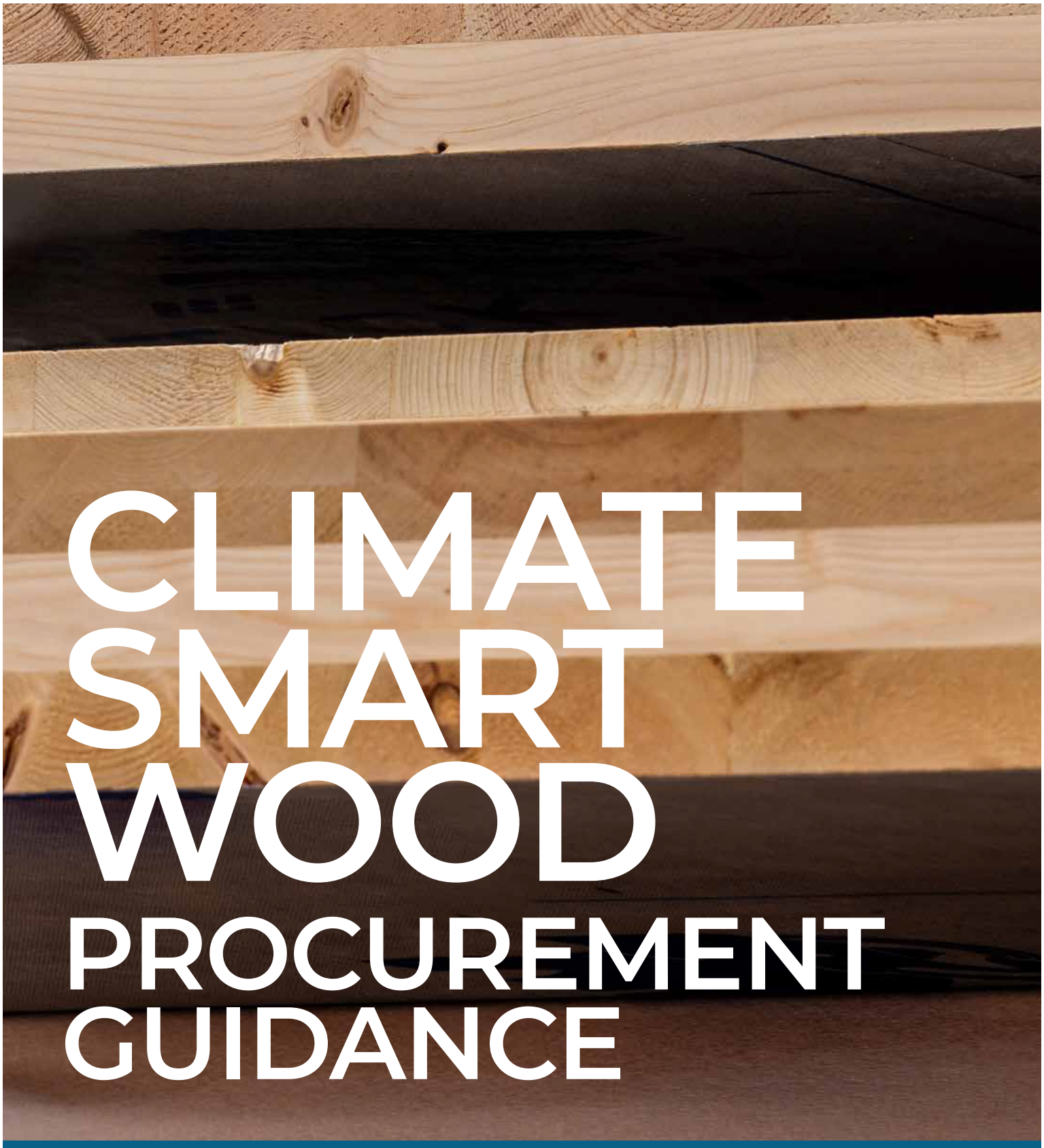
CLIMATE SMART WOOD GROUP



CLIMATE SMART WOOD PROCUREMENT GUIDANCE

Version 3, January 2026

ACKNOWLEDGEMENTS

VERSION 3

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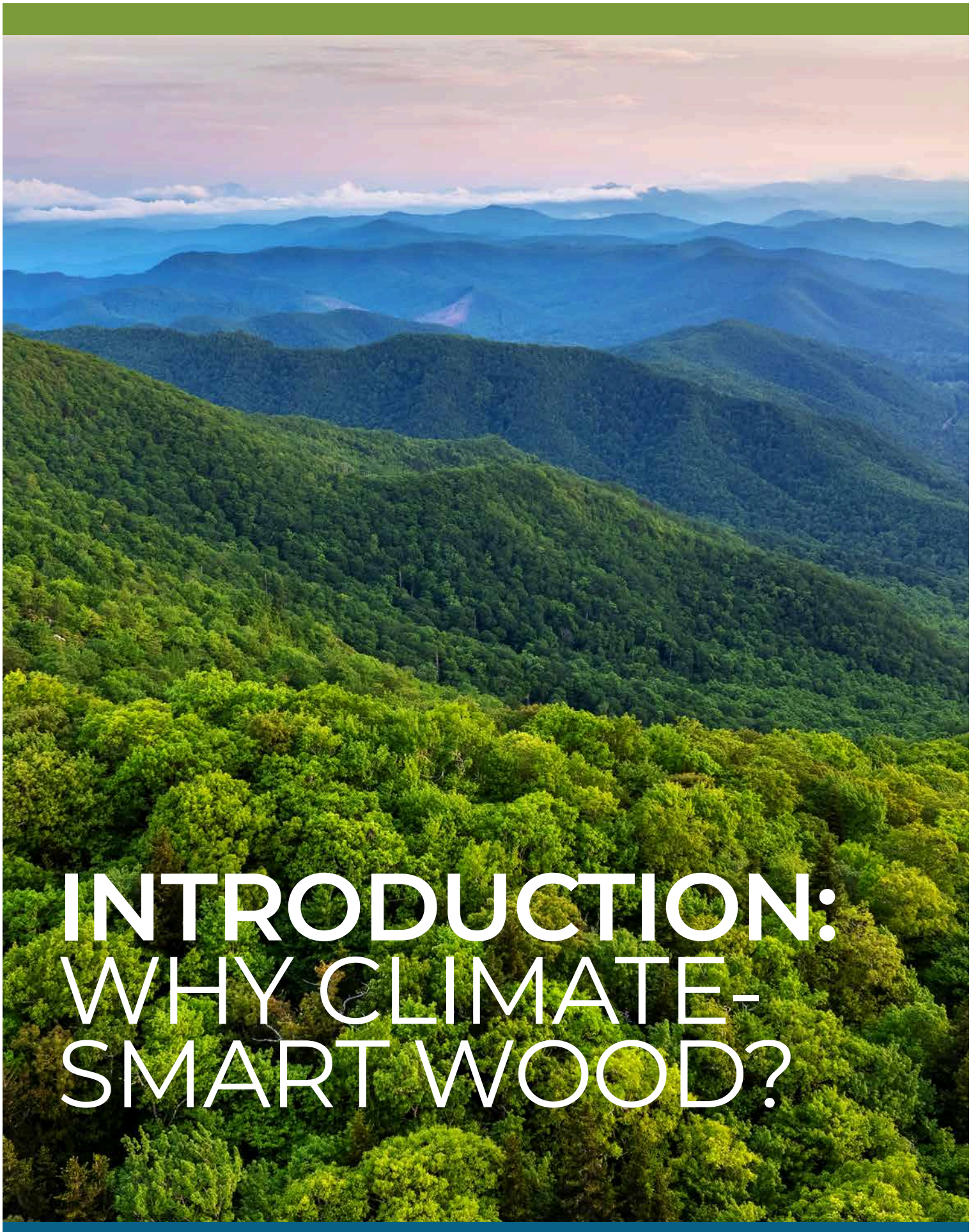

INTRODUCTION: WHY CLIMATE-SMART WOOD?

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Forests — both managed and protected — have the potential to be powerful climate solutions. To keep global warming under 1.5 degrees Celsius, we need to protect intact forests, restore degraded forests, plant new forests and improve the ways that working forests are managed.

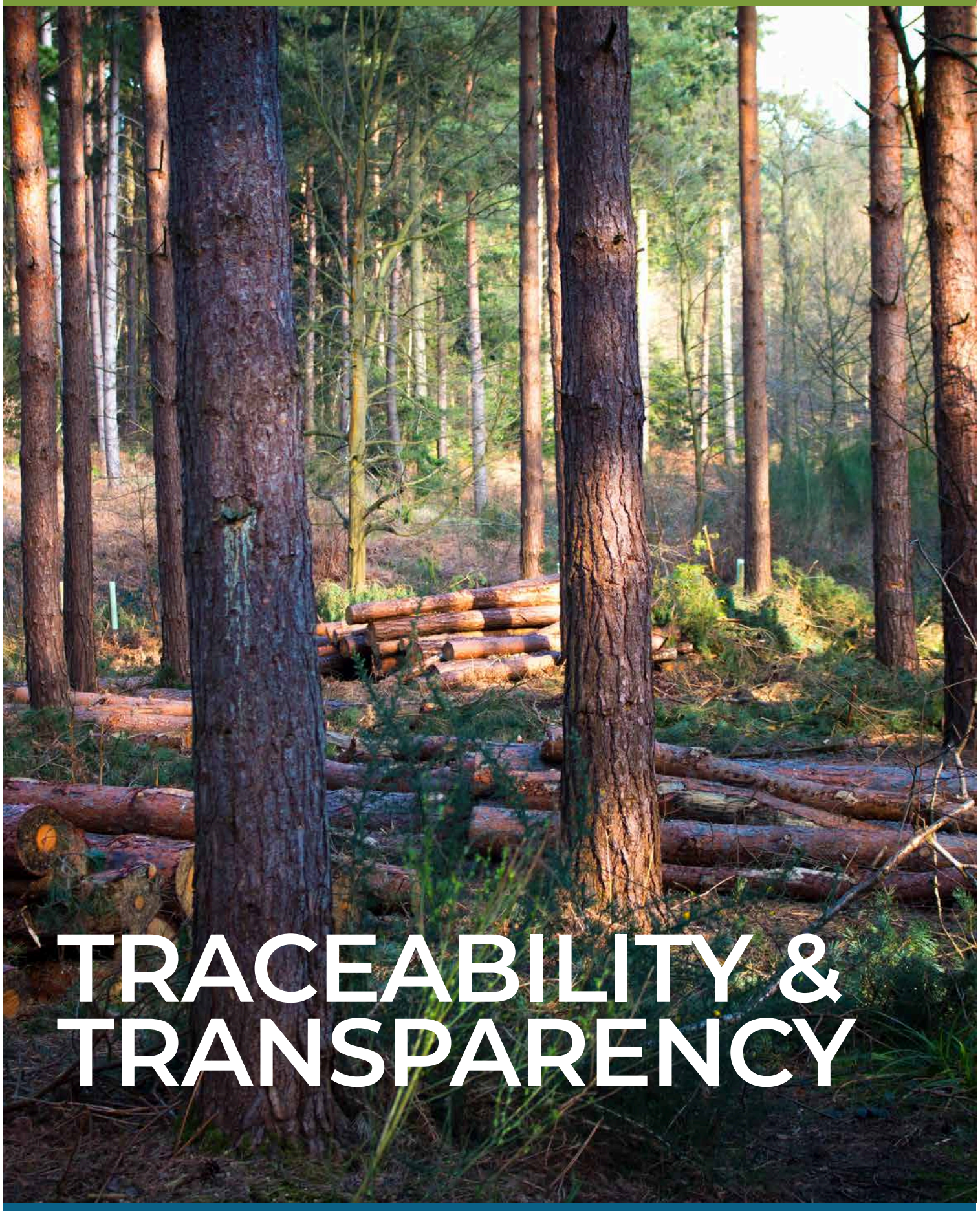
Unless it's recycled, reclaimed, or salvaged, climate-smart wood (CSW) comes from climate-smart forestry (CSF). In working forests, CSF increases ecological resilience in the face of climate change and sequesters and stores more carbon over time compared to conventional practices. The net effect of CSF is to reduce greenhouse gas concentrations in the atmosphere and enhance the health of forests and the multiple values they deliver.

There is a spectrum of forest management from more to less climate smart, not an either-or distinction. CSF generally entails ongoing improvements over conventional practices without a fixed end point, as understanding of climate adaptation and forest dynamics evolves. It also involves achieving additional climate benefits beyond minimum regulatory requirements.

CSF promotes a wide array of services and goods, including local economic vitality, watershed protection, biodiversity, and the production of wood and fiber. CSF also addresses issues of equity and climate justice, fostering community engagement and respecting the rights of Indigenous Peoples.

Examples of CSF may include:

+ Reducing the average size of harvest openings, increasing live-tree retention (trees that are left behind after logging), and lengthening harvest rotations (the length of time between harvests).
+ Managing for a diversity of tree sizes, ages, and native species that make up multiple forest conditions and habitats.
+ Thinning unnaturally dense and fire-prone forest stands, and restoring the capacity to withstand natural disturbances using prescribed fire and other means.
+ Protecting water quality and aquatic habitat with ecologically appropriate buffers along streams and around wetlands.
+ Reducing greenhouse gas emissions and biodiversity impacts associated with forest management and the application of chemical fertilizers, herbicides, and pesticides.
+ Protecting high conservation values in forests, including but not limited to old growth, and protecting and restoring habitat for imperiled, threatened and endangered species.
+ Understanding, respecting, and upholding the rights and sovereignty of tribal nations and Indigenous peoples through early and ongoing consultation and co-stewardship of cultural and natural resources.
+ Ensuring communities most impacted by forestry activities have a meaningful voice in decision-making and benefit equitably from the outputs derived from them.



TRACEABILITY & TRANSPARENCY

TRACEABILITY & TRANSPARENCY

OVERVIEW

Encouraging transparency within the forest industry and improving the traceability of forest products are vital to the goals of promoting climate-smart forestry (CSF) and rewarding companies and forest managers who go the extra mile to supply climate-smart wood (CSW).

+ **Traceability:** The ability to trace a product to or track one from the forest origin, either through a 'product backward' approach that works up a supply chain to the forest or through a 'material forward' approach where origin or other information is provided at the top of a supply chain and cascades downward to the end user.
+ **Transparency:** The disclosure of information about both the supply chain and origin. In the forest industry, there are two main components (see below for detail): supply chain mapping and disclosure of relevant information about the source forest or forests.

WHY ARE TRACEABILITY & TRANSPARENCY IMPORTANT… AND CHALLENGING?

Traceability and transparency are necessary to link specific products to specific sources — whether they be forestry operations practicing CSF or the salvaging of wood from an urban forest — enabling a direct connection between building projects and the people and forests that underlie wood used in construction. The insight that grows from this connection enables building project teams to identify willing partners and opportunities to link the wood in buildings to specific environmental, equity, and economic outcomes. It requires communication, trust and relationship-building between project teams and value chain actors, from distributors to manufacturers to landowners. **Pilot projects** conducted to date have clarified needs, identified what is possible for each partner, and elevated the broad set of values represented by forest managers and managed forests.

This guidance offers three **Procurement Options** for sourcing CSW that may entail different degrees of traceability and transparency. Option 1 addresses salvaged, reclaimed, reused, and recycled wood, Option 2 addresses certified wood, and Option 3 addresses methods for intentionally sourcing CSW in the absence of third-party certifications. While Option 2 (certified wood) offers more established processes for sourcing that can be reassuring and convenient, it does not necessarily require or deliver traceability or transparency. Option 3, however, does require a more rigorous tracing of wood to help validate claims that might be made about the management of source forests, absent certifications. This uncertified but intentional sourcing approach requires new and innovative ways to engage the supply chain and can actually strengthen claims of directly supporting landowners who are practicing CSF. In short, transparency and traceability underpin the ability to intentionally source CSW.

