

What Are We Leaving Behind? The Challenge of Assessing Residual Biomass in Hardwood Operations



Understanding value beyond roundwood

In hardwood operations, the products generated from a tree are rarely fixed. They depend on a complex mix of tree characteristics, market conditions, equipment, and the split-second decisions made in the field.

Species, size, stem form, and defects dictate the potential. But just as important are operational factors: how the tree is processed, what markets are available, and how much effort is invested in recovery.

This distinction is critical when considering residual forest biomass.

“What if we could recover more volume without harvesting more trees—simply by maximizing the potential of each one?” ~ Pamela Hurley, NHRI

What gets measured—and what doesn't

We define **Gross Merchantable Volume** (GMV) as the portion of the tree utilized for conventional roundwood. **Above-Ground Biomass** (AGB) is the full tree. The difference between the two is **net residual biomass**; the material often left behind after harvesting.

While GMV is well understood and consistently measured, residual biomass is not.

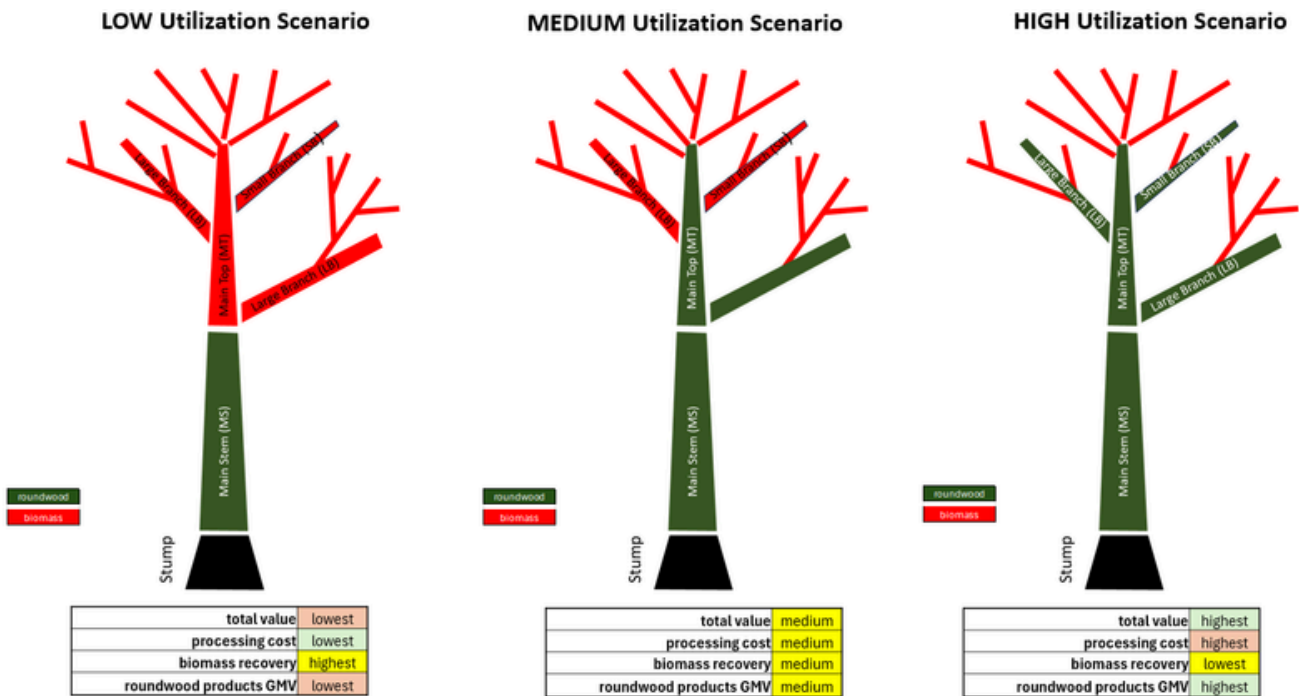
Operators make daily decisions that influence how much of this material is recovered or left in the stand. But from an operational standpoint, it is difficult to quantify at the scale needed for planning. Consequently, a potentially valuable resource is often treated as incidental rather than a planned asset.



Utilization is a decision, not a fixed outcome

The mix of products recovered is shaped by utilization choices: merchandizing strategy, equipment capabilities, operator experience, and market access. At NHRI, we categorize these into **low**, **medium**, and **high utilization** scenarios. Each leads to vastly different outcomes in roundwood recovery, processing costs, and residual biomass volume.

