



United States Department of Agriculture

The Urban Wood Workbook

A Framework for the Baltimore Wood Project

Mike Galvin, J. Morgan Grove, Sarah Hines, and Lauren Marshall



Abstract

The [Baltimore Wood Project](#) is a collaborative effort among the USDA Forest Service, Humanim (Details Deconstruction; Brick + Board), the City of Baltimore, Room & Board, Quantified Ventures, and many other partners. Since 2012, the goal has been to develop and support a diversified regional wood economy that promotes sustainability; creates jobs, especially for people with barriers to employment; and improves lives. The project involves diverting wood that is often wasted and instead capturing its value. Salvaging wood from the deconstruction of abandoned rowhomes and “fresh cut” wood from urban tree operations can create opportunities for employment and neighborhood greening. This workbook shares lessons learned in Baltimore in an effort to provide a framework to develop a sustainable supply and demand for urban wood nationwide.

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Cover Photos

Baltimore skyline as seen from the rooftop of Brick + Board. Photo by Max Pollock, Brick + Board, used with permission. Bottom left to right: Exposed floor joists on a Baltimore rowhome that is being deconstructed. Photo by Max Pollock, Brick + Board, used with permission; Deconstructed wood run through a planer is given new life. Photo by Max Pollock, Brick + Board, used with permission; Fresh cut slab finished to create a one-of-a-kind table. Photo by Mike Galvin, on behalf of USDA Forest Service.

Please note that this is an early release of this publication and is subject to changes in the final version.

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FOREWORD

The Baltimore Wood Project began with a goal to reconsider uses for urban wood, yet it quickly expanded into a multisector partnership that is fostering holistic change and ecological, economic, and social sustainability. Since 2012, a transdisciplinary team anchored by the USDA Forest Service, Humanim (Details Deconstruction and Brick + Board), and the City of Baltimore, MD, has been working together with other municipal, private, and nonprofit partners to create and pilot a diversified regional wood economy in Baltimore and beyond. At its core, the project involves diverting wood from being sent to the landfill and instead capturing its value. The wood comes from the deconstruction of abandoned rowhomes (deconstruct) and urban tree operations (fresh cut). The project is now supporting, strengthening, and replicating diversified regional wood economies that foster urban to rural sustainability and create jobs, especially for people with barriers to employment.

The value of most urban wood is based on characteristics not found in rural forests—species diversity, large diameter, or character (flaws). Wood harvested in Baltimore is primarily valued for its story and aesthetic and is being used to create excellent furnishings and architectural enhancements. In this way, the wood captured in these efforts compliments the wood being produced in rural settings. In addition, wood harvested in Baltimore is sometimes shipped to rural communities in other states for secondary processing, generating economic value across state lines. A partnership with Room & Board, a sustainable furniture company, has yielded the Urban Wood Project furniture line. As of summer 2018, Room & Board has reused over 16,000 board feet from Baltimore rowhomes. Many of the products are manufactured in Vermont, Pennsylvania, and West Virginia.

The involvement of the USDA Forest Service in Baltimore is anchored through the Baltimore Urban Field Station. This urban field site is part of a national network and represents exemplary collaboration and coproduction of knowledge by providing a model of effective customer service and shared stewardship that spans communities, forests, and regions. The Urban Field Station Network conducts collaborative, partnership-based research that addresses place-based, yet widely relevant management issues. By using a pilot, prototype, and production business model, the Urban Field Stations strive to take projects from one location and apply them at regional and national scales. Specifically for urban wood, this model is being applied in the following ways:

- The Urban Wood Academy, a multi-day, interactive, experiential workshop, convenes practitioners across sectors and geographies. The workshop provides opportunities to share lessons learned and best practices for building a networked, regional wood economy in Baltimore and beyond; exchange knowledge among all practitioners; and inform future research directions. The goal is to advance urban wood utilization as a holistic means to address complex ecological, economic, and social issues throughout the country; the connections made and networks built and strengthened at each Urban Wood Academy play a role in making this a reality.



Worker from Brick + Board sawing reclaimed wood. Photo by Bill Shewbridge, UMBC New Media Studio, used with permission.

