visitor center space with the forest and open areas which would involve the building of small houses made entirely of the wood on sight. These buildings I hope would be involved in expanding the learning process for people of low income in the area, who are figuring out how to process and sell wood directly on the site.

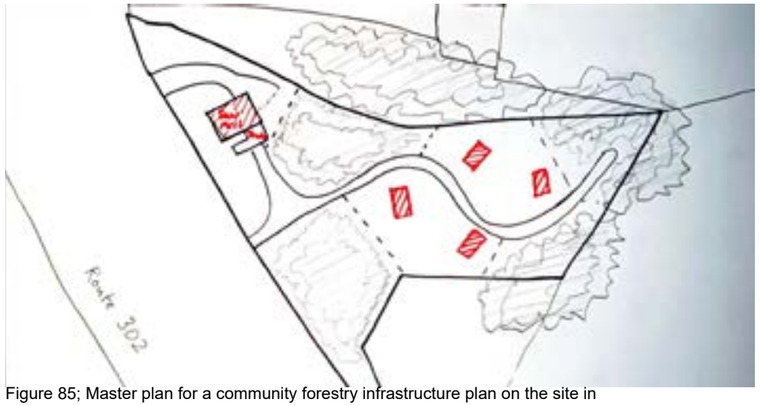


Figure 85; Master plan for a community forestry infrastructure plan on the site in North Conway

REFLECTIONS

The tests conducted serve as a good beginning of what can be done to further sustainability and potential community involvement. What we have looked at thus far is a response to research conducted by multiple people on a more technical aspect but the ideas sit incomplete because they lack to provide a stronger concrete connection to the community which is part of addressing this thesis. While the programmatic proposals put forth do somewhat lead us in the direction of a necessary conversation that needs to be had, they must find a way to be more concrete. The ideas of proposing educational aspects do a great job of informing us what might be involved in a community-based solution geared towards timber construction. I think proposing them along side the ideas of a CLT factory and a community sawmill is an idea that has some relevance and makes sense for this thesis. However, the struggle comes with connecting the contrasting program in a more defined sense. What can be done to bring people to a community center?

What has been done collectively well has been setting the groundwork for where this thesis can continue forward. While yes we need more connection and stronger programmatic relationship with communities in order to make this argument more cohesive, the research and details gathered provide a thorough investigation that considers many factors. Going forward, we might propose an idea circling around shared ownership of government lands, and perhaps take greater consideration on the affects of harvesting specific trees, and how that impact can affect an entire forest.

I think it would be necessary to look more into detail on how certain design choices specifically affect forests. I think what this thesis does well so far is test the possibilities of construction off what we know, but doesn't analyze the real time affects of certain decisions and how they can alter the environment. Taking into account sustainability and how we can use it to affect the forests of the United States is important and thats why every single step involved in timber construction which impacts these forests, needs to be analyzed to the fullest extent possible.

With all things considered, I do think looking at a potential relationship between a commercial and communal space in Russell Massachusetts through the lense of my Masters travel studio was extremely helpful. The processes conducted within a cross-laminated timber factory, paired with the porcesses of the entire industry through the lense of an educational aspect I think was achieved well with a timber structure that already considers a lot tectonically.

As for North Conway New Hampshire, I think more design development and experimentation is in order. Though the basic proposal for a community center that shares a relationship with the surrounding community close is a pretty picture in terms of the future of timber construction, there needs to be more considered. I think It displays a relavent connection to the style of construction used in large Timber buildings today, and displays

some conciousness on a thermal level. However, I think more can be done, and this would happen through more experimentation on the possibilities of detail shown in experiments like *The Littleton Trials*, and some of the proposed wall and roof assemblies shown that were designed based off the principles discussed.

Mass timber is an important topic amidst out current time period. The world and specifically the United States, could gain significantly by learning of new ways to conduct timber construction. In this time period, we need action on sustainable practices quickly. I believe this thesis does open peoples eyes on a subject so important and explores valid possibilities. This time period needs more though, we need to get closer to the answers being sought out in thesis' like these and give back to our environment and communities through access to our natural resources, that has yet to be exercised properly or at all in some cases.

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Critique

- I think my thesis has lacked an upfront approach on how community forestry can directly impact communities.
- So far, I've struggled to grasp the focus of how the processes of timber construction can be used to better enhance communities.

For the Future

- Long Term: Going forward I hope to build a more direct set of solutions to the processes of Timber Construction by stressing how it can be involved in education and development in communities.
- Short Term: I plan to select a new site that better encompasses past ideas I've had by involving a more evolved approach which directly affects the citizens of a town or city which better fits the criteria for a community forest system in the first place.
  - -Currently, Ellenville in Ulster County New York, seems to fit the criteria needed for a community forest system.
- Medium Term: Create Design Tests based on the new Ellenville site and propose my design tests with reasoning based off the new site's context