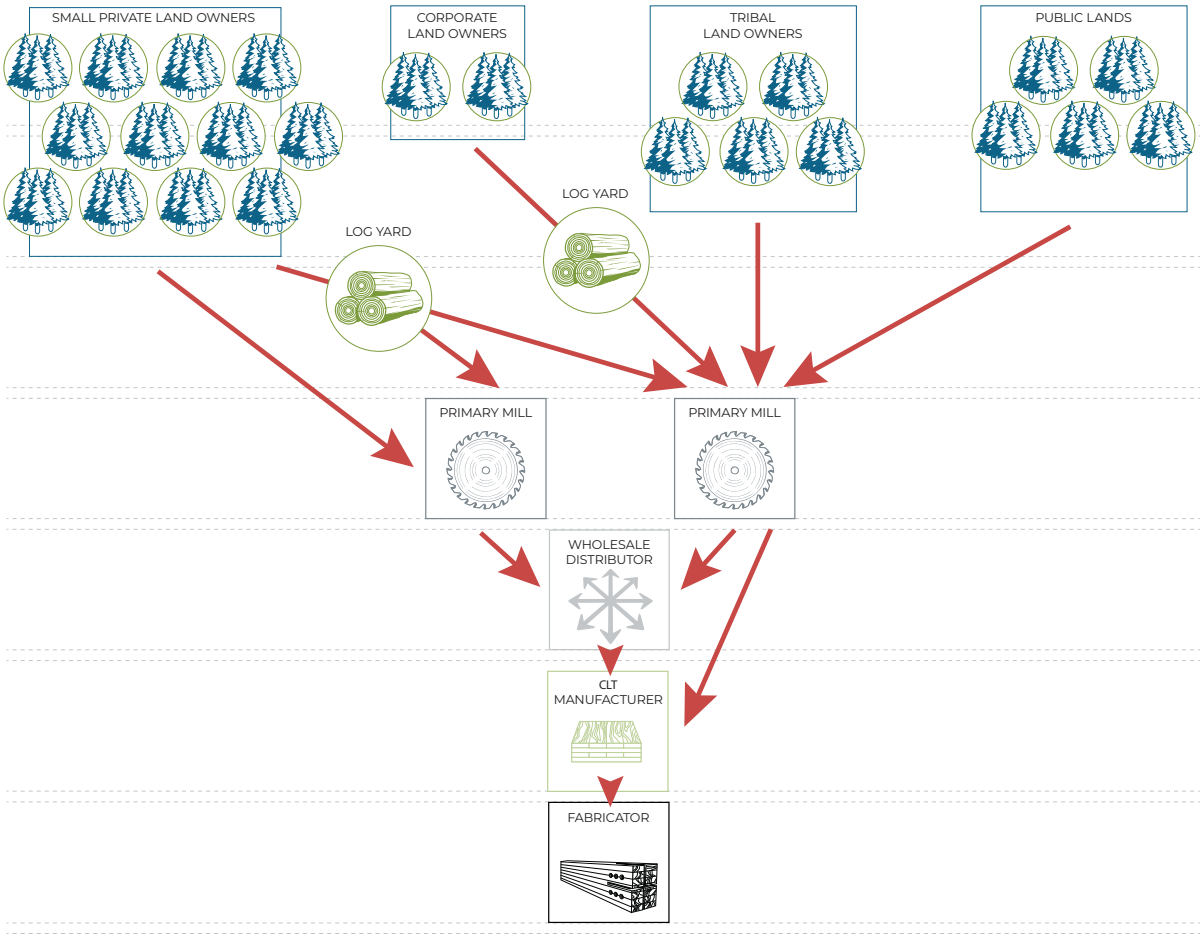
While traceability and transparency are important, implementing them can be challenging. This is because forest product industry supply chains are often complex. Materials are commonly mixed at different stages of distribution or manufacturing in ways that make direct traceability from an end product to one or more specific forests of origin difficult or impossible.

A typical wood product supply chain originates with a diverse combination of forest owners and harvest practices. Logs are received, sometimes through intermediary traders such as log yards that perform various sorts, at primary mills that process them into one of the industry's foundational products: lumber, veneer or chips. These primary products are often used in secondary manufacturing: for example, lumber may be used in the production of mass timber, veneer in plywood, and chips in pulp/paper, MDF, and particleboard. In some cases, secondary products are used in an additional manufacturing step: for instance, solid lumber, veneer panels (architectural veneer laid up on MDF), and hardwood plywood could be combined in the fabrication of an architectural millwork package. Adding to the complexity, there can be multiple steps in the distribution of materials, from wholesale to retail, and different types of products may have different distribution channels: softwood lumber and construction plywood used in building structures, for example, are handled by a branch of the industry that is separate from hardwood lumber and hardwood plywood used in interiors.

Figure 1 below depicts a relatively simple case where logs from a variety of landowners are processed into lumber by two sawmills and pass through additional value chain steps to be made into mass timber. A more complex illustration of wood product supply chains can be found in figure 2 in the section on disclosure.

Figure 1.

A SAMPLE MASS TIMBER SUPPLY CHAIN



Each layer in this value chain adds complexity, but also presents opportunities to learn more about where our wood comes from.

- Logging contractors take ownership of standing trees after winning timber sales or being contracted by landowners to harvest timber. After felling, timber is cut to length and sold to buyers interested in specific species and grades.
- In some instances, logs are not sold directly to mills but instead go to concentration yards that buy timber from numerous landowners and/or logging contractors and do further sorting.
- Sawmills procure logs from a variety of sources (e.g., forest owners, logging contractors, and concentration yards) and deck them in the log yard, sorting by species, grade, and length. Logs are pulled for manufacture into lumber in batches focused on yield or production of target dimensions and grade, often making it difficult to tie an individual board to a specific source[1].
- In some cases, sawmills sell lumber (graded lamstock) direct to CLT manufacturers while in others lumber is sold to wholesale distributors who sell whole units (banded or packaged lots) to CLT manufacturers or pull material from different units of lumber in inventory to fill an order.
- CLT manufacturers purchase lamstock from distributors and/or sawmills.[2] Units from different suppliers are not routinely tracked in such a way that specific origins can be shared with customers. This is particularly true of material that is sourced from distributors who are combining lumber from different sources.
- Fabricators fashion CLT into a finished product that is ready for installation.

For all the above reasons, in many cases establishing traceability and transparency requires a commitment of dedicated resources; project teams who pursue them should be prepared to educate building owners about the need to underwrite the extra work needed to engage actors across the supply chain to secure their cooperation.

Benefits

- Enables a deeper **connection between our buildings and the people and forests** that produce the wood products.
- Helps meet clients' **Environmental, Social, and Governance (ESG) goals** and illuminates the full range of possibilities available to meet individual project goals. Builds understanding and potential to elevate the CSF, community, conservation and equity opportunities that align with client values.
- Creates conditions for project teams (building owners, architects, designers, contractors) to develop deep supply chain relationships. These relationships can help **manage cost and supply chain risk** related to material availability and build networks contractors can leverage to secure future project bids.

[1] Note, however, that mills that focus on cutting higher grade lumber track individual log sources more often than mills focused on high production rates. For this reason, beams and wood used for lamstock offer a better opportunity for projects asking for segregation of logs from specific landowners than do mills cutting for standard dimensional lumber markets.

[2] Custom purchase of lamstock happens more frequently for large custom orders while production from inventory occurs more frequently at mills fulfilling smaller orders and commodity CLT dimensions. Options for custom purchase are often limited to known suppliers to reduce risks.

+ Creates demand and elevates expectations for wood product suppliers to **document and differentiate source forestry that provides enhanced climate benefits** versus business-as-usual. This can also drive investment in infrastructure and systems that reduce associated burdens.
+ Can better **capture and connect sourcing to environmental impacts and outcomes important for procurement evaluations** (e.g., GHG emissions or removals associated with timber harvest and transportation, biodiversity benefits, fire-risk reduction, etc.).

Challenges

+ Requires **additional time and planning** up front.
+ **Some pathways require much more effort than others,** depending on context (e.g., procurement geography or product-specific considerations).
+ **Requirements that add labor or other costs need to add value** to the material, or otherwise be compensated for, before industry will adopt them.
+ **Secrecy, resistance, and inertia throughout the supply chain** — for competitive reasons, it is typical for supply chain actors to closely guard information about their sources.
+ **Requires a local understanding of the supply chain.** Learning whom to ask, what to ask for, and where to go for sourcing information in a given region can be a time-consuming task, particularly in early project stages when suppliers have not yet been selected.

INFORMATION GATHERING

The approach to transparency and traceability information gathering can be adapted to meet project needs and available resources. When gathering information on traceability and transparency, project teams can adopt an approach suited to the level of disclosure desired (see Source Forest Disclosure section below). Regardless of the information-gathering method used, project teams should view themselves as a demand driver in the marketplace to draw out and partner with companies to create greater traceability and transparency in the forest products industry. It can be anticipated that with time and sufficient demand, an increasing number of wood product manufacturers and distributors will implement systems that make it easier to gather and provide desired information when requested.

TRACEABILITY INFORMATION GATHERING

Traceability information gathering starts with asking suppliers about their capacity and willingness to provide information that allows for tracking end products to one or more sources. It is linked to **supply chain mapping** but focuses on tracing individual products or batches of product either backward or forward through part or all of a supply chain map[3].

[3] While often discussed in similar contexts, supply chain mapping and traceability serve distinct functions in sourcing CSW and supporting CSF. Recognizing their differences is important, particularly in complex supply chains where the two must be strategically combined. Supply chain mapping is the process of documenting and visualizing the network of suppliers, facilities, and processes *potentially* involved in the production of goods across different tiers of the supply chain. It typically involves mapping suppliers tier by tier, providing project teams with a network-level view that answers "who" and "where" and helping them understand the potential actors in their supply chains. While this is critical for transparency, in and of itself it does not deliver traceability which enables end users to connect a wood product to or from the forest(s) of origin to the final product. Mapping identifies the universe of potential actors, while traceability validates what actually happened to a specific product or material within that universe.

Aids to establishing traceability include:

+ **Chain of Custody (CoC) Documentation:** A basic method for establishing traceability using a paper trail (invoices, bills of lading, etc.) provided by the product vendor that extends as far up the supply chain as possible. This documentation should be collected, reviewed and authenticated.
+ **Lumber Grade Stamps:** These are common for softwood lumber products in North America and identify the sawmill that made them. Having identified the originating mill, one can begin to gather information about the forestry in its 'supply area.' NOTE: The 'supply area' for a primary mill is the area that it draws logs from. Other terms with the same meaning are 'wood basket' and 'fiber basket.'
+ **QR Codes or Inventory Tags:** For urban wood such as material from street trees and city parks, traceability can be even more direct. Municipal or institutional removals can be recorded at the tree level, including species, location, and date of removal. Logs can be tracked as they enter local log yards, where QR codes or inventory tags can maintain provenance through milling and into final use. These short, segmented supply chains reduce mixing and make it practical to connect individual projects to documented sources.
+ **Commercial Traceability Tools:** There are dozens of "Software as Service" tools available that are designed to track a product's journey from origin to sale. As of this writing, however, they are not yet widely used by the North American forest products industry[4]. Digital traceability systems have also been established by some national governments to improve law enforcement and improve revenue collection in the forest sector, but not in the US or Canada.[5]
+ **Internal Traceability Systems:** Some manufacturers (particularly primary manufacturers) have sophisticated internal traceability systems that can enable accurate tracing up the value chain to the forest source. While some companies might be hesitant to admit having these systems for proprietary reasons, others who can use them to manage and share information about above-business-as-usual forestry may see a competitive advantage.
+ **Wood ID Testing:** There are a number of testing methods that can identify the species or verify the declared origin of most types of wood products. With these technologies, the forest of origin for a final wood product can potentially be identified even without knowing the full supply chain. However, for a variety of reasons including cost and limited reference data[6], use of these methods is currently limited.

Chain of Custody Documentation vs. Chain of Custody Certification

Of the above, the most straightforward way to establish traceability for wood products today is through Chain of Custody documentation. It should be noted that Chain of Custody (CoC) documentation is not the same as CoC certification.

As described above, CoC documentation is basically a paper trail from the end product up through the supply chain. CoC certification, on the other hand, is a core component of forest certification systems like Forest Stewardship Council (FSC) and the Sustainable Forestry Initiative (SFI). CoC certification standards lay out a set of requirements that control the handling and processing of

[4] For more information, see Preferred by Nature's **Due Diligence Toolkit** DD 16
[5] **https://www.worldwildlife.org/pages/tnrc-topic-brief-traceability-systems-potential-tools-to-deter-illegality-and-corruption-in-the-timber-and-fish-sectors**
[6] However, there is a large and growing library of reference data for US hardwoods.

certified materials within and transactions of certified products between companies. Companies' implementation of these requirements is verified through annual audits against the standard in question.

While all forest certification systems' CoC standards require basic traceability procedures to help ensure that certified materials are accounted for as they move through the supply chain, currently none of them provide continuous or granular traceability through each stage of production and distribution[7]. Nor do any of them provide access to transparent information on the companies and forests that are upstream from a certified product.

While CoC certification is based on the auditing of documented systems and records, traceability refers to tracking the journey of specific lots of material through each step of the supply chain. In simple terms:

+ CoC certification answers the question: Can we prove that this material was handled according to specific requirements?
+ CoC documentation seeks to answer the question: Can we follow the actual journey of this material — where it originated, how it moved, and where it ended up — based on real-world events and data?

TRANSPARENCY INFORMATION GATHERING

Transparency entails disclosure of information by manufacturers, mills, landowners and others in the supply chain, which is generally necessary to unlock traceability. Gathering the information needed for transparency can happen proactively, by engaging supply chain actors before making a procurement choice, or it can occur retroactively, by looking back up the supply chain after procurement has commenced to at least learn more about where wood has come from. Obviously, proactive transparency is necessary if a project team has intentional wood sourcing goals.

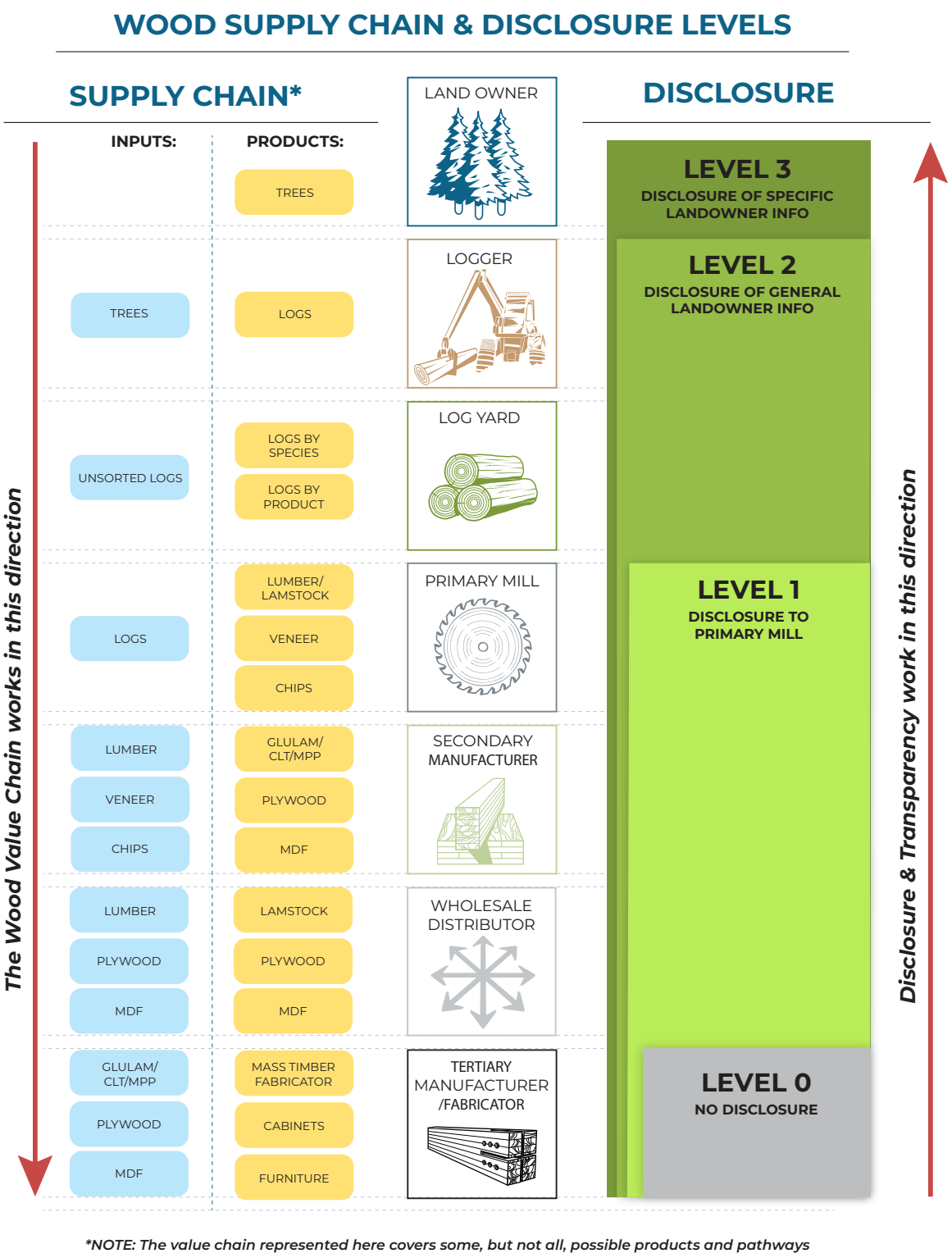
Unfortunately, many companies that are direct suppliers of wood products to building projects don't know where the material originates, and even if they do, they may resist disclosing what they consider sensitive information. The ask for information is often best made by a vendor's direct customer whom they may know well and trust instead of by a project team member they are less familiar with (or in tandem). Information can be gathered with pre-procurement questionnaires, **architectural specifications and/or reporting forms**. Each of these methods typically rely on early engagement on the part of the project team with supplying manufacturers and mills. See the **Project Phases** section to learn more about how early engagement can enable proactive and intentional procurement.

[7] This said, supply chains that have CoC certification may be better able to provide granular traceability since some level of tracking is intrinsic to the system.

Source Forest Disclosure

Suppliers can be asked to disclose information that can allow project teams to identify source forests that best match project goals and avoid sources that don't. CSWG proposes three different levels and methods of disclosure:

Figure 2.