- The USDA Forest Service supported business feasibility analyses of both deconstruct and fresh cut operations, which resulted in the following actions:
 - o Informed a decision by the State of Maryland, which involved the City of Baltimore and Humanim, to scale up deconstruction in Baltimore. The specific objectives included employing 100+ people to deconstruct 250+ homes over 5 years.
 - o Served as the “proof of concept” that has enabled the team to begin conversations and seed partnerships with more than a dozen post-industrial cities with similar challenges.
 - o Provided the foundation for a city-financed \$1.5 million proposal to scale up fresh cut wood operations in Baltimore that will generate 14 full-time jobs, \$265k in increased earnings, \$2.5m in revenue/savings, and \$150k in tax revenues while diverting 16,000 tons of wood from the waste stream and sequestering 2,000 tons of carbon.

The 21st century is full of challenges that will require new partnerships, innovations, and mindsets to effectively be addressed. The most robust solutions for ecological, social, or economic problems are often integrated solutions that recognize the connectedness and interdependence of both related and seemingly unrelated variables. This workbook presents the basic framework designed by the USDA Forest Service, Humanim, and the City of Baltimore to encourage the development of networked wood economies that divert waste, create employment, and reinforce a broad range of partnerships and goals. This framework has potential for many postindustrial cities. Collectively, urban wood efforts across the county have the potential to generate revenues, reduce costs, create jobs, improve lives, reduce crime, improve ecosystems, achieve sustainability goals, and diversify and sustain the U.S. wood industry.

Sincerely,

Tony Ferguson — Station Director, USDA Forest Service, Northern Research Station

Jeff Carroll — Vice President, Humanim

Erik Dihle — City Arborist and Chief of Urban Forestry, City of Baltimore

CONTENTS

Foreword	iii
Introduction: A Focus on Wood, Employment, and Partnerships	1
Wood	1
Employment.....	3
Partnerships.....	3
The Baltimore Wood Project Vision	4
How to Use the Urban Wood Workbook	4
Rhetorically Speaking	4
Use by Public Agencies	5
Use by Nongovernmental Organizations (NGOs)/Nonprofit Organizations.....	5
Use by Companies	5
How this Workbook is Organized	5
Urban Wood Flows Model	7
The Urban Wood Supply Chain	7
Quantity Versus Quality	8
Steps in the Urban Wood Flows Model	9
1. COUNT.....	9
2. Generate	12
3. SALVAGE	13
4. SORT	14
5. Process.....	16
6. Produce	18
7. Consume.....	19
Applying the Urban Wood Flows Model	20
Quick Tips	22
Where Can I Get Urban Wood?	22
Where Can I Dispose of or Recycle Urban Wood?.....	22
Where Can I Get Urban Wood Processed So I Can Make Something From It?.....	22
Where Can I Find Additional Information?	23
Acknowledgments	23
References	24
Appendix	27
What Does it Take to Set Up a Sort Yard?	27

“Waste is a verb, not a noun.”

- Brian Becker, Program Manager for the Virginia Community Wood Energy Program, The Center for Natural Capital.



With some thought and planning, some urban trees can be processed into logs rather than chips when a tree needs to be removed. Photo by Mike Galvin, on behalf of USDA Forest Service.

INTRODUCTION: A FOCUS ON WOOD, EMPLOYMENT, AND PARTNERSHIPS

Wood

Wood is an abundant renewable resource. Yet each year over [78,000 tons](#)¹ of urban wood (about 3,900 truckloads) are wasted in Baltimore, MD, alone. Throughout the country, over [30 million tons](#)² of urban wood waste is generated annually. Communities often fail to recognize the potential of urban wood to produce wealth and improve well-being (Fig. 1). When wood is treated as waste, it becomes both a cost and a missed opportunity. The costs are borne by the public or private sectors, or even by individuals. Wasting wood increases inputs to landfills and squanders opportunities for workforce and economic development. Reusing urban wood waste can have many benefits for society:

- Saves money (increase revenues, reduce costs).
- Supplies local production and consumption campaigns.
- Creates jobs that cannot be exported.
- Reduces crime and recidivism.
- Improves ecosystems.
- Provides green materials.
- Helps a city achieve its vision of a sustainable future.
- Supports and diversifies the U.S. wood industry.

This workbook is based on the experiences of the U.S. Department of Agriculture (USDA) Forest Service and a broad partnership of community groups in Baltimore that have worked together to study and build an urban wood economy that includes employment and development in the form of jobs, businesses, and markets. The focus is on two sources of urban wood waste streams that make up a significant resource across the United States: woody materials from live trees (fresh cut) and urban lumber from buildings (deconstruct).