NHRI's Three Utilization Scenarios



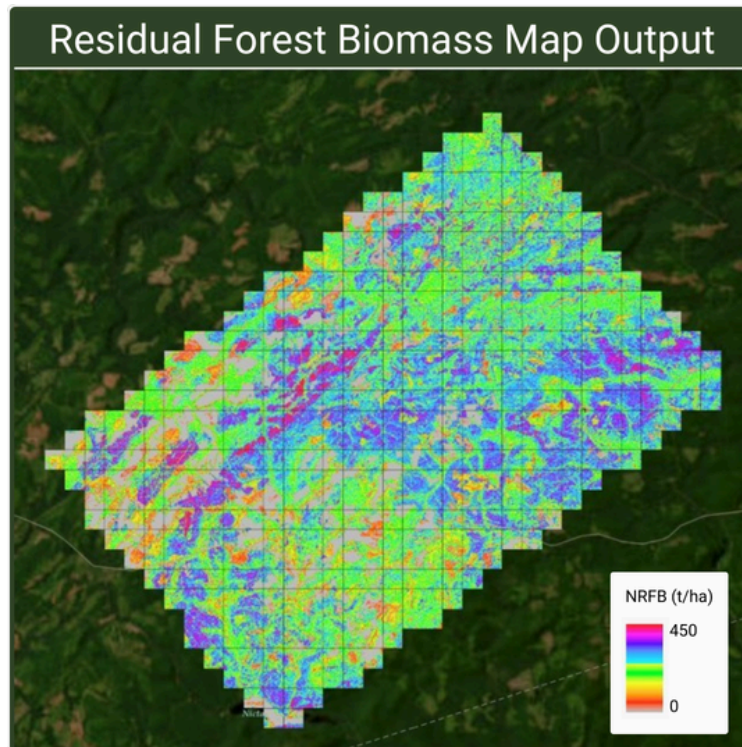
The same stand, and even the same tree, can produce very different results depending on the operational approach. This variability is where both risk and opportunity exist.

Making residual biomass visible

Residual biomass is present in every harvest, yet it remains inconsistently measured. This limits the ability to plan recovery, assess supply, or evaluate trade-offs with productivity.

Our research team is addressing this gap. We are developing large-scale, near-real-time estimates of net residual forest biomass across New Brunswick by combining LiDAR, Sentinel-2 satellite imagery, and AI. The goal is to make this "invisible" resource measurable so it can be integrated into operational planning.





The map above shows biomass concentrations that cannot be seen from the ground.

From Map to Machine: Proving the Value

A map is only useful if it works in the field. That's why we aren't just building models in a lab; we are validating them live in active harvesting operations with industry partners like Groupe Savoie.

Our goal? To bridge the gap between satellite data and harvester reality.



We know that recovery isn't free. Pushing for more biomass can slow productivity or increase costs. The real challenge isn't just finding the wood, it's figuring out the sweet spot where you maximize value without breaking the bank.

By testing our models against real-world operations, we are identifying:

- **Where** the recoverable biomass is.
- **How** different equipment and strategies impact net yield.
- **What** the true cost-benefit trade-off looks like for your specific operation.

This isn't just about sustainability; it's about making biomass a viable, profitable part of your daily schedule.

The Bottom Line

Forest value isn't determined by a single product stream. It is the result of how biological potential, operational decisions, and market demand interact.

Residual biomass is part of every harvest, but its recoverability depends on how systems are designed. Too often, it remains under-quantified not because it is absent, but because it is not easily measured.

Improving outcomes requires making this resource visible. At NHRI, we are actively developing the tools to help you understand how residual biomass fits within your operations, supply chains, and emerging bioenergy markets.

Related Work & Deep Dive

For those interested in the technical foundations, we are pleased to share a new paper co-authored by former Mitacs GRA student Revathi Gundluri Nagaraju, along with NHRI's Rakesh Mishra and Gaetan Pelletier.

Published in Communications in Computer and Information Science (Springer Nature), the paper reviews how residual biomass from agriculture and forestry can be converted into low-carbon energy. It covers current conversion technologies, life cycle considerations, and the role of AI and IoT in improving efficiency.

[\[Residual Biomass Utilization: A Review on Newly Emerging Techniques for Mitigating Climate Change |...\]](#)

If you are working in harvesting operations, planning, or wood supply management, we are interested in understanding your perspective.

Where do you see opportunities or constraints when it comes to residual biomass in your operations? Contact: info@hardwoodsnb.ca



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