**NOTE: The value chain represented here covers some, but not all, possible products and pathways*

- **Level 1** disclosure starts with project teams working with their immediate (Tier 1) suppliers to identify primary mill(s) at the beginning of the supply chain for the product(s) they are procuring. Once the location of a primary mill is known, it's possible to make an assumption about the supply area (also referred to as a wood basket or a fiber basket) for the timber. This is because most primary mills don't source logs from farther away than a few hundred miles due to hauling costs. Thus, one can draw a circle around the mill to estimate where material is most likely coming from and conduct research on the working forests within that area. If one or more CSF operations are identified, then the mill can be asked to disclose if they are already buying timber from them or be encouraged to do so. Level 1 disclosure is necessary for achieving levels 2 and 3.
- **Level 2** disclosure relies not on assumptions but rather on primary mills willingly providing more specific information on the working forests from which they buy logs. At minimum this should include landowner type (e.g., federal land, state land, family forest owners, tribes, etc.) by volume or percentage and general location (e.g., county or zip code). This type of generalized information maintains the anonymity of landowners and may be more palatable to mills that are reluctant to disclose information they consider sensitive. Level 2 disclosure provides a basis for level 3 disclosure.
- **Level 3** disclosure relies on a primary mill and/or landowners within the supply area providing still more specific information on procurement, source forests and management practices. Achieving this level of disclosure can be challenging since some landowners may be reluctant to share information about their forests and how they are managed. In such cases, sensitive information could be protected through non-disclosure agreements. On the other hand, landowners who are practicing CSF may be eager to share information about their operations. In any case, it is at this level of disclosure that a much clearer understanding of how "climate smart" a wood source is can be achieved. See **Procurement Option #3** (Intentional Sourcing from Climate Smart Forestry Operations)) for more information.

Sourcing material directly from specific landowners almost always requires segregation of logs at the primary mill, since that material would otherwise get mixed in production with logs from other sources. It is possible, however, to reward specific landowners indirectly through a mass balance system approach. For more detail, see the relevant section under Procurement Option #3.

Supply Chain Mapping

Disclosure of supply chain and source forest information can result in a supply chain map: a schematic depiction of all of the supply chain links (manufacturing and distribution steps) from forest(s) of origin down to the final product. It is not necessarily obligatory, however, to identify all the intermediary companies between a Tier 1 supplier and a primary mill in order to achieve transparency around forest sources.

Urban, salvaged and reclaimed wood supply chains are often simpler: removals can be documented at the point of origin by cities, schools, or landowners, creating a transparent record before logs enter log yards or mills.

Moving toward more transparent and intentional procurement can take different trajectories.

Before launching into a transparency effort, broad buy-in is necessary, from the project client to the design team to the contractor, since the level of effort and commitment can vary based on the sourcing pathway chosen. See the **Project Phases** section to learn more about advocating for and collectively choosing sourcing pathways and levels of transparency that are necessary to make credible claims around the wood being sourced.

Unacceptable Sources

A foundational element of projects' traceability and transparency objectives must be avoiding wood from unacceptable sources. These include:

+ **Illegal logging:** The risk of illegal logging in North America is widely considered to be low, however.
+ **Conversion of forests to plantations or non-forest uses:** Deforestation and conversion is not just a phenomenon in far-off lands. Across the US and Canada, natural forests are being converted to monoculture tree farms and large areas of forestland are lost to agricultural conversion and sprawl each year.
+ **Destruction or significant degradation of High Conservation Values (HCVs):** HCVs include but are not limited to primary (old growth) forests, intact forest landscapes (areas of primary forest that are 50,000 hectares or larger), and habitat for Rare, Threatened and Endangered species. In some geographies in North America, logging is causing harm to HCVs.

Best practice is for project teams to:

+ include a requirement for suppliers to avoid wood from unacceptable sources in specifications and procurement documents. Many firms already operate with a practice-wide master specification that prohibits wood from old growth forests or requires FSC certification whose standards protect old growth and other High Conservation Values.
+ conduct a risk assessment of source supply areas that have been identified. The most reliable source of information on risk can be found in FSC Risk Assessments[8].

Where an FSC Risk Assessment has a finding of elevated risk in a given geography (in FSC terminology, "specified" or "non-negligible" risk), project teams can ask suppliers for evidence of compliance with their commitments. Such evidence can take a variety of forms, some of which are more robust than others. Here are examples ranked from least to most reliable:

+ Formal declarations by suppliers
+ For deforestation/conversion, analysis using remote sensing tools (e.g., Global Forest Watch)
+ Attestations from independent experts (NGOs, academics, etc.)
+ Supplier invoices or other documentation indicating that the material is FSC Controlled Wood

[8] As of this writing, FSC Risk Assessments can be found in the **FSC Document Center**. In the future, they will be on the **FSC Risk Hub**.

A NOTE ON ENVIRONMENTAL PRODUCT DECLARATIONS

It is understood that building professionals often refer to Environmental Product Declarations (EPDs) based on Life Cycle Assessment (LCA) studies to assess impacts and make sourcing decisions for the products they specify. While EPDs can be a valuable source of information for certain environmental impacts, they may not be useful when it comes to wood traceability or transparency as described above. Even product-specific EPDs do not disclose specific forests of origin or the impacts of forest management practices in source forests. To learn more about the benefits and limitations of EPDs and LCAs, see **Carbon Considerations (Appendix 2)**.

PROCUREMENT OPTIONS

PROCUREMENT OPTIONS

OVERVIEW

CSWG proposes three options for CSW procurement that may be used individually or in combination, offering flexibility for projects with different goals and levels of aspiration and resources.

1. Recycled, Reclaimed, Reused Products or Salvaged Wood
2. Certified Wood
3. Intentional Sourcing from Climate-Smart Forestry Operations

These procurement options reflect CSWG's current knowledge of methods to identify, source and validate CSW or otherwise support CSF; we expect to improve and augment them with time. Each option also includes a discussion of the importance or relevance of traceability.

OPTION 1A: URBAN OR SALVAGED WOOD

Wood recovered from trees removed for reasons other than their timber value: e.g., hazard, storm damage, disease, infestation, development, utility work or retired orchard trees. This is often referred to as *urban wood* even when sourced from suburban or rural removals. Sources include but are not limited to municipal streets and parks, private yards, campuses, and utility corridors. In the urban wood industry, salvaged orchard trees are also included even though they are not located in cities.

NOTE: *Salvage logging after fires, insect infestation, and other natural disturbances is sometimes controversial and should not automatically be considered "climate smart." Only salvage logging within ecologically restorative forest management plans that are attempting to maintain the restorative values associated with that stand should be considered climate smart.*

Why this is Climate Smart

1. Diverts material from landfills, chippers or grinders, avoiding methane and carbon emissions
2. Stores carbon long-term when logs are milled into durable wood products
3. Reduces fossil fuel use and transportation climate impacts when locally sourced, which is often the case
4. Builds local circular economies and workforce opportunities
5. May reduce pressure on forests, allowing them to continue providing vital environmental services such as storing carbon, providing wildlife habitat, improving water and air quality, etc.

Traceability & Transparency

It may be relatively easy to establish traceability and transparency for urban or salvaged wood due to shorter supply chains and municipal and institutional records such as:

+ Tree removal permits
+ Forestry or GIS databases
+ Institutional/utility removal logs
+ Carbon data tracking software such as GoodWood Verified, Traece, or AncesTREE
+ Urban Salvaged and Reclaimed Woods (USRW) Certification

Pros

+ **Clear benefits for climate & forests:** Delivers high climate impact by diverting removed trees to their highest and best use rather than disposal or low value uses, such as chips, mulch and firewood. May reduce pressure on natural forests, allowing them to continue storing carbon and supporting biodiversity.
+ **Jobs:** Drives local economic development through milling, fabrication, and value-added manufacturing.
+ **Expanded design palette:** Expands access to a wider variety of wood species with distinct character and aesthetics.
+ **Storytelling:** Creates authentic storytelling opportunities around place, people, and circular design.
+ **Recognized green building material:** Eligible for recognition in some green building and product rating systems, including Living Building Challenge.

Cons & Resolutions

+ **Variable availability:** The availability of urban wood varies depending on the geography, as does the selection of products (e.g., only lumber may be available from some sources while others may offer a wider variety of products).
    - **Resolution:** Identify and prioritize cities and regions with log recovery programs. Research which products are available.
+ **Market and product unfamiliarity:** Design and construction teams may not be familiar with the urban wood supply chain, its applications, or how to specify and work with unusual species or mixed character.
    - **Resolution:** Provide basic training, share case studies, direct teams to supplier directories, and engage consultants or other experienced industry professionals who can guide specification and sourcing.
+ **Limited processing capacity:** Some areas may have limited infrastructure for milling, drying, or fabricating urban wood.
    - **Resolution:** Encourage the development of regional log yards or aggregation hubs that can handle processing and distribution of urban wood.

+ **Unusual product characteristics:** Urban wood is often available in unusual species, and its character (appearance) is generally less uniform than virgin wood. Also, quality can vary depending on the source.
    - **Resolution:** Position unusual character and species as a design advantage and apply USRW quality assurance standards. Source from reputable, experienced and/or USRW certified providers. Use model Salvaged & Reclaimed Wood spec to dictate quality controls.

OPTION 1B: RECLAIMED OR REUSED WOOD

Wood reclaimed through the careful dismantling of buildings or other structures (e.g., water tanks, bridges, fences, etc.) and remanufactured into new products. This category also includes adaptive reuse of timbers, flooring, doors, windows, etc.

Why this is Climate Smart

1. Extends life of existing wood, preventing carbon release through burning or disposal.
2. Avoids logging-related emissions and forest carbon loss.
3. Reduces manufacturing emissions since the wood is already processed.
4. Preserves cultural and architectural value by reusing historic materials.
5. Often decreases transportation impacts as it is typically more locally sourced.

Traceability & Transparency

The extent to which reclaimed or reused wood can be traced to source varies depending on the circumstances: in some cases, vendors will know exactly where materials come from and be able to provide evidence if asked; in other cases, it can be impossible to get this information.

Pros

+ **Clear benefits for climate & forests:** Extends the life of materials that would otherwise be landfilled or burned. May reduce pressure on natural forests, allowing them to continue storing carbon and supporting biodiversity. Offers possible cost savings from avoided disposal and can reduce transportation-related climate impacts when sourced locally.
+ **Storytelling:** Present opportunities for compelling storytelling.
+ **Recognized green building material:** Recognized under multiple green building rating systems, including LEED v5 and Living Building Challenge.

Cons & Resolutions

+ **Variable availability & quality:** As with urban wood, the availability and quality of reclaimed and reused wood can vary widely depending on the geography and product.
    - **Resolution:** Take advantage of reuse networks and directories. Use grading and QA protocols such as USRW Standards. Use model Salvaged & Reclaimed Wood spec to dictate quality controls.

+ **Added costs:** Reclaimed and reused wood can cost more than virgin material, and some products require additional processing such as kiln drying, milling, or testing.
    - **Resolution:** Budget for these costs early in the project and look for offsets through avoided disposal fees, grants, or targeted use of materials that require less processing.
+ **Policy ambiguity:** Local or regional policies may not clearly support reclaimed or reused wood.
    - **Resolution:** Budget for these costs early in the project and look for offsets through avoided disposal fees, grants, or targeted use of materials that require less processing.
+ **Code/regulatory** hurdles**:** Depending on the product and application, there can be bureaucratic barriers to using reclaimed or reused wood.
    - **Resolution:** Engage officials early and target non-structural uses of ungraded materials.

OPTION 1C: PRE-CONSUMER RECYCLED WOOD

Composite wood panels such as MDF and particleboard often use by-products generated during primary or secondary manufacturing, such as sawdust, shavings, chips, and bark.

Why this is Climate Smart

1. Avoids disposal or incineration emissions by putting byproducts in long-lived products
2. Substitutes virgin inputs, reducing pressure on forests

Traceability & Transparency

Establishing traceability and transparency for recycled material is desirable but can be quite difficult and is often considered lower priority than for virgin material.

Pros

+ **Waste reduction & avoided emissions:** Significant diversion of high-volume waste streams and avoided emissions.

Cons & Resolutions

+ **Limited market transformation:** Use of pre-consumer content in wood composite panels such as MDF is standard practice and often lacks transparent verification, limiting market transformation.
    - **Resolution:** Encourage EPD disclosure. Prefer products where recycled content is independently verified and/or is higher than average. Seek out innovative products (i.e., beyond conventional panel production) that utilize pre-consumer by-products and/or post-consumer material.

OPTION 2: CERTIFIED WOOD

Forest certification systems are voluntary, market-based tools designed to verify forestry and forest products as "responsible" or "sustainable," enabling consumers to choose wood and other forest products that meet their environmental and social standards. The major systems in North America are the **Forest Stewardship Council** (FSC) and the **Sustainable Forestry Initiative** (SFI)[9]. Procurement of certified wood can be a relatively straightforward way for project teams to support CSF when a certification standard is strong enough to secure climate benefits.

Why this is Climate Smart

CSF may be practiced under any certification system as well as in forests managed by landowners who choose not to participate in certification programs. However, when using certification as a tool for identifying and procuring CSW, peer reviewed studies[10] and independent reporting[11] from respected outlets like BuildingGreen indicate that FSC standards prescribe[12] key elements of CSF to a degree that other systems have yet to achieve.

In general, in order to meet FSC forest management standards, forestry operations must adopt practices that lead to improved long-term outcomes compared to conventional forestry in the three critical areas of: 1) mitigation, 2) adaptation, and 3) equity (see CSF definition).

While FSC requires practices that exceed most forestry regulations in the USA and Canada, SFI may not assure management that reaches significantly beyond the regulatory floor[13]. This difference informs a consensus within the conservation community that FSC is the stronger standard[14]. Examples of practices required by FSC's forest management standards that result in greater carbon storage[15], ecological resilience, and social equity include:

+ Smaller clearcuts in some US regions (mitigation & adaptation). FSC has regional clearcut (opening size) harvest limits in several regions, ranging from 2 acres to an 80 acre maximum/40 acre average size restriction. Maximum opening sizes vary because of differences in forest composition in different geographies, where, for example, certain tree species may need more sunlight and larger openings to regenerate and thrive. SFI openings cannot exceed an average of 120 acres and the American Tree Farm System does not have a maximum limit on clearcut size.
+ Greater requirements for long-term forest retention (a percentage of live trees left in a stand after harvest) in some US regions for purposes of mitigation and adaptation. In select regions, FSC requires up to 30% of the pre-harvest basal area to be retained through the harvest.
+ Higher levels of live and dead tree retention within the harvest unit that provide refugia for plant and animal communities.

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[9] While FSC is a global system, SFI operates only in the U.S. and Canada. Internationally, SFI is one of numerous national forest certification schemes that are united under the umbrella of the Programme for the Endorsement of Forest Certification (PEFC) and have the right to use the PEFC name and label. PEFC does not itself set sustainable forestry standards at the national level; instead, it endorses systems that meet its international standards and guides. SFI has its own label and brand identity, thus the PEFC label is generally only seen on imported products. SFI also recognizes and accepts material certified under two additional systems that operate in North America, American Tree Farm System Certification which serves smaller, non-industrial landowners and PEFC Canada which operates only in that country.

10 **https://www.mdpi.com/1999-4907/11/8/863**

11 **https://www.sierraclub.org/sites/default/files/2025-04/webpage-5.pdf**

12 **https://journals.sagepub.com/doi/full/10.1177/1086026619858874**

13 **https://www.mdpi.com/1999-4907/9/8/447/htm**

14 **https://www.ecologyandsociety.org/vol16/iss1/art3/**

15 Globally, FSC forests that measure carbon on average realize a 17% increase in carbon stocks over a management cycle

- 10% of a certified forest management unit to be identified and managed with a primary purpose to conserve environmental and cultural values, including conserving ecosystems and/or ecological conditions that are not adequately represented and protected in the landscape.
- Protection of high-conservation values like old growth and threatened species habitat.
- Wider riparian buffers (areas bordering streams and rivers). There are regional requirements for the protection of riparian areas that at a minimum require the implementation of voluntary Best Management Practices.
- Conversion of natural forests to plantations or other land uses is prohibited. Where forest ecosystems have been harmed, organizations must restore them.
- Protection of workers' rights. FSC's requirements cover forced labor, job safety, the right to organize, fair wages, gender equity, using local workers etc. SFI asks participants to develop a plan, program, or policy that addresses social and economic impact. The ATFS standard requires that landowners comply with local laws.
- Protection of Indigenous Peoples' rights. FSC requires forest owners to identify and uphold Indigenous Peoples' rights of land ownership, use of land, and access to resources the land may provide, as well to secure Free, Prior, and Informed Consent (FPIC) for forest management on their lands that may affect legal or customary rights.

Again, CSF may be practiced under any certification system as well as in forests managed by landowners who choose not to participate in certification programs. SFI-certified and non-certified wood may be considered climate smart when additional supply chain transparency and traceability support a conclusion that CSF is being practiced in the source forest.