- **Fresh cut** consists of wood from tree care and maintenance operations and may also include wood from clearing activities related to development and construction. Sources include municipal and private (arborist or utility) operations. Logs and other wood material from these operations may be sent to the landfill, or alternatively, the wood may be put to some use. Using the wood, however, requires that systems for assessing the materials are already in place, so the highest and best use can be considered. Allowing for end-of-life use of wood encourages a cradle-to-cradle approach to urban forestry operations. Revenues from wood utilization can be reinvested into a range of urban forestry efforts, from seedling development, to tree management, and back to wood utilization. The ultimate goals are to increase tree canopy cover, improve urban livability, and reduce waste.
- **Deconstruct** refers to wood that comes from the removal of existing buildings (often vacant or abandoned structures located in post-industrial cities) and may include flooring, framing, and other wood. Demolition, the standard method of removal, consists of the destruction of a building followed by the disposal of materials in a landfill. Deconstruction is an alternative method that involves the removal of a building in such a way that the materials used in its construction can

be recovered. Even though demolition tends to be quicker, deconstruction creates at least twice as many jobs and can provide health and economic benefits. In Baltimore, deconstruction is done in a way that is cost competitive with demolition, even before accounting for additional positive externalities.



Figure 1.—Wood from tree care operations and building deconstruction as an input to the urban wood flows model.

Employment

The partnerships in Baltimore are somewhat unique among urban wood efforts because of their focus on urban wood reuse as a vehicle for co-benefits beyond waste reduction. An equally important area of emphasis has been on the development of an urban wood economy that involves the creation of jobs, businesses, and markets, especially for people who are faced with barriers to employment, such as low education or previous incarceration. People with barriers to employment can be trained in the extraction, processing, and manufacturing of urban wood, but it is the inclusion of other support and civic re-entry services that enable individuals to make a successful and long-term change. By connecting urban wood reuse with employment and efforts to reduce recidivism and support social re-entry, the project in Baltimore involves many co-benefits.

Partnerships

Baltimore is just one of hundreds of post-industrial cities that face similar challenges. Although the size and geographies of these other cities may differ, the information and approaches in this workbook are intended to be replicated and adapted by other communities. One of the most crucial aspects of being able to replicate this approach is having the involvement of multiple committed partners. In Baltimore, the success of urban wood efforts and the creation of a networked, regional wood economy that is contributing to the larger wood industry is the result of multisector collaboration. Baltimore has many partners, ranging from the federal, state, and local governments to the private sector, nonprofits, and social enterprises. Some of the key partners of the Baltimore Wood Project include the following organizations:

- [Humanim](#),³ a workforce development social enterprise committed to developing job opportunities for people with barriers to employment. Specifically, Humanim's [Details Deconstruction](#)⁴ and [Brick + Board](#)⁵ are two flagship social enterprises that have created employment for hundreds of people.
- The City of Baltimore's Departments of [Housing & Community Development](#),⁶ [Recreation & Parks](#),⁷ and [Office of Sustainability](#),⁸ each of which has demonstrated incredible innovation and leadership in transforming waste to wealth.
- The State of Maryland's Department of Housing & Community Development, which embraced holistic metrics for success to support and enable innovation and scaling up of deconstruction efforts in Baltimore.
- [Room & Board](#),⁹ a modern furniture and home decor retailer committed to sustainable practices and American craftsmanship. In 2018, Room & Board launched nearly a dozen products made of reclaimed wood under the branding "[Urban Wood Project: Baltimore](#)."¹⁰ The line has since expanded to additional products and other cities, through extensive partnership-building facilitated in part by the USDA Forest Service.

THE BALTIMORE WOOD PROJECT VISION

The Baltimore Wood Project focuses on wood, employment, and partnerships. The sum of these pieces is greater than the parts. The vision statement developed by the project is shared here in the hope that it proves helpful or inspirational to catalyzing efforts in other locations.

The partners of the Baltimore Wood Project are committed to a sustainable future that includes a vibrant, self-sustaining, and comprehensive urban wood economy. Tenants of this vision include the following:

- *Urban wood is no longer taken to the landfill or incinerated.*
- *All wood is sustainably repurposed.*
- *Networks of supply and demand for local wood contribute significantly to employment, economic development, community revitalization, and the U.S. wood industry.*

We see a day when food grown in cities throughout the United States is served on dining tables made from fresh cut or deconstructed wood; homes, businesses, municipalities, and bioenergy facilities source a range of low-to-high value urban wood products from community sort yards; residents who have struggled to develop skills and work experiences gain access to the workforce in jobs and careers that cannot be exported; and opportunities proliferate for urban residents to develop their own businesses based on this vibrant local economy.

HOW TO USE THE URBAN WOOD WORKBOOK

Rhetorically Speaking

This workbook is designed to be a practical reference for practitioners. To that end, it employs informal terms—we, you, and I. The term “we” refers loosely to the members of the Baltimore Urban Wood Project; the terms “you” and “I” are used in rhetorical ways. You is used loosely and may not be universally applicable to each reader, but broadly speaking, the term “you” may include users of this workbook, ranging from public agencies, to social and nonprofit enterprises, to private organizations.

A broad range of users should find this workbook helpful, whether you are a tree care company trying to identify sustainable disposal options, a city agency looking to aggregate wood debris and avoid sending materials to the landfill, a nonprofit looking to build out a social enterprise that utilizes urban wood, a sawmill or portable band saw operator looking to acquire logs, or a crafts person looking to find unique wood material.

Specific and realistic examples of how different types of stakeholders can approach planning and expect to benefit from using urban wood are included in the section entitled “Applying the Urban Wood Flows Model.” Recommendations are also provided to empower managers and leaders to take action in their communities. The following are examples of ways different sectors can apply the concepts discussed in this workbook:

Use by Public Agencies

- Identify waste streams.
- Identify potential markets for recovered materials.
- Reduce inputs to landfills.
- Offset operational costs with non-general fund revenues.
- Reduce operational costs through savings by providing a public agency with materials that they currently purchase from external sources.
- Require public agency contracts to utilize urban wood materials when appropriate.
- Fulfill sustainability objectives.
- Identify key partners that can help public agencies meet urban wood utilization goals.

Use by Nongovernmental Organizations (NGOs)/Nonprofit Organizations

- Identify ways to create jobs by turning waste materials into products.
- Diversify income streams by adding the sale of materials to income generated from sources such as gifts, donations, grants, and contracts.
- Provide new pathways to meet sustainability goals.

Use by Companies

- Improve financial bottom line by avoiding or reducing disposal costs.
- Improve financial top line by adding value to a waste, converting it into a product, and producing new revenues.
- Diversify revenue sources.
- Know where to get raw or processed woody material.
- Obtain U.S. Green Building Council [LEED](#)¹¹ certification points for partners and clients.
- Advance corporate citizenship and sustainability.

How this Workbook is Organized

Urban wood waste is a byproduct of activities such as tree care operations, land clearance, and building demolition. Unlike traditional forestry in which trees are managed as a crop for harvest, urban wood utilization begins as a way to divert wood from the waste stream. This switch from urban wood waste to urban wood utilization adds value by reducing or eliminating transportation and landfill costs and by using materials to create products that support jobs, businesses, and markets.

The generation of wood waste material, as well as its disposal or reuse, can happen opportunistically or strategically. If wood waste is viewed as a byproduct of an activity, it will likely be handled opportunistically, with the waste being disposed of in a path of least resistance with minimal effort. This often means the material will go to a landfill or, in the case of fresh cut wood, will be chipped into mulch. Alternatively, if wood waste is viewed as part of a reuse process, it may be handled strategically such that it is salvaged, sorted, and aggregated to sufficient scales, providing an opportunity for highest and best use through various wood markets.

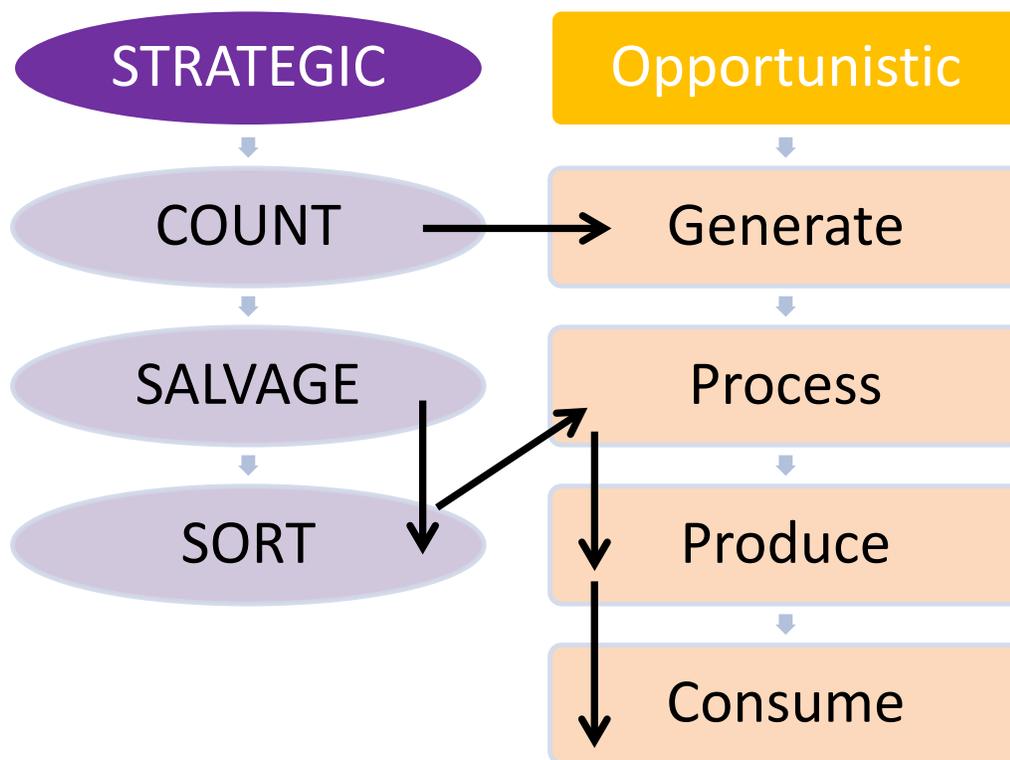


Figure 2.—Urban wood flows model. This diagram represents ways wood might enter and move through a potential urban wood economy. The strategic steps are differentiated from the opportunistic steps by color and CASE. A key component of the model is to recognize that waste can be avoided by thoughtfully and strategically considering all steps.

This workbook is organized according to the typology outlined in Figure 2. The strategic steps are critical for minimizing waste and maximizing value:

- **COUNT**—an inventory of available materials and facilities.
- **SALVAGE**—recovery of materials from the waste stream.
- **SORT**—a centralized place and organized process for sorting salvaged materials according to potential value-added uses.

The opportunistic components occur as part of a waste stream creation and use process:

- **Generate**—generate is the first step in diverting wood from the waste stream.
- **Process**—primary processing is the first step in preparing raw plant material for use as is, or for secondary processing into finished products.
- **Produce**—production, or secondary processing, is taking the woody material after it has been sawn, dried, shredded, split, ground, etc. and making it into a product for sale or consumption.
- **Consume**—consumption drives the urban wood economy; if no one buys it at a profitable, self-sustaining scale, it’s a hobby rather than a business.

A key point in this workbook is that identifying and implementing the strategic steps in the urban wood flows process can result in substantial opportunities to increase value. By knowing materials inventory (COUNT), recovering materials so they can be assessed for

the highest and best use (SALVAGE), and operating a yard that allows for the separation of materials by type and quality rather than just as a dump (SORT), the value of incoming materials can be maximized. The more steps in the urban wood flows process that are in place, the more comprehensive the urban wood reuse effort can be, which can increase value, reduce costs, and maximize employment and business opportunities.

URBAN WOOD FLOWS MODEL

The Urban Wood Supply Chain

Understanding the urban wood supply chain is a fundamental concept in this workbook. Knowledge of the supply chain enables the development of everything from a small-scale successful business operation to an urban wood economy that may involve multiple businesses and markets. The supply chain follows the flow of materials from the urban forestry operation, land clearance site, or building deconstruction where they are first generated, to the finished product that is delivered to a consumer. The urban wood supply chain comprises all the steps in which the wood is handled. The process depends on the product type and may differ for compost, mulch, chips, firewood, flooring, and slabs.

Because understanding the wood supply chain is so important, we provide examples showing where urban wood waste is generated and how it is salvaged, sorted, processed, and finally produced into an end product. The type of entity and scale of operation affects the supply chain. For example, you may be a small operation that already has a place to get rid of your waste, but you would like to take your waste to a place that will not create additional cost or where costs are offset by revenues. In this case, it may simply be a matter of taking your material to a sort yard (a site where materials are sorted and aggregated based on potential future use) instead of a dump yard (a place where material is disposed of and not recovered for future use). If you generate or accept a large amount of debris, you may benefit from a more comprehensive look at the supply chain. The more waste at hand, the larger the potential resource, and the higher the potential for adding value to processing.

By identifying the elements in the supply chain, from the generation of wood materials to the sale of a consumer product, a business, agency, NGO, or jurisdiction can inventory the elements they have, perform a gap analysis to identify missing components in the supply chain, create strategies to develop the components they need, and ultimately create an urban wood utilization supply chain that is more efficient, productive, and sustainable.



A log loader operating at the Camp Small sort yard in Baltimore (left), and the inside of Brick + Board, where reclaimed materials are reborn. Photos by J. Morgan Grove, USDA Forest Service.

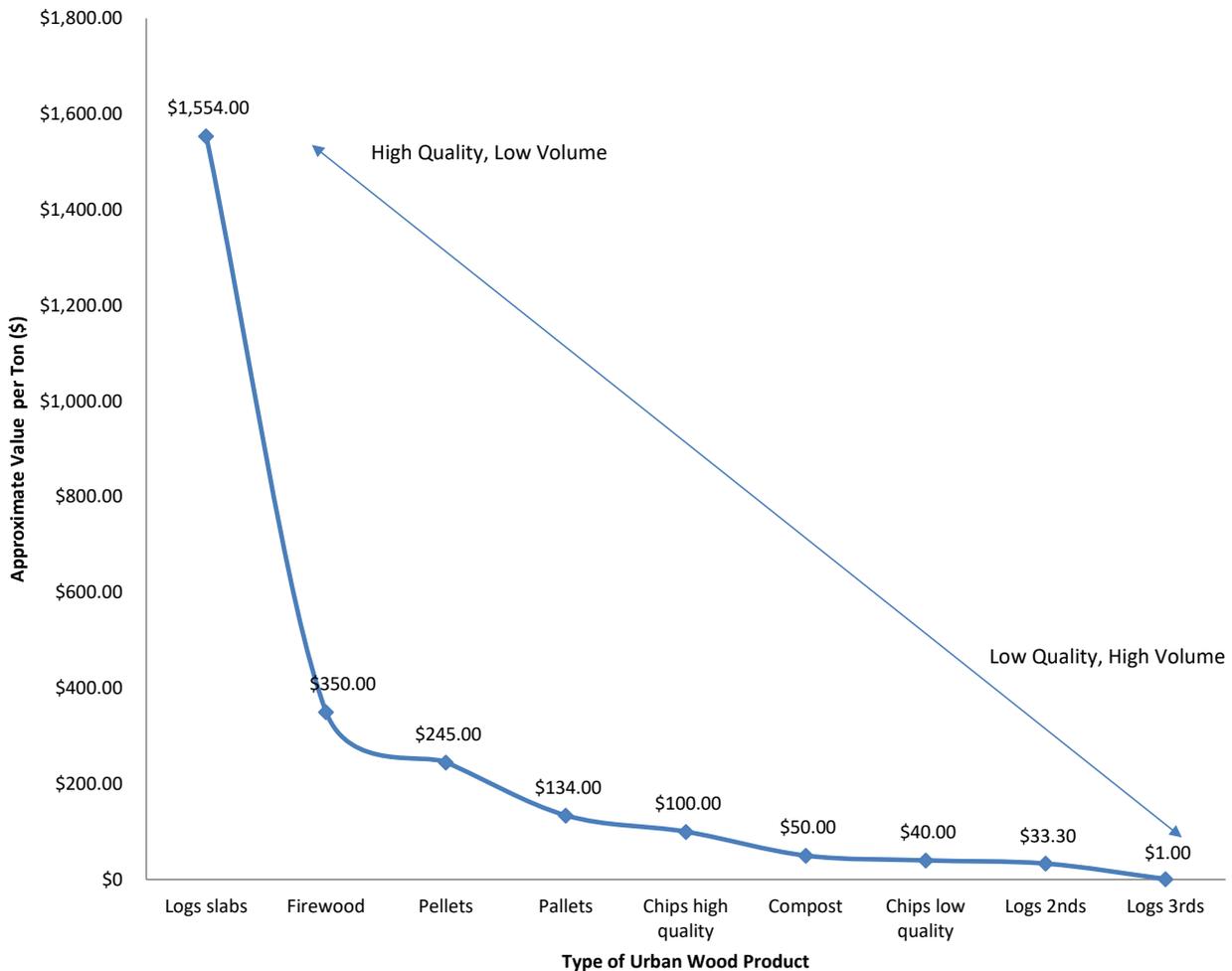


Figure 3. — Approximate value per ton for various urban wood products. (Data sourced from the Quantified Ventures report, “The business viability of processing freshly cut urban wood in Baltimore City” available at www.baltimorewoodproject.org.)

Quantity Versus Quality

Urban wood utilization often involves a relatively high volume of low-quality material and a relatively low volume of high quality material (Fig. 3), so it is best to plan end-use production accordingly. Assessing material streams, developing staging and processing strategies, and identifying destinations for different types of materials will help to protect against variations in supplies of urban wood materials or fluctuations in market demand and price.

To receive the highest returns, you must be intentional and plan early. For example, if you have high quality slab material, producing live edge slabs can return about four-and-a-half times the revenue as the same volume of firewood. For middle quality material, firewood can provide about ten times the return as log seconds, which get about \$0.30 per board foot. By thinking about volume, quality, and highest and best use of the materials early on, you can maximize profitability.

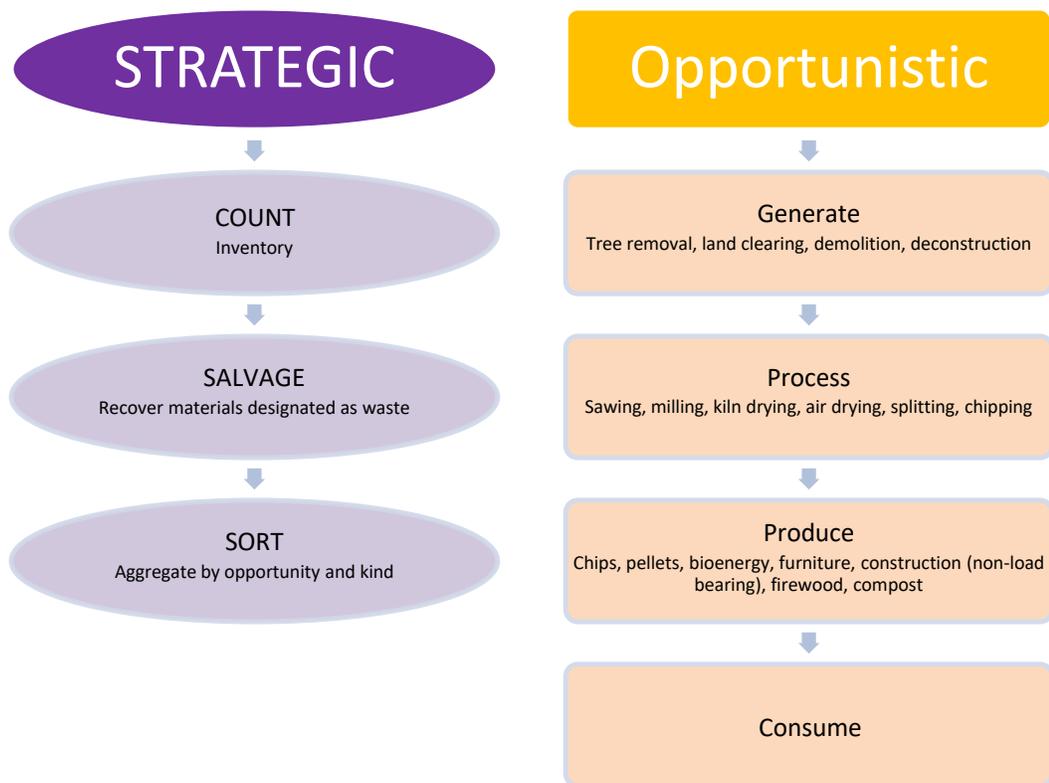


Figure 4. —Urban Wood Flows model.

STEPS IN THE URBAN WOOD FLOWS MODEL

Some parts and pieces of the Urban Wood Flows model (Fig. 4) may already be in place within some cities or communities. When trying to identify the network of actors in an Urban Wood Flows model, it may be easier to start at the end product and trace it upstream to the point of generation. Here the individual steps in the Urban Wood Flows model are described in more detail, followed by a section with examples of how you can apply the information to develop your own waste wood reuse efforts.

1. COUNT

Key Points

- » Uncertainty and unknowns increase risk, and businesses seek to minimize risk. Developing an urban wood inventory can help reduce unknowns and uncertainty. This might involve data from various sources, including, but not limited to, street tree or other tree inventories and estimates of the number of properties available for deconstruction. Developing a list of current or potential actors, the roles they play, and the facilities and equipment within the potential network can also illuminate opportunities.
- » A successful business operation can benefit from understanding its supply of materials in terms of quantity, quality, and rates.
- » Knowing the quantity and quality of urban wood waste being generated in Baltimore helped partners move forward with efforts to use, rather than dispose of, urban wood waste.

COUNT is a strategic part of the urban wood economy. The objective of COUNT is to inventory and anticipate the actual and potential amount and supply of urban wood materials and the locations and types of processing and production facilities that are available. Some operations that generate woody materials may view urban wood as a waste byproduct of their primary activity, and therefore, look for ways to dispose of the waste as quickly and cheaply as possible. Such an operation may not have a need to anticipate the supply of available materials because the goal is to dispose of what is on hand, and a landfill or other such facility is always available.

Alternatively, when COUNT is considered the first step in a strategic process, organizations may be more motivated to research the quantities, condition, and rates of different wood materials and how their organization is connected to other facilities. Depending on who is seeking the information and their role in the supply chain, having an inventory of potential and available wood materials allows for the determination of proper staffing, sizing of sort and storage facilities, and estimating potential revenues and costs. For example, urban wood use networks need an estimate of the annual flow of materials to justify making infrastructure investments needed for a successful operation.

Many types of urban wood materials may need to be aggregated to make other parts of the process, such as processing and production of value-added products, more profitable. For example, if you are a sort yard operator, you need to have an idea of the amount and types of different materials that you expect to receive within a given timeframe so you can properly plan. By knowing this information, you can assess your supply and determine how much to invest in equipment, staff, or facilities. You can also advise your markets on how much product you expect to produce.

Although traditional log grading can be applied to urban lumber, few urban wood logs are considered top quality when graded with the same standards that are used in large commercial mills. For example, logs with certain flaws such as knots or burrs are considered undesirable in traditional log grading, but urban logs with these flaws are often referred to as “character wood” and are highly valued.

It takes training and experience to be able to look at a stand of trees, a pile of woody debris, or abandoned homes and estimate the value they represent. Make sure to have a skilled person who can make such assessments before you invest in other elements of the supply chain. Currently, no certifications in urban lumber or timber assessment are available, so consider the following areas of expertise when seeking a qualified individual:

- Involvement in an urban wood network with experience performing one or more steps in the Urban Wood Flows model.
- Experience operating a successful urban wood utilization endeavor, whether from the commercial, NGO, or public sector.
- Ability to look at a piece of wood and recognize the tree species.

Some examples of sources and components of information for COUNT include the following:

- Urban tree inventories
 - Inventories on the amount and type of trees in a given area. Inventories are sometimes performed by public agencies as a means to track, understand, or care for a public resource. If a complete tree inventory does not already exist, one may be able to derive at least partial data from other sources:

- Review of work orders performed by tree crews
- Street and park tree inventories
- Forest stand reports
- Wood waste volume inventories
 - o Inventories on the amount and type of wood debris being dumped, including landfill reports of incoming material.
 - o Inventories of amount and type of vacant and abandoned buildings:
 - Dates of construction
 - Square footage of building(s)
 - Type(s) of wood used in building construction
 - Building condition
 - o Inventories of locations that receive, process, and make products from urban wood

Inventories often encompass multiple factors. Through Baltimore's [recent citywide tree inventory and linked asset management system](#),¹² anyone can easily view scheduled tree removals. Information about location, tree species, size, and condition is linked to the work order for each removal. Trees that meet certain specifications are flagged as potential mill logs, which organizes and streamlines the timber acquisition process and allows for the preparation of incoming logs and other wood materials.

Baltimore Wood Project Partner Highlight: USDA Forest Service Urban Forest Inventory and Analysis

The USDA Forest Service's Forest Inventory and Analysis (FIA) program has served as the census of forests in the United States since 1930. In 2014, FIA began collecting information on trees and forests in urban areas, as directed by the [Agricultural Act of 2014](#),¹³ also known as the U.S. Farm Bill of 2014. The Urban FIA program annually monitors the Nation's urban forests, with an emphasis on the largest cities. With the phased implementation of the urban forest inventory, new cities are added each year. Baltimore, one of the first participating cities, is on a 7-year panel. This means data are collected on one-seventh of the total number of plots each year. Different plots are sampled each year, and after 7 years, data collection on all Urban FIA plots in Baltimore will be complete. In the 8th year the process will repeat, with data collection beginning on plots from Year 1 and continuing each year. Over time, FIA data can be used to estimate how many trees are in Baltimore, where they grow, their size and diameter, what condition they are in, and how population, species, and condition are changing. For more information, see the USDA Forest Service [Urban FIA website](#).¹⁴

2. Generate

Key Points

- » Generate is the first step in diverting materials from waste into products that can produce value and well-being.
- » Decisions on highest and best use of the wood need to be made as far ahead as possible in the process. You can make firewood out of timber, but you cannot make lumber out of firewood.
- » Extreