Timber Stories: Narratives of a forest resource

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Introduction

Timber Stories examines the timber value chain – from forestry to architectural assembly – and expands on the different scopes and environments that are also affected by each stage in the chain. Forestry is directly linked to the ecology of the forest, land ownership, and territorial politics. Sawmilling is tied to economies of production, technology – i.e. digitization - and the behaviour of heterogeneous organic materials. Important for us is both what is cut and preserved, what is left behind, and what is affected collaterally. In our work, we try to find a place for a wider range of the forest resource in the final architectural object – this is where we leverage digitization (i.e. new imaging techniques) – and through tracing this resource, we come across tangential effects and neighbouring domains of interest. What begins as a look into the introduction and development of specific new digital technologies in sawmilling broadens into larger questions of how digitization is also revealing and linking different contexts that intersect around the timber value chain.

The RawLam concept

We begin with the harvested log, which is digitally mapped in high-resolution detail using computed tomography (CT) scanning. The log passes through the scanner, illuminated with X-rays, creating a three-dimensional record of its varying internal density. This is typically used to position the saw blades in such a way as to cut out the most high-quality lumber from the log. We ask how this data could be exploited even further if it were integrated into computational design processes. Interfacing with this high-resolution volumetric data allows us to steer the subsequent sawing of the log into construction material that is uniquely tied to a specific design output – rather than a range of standard lumber grades. For example, by simulating the loads and stresses placed on an as-yet unrealized design model, we find out which parts of the elements are working the hardest, and which parts the least. We then allocate the strongest parts of the log to those hardworking areas, and allow the usage of the weaker parts of the log in the other areas. This mixture of wood qualities means that we can potentially use more of the harvested log, lessening the amount of downcycled wood in the production process. The RawLam project demonstrates this integration of volumetric material data into digital design workflows, enacting this augmented tree-to-product workflow and prototyping a new method of composing tailored structural glulam elements that leverage this data. We demonstrate how through the integration of all of this data and detailed design analysis we could use more of the tree in leaner timber buildings.

The forest network

Confronting the uniqueness of the individual tree resource in this way, we look further back in the value chain – where does this harvested log come from? We therefore expand our view to encompass the actual territories and landscapes that yield the forest resource and encounter practices of forest management, ownership, and harvesting. The harvester becomes the tool and interface between the material demands of production and the natural forest resource – the first point of contact between the timber value chain and the ecology of the forest. Here we find concerns about the effects of these machines on the delicate biome of the forest – we discover the different patterns of harvesting which allow trees to grow and mature while maintaining the health of their undergrowth; we see developments of the tires on the harvester which enable it to tread more lightly on the forest floor. We also see the tensions between land owners, land users, large companies, small businesses, recreational associations – all actors with a

particular stake in the forest and its state. The sawmill converts the harvested log into graded product, focusing on issues of process efficiency, material stability, and production technology. Its voracious appetite consumes thousands of logs daily – analysing, evaluating, and breaking them down into different categories of lumber through its mechanized digestive tract. Here wood science research groups study more efficient kiln drying practices, machine manufacturers construct smarter and faster machines, regulatory organizations arbitrate the assignment of economic value to the incoming timber resource, and the entire complex is worked into the daily socio-economic life of the town and its inhabitants.

Seeing the forest for the trees

This forces us to pause and reflect on our design and construction practices: these interrelations and collateral relationships with all these different stakeholders and actors within the network surrounding the forest mean that it is harder and harder to dissociate the design and construction of timber architecture from the origins of its material substrate. The digitization of the different parts of the forestry sector provides us with troves of data, which we can exploit to gain a wider grasp of what goes into our built environment and how it does so. Setting this wider domain next to our role in the steering and enabling of the built environment, expanding our remit to include these complex interrelations in the forest can help us make more informed and tactical decisions about the provenance of our buildings – towards a more just, equitable, and ecologically sensitive exploitation of the natural forest resource.

The story

Timber Stories begins with a territorial map of northern Sweden, taking the viewer through the specific regions surrounding a sawmill in Sävar - just outside of Umeå. This map spatializes the relationship between forested areas, land use, and the sawmill, showing where the wood comes from and what sort of distances are travelled. This ties the procurement of the forest resource to very real considerations of place and the minute impacts of this network on the mundane – explaining the presences of logging trucks on certain stretches of the highway. The operating radius of the sawmill affects both how much energy is used to transport logs from the forest as well as exactly which forests are harvested.

We zoom into a more detailed map of an individual forest, showing the diversities of tree species, their rates of growth, and what the abstract notion of “forest” actually means in practical terms – individually identified trees, each growing under unique conditions, interspersed with undergrowth, geology, and fauna. We trace the path of a harvester as it enters the forest, its path dictated by the radius of its swinging arm and the topology of the terrain. Its aim is to efficiently gather its target yield while conserving fuel and driving distance – its machine parameters and systems constantly monitored for wear and tear.

We flip to a transparent section of the forest – between the layers of soil underneath the forest floor and the strata of foliage, trees, and air quality above. The harvested log occupies only a portion of this rich gradient of heterogeneous media – a neatly trimmed portion of an organism that stretches as far below the earth as it does above it. We treat the air in between the trees and foliage as a material itself – temperature, humidity, molecular composition – simply a less dense material substrate that the harvester thrusts through; that the branches of trees slowly penetrate over their decades-long growth cycles.

We follow the harvested logs back to the sawmill, loaded into trucks and managed between pickup points, highway routes, and waiting sawmills. In the sawmill, we see the movement of these logs through the eyes of the machine. Status updates, health monitors, fan speeds, saw states, RPMs, limit switches. The machine diagram tracks the material as a series of on-off states, conveyor belt speeds, simulated projections of lumber yield, and feedback from digital sensors.

The logs pass through a CT scanner at a rate of several hundred meters per minute. We dive into this rich, volumetric world of the interior of the log. We recognize knot vectors, the wandering pith line, and the varying density of the tree between the heartwood and sapwood. We see how this translates into a tailored cutting pattern in order to ensure maximum economic yield out of the resultant lumber.

We rapidly zoom out, past the forest, past the territory, to a view of the world. The distribution of the forest resource spans thousands of miles and countless border checks. The unique tree in the forest is scattered around the globe on the wind of global trade and logistics.

We conclude with a perspective on one particular way in which this forest network can be touched by our hands - the way in which this forest resource is sorted and puzzled into our new vision for tailored engineered timber elements – the RawLam project. This is but one story among many, and a very specific one at that. What other stories are being told in the forest?

Finally, we end with a look at the main character of these stories: a simple tree, in the middle of a forest. So familiar to us, yet so fully loaded with implications, relations, and consequence.