Additionally, it should be noted that not all FSC certified products come directly from FSC certified forests — a fact that applies to other forest certification systems as well. All certification systems allow for the mixing of material from certified and non-certified forests in manufacturing, albeit with the application of controls on the latter to avoid wood from unacceptable sources such as illegal logging, destruction of high conservation values, etc. In FSC, the system of controls over non-certified material used in mixing is called "Controlled Wood." Products that come from certified forests and those that result from mixing are also labeled differently: "FSC 100%" in the former case, "FSC Mix" in the latter.

Most mixing relies on a mass balance system where the volume output of certified products must be "covered" by the volume of certified material that comes into the manufacturing process. In FSC, this is called the "credit system" — credits are banked in an account based on the quantity of certified material procured and can be applied flexibly to outputs sold as "FSC Mix" anytime in the 48 months after they are banked.

Practically speaking, mixing is essential for the workability of FSC and other forest certification systems. It reduces the operational costs and hassle of making certified products significantly because it avoids the need to segregate certified and non-certified material in dedicated production runs. And it is unavoidable in certain sectors such as pulp/paper where there is insufficient certified material to produce FSC 100% and the nature of the manufacturing process is such that segregation is impossible. The drawback, of course, is that the direct link between certified products and certified forests is broken because it is impossible to tell if any given FSC Mix product is from certified forests, if it is Controlled Wood, or some combination of the two.

Traceability & Transparency

Traceability and transparency are not currently inherent to forest certification systems[16]. However, in the case of FSC which generally requires performance significantly beyond regulatory baselines, certification reduces the need to map supply chains and verify specific forest origin, forest management plan, or harvest prescription. Wood certified under other certification systems should be complemented by additional information gathering efforts to verify the specific practices that enable a project team to conclude climate benefit compared to status quo practice.

Pros

+ **Independent verification to above-BAU standards:** Through third-party auditing, assures compliance with publicly available forest management standards with environmental and social requirements that are generally well above the regulatory floor.
+ **Simplicity:** Can be the most straightforward method for procuring CSW without need for further information gathering.
+ **Recognized green building material:** Recognized under multiple green building rating systems, including LEED v5 and Living Building Challenge.

Cons & Resolutions

+ **Lack of availability:** It can be difficult to procure certified wood products if certified supply chains are incomplete (the chain of custody is broken) or there is not enough underlying certified forest land. Many producers, from small landowners to Tribal and government forestry agencies, choose not to get certified for a variety of reasons even though they may be practicing CSF. For either reason, availability of certified products can be an issue.
    - **Resolution:** Pursue hybrid sourcing strategies, combining certified material with non-certified wood that meets climate smart criteria verified through traceability and transparency methods (Option 3). Also, if you try to source certified wood and fail, don't give up. Ongoing demand signals are needed to develop supply.
+ **Added cost:** Although it depends on product type, timing, and a host of other factors, certified products typically come with some level of cost premium.
    - **Resolution:** Contact potential suppliers early to explore less expensive options and to ensure cost information specific to the product/project and not based on a "typical" premium.
+ **Certified products may not come directly from certified forests:** As noted above, products that are labeled FSC Mix may or may not come directly from operations that are practicing climate smart forestry (though using FSC Mix products does provide markets for material from certified forests in an indirect manner).
    - **Resolution:** Use products that are FSC 100% wherever they are available.

[16] The FSC 100% label, though uncommon in North America, does provide some additional traceability and transparency, especially for products with short supply chains like lumber.

OPTION 3: INTENTIONAL SOURCING FROM CLIMATE-SMART FORESTRY OPERATIONS

This "Choose Your Own Adventure" option entails identifying specific forestry operations that are practicing CSF — whether or not they are certified — and rewarding them through procurement. This can be done by establishing traceability and transparency for a given product, working up the supply chain to primary mills and analyzing working forests in the relevant supply areas. It can also be done by working forward from identified CSF forestry operations, engaging the supply chain actors needed to obtain a particular product for a project. Either way, this option relies on moving well beyond business-as-usual procurement.

In this procurement option, it is up to the project team to decide which forestry operations align with their goals and the CSWG definition of CSF. It is good practice to work with local or regional experts to identify CSF practitioners and their supply chain partners.

CSF is tailored to the ecological and social setting where it is practiced, but in general it improves outcomes across these three dimensions over the long term:

1. **Mitigation:** Increasing storage of carbon in forest ecosystems and wood products, and reducing emissions from forest operations.
2. **Adaptation:** Maintaining or building ecological integrity and diversity that are the basis for resistance and resilience as the climate continues to change.
3. **Equity:** Addressing issues of equity and climate justice, improving community well-being and respecting the rights of Indigenous peoples. To be viable and sustainable, forestry must address how social and economic benefits and impacts are distributed among landowners, workers, and communities.

A fuller definition of CSF can be found **here**.

Landowner Types & Management Regimes

It is common for intentional sourcing to be focused on specific geographic areas, certain landowner types, and/or specific methods of forestry. The following are some examples of landowner types and management regimes that could represent CSF and be targeted for intentional sourcing of CSW:

+ **Non-Industrial Forest Lands:** In general this could include Indigenous or tribal, non-profit organizations and land trusts, and family forest owners. Publicly owned forests such as US federal, state and Canadian crown lands could fall in this category, or they may be intensively managed in ways that should not be considered climate smart; therefore, they should be considered on a case-by-case basis. Government- and some tribally-managed lands can have a transparency advantage in that management plans may be publicly available.
+ **Restoration Forestry:** Forests where management produces improvements in forest health, resilience, water quality, ecological integrity and diversity, etc. Examples include environmentally-responsible thinning to reduce wildfire risk, management that restores forests degraded by past intensive logging toward more natural conditions, and reforestation projects where the right trees are planted in the right places. Organizations exist across North America that practice restoration forestry and are likely to accommodate the intentional sourcing goals of project teams.

+ **Above-BAU Regulations:** Some forests are governed by environmental or management regulations exceeding business-as-usual (BAU) practices at the legal floor. One example are the many millions of acres in the US that are governed by Habitat Conservation Plans, which entail a set of required commitments to protect federally listed species under the Endangered Species Act. HCPs commonly require additional conservation measures and management practices that are aligned with climate-smart forestry outcomes. Forests managed under an HCP are also highly likely to have inherent documentation requirements that can help satisfy project traceability and transparency objectives.
+ **Above-BAU Practices:** Forests consistently managed using practices that exceed BAU regimes are likely to enhance climate, community, and ecological outcomes. This could include forestry operations that implement smaller clearcuts than allowed by regulation; extended harvest rotations (longer time periods between harvests, allowing trees to grow larger and sequester more carbon): increased green tree retention (leaving more live trees behind after harvest instead of removing everything); expanded riparian and wetland buffers (protected areas along waterways); habitat enhancements for fish and wildlife; etc. It could also include forests that have a positive **Carbon Stock Change Factor** such as third-party **certified forest carbon projects** that offer carbon offset credits tied to increased carbon storage over a regulatory baseline.

Sourcing Methods

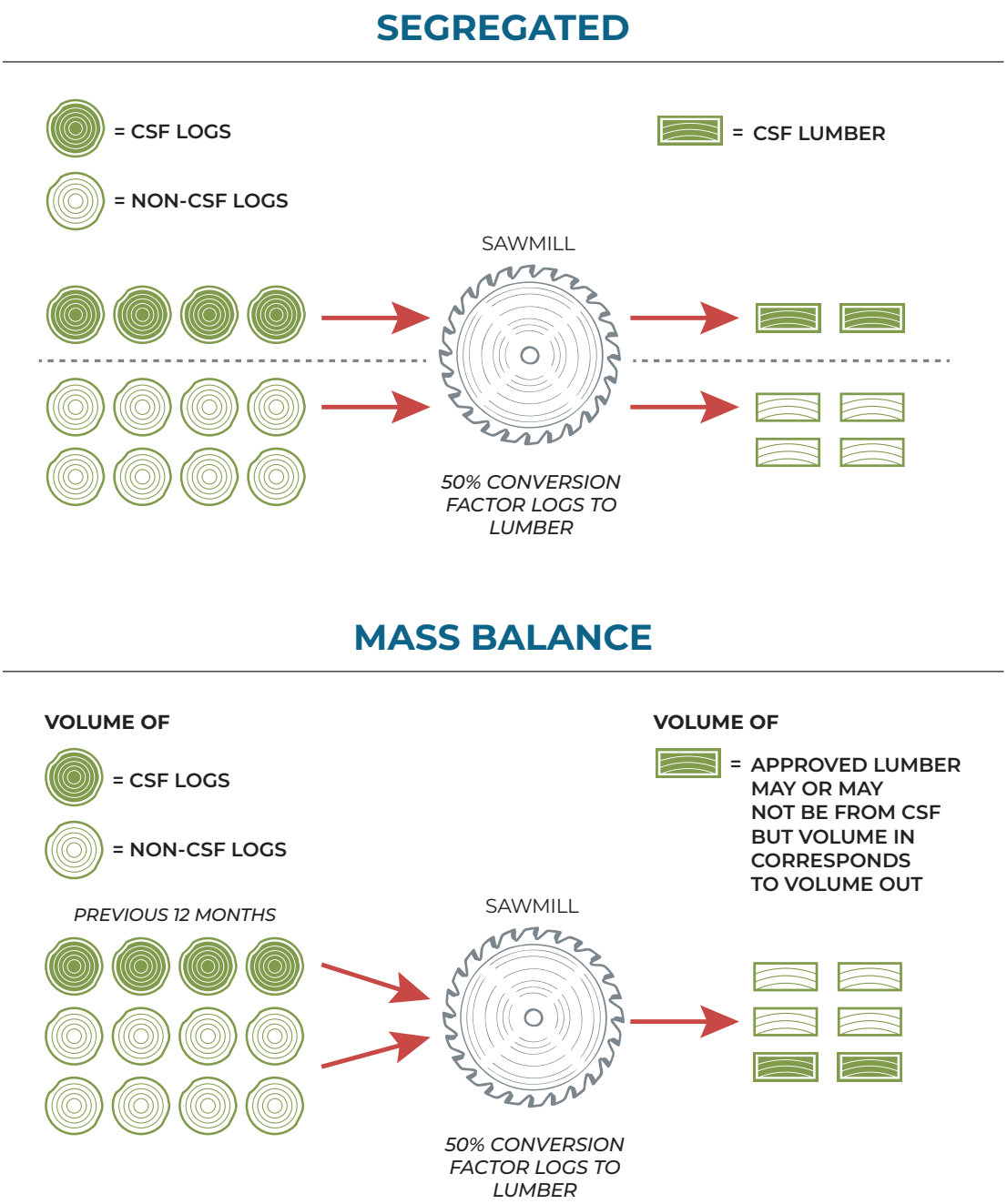
Of course, with more specificity comes the need for more diligence. CSWG suggests two main methods for intentional sourcing of wood from CSF:

+ **Direct Sourcing & Segregation:** To make a claim that wood from specific forests is literally built into the building, it means that wood must be tracked and segregated through stages in the supply chain where mixing is likely to occur, such as at log yards and mills. Sourcing wood directly from CSF operations requires segregating materials at different stages of manufacturing and tracking them through production runs and distribution. This requires enhanced logistics, so it takes the right partners, the right timing, the right size of job, financial incentives, and early engagement to make it work. More vertically-integrated or small-scale mills are generally better suited for segregation. In spite of its disadvantages, this method is often the only way to link wood products directly to their specific forests of origin.
+ **Mass Balance:** Another, generally more practical way to reward landowners who practice CSF without relying on segregation is to take a mass balance system approach. This is a volume in/volume out method where a primary manufacturer is asked to provide documentation showing that they have procured enough logs from a given source over a fixed time period — e.g., 12 or 24 months — to “cover” the volume of product needed for a project. Greater certainty about the actual sources can be achieved by aiming for tighter production windows.

This method can also be applied at the secondary manufacturing level. For example, if it is inefficient for a mass timber manufacturer to segregate material that has been approved by the project team either because it stems directly from a selected landowner via segregation at the sawmill level or because it has been supplied through a mass balance system at the sawmill, the mass timber manufacturer could provide purchase documents showing that they procured enough lumber from the sawmill in a designated time period to "cover" what is needed for them to produce the package.

While using a mass balance approach breaks the direct connection between the product and the source forest, it still represents a basis for credible claims about what kinds of landowners and forestry practices the project supported. As noted above, many products certified under forest certification systems are manufactured using this method because it is more efficient and less costly than segregation. Although this approach is indirect in that you cannot claim where the actual wood in your project is coming from, it is still a way to reward CSF producers financially and sends a positive market signal about what clients and project teams value.

Figure 3.



Here are examples of how a mass balance approach could be applied: Suppose that a project team needs a mass timber package that uses 100,000 board feet of lamstock lumber. The mass timber manufacturer connects the team with a sawmill that supplies them with lumber and that procures logs from a forest owner whom the project team wishes to reward because they are practicing CSF. The conversion factor from logs to lumber is about 50%, so in order to "cover" 100,000 board feet of the lumber the mill will need to procure 200,000 board feet of the logs from the landowner. If there is sufficient lead time, the project team could request that the mill provide purchase documents showing that they have sourced this quantity of logs between the time the sawmill was contacted and the time that the lumber is produced for the project. Or the project team could allow a "look back" that credits the mill for procuring logs from the landowner prior to their engagement for a given timeframe (e.g., 12 months). The tighter the window, the better.

Why this is Climate Smart

The description above provides examples of indicators of potential climate-smart attributes that align with the CSWG's **definition of CSF,** corresponding landowner types and implications for the level of traceability/transparency required to make credible claims. None of these indicators represents a stand-alone guarantee of climate-smartness. The inclusion of indicators like these in any procurement policies or specifications should include additional information and regional context. Examples may include describing why certain types of landowners are believed to produce improved climate[17], community, or biodiversity outcomes that exceed business-as-usual, or which forest management and conservation practices employed by timber producers are considered (e.g., extended harvest rotations, increased green tree retention, expanded riparian and wetland buffers, habitat enhancements for fish and wildlife, etc.).

Traceability & Transparency

Exercising this option requires traceability and transparency, as described in the first section of this guidance. Ideally, the exercise of this option will involve gathering data at the forest management unit (FMU) level (**Level 3** disclosure). If working up the supply chain from an end product as opposed to forward from a CSF operation, then at minimum this option must incorporate traceability and transparency to the primary mill supply area (**Level 1** disclosure).

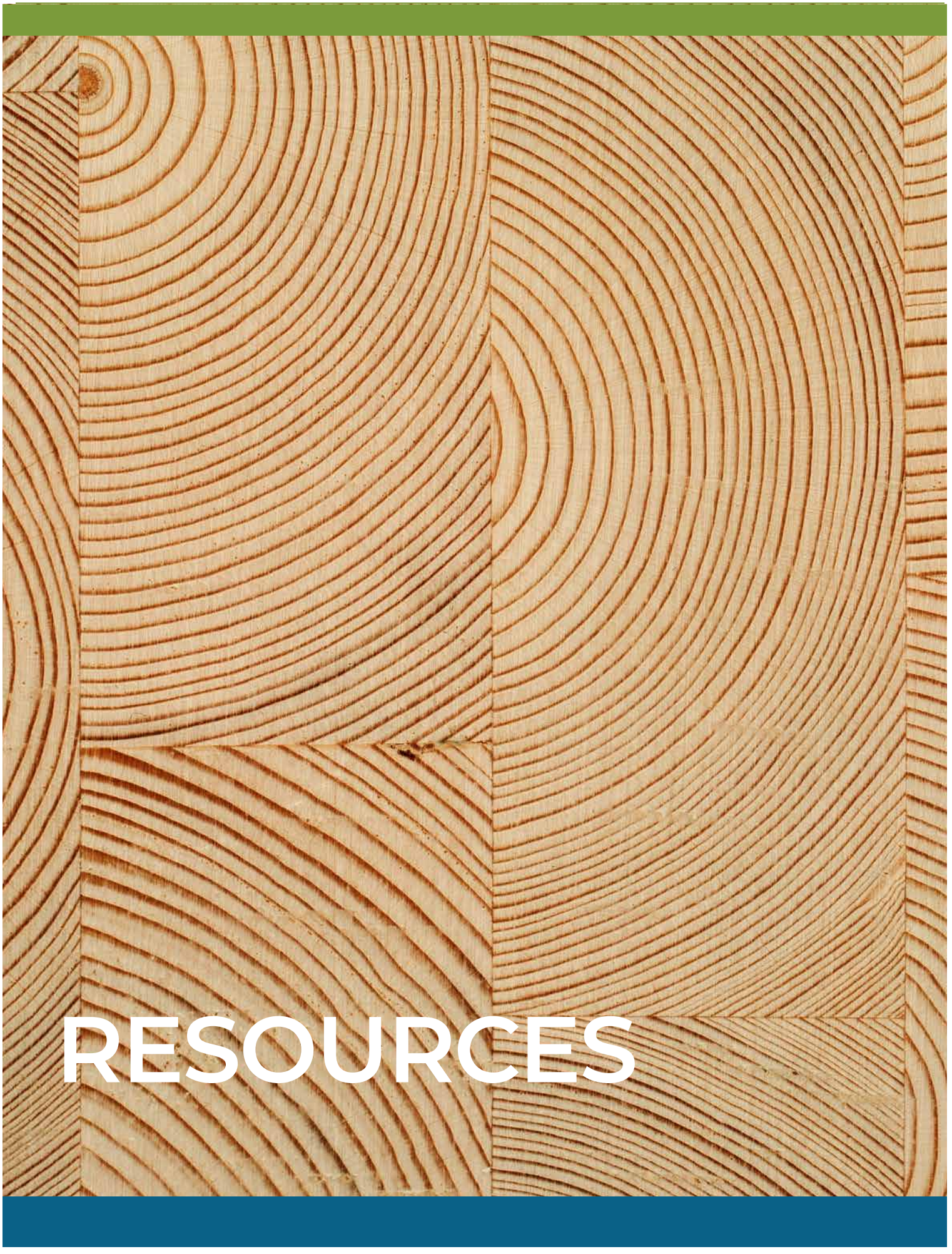
Pros

+ **Direct Impact:** With proper transparency and traceability, this pathway provides a direct method for supporting CSF practices. With full supply chain mapping and source forest disclosure, project teams should be able to point to specific positive outcomes that their projects have supported within specific forests.
+ **Market Transformation:** By asking supply chains for the transparency and traceability needed for this option, project teams can transform the forest products industry in ways that differentiate forest practices, reward CSF, and make transparency requests more accessible for future projects.

Cons & Resolutions

+ **Added Complexity & Cost:** This will generally be the most complicated option for sourcing CSW because identifying CSF operations, winning the cooperation of supply chain actors, and tracing wood products to their source can be a difficult, time-consuming and costly effort.
    - **Resolution:** Seek the support of advisors and consultants familiar with wood supply chains and forest management practices in a particular region.

[17] See discussion of Forest Stock Change Factors in Appendix for an example of one method that can be used to characterize climate impacts within timber supply areas.


RESOURCES

RESOURCES

RESOURCES FOR PROCUREMENT OPTION 1 (URBAN, SALVAGED, RECLAIMED, & RECYCLED WOOD)

Option 1A - Urban or Salvaged Wood

Program / Organization	Geography / Scope	Urban Wood Utilization Focus	Website	Contact info
Arbor Day Foundation — State Urban Forester Directory	United States —National	**Partial** — depending upon the state programming may or may not include urban wood utilization and instate resources	LEARN MORE	Pending
USRW Certified Urban Wood (Urban Salvaged and Reclaimed Woods Inc.)	United States — National	**Primary** — standards, certification and chain-of-custody program for urban, salvaged and reclaimed wood	LEARN MORE	Contact form on website
Urban Wood Network (UWN)	United States — National	**Primary —** dedicated to urban wood utilization, with member directory, chapters and resources for mills, designers and municipalities	LEARN MORE	info@urbanwoodnetwork.org
Vibrant Cities Lab (Urban Wood / Wood Reuse resources)	United States — platform by American Forests and USFS	**Strong —** hosts the Urban Wood Use Action Guide and multiple urban wood reuse case studies and tools	LEARN MORE	Contact form on website
Dovetail Partners (Urban wood research and case studies)	United States — National	**Strong —** multiple reports on urban wood utilization, clusters, awareness and state-level case studies	LEARN MORE	info@dovetailinc.org

Option 1B - Reclaimed or Reused Wood

Program / Organization	Geography / Scope	Reclaimed/Reused Wood Focus	Website	Contact Info
The ReUse People of America (TRP)	United States — multi-state	**Primary** — deconstruction services, lumber recovery, resale yards; long-standing national player	LEARN MORE	info@thereusepeople.org;
Habitat for Humanity — ReStore Network	United States — 900+ locations	**Strong** — large-scale resale of reclaimed building materials including lumber, timbers, furniture, cabinets, fixtures	LEARN MORE	Contact via local ReStore directory
Reuse Alliance	United States	**Strong** — national advocate for reuse economies including building-material and wood reuse	LEARN MORE	info@reusealliance.org
Build Reuse (formerly BMRA)	United States — national	**Primary** — national leader in deconstruction standards, training, policy, and building-material reuse	LEARN MORE	info@buildreuse.org
Association for Preservation Technology (APT)	United States & Canada	**Strong** — historic-building preservation that relies heavily on reclaimed timber and architectural salvage	LEARN MORE	info@apti.org
Rebuilding Center (Portland, OR)	Pacific Northwest (national influence)	**Primary** — deconstruction services, lumber recovery, training; national model	LEARN MORE	info@rebuildingcenter.org;
Lifecycle Building Center (Atlanta, GA)	Georgia (national influence)	**Primary** — reuse center for deconstructed building materials	LEARN MORE	info@lifecyclebuildingcenter.org
Reclaimed Wood Marketplaces (various)	United States — national	**Strong** — online and physical marketplaces for salvaged lumber	LEARN MORE	Varies by listing

Option 1C - Pre-consumer Recycled Wood

Program / Organization	Geography / Scope	Pre-consumer Recycled Wood Focus	Website	Contact Info
Composite Panel Association (CPA)	United States & Canada	**Primary** — Represents manufacturers of particleboard, MDF, and hardboard made from pre-consumer recycled fiber; provides technical standards and industry data	LEARN MORE	info@compositepanel.org
ECC Certification (Eco-Certified Composite)	North America	**Primary** — Certification verifying recycled wood fiber content, responsible sourcing, emissions standards; directly applicable to recycled-content composite panels	LEARN MORE	Via CPA website
mindful MATERIALS Library	United States — National	**Primary for procurement** — Aggregates product transparency labels; includes recycled-content MDF, particleboard, fiberboard, and composite wood manufacturers	LEARN MORE	contact@mindfulmaterials.com
USFS Forest Products Laboratory (FPL)	United States — National	**Strong** — Research and data supporting wood fiber recovery, panel manufacturing, and utilization of mill residuals; useful for technical validation	LEARN MORE	Via site directory
American Wood Council (AWC)	United States — National	**Partial** — Codes, standards, and technical guidelines relevant to specifying engineered wood with recycled fiber	LEARN MORE	info@awc.org
WoodWorks — Wood Products Council	United States — National	**Partial** — Technical support for design teams specifying wood products, including recycled-content panels and non-structural products	LEARN MORE	info@woodworks.org

RESOURCES FOR PROCUREMENT OPTION 2 (CERTIFIED WOOD)

Direct Assistance

FSC US has staff available to assist project teams with specifying and sourcing FSC certified products for construction:

Jonathan Reese
Built Environment Strategic Partnerships
Forest Stewardship Council
Cell: 415-830-2887
Email: j.reese@us.fsc.org

FSC Search

All companies that have FSC Chain-of-Custody certification can be found using **FSC Search.** Note however that just because a company has a CoC certificate does not mean that they actively trade FSC certified wood, or that the wood on offer is FSC certified. Be sure to confirm that products are certified if using this method to identify potential suppliers. Such confirmation is made through checking 'claims' on invoices (e.g., FSC 100%, FSC Mix Credit) and/or on-product labels. See the Option 2 Certified Wood model spec below for more detailed instructions.

CEU Program

FSC has an AIA-approved course for building professionals that offers continuing education units (CEUs), specifically 1 Learning Unit|Health, Safety, and Welfare. This course goes in-depth on the different FSC labels and sourcing.

+ It can be accessed on-demand at no cost through GreenCE.
+ For firm-wide live, remote Lunch & Learn-style presentations, contact Jonathan Reese, above, for scheduling.

RESOURCES FOR PROCUREMENT OPTION 3 (INTENTIONAL SOURCING FROM CLIMATE-SMART FORESTRY OPERATIONS)

Advisors & Consultants

Project teams can seek help in identifying CSF operations and procuring CSW from organizations whose ethics and expertise they trust. On many projects, it may be possible to achieve intentional sourcing goals by working directly with a wood product supplier who is knowledgeable in CSF and procurement options for CSW. When this is not an option, project teams can consider engaging a 'wood advisor' consultancy that is in the business of facilitating intentional wood sourcing. Finally, there are a number of reputable organizations who are not set up to help project teams in the way that wood advisors can, but nevertheless are knowledgeable about CSF practices in different geographies and may be able to suggest particular CSF operations as potential suppliers.

Following are a list of not-for-profit organizations that are broadly aligned with CSWG's goals and values that may be able to provide assistance:

Organization	Geography / Scope	Description	Website	Contact Info
Forest Stewards Guild	United States	The Forest Stewards Guild is a national organization that both practices and promotes science-based, ecological forestry. We have members and staff across the country engaged in all aspects of stewardship from planning with climate in mind through to low-impact logging. Because we work directly with landowners and forest managers, we could help project teams who are interested in intentional wood procurement identify prospective source forestry operations.	**LEARN MORE**	Contact info on website
New England Forestry Foundation	New England	The New England Forestry Foundation (NEFF) is a regional non-profit organization that manages more than 150 community forests and over 160 conservation easements —protecting more than 1.2 million total acres of forestland throughout the region. NEFF also advances forest practices that improve long-term forest health, ecological integrity, carbon storage, and timber productivity of working forests in New England, and works to demonstrate an Exemplary Forestry approach. Drawing on extensive regional expertise, NEFF can outline and provide a spectrum on what good, sustainable, or climate-smart forest management looks like in New England. While NEFF generally does not directly facilitate wood procurement at this time, NEFF staff can serve as a starting place for project teams by offering guidance and connections to regional procurement options.	**LEARN MORE**	Contact form on website
Northwest Natural Resource Group	Washington state	Northwest Natural Resource Group (NNRG) is a regional non-profit organization that promotes and demonstrates the use of ecological forestry in Washington and Oregon, connecting landowners with the knowledge, skills, and resources they need to steward their land. NNRG also holds a Forest Stewardship Council® group certificate through which 75 landowners have enrolled 190,000 acres of forestland in FSC certification. NNRG has modeled approaches to forest management that take the climate into account and consulted on manuals of "climate-informed" forestry for the Pacific Northwest. NNRG staff can offer guidance to project teams for whom the climate implications of wood sourcing is important and connect them with sources of logs across the region, be they managed by its own foresters or by others.	**LEARN MORE**	Contact info on website
Sustainable Northwest	Pacific Northwest	Covering the Pacific Northwest and Intermountain West regions, SNW's Wood Advisor Service provides building owners and project teams with consultation and implementation support surrounding specification criteria, wood sourcing optimization, supply chain transparency, 3rd party chain of custody and forest management verification, and storytelling.	**LEARN MORE**	Contact info on website

The Watershed Research & Training Center	California	The Watershed Research and Training Center (WRTC) started in the early 1990s as a local project to re-train displaced loggers and millworkers on the topic of community-based forest stewardship. Today, WRTC is a vibrant nonprofit, serving the local communities in Trinity County through a full spectrum of forest planning and implementation services, and leads statewide and national initiatives on all aspects of forest resilience while living with fire. Drawing upon our long, trusted relationships across public and private landowners, WRTC can help prospective teams understand more about ecological and climate smart forestry in California and explore options for targeted wood procurement strategies.	**LEARN MORE**	Contact info on website

REGIONAL CRITERIA FOR RESPONSIBLE WOOD SOURCING: NORTH AMERICAN MASS TIMBER BUILDINGS

This study commissioned by Amazon provides a wealth of information about ecological and climate-smart forestry practices specific to regional "timbersheds" across North America. For each timbershed, it provides spectrums for good-better-best harvesting practices and CSF. It also provides an "implementation roadmap" for how project teams can leverage the study to identify CSF operations and procure CSW.

MODEL SPECIFICATIONS

As more firms and project teams commit to CSW sourcing, clear and consistent specification language has become a top priority for CSWG and its partners. To support this need, CSWG is offering drafts for a **Transparency Specification and model procurement specifications** that align with the three CSW **procurement options**. These tools are available for free download and use on potential projects. Each model specification provides designers and specifiers flexible prompts and options to tailor procurement requirements to project goals. They can be used independently or in combination. **In all cases, the Transparency and Procurement specifications are intended to work together**.

Traceability & Transparency

Transparency- and traceability-focused specification with supporting disclosure forms, designed to support the diversity of disclosure objectives that may exist across a project's procurement approach.

Traceability & Transparency Spec

Procurement

1. **Salvaged/Reclaimed/Reused/Recycled Wood Specifications**
   These specifications for Option 1 procurement provide language and requirements tailored to verifying and documenting salvaged, reclaimed, reused and recycled materials that may not flow through a traditional mill. Therefore, prompts call attention to additional drying, storage and pest control requirements.
   Salvaged & Reclaimed Wood Spec

2. **Certified Wood Specifications**
   Specifications for FSC certified wood under Option 2 are the most straightforward and reflect a procurement path in which wood products often pass through traditional supply chains. These specifications outline the documentation requirements that must be fulfilled to verify that material meets certification criteria.
   Certified Wood Spec

3. **Intentional Sourcing Specifications**
   Option 3 procurement prefers particular land ownership and/or management models while still procuring wood through typical mills and supply chains. These specifications support project teams in identifying and securing documentation of lands and supply chains that meet intentional sourcing goals. The specific criteria will vary widely but generally fall into three categories that must be defined: ownership and/or management definitions; documentation required to prove a wood source meets these definitions; and a directory indicating potential starting points for the supply chain. Sample model specifications for Option 3 are not comprehensive, but may be modified to meet specific project needs.
   Forest Restoration Wood Spec

   Land Trust Wood Spec

CASE STUDIES

Following are several case studies that represent a variety of approaches and lessons learned in climate-smart wood sourcing.. Additional information is available in the **Knowledge Hub.**

Meyer Memorial Trust Headquarters

+ Sourcing criteria adopted to optimize economic, social and environmental outcomes
+ 3 tiers of acceptable traceability in wood supply & associated tolerance for cost premium
+ 12 wood products: 12 sourced from regional forests; 6 from minority-owned business;[7] from small businesses; 9 support ecological forest management.
+ **View Website**

Oregon State University Ray Hall

+ Complete supply chain mapping of Glulam and CLT
+ Wood sourced from ecological forestry on Yakama Nation and Colville National Forest

+ Local jobs and rural economies supported through logging and milling infrastructure
+ **View Website**

Port of Portland, PDX Airport Main Terminal Expansion

+ 600,000 board feet of timbers segregated and directly tracked back to forest of origin (Disclosure Level 3)
+ 1.5 million board feet of 2x8” lamstock traced to forest of origin through 3rd party credit disclosure (Disclosure Level 3)
+ 400,000 board feet of 2x8” lamstock with simple log purchase disclosure from both vertically integrated and non-vertically integrated mills (Disclosure Level 3)
+ 700,000 sq. ft. of mass plywood tracked back to forest of origin by landowner type (Disclosure Level 2)
+ Wood sources include (but not limited to): 3 PNW Tribes and Tribal Nations, small family forests, and non-profits like the Nature Conservancy
+ **Supply Chain Story & Map**
+ **1.5 Hour presentation on Sourcing Story and Transparency**
+ **View Website**

PROJECT PHASES

PROJECT PHASES

OVERVIEW

CSWG has collaborated with its technical partners to produce guidance about how to get better options and results sourcing climate-smart wood at each major project phase.

Owners and project teams have numerous potential motivations to use CSW in construction, including project ESG goals, improved tenant experience, and pro forma cost benefit, among others. The key is early engagement with project leadership and finding suppliers and/or other partners who can provide timely and accurate market knowledge, secure any documentation needed to validate claims about "climate smartness," and ensure that wood products delivered meet expectations.

Climate Smart Wood Isn't Just for Structural Elements

While much of the buzz around CSW centers on mass timber, it is important to remember that **there are many more opportunities to incorporate CSW procurement in a project beyond the structural system or other mass timber components**. Oftentimes, the nonstructural wood elements of a design are easier to source creatively since they are not as beholden to structural or code performance parameters. **Do not overlook CSW sourcing opportunities for interiors, custom furniture, envelope systems, or landscape elements as these can serve as another engaging touchpoint in addition to structural systems for owners and their tenants.**

What if my Project is Already in Progress?

It's also understood that it may be challenging for project teams to strive for CSW if their project is already well underway. Even in those situations, consider implementing retroactive traceability to gain an understanding of where the project's wood is actually coming from. Although not as ideal as proactive intentional sourcing, these kinds of activities can still be a useful first step for project teams as they move toward incorporating CSW into their practice.

DELIVERING MASS TIMBER STRUCTURES USING CLIMATE SMART WOOD

Buildings that are designed to be built out of mass timber represent significant volumes of wood and potentially major impacts for the forests it is sourced from. Mass timber itself requires early engagement and careful timing when it comes to delivery. Procuring these elements with CSW requires an added level of rigor, but the pay-off for both the building's story and the forests and people supplying the material can be extraordinary.

Projects that are considering mass timber as a structural system typically make a commitment to proceed at three different stages. In turn, these stages inform how CSW criteria can be applied:

+ **Day one of design:** A project that is committed to mass timber from day one provides the best timeline and opportunity to engage with the supply chain in order to secure CSW.

+ **At the end of Conceptual Design or early in Schematic Design:** This scenario may involve comparison between a mass timber system and alternative systems such as concrete or steel. Here, presenting the potential for climate benefits associated with CSW sourcing can inform structural option comparisons and material selection.
+ **Near the end of the Design Development phase:** By this point, most projects have committed fully to mass timber, but the final selections of suppliers may still be up in the air. This often represents that last moment where sourcing criteria can be applied before commitments must be made so that procurement can begin.

A more detailed set of project phases (aligned primarily around mass timber projects) has been itemized below that will look familiar to design and construction teams. Within each phase, guidance has been provided to help implement intentional sourcing of CSW.

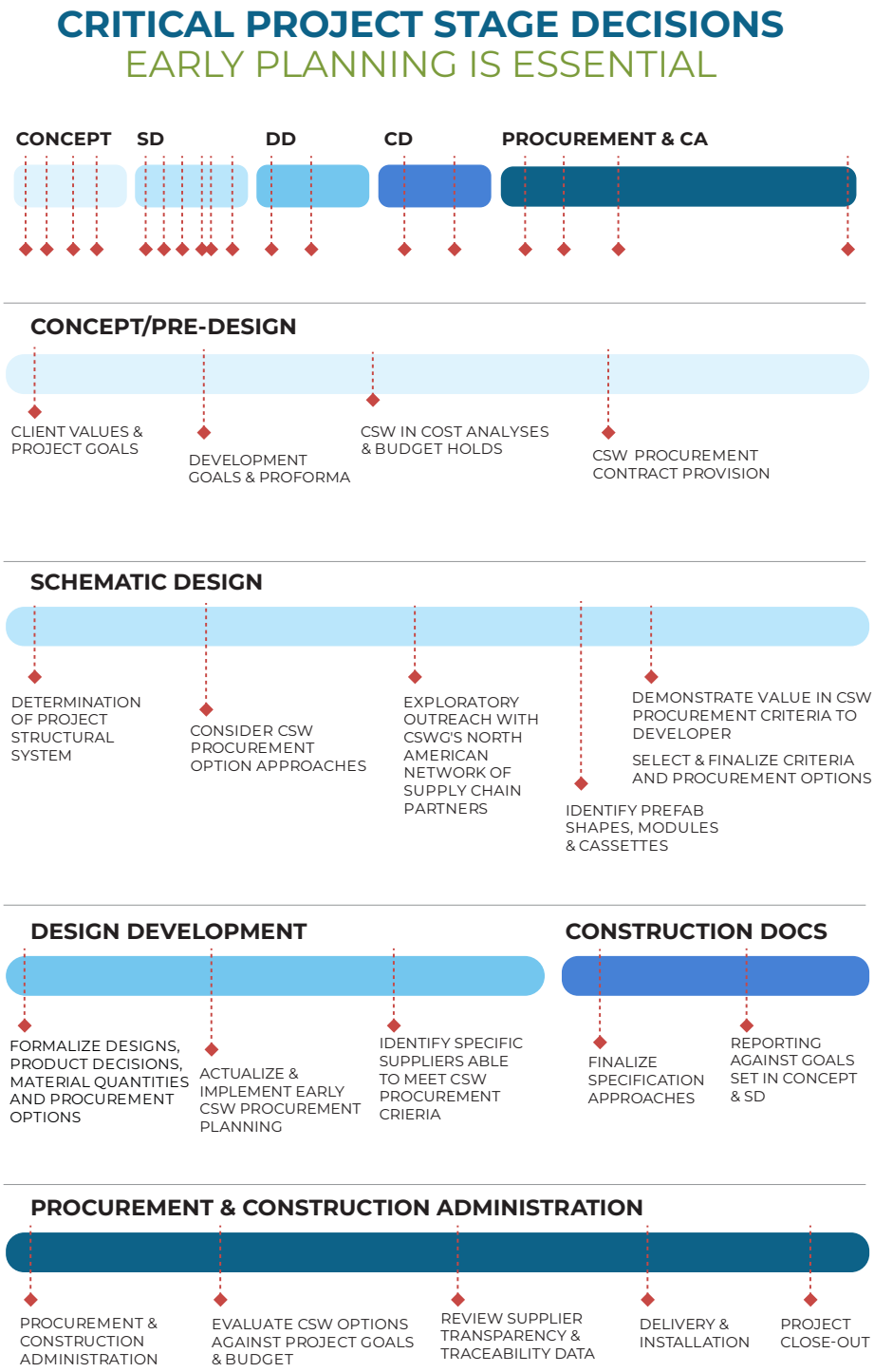
Of course, these phases can look a bit different depending on the project type and the contract delivery method being used. For instance, there may be inherent tensions within traditional delivery methods (especially in design-bid-build arrangements) where the final specification for timber elements are not released until sometime during or after the Construction Document (CD) phase. If the scope is bid from the final construction documents without earlier work to explore sourcing options with prospective CSW suppliers, then opportunities to secure the best set of outcomes may be lost.

Most mass timber projects, and especially those that are engaged in sourcing CSW, benefit from more collaborative construction delivery methods such as Construction Manager - General Contractor (CM-GC) or Design-Build (DB) delivery that engage the contractor and supply chain much earlier in the design and procurement process.

CRITICAL PROJECT STAGE DECISIONS

Regardless of the project delivery method, early goal setting and buy-in is essential ahead of formally beginning procurement in order to mitigate potential cost premiums, material availability challenges, and schedule constraints.

Figure 4.



PRE-DESIGN/CONCEPTUAL DESIGN/FEASIBILITY

In the earliest stages of a project, high level decisions are made with implications for later design and procurement options, each tied to performance goals and project pricing. **Early goal-setting exercises can be a great place to introduce the value of using climate smart wood.** For example:

+ Reduced embodied carbon (Scope 3) emissions attributable to wood vs. other structural systems may be valued within the Owner's organizational governance (such as ESG policies). CSW takes this a step further, by optimizing wood sourced from forests that are practicing CSF. Managing forests in ways that increase forest carbon stores over BAU means that the timber coming from those forests has a relatively lower carbon footprint (see **Carbon Considerations**).
+ Alignment with broader building certifications. LEED v5 and the Living Building Challenge are continuing to evolve their guidance around responsible wood sourcing, and adopting CSW intentions can synergize well with their credits and imperatives.
+ And perhaps most relevant, the value that sourcing CSW can have on the forests of origin and their surrounding communities. This can include sourcing wood from thinning projects that improve a forest's resilience to devastating wildfire, and/or it could help to bring much-needed economic development to communities that rely heavily on timber sales. All of these potential positive impacts set the stage for project storytelling that can inspire the owners, users, and communities in which these buildings are being built.

Recommendations

In the pre-design/conceptual design phase, multiple options will be on the table and specific material choices will rarely be fully defined.

CSWG recommends that the owner and project team review the CSWG **Climate Smart Forestry definition**, **Transparency & Traceability**, **Procurement Options** and **Case Studies** as part of a process to clarify values and establish high-level project goals that will guide future decision-making. Early engagement with suppliers and contractors can be useful, however it's often too early to gain serious traction on procurement pathways.

Prior to publishing a conceptual budget, project teams should introduce the principles of CSW with the ownership team. Many in the industry may have preconceived notions regarding cost premiums associated with CSW sourcing efforts. **It is important to unpack Traceability and Procurement Options early so that these decisions, benefits, and potential cost premiums can be incorporated into early estimates and decision matrices.**

The Owner and broader project team should consider:

+ What are the values being prioritized with a more intentional sourcing approach?
+ Can a building with a high level of CSW command higher rent/sale value/return on investment?
+ Can CSW sourcing aid in defining and prioritizing project ESG goals, such as by engaging local minority- or women-owned businesses?
+ Are standard pro forma assumptions the most appropriate?
+ How much will Traceability be invested into the Design and Construction processes? Is connecting all the way back to Forests of Origin a priority for the project?
+ If a high degree of supply chain engagement is desired, and if the project is seeking to pursue Level 3 Transparency, consider hiring a Wood Advisor onto the team. They can be hired directly by the Owner, Architect, or Contractor. In some cases, it can make sense to have the Wood Advisor begin under the Design Team to help identify sourcing options, and then initiate a new contract with the Construction Team during construction to assist with validation and verification. Alternatively, engaging with a manufacturer early in the design decision-making process may provide sufficient insights toward meeting project goals.

SCHEMATIC DESIGN

Schematic Design (SD) is the phase where the CSW Procurement Options discussed in this guide come into sharper focus. **As the approximate quantity and type of wood products begin to be identified, this is an opportunity to move from sourcing concepts to commitments.** Potential wood criteria/metrics could include any number of elements from the **CSF definition** that align with the project's goals, for example:

+ Reclaimed or urban-salvaged wood
+ Certified wood
+ Locally or tribally produced wood
+ Forestry practices that are above business-as-usual and regulatory baselines
+ Ecologically restorative forestry
+ Wood with a transparent, traceable embodied carbon benefit

Preliminary conversations with trade partners should begin and evolve through SD to ensure that project goals can be evaluated in an informed manner.

+ Revisit and validate sustainability goals developed during the Conceptual Design process.
+ Is virgin or recycled/reclaimed/salvaged wood preferable? Is there an available source of reclaimed wood that meets the structural and architectural design criteria?
+ If virgin wood will be used, which pathway is right for the project? Identify suppliers and vendors to target any previously established goals of engagement of local businesses, woman- or minority-owned businesses, tribal operations, etc.
+ Begin outline specification or preliminary project description of wood scope and procurement options.

+ If a General Contractor (GC) has come aboard, begin to map potential sourcing pathways and develop opportunities and constraints around these options. This can include potential manufacturers or even specific landowners if project goals are aligned in that manner. Tracking cost, schedule, embodied carbon (and other sustainability metrics), and risk implications of procurement pathways allows the project team to find the best approach to achieve the overall project goals.

Recommendations

Although the SD phase can be the most impactful in terms of making decisions that will set the course for the project, it's also important to recognize that both Owners and General Contractors will tend to want to manage cost exposure and risk by keeping options open.

Given this reality, project teams should continue to seek clarity around some of these considerations that can influence cost and risk:

+ Will this intentional sourcing effort require segregated milling that might come at a premium from the mill(s)or manufacturer?
+ If traceability is a priority, how will disclosure be documented? Does the Design Team or Construction Team require additional fees to help administer higher degrees of supply chain engagement?
+ Should any budgetary holds, allowances, and/or contingencies be incorporated to hedge against potential premiums associated with procuring CSW?
+ Creating a plan for maintaining financial commitment to CSW procurement as the project progresses.
+ As the project proceeds into later stages of design and the CSW pathways for the project are selected, develop agreement on how any unused allowances will be distributed back into the project or realized as savings for the Owner.
+ Establishing a contractual provision between the General Contractor and Owner that expresses a mutual expectation of at least exploring CSW sourcing options and considering these factors in material selection and procurement.
+ Is the Owner interested in leveraging its investment in CSW for project storytelling and marketing, which may also require paying for additional services or hiring additional consultants?

While some studies will continue to be vetted into Design Development (DD), the end of SD typically coincides with clarity on large scope items such as the preferred framing schemes, species of wood, and often some initial thoughts on procurement pathway(s).

DESIGN DEVELOPMENT

As schematics formalize into designs, product decisions, material quantities and priority procurement options come into focus. **This is the stage where planning and intention for sourcing CSW can be locked into construction and scheduling plans through:**

+ Design refinement optimization, benchmarking.
+ Assessing sustainability goals considering current design and budget.
+ Gathering information and timelines from suppliers. Building relationships with suppliers is often critical to obtaining good information at critical decision points in procurement (must be done by early DD, however it's best to start relationships during SD).
+ Constructability reviews which assess strategies for transportation, erection, and installation.

The end of DD typically coincides with "locking" of the geometry, size and location of the vast majority of structural and architectural elements, including mass timber, in the project. This also means that sourcing should also largely be locked down. To do this requires concerted decision-making from the Owner, Design Team, and Construction Team.

Recommendations

A firm commitment to a specific CSW path that has been developed throughout earlier project phases is ideally made at this time. Once the plan is in place, the next step is to implement that plan.

Some projects arrive at this stage without having considered CSW sourcing as a fundamental goal. If that is the case, **the project team should review general options for** CSW characteristics, **Traceability & Transparency**, **and Procurement Options to gain a stronger footing in what may still be possible and meaningful at this stage of the project.**

PROCUREMENT

As projects go out for competitive proposals, criteria established at the concept, SD and DD decision points will be instrumental for communicating project goals and priorities to potential trade partners. Procurement goals may be both signaled and vetted by:

+ Collecting data from potential trade partners and comparing against established criteria/metrics.
+ Awarding contracts, considering cost and other CSW quantifiable criteria. Utilizing a weighted scoring system that assesses this data against the project goals is one way to establish a trade partner selection criterion.
+ Of course, relationships that have been cultivated earlier in the project may also mean direct awards because of specific outcomes they're able to point to that directly aligns with project goals.

Recommendations

Wood procurement typically occurs concurrently with the end of the **Design Development** or early **Construction Documents** phase, though different timelines apply depending on contract delivery method and project timeline. **A procurement commitment to CSW mass timber will likely need to be made on the order of 8 months prior to the start of erection of mass timber (depending on overall quantity of material being procured and level of disclosure being targeted)**. A procurement commitment to CSW for sawn lumber (ex. stick-built applications), interior or landscape elements can potentially be made later in the project timeline, but it is important to keep procurement goals in mind when making vendor selections.

Early involvement from the general contractor, and/or a CSW advisor, as well as the manufacturer/supplier, allows project teams to maintain a connection to the upstream supply side of procurement - potentially even learning when wood is being harvested in the forest. Staying this connected can be inspirational for the broader project team and helps to set up storytelling potential that the broader community may find interesting.

This early involvement is often made possible by collaborative contract delivery methods such as Design-Build and CM-GC. It is less possible in a more traditional design-bid-build arrangement where the general contractor (and all of their subcontractors) must bid on the construction documents of the project, meaning engagement doesn't even begin until right at the end of design. Although this is a real challenge, and can be common with public projects, the design team can mitigate the potential obstacles by engaging with the supply chain on their own throughout the design phases. There are risks that the prevailing construction team may have a very different sourcing strategy in mind, but if the groundwork has been laid and the specifications are clear with intention, projects can still successfully source CSW.

CONSTRUCTION DOCUMENTS

Unless the project is a design-bid-build, most of the critical decisions have already been made by this stage, with coordination focusing more on detailing and preparation for permitting. If intentional sourcing specifications and/or disclosure forms have not yet been issued to steer procurement, this is the last responsible moment to ensure they are incorporated into the project manual (a.k.a. specifications). **Options for procuring CSW through any of the procurement pathways for nonstructural and interior finish elements may still exist going into the construction document phase and should be considered.**

If the project is being delivered as design-bid-build, or if procurement is waiting until construction documents are published (not recommended), then this is a critical time for the design team to be sure the specifications are clear and specific, while remaining flexible. Specifications that are too exacting around particular sources, or particular parameters, run the risk of higher cost premiums and/or potential for the construction team to propose substitutions that may or may not align with CSW goals. Imbuing a design-bid-build specification with some degree of flexibility that provides optionality for achieving CSW can enable construction teams to find innovative ways to meet project goals while striving to produce their most competitive bid.

CONSTRUCTION

The construction phase represents the last moment of validation on sourcing prior to installation. This is the period where submittals are issued from the construction team to the design and owner teams to demonstrate that sourcing has followed the construction documents.

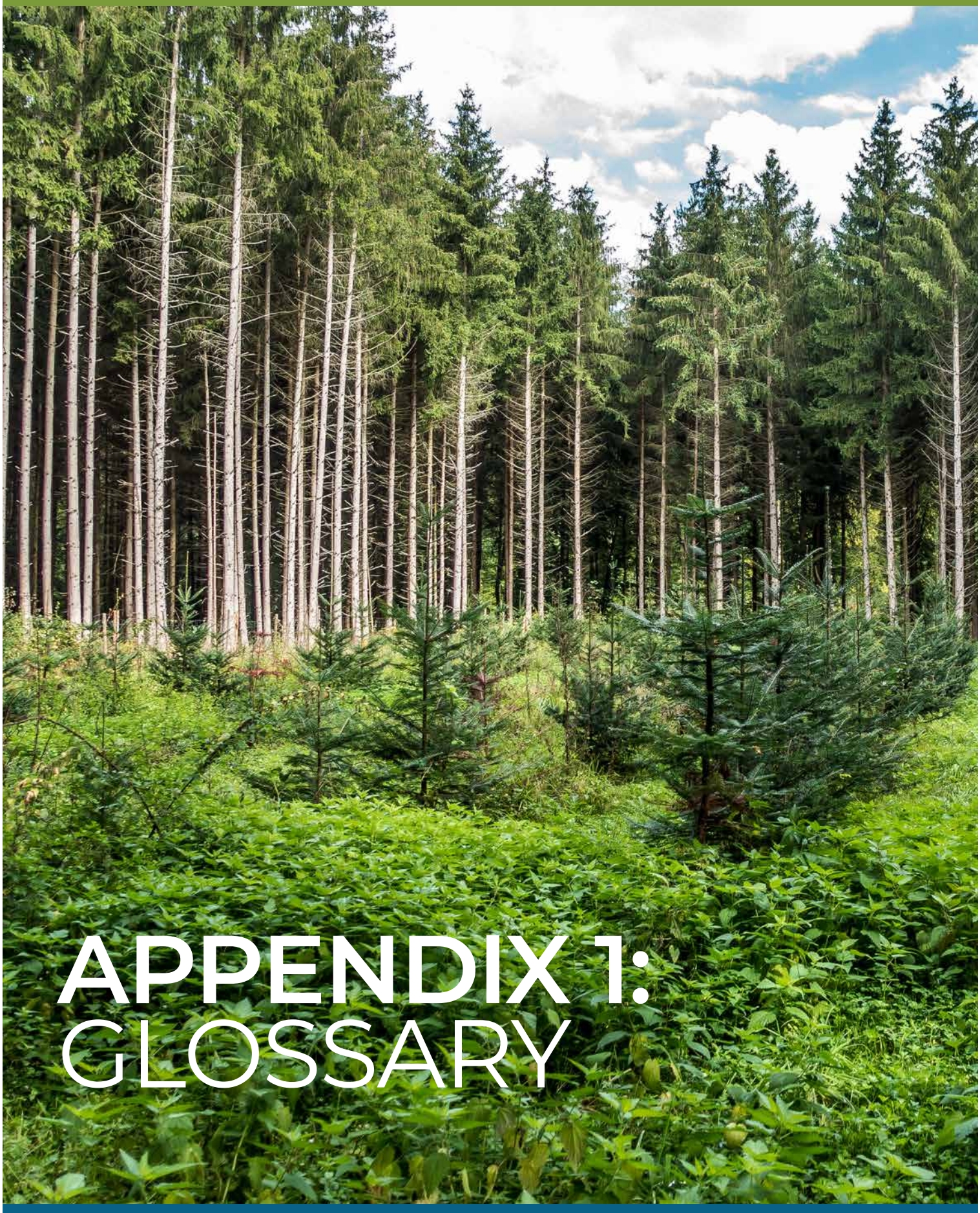
During these reviews, teams should be ensuring that the disclosures provided in the applicable submittals align with the levels of transparency previously agreed to and documented within the project's specifications. This may require reviewing completed disclosure forms or chain-of-custody documentation, as well as confirming that applicable certifications are noted.

This is the time when project teams must be prepared to pivot if previously agreed-to sources are no longer available (such as a selected forest being subjected to unpredictable wildfire), which is rare but has occurred. Similarly, substitution requests may be proposed by the installing subcontractor if they believe that a substituted wood product can meet or exceed the contract's expectations, which could include intentional sourcing goals. Project teams will need to evaluate these potential deviations in real time and should rely on partners, such as wood advisors if they are part of the project team, to validate if any changes are justified.

PROJECT CLOSE-OUT

The end of a project is a chance to clarify what stories might want to be elevated and woven into the broader tapestry of a project's origin story. Are there climate smart attributes that are worth highlighting? Can sourcing pathways be graphically represented into a supply chain map that may be useful for future projects to follow? Are there communities or specific landowners that may want to contribute aspects of their own stories into the broader project story?

Closing out a project has a myriad of lingering loose-ends to wrap up and documentation to chase down. Often teams are excited to move onto their next project, but it's important to remember that documenting what was learned and what might be possible on the next project is extremely valuable both to the organizations that compose the project team, but more broadly to other teams within the industry as well. It's the accumulation and dissemination of these stories and lessons learned that can manifest true market transformation toward utilizing more climate smart wood.



APPENDIX 1: GLOSSARY

APPENDIX 1: GLOSSARY

GLOSSARY - CLIMATE SMART WOOD PROCUREMENT

AEC (Architecture, Engineering, and Construction)
A professional sector involved in designing, engineering, and constructing buildings and infrastructure. Delegated Designers are often a further subset, working on behalf of the Architect or Engineer(s), despite their design contract being held by the Contractor.

Above Business-As-Usual (BAU)
Forest practices or policies that exceed the legal or conventional baseline, offering enhanced climate, ecological, or community outcomes.

Chain of Custody (CoC)
In forest certification systems (e.g., FSC, SFI) CoC certification governs the handling and processing of certified materials within and transactions of certified products between companies. Companies' implementation of these requirements is verified through annual audits.

Climate Smart Forestry (CSF)
Forest management practices that aim to mitigate and adapt to climate change while supporting equity. This includes increased carbon sequestration and storage, maintenance or restoration of ecological resilience and biodiversity, and support for local or Indigenous communities.

Climate Smart Wood (CSW)
Recycled, reclaimed, salvaged and reused wood, as well as virgin wood from CSF operations that is FSC certified or non-certified wood that is verified through traceability and/or transparency.

Construction Manager - General Contractor (CM-GC)
A construction contract delivery method in which the General Contractor is hired by the Building Owner relatively early in the design process to assist the Design Team (which is also contracted directly to the Owner in parallel). Having early contractor engagement often enables earlier decision-making around cost, procurement strategies, and constructability.

Controlled Wood

Within Forest Stewardship Council (FSC) certification, a term referring to non-certified wood that can be combined with FSC-certified wood in the manufacture of FSC Mix products. Although Controlled Wood does not come from certified forests, in order to designate material as such, companies must meet FSC's requirements for assessing and mitigating the risk of it coming from controversial sources (e.g., illegally harvested timber, timber harvested in violation of human/worker rights, and/or timber from forest where high conservation values are threatened).

Credit or Mass Balance System
A method that allows certified and non-certified material or CSF and non-CSF material to be mixed, so long as the total volume of certified/CSF input equals or exceeds the certified/CSF product output over time. Less precise than segregation but easier to implement.

Design Phases
Across the development of a project, there are often defined design phases (generally accepted by the industry, as well as articulated by some institutions such as the American Institute of Architects and Construction Specification Institute) that establish the level of detail in a design. These are often

expressed by initials:

- **SD = Schematic Design,** which establishes scope and general arrangement of design elements. This is most often executed with floor plans, reflected ceiling plans, exterior building elevations, and potentially 3D views such as axonometrics and/or perspectives. Often building upon any work done before in a concept or pre-development phase of work.
- **DD = Design Development,** which is the phase when materials are most often specified for the first time. Additional drawings are developed at this stage, including interior elevations, various schedules for finishes and hardware, and key details.
- **CD = Construction Documents,** which represents the documentation of all necessary elements to construct the building, i.e. the Issued For Construction (IFC) set. Sometimes the culmination of this phase represents a milestone for establishing a project's contract price and/or represents the Issued for Permit (IFP) set. However both contract pricing and permitting may occur earlier in the design phases.

Design-Bid-Build
A construction contract delivery method in which the General Contractor is not awarded a contract until the design phase is nearly complete, often competing for the contract through a bidding process. This method is still common on public institutional projects, and yet it has many shortcomings because it means no early contractor engagement during the design phase. This can hinder supply chain engagement, because much of it doesn't happen until the contractor is onboard.

Design-Build
A construction contract delivery method in which the General Contractor is hired at the beginning of a project by the Building Owner, with the Design Team subcontracted under the General Contractor rather than direct to the Owner. This method is favored on complex projects, and those in which speed is prioritized. Note that many public institutions do not yet entertain the Design-Build delivery method, preferring Design-Bid-Build or CM-GC instead.

Design for Manufacture and Assembly (DfMA)
A process that optimizes the design of building components for efficient fabrication and installation, often applied in mass timber construction.

Embodied Carbon
The total greenhouse gas emissions associated with the extraction, production, transportation, and construction of building materials.

EPD (Environmental Product Declaration)
A standardized, third-party-verified report detailing the environmental impacts of a product over its life cycle. EPDs are based on LCA but typically exclude carbon stock changes in forests.

Forest Management Unit (FMU)
A defined area of forest managed under a specific plan or by a specific entity. The ideal unit for traceable forest-level sustainability or carbon impact assessments.

Forest Stewardship Council (FSC)
A third-party forest certification system recognized for strong ecological and social standards. Includes chain-of-custody and forest management standards.

GIS (Geographic Information Systems)
Mapping technology used to spatially track and manage tree removals, log locations, and forest data. Useful in urban wood traceability.

LCA (Life Cycle Assessment)
A method to assess the environmental impacts of a product or system throughout its entire life cycle, from raw material extraction to disposal.

Levels of Disclosure
See **Source Forest Disclosure** within the Traceability & Transparency section for detailed descriptions of each level of disclosure. Refer to Supply Chain Tiers below for more information regarding how these levels relate to broader supply chain transparency.

Mass Timber
A category of engineered wood products like CLT (cross-laminated timber) or glulam used in structural building systems.

Procurement Options (CSWG)
Three primary sourcing pathways defined by CSWG:

- Salvaged, Reclaimed, Reused or Recycled Wood
- Certified Wood
- Intentional Sourcing from Climate-Smart Forestry Operations

Segregation (in supply chains)
Keeping wood products from a specific source physically separate throughout processing and distribution to maintain traceability.

Stock Change Factor (Forest Carbon Stock Change Factor)
A metric that quantifies the net change in carbon stored in a forest over time, used to assess the climate impact of timber production in a specific area.

Supply Chain Tiers
This terminology describes the tiers within a supply chain, reaching back from the seller to the end customer to the original raw material extraction and development. This use of the term and concept of supply chain "tiers" is widespread, reaching well beyond wood products, and has influenced the development of traceability and disclosure in this guide. Tier 1 is the immediate supplier to a company, Tier 2 is their supplier(s), Tier 3 is those suppliers' suppliers, and so forth up to the raw material origin.

Traceability
The ability to track a product or material through the supply chain back to or forward from its forest or recovery origin. Can be achieved via documentation, technology, or segregation.

Transparency
Disclosure of information about the origin and journey of wood materials through the supply chain.

Urban & Salvaged Wood
Wood recovered from non-timber removals, such as dead or hazard trees, urban development, storm damage, or infrastructure upgrades. Often sourced from cities, counties, universities, or institutional lands.

USRW (Urban Salvaged and Reclaimed Wood) Certification
A certification program specific to urban and salvaged wood, verifying origin, environmental handling, and chain-of-custody for non-traditional wood sources.

GLOSSARY OF STAKEHOLDERS IN CLIMATE SMART WOOD PROCUREMENT

Project Owners / Developers
Initiate and oversee building projects. Set project-level priorities around carbon, transparency, equity, and procurement. Includes private developers, public institutions, real estate trusts, and commercial property managers.

Building Owners (Private, Institutional, Public)
Hold long-term interest in building performance, embodied carbon, and social outcomes. They influence decisions around certifications, traceability, reuse strategies, and post-construction reporting. Can be key champions of CSW principles in renovations and adaptive reuse.

Design Teams (AEC Professionals)
Architects, engineers, and consultants who specify materials and design structures. Their early involvement is critical for embedding traceable and climate smart wood into drawings, schedules, and bid documents.

General Contractors / Construction Managers (GCs/CMs)
Translate specifications into procurement actions and manage construction workflows. Their awareness of CSW sourcing, traceability protocols, and material handling can make or break implementation on the ground.

Mass Timber Manufacturers / Secondary Fabricators
Produce engineered products like CLT, glulam, and nail laminated timber. Often source lumber from multiple suppliers. Their batching and inventory systems greatly affect transparency and origin traceability.

Primary Manufacturers or Mills
Convert logs into one of three primary products: lumber, veneer or chips. Mills often source from a mix of suppliers, which can dilute traceability unless specific segregation protocols or tagging systems are used.

Secondary Manufacturers
Manufacturers that process primary products into any of a number of value-added products — e.g., flooring, plywood, mouldings, doors, windows, lamstock, mass timber. This can also include services like kiln-drying and surfacing lumber that is in the rough.

Tertiary Manufacturers / Fabricators
Manufacturers and millworkers that are located down the value chain from secondary manufacturers, closer to the end user. Examples include furniture manufacturers, cabinet makers, architectural millworkers, and mass timber fabricators.

Urban Wood Processors / Municipal Log Yards / Small Mills
Handle wood from urban tree removals, storm events, or deconstruction. These operators typically maintain high levels of traceability and may operate under USRW certification or similar recovery guidelines. Often serve local markets and prioritize non-timber wood utilization.

Distributors / Brokers / Material Resellers
Act as intermediaries between companies at successive stages of manufacturing and end users. While they can offer convenience and cost savings, they may mix material from different sources, which can obscure origin data unless traceability practices are maintained.

Landowners (Public, Tribal, Private, Industrial, Institutional)
Own the forests or landscapes from which wood originates. Includes

+ Public: Cities, counties, state agencies, federal land managers
+ Tribal: Indigenous sovereign nations
+ Private: Family woodlots and smallholders
+ Industrial: Large-scale timber firms and real estate investment trusts
+ Institutional: Universities, utilities, land trusts. Landowners' forest management choices directly impact the carbon, ecological, and social characteristics of the resulting wood products.

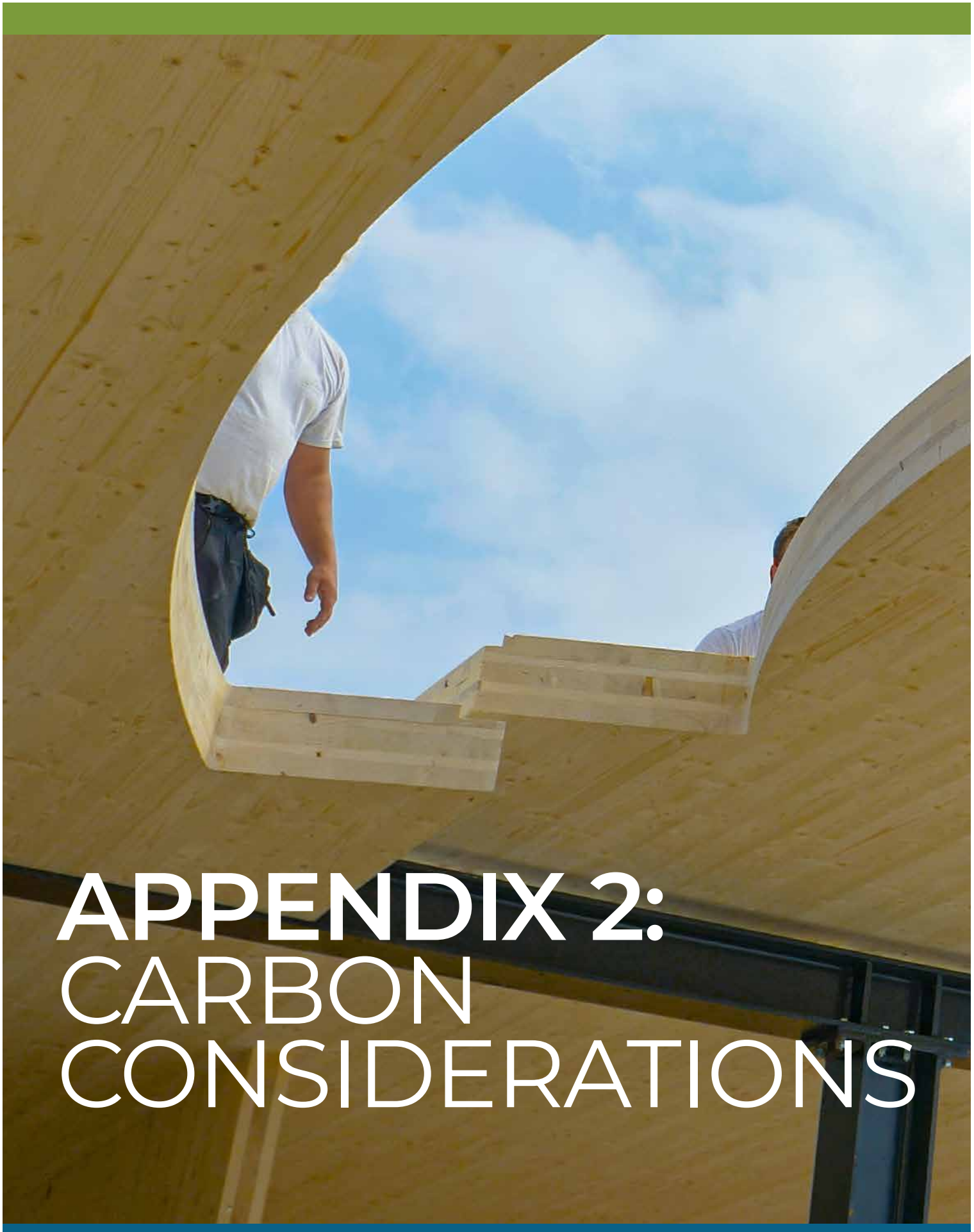
Urban Salvaged & Reclaimed Wood (USRW) Certified Entities
Certified through the Urban Salvaged and Reclaimed Wood standard. These processors or handlers document tree origin, legality, recovery method, and product characteristics. Certification ensures traceability, climate impact tracking, and alignment with circular economy goals.

CSW Advisors / Technical Consultants
Provide expert guidance on climate smart wood sourcing, carbon impact review, traceability implementation, and specification development. Help bridge the gap between procurement guidance and real-world supply chains.

Certification Systems (FSC, SFI, USRW, etc.)
Standards-setting bodies for verification via third-party audits of sustainable forestry practices, chain of custody of certified products, and/or salvaged and recycled wood recovery processes. Each varies in scope, rigor, and traceability. FSC is often cited as having the strongest alignment with climate smart forestry principles while USRW focuses on urban and reclaimed sources.

Academic / Research Institutions
Advance scientific understanding of carbon impacts, forest practices, material flows, and ecosystem services. Can serve as validators, carbon modelers, or collaborators in CSW pilot programs and data standardization.

Government Agencies / Regulators
Set policy, building codes, procurement standards, and environmental criteria. May also manage publicly owned forests or urban tree assets. Their involvement is crucial to enabling procurement of local climate aligned wood.



APPENDIX 2: CARBON CONSIDERATIONS

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As green builders seek to decarbonize the built environment, many project teams are establishing ambitious embodied-carbon goals. Wood has become an attractive material for its biobased/biophilic and perceived carbon benefits. However, for reasons detailed below, current practice can make it difficult to know the true climate profile of wood products. This said, innovative methods are emerging to overcome this challenge.

LCA & EPDS

Understanding the utility and limitations of Life Cycle Assessment (LCA) and Environmental Product Declarations (EPDs) for wood products is fundamental. LCA is a method for quantifying the environmental impacts of a product or an entire building project throughout its life cycle. During the design and procurement process, EPDs are increasingly used to gather data on specific products as a basis for considering and comparing different materials, for different suppliers of the same material, and to run calculations for Whole Building LCAs.

EPDs are independently verified documents that report on a range of environmental impacts estimated by an LCA study, including global warming potential, acidification, eutrophication, and others. When LCA studies are conducted for individual companies or supply chains and the results are reported in product-specific EPDs, it is possible to compare the carbon footprint of competing products of the same type and/or that of different materials that can be used for the same purpose. This allows specifiers and purchasers to select the product that has less negative environmental impacts and feed that information into Whole Building LCAs in pursuit of reducing a building's overall embodied carbon.

Why then doesn't CSWG's guidance include LCAs and EPDs as a procurement option for CSW?

The answer is that while they can be used to compare emissions associated with manufacturing and transporting a product, contemporary EPDs do not meaningfully capture nor convey the "climate smartness" of wood products because net emissions or removals associated with observable changes in forests due to management practices **are not accounted for** in the underlying LCA models. In other words, **current LCA methods used in the forest sector do not account for readily observed changes in forest carbon stocks resulting from forest management activities across managed landscapes over time.** The magnitude of these changes can dramatically increase or reduce the true carbon benefit or burden attributable to a wood product.[1]

Instead, nearly all North American (and European) wood EPDs adopt the **"biogenic carbon neutrality assumption"** which assumes carbon gains from forest regrowth in a managed forest are exactly equal to the amount of carbon emitted from soils, logging slash (branches, leaves and needles), and roots through decay or burning post-harvest, as well as emissions resulting from the conversion of logs into finished wood products.[2] This assumption is often invoked so that emissions of "biogenic carbon" that occur during the processing of logs into finished products can be conservatively ignored.[3]

According to the international standards that govern LCAs and EPDs, the biogenic carbon neutrality assumption can be invoked if forests are "sustainably managed" under 3rd party certification or through national-scale reporting under the United Nations Framework Convention on Climate Change (UNFCCC). **In the latter case, the assumption rests on estimates that overall forest carbon stocks—or forest area—at a national level are stable or increasing, including both actively managed and unmanaged forestland (including protected areas)**[4].

This obscures the critical underlying reality that no managed forest is exactly carbon neutral. Through the lens of LCA, wood products from forests that represent a wide variety of management practices and starting conditions[5] are treated the same — the only differences captured are in emissions resulting from a given company's use of energy and fossil fuels in timber harvest and downstream manufacturing and transportation. **Yet, the carbon benefit of CSF can easily outweigh all these other factors combined. In other words, current LCAs and EPDs for wood provide no advantage to companies that practice or source wood from CSF, and thus they have limited relevance in CSWG's procurement guidance.**

LCAs and product-specific EPDs for materials other than wood promote internal competition among companies within the industry in question to reduce their net emissions. However, the assumption of forest carbon neutrality blunts this effect in the forest products industry.

Research on improving standards for forest product LCA and corporate greenhouse gas reporting more generally to address this blind spot is underway. CSWG guidance regarding the use of LCAs and EPDs will change when science-based methods for factoring forest carbon stock changes into LCAs and translating those changes into EPDs for wood products are developed.

FOREST CARBON STOCK CHANGE FACTORS

The assumption that all forestry is carbon neutral makes it impossible to differentiate timber suppliers or supply areas based on observable increases or decreases in carbon stocks occurring in different forests managed in different ways. **The fact is that many forest managers are intentionally increasing carbon stocks as a CSF strategy while others may have flat or decreasing carbon stocks in their forests over time.**

Until and unless LCAs and EPDs improve, measuring the carbon stock changes in forests in a given woodshed[JG1] and allocating this value to the products coming out of it offers a way to more accurately calculate a wood product's true carbon footprint: this is the Forest Carbon Stock Factor approach.[6] This is an emerging method that relies on publicly available forest inventory information and geospatial monitoring to calculate the change in forest biomass and the volume of timber outputs from a supply area over time.[7] The division of the former by the latter yields a factor that can be incorporated into EPDs as a carbon benefit or burden associated with each unit of industrial roundwood (i.e., logs) coming from that area, thus correcting the assumption that managed forests are all exactly carbon neutral. The calculation of such factors can be used in procurement options 2 (Intentional Sourcing of Climate Smart Wood) and 3 (Certified Wood) provided there is disclosure of information about the forests that a mill sources from (levels 2 or 3).

Options

Carbon stock change factors can be calculated in one of two primary ways based on scale and granularity, both of which require nuanced interpretation to justify claims of climate-smartness. As a novel and innovative approach, the specific methods, data sources, and understanding of precision and uncertainty in their use are evolving and expected to improve over time — and project teams who adopt it and share their experiences can help advance its improvement.

+ **Option A: Stock change factors for specific forests:** Carbon stock change factors can be calculated for specific timberland ownerships from which timber supply can be directly traced to a project, provided a sufficiently long and consistent history of ownership and timber output are known (at least 10 years). The suitability of this approach is currently limited to ownerships of sufficient size (e.g., hundreds to thousands of acres) where the volume of timber removed each year is relatively consistent. The calculation of stock change factors for smaller properties and properties with irregular harvest practices may be too "noisy" and too sensitive to the choice of the lookback window to allow confident conclusions to be drawn for these timberland owners. These cases would be better handled using regional factors based on landowner type (see Option B).
+ **Option B: Regional stock change factors for distinct landowner types:** In cases where the material produced at a primary mill (e.g., lumber) cannot be traced to specific properties or where the calculation of carbon stock change factors under Option A would be too uncertain, regional averages may be used. Regional averages will generally be defined at county or multi-county scale for different types of forest owners, including private industry, private non-industry (e.g., family forests, conservation organizations), tribes, states, and federal owners. If mills are able to provide estimates of the landscape from which they source wood and the proportion of wood sourced from different types of owners, a custom stock-change factor can be calculated as a weighted average (sum of stock change factors for each landowner type in the supply area after being weighted/multiplied by the proportion of a facility's wood sourced from each landowner type). If a project is unable to confirm the mix of sourcing used by a wood processing facility supplying the project, an overall regional average for the working forests in that woodshed can be used.

Traceability & Transparency

Carbon stock change data can be found reported by landowner types at county-, multi-county, or regional scales. Thus, the application of stock change factors to projects should incorporate traceability and transparency down to the level of the primary manufacturer supply area at minimum (**Level 2**) and to the level of the source FMU if possible (**Level 3**). More precise estimates may be employed where timber supply can be traced to specific owner types (e.g., industrial, federal, tribal, state) or to specific ownerships.

Pros

+ **Based on Objective Measures:** This approach is based on observational data of how a timber supply area has actually changed over time rather than relying on industry-wide averages or simulations of hypothetical landowner behavior.
+ **Identifying Source Forest Not Required:** Does not require tracing to a specific source forest, but increased levels of disclosure lead to less uncertainty in carbon stock change factors.

+ **Increasing Data Availability:** Data on annual forest carbon stock change is now readily available across the globe from commercial vendors. These data generally do not include estimates of timber removal. In addition, county or provincial and national-scale reporting by smaller countries is often available that may be suitable for estimating carbon stock change factors from countries that report forest carbon stock changes under the UN Framework Convention on Climate Change and that report timber product output and forest conditions to the UN Food & Agriculture Organization.

Cons

+ **Still in Development:** Peer review and methodology refinement are needed to establish confidence that carbon stock changes are accurately calculated and attributed to wood production over time. For example, more research is needed to better separate the impacts of natural disturbance on carbon stock changes compared to impacts of management.
+ **Boundary Size-Dependent:** The calculation and accuracy of stock change factors is very sensitive to the definition of the timber supply area in terms of geographic extent and lookback period. For example, a factor can be skewed by the inclusion of forests that are not managed for timber (e.g., parks or protected areas). The calculation of a stock change factor may also vary significantly based on the lookback window chosen and the consistency of timber harvesting. It may ultimately be infeasible to generate usable carbon stock change factors for smaller properties with more irregular harvesting activity over time, and further research is needed to define appropriate levels of confidence to justify reporting and using these factors when they vary substantially over time.
+ **Narrow Focus:** Although growth in carbon stocks can often be a useful indicator of "climate smartness," it does not necessarily address impacts on ecological health and resilience, and information on climate, community, and biodiversity impacts beyond carbon stock change may be necessary to confidently characterize the climate-smartness of a particular product or timber supply area.
+ **Insufficient Data Availability:** The development of these factors is limited by the availability of data on forest carbon stocking and timber output over time. Publicly available data for carbon stocking and timber outputs across the contiguous United States currently lag the present by several years. New vendors that sell annual forest carbon data do not yet provide timber output estimates, and the cost of acquiring these data at landscape or regional scales is prohibitive.
+ **Doesn't Account for Everything:** questions of leakage and land use impacts are not captured with this type of attributional approach or the carbon stock change factor alone.

CARBON & CLIMATE SMARTNESS

Forests where carbon stocks are growing over time are a sink for atmospheric carbon. This occurs when forest growth exceeds timber harvest and natural mortality and disturbance. Declines in forest carbon stocks over time represent a source of carbon to the atmosphere. Negative carbon stock change factors indicate a net gain of forest carbon stocks in the timber supply area and may be considered an upstream embodied carbon benefit, while positive carbon stock change factors indicate a net loss of forest carbon stocks in the timber supply area that represent an upstream embodied carbon burden.

Carbon stock factors can be multiplied by the Global Warming Potential impact derived from an LCA study and reported in a product-specific EPD to correct for the carbon neutrality assumption.

Even without directly tying the carbon stock change values to the building, these factors and thresholds of performance could be used as criteria for choosing among suppliers. By comparing carbon stock change factors between timber suppliers within and across regions, wood purchasers have the option to steer procurement towards suppliers that are adding more carbon to the landscape than their counterparts.

However, carbon stock change factors should not be used as the exclusive indicator of climate-smartness. There are no absolute thresholds for designating a timber source as climate smart based solely on carbon stock change factors. To be used to characterize climate-smartness, carbon stock change factors should be interpreted within the relevant regional context considering forest ecology and management practices. This approach also does not address improvements or harms other important dimensions of CSF such as ecological integrity, biological diversity, soil and water quality, etc.

The approach is also complicated by the fact that in certain regions and forest types climate-smart forestry may encourage the reduction of carbon stocks over time to restore forest health and reduce the risk of catastrophic wildfire. Drier, fire-prone forests across the western US are a clear example where reductions in carbon stocks should be interpreted within the context of climatic risk and vulnerability. These same regions and forest types are also often where wood processing infrastructure has been dwindling, and where market access and increased demand for forest products are critical enabling conditions for improved forest management and restoration.

The carbon intensity of timber production is best viewed as an emergent property of a forest management system that accumulates through numerous interventions across a managed landscape over time. This approach is designed to characterize carbon impacts of a forest management *system* rather than to characterize impacts of a specific timber harvest. Calculations of carbon stock change factors should generally encompass all working forest areas controlled by a timberland owner or type of landowner in a particular timber supply area, not to individual harvest areas or cut blocks.

Thus, a timber supply area where this type of analysis is applied should include areas that are regrowing from previous harvests, areas that are expected to be harvested in the future, and areas where management may be limited or constrained as part of best management practices (e.g., riparian management zones, steep and erodible slopes, or areas of high conservation value within an actively managed landscape). This type of analysis should not include areas that are permanently reserved from timber harvesting (e.g., wilderness areas or parks).

CARBON OFFSET CREDITS

Companies motivated to procure climate smart wood (CSW) are often also interested in carbon offset credits. What is their relationship?

Carbon credits are earned through a verification process for projects that reduce, remove, or avoid carbon dioxide emissions from the atmosphere. Credits earned are listed in a registry where companies who wish to offset emissions can buy them to offset their emissions and meet jurisdictional or corporate greenhouse gas reduction targets. There are two types of markets for

carbon offsets: regulatory or compliance markets are established and regulated by governments and operate on a mandatory basis, while non-regulatory voluntary carbon markets are not.

Forest carbon offset projects are one way to earn carbon credits. The degree of rigor of carbon offset projects is variable. Forest carbon offsets have faced criticism related to credibility, additionality concerns, and environmental justice issues, including providing a pathway for greenhouse gas emitters to continue to pollute.

The primary forest carbon offset project types are reforestation, avoided conversion, and improved forest management. For the latter, measurement and verification protocols are applied to forestry operations to determine if their management practices result in "additionality" — that is, higher levels of carbon storage and sequestration than would occur in forests managed at the regulatory floor. An important benefit of forest carbon offset projects is the provision of financial incentives for landowners to implement forest management practices that result in additionality and often increase ecological resistance and resilience in the face of a changing climate. In short, **registered forest carbon projects that have earned credits for improved forest management can generally be assumed to be practicing CSF and sourcing wood from them can be one pathway to climate-smart procurement under Option 2 (Intentional Sourcing From Climate Smart Forestry Operations)**. Because they also provide credible forest-level carbon data, they also have a built-in mechanism for transparency.

In contrast, CSW procurement leverages purchasing power to promote supply chain transparency and CSF management practices, creating a direct link between wood used in a project and climate impacts. These market signals in the building sector supply chain are necessary to transform wood supply chains, and therefore expectations related to the management of forests.

For these reasons, though purchasing carbon offsets and CSW procurement can be complementary, the former is not a replacement for the latter and carbon offsets are not presented as a procurement option in CSWG's guidance. Prioritizing CSW procurement for building projects or within a company's supply chain can decrease the direct impact of sourcing and promote climate adaptation and mitigation in forests of origin. These efforts can lower the carbon footprint of a building that uses wood in its construction, but the larger project will generally still produce net carbon emissions. A company could subsequently choose to offset remaining carbon emissions by purchasing carbon offset credits at the level of a project and/or a company's operations.

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[1] Importantly, CSF is about more than carbon accounting. CSF also aims to increase the health and resilience of forests, and includes techniques that address climate mitigation, adaptation and equity. While EPDs are a robust tool for understanding some facets of environmental impact, they do not measure broader ecological metrics such as biodiversity, ecological health, or environmental justice.

[2] Of a living tree's total biomass, about 40-55% (hardwoods) and 50-55% (softwoods) is contained in the "merchantable" portion that would ultimately enter a sawmill. The remainder of the tree's biomass is contained in its fine roots, stump, branches, bark, and top of the tree, which are generally left on-site to decay or are burned following timber harvests. These ratios are drawn from: Jenkins, J. et al. (2004). "Comprehensive Database of Diameter-Based Biomass Regressions for North American Tree Species." NE-GTR-319. U.S. Department of Agriculture, Forest Service, Northeastern Research Station: Newtown Square, PA: 45pp. **https://doi.org/10.2737/NE-GTR-319** and Cairns, M. et al. (1997). "Root Biomass Allocation in the World's Upland Forests." Oecologia 111(1): 1-11. **https://doi.org/10.1007/s004420050201**

[3] The process of converting logs into finished products retains a fraction of the carbon in the log, with half or more of the carbon in logs commonly transformed into waste or by-products (e.g., chips or sawdust) which have short lifespans and are often combusted for heat and/or energy during manufacturing. For example, the "recovery ratio" for producing softwood lumber from logs in the Pacific Northwest was estimated at 0.505 m3 lumber per m3 of logs: Milota, Mike. (2015). "CORRIM REPORT: Module B Life Cycle Assessment for the Production of Pacific Northwest Softwood Lumber." CORRIM: Seattle, WA. 73pp. **https://corrim.org/wp-content/uploads/Module-B-PNW-Lumber.pdf**.

[4] Ellingboe, E., Hariadi, K.S., and Carlisle, S. (2025). Biogenic Carbon Accounting in Environmental Product Declarations: A comparison of methodologies in European and North American Wood Product EPDs. Carbon Leadership Forum, Seattle, WA. **https://hdl.handle.net/1773/53048**

[5] The "starting condition" refers to what was there before timber production began. Harvesting trees grown on landscapes that were not forested previously represents a very different starting condition than an old-growth or mature forest

[6] The approach to accounting for the "upstream" carbon impact for biomass products such as wood is described in: Johnson, Eric. (2009) "Goodbye to Carbon Neutral: Getting Biomass Footprints Right." Environmental Impact Assessment Review: 29(3): 165—68. **https://doi.org/10.1016/j.eiar.2008.11.002**

[7] **https://ecotrust.org/mapping-forest-carbon-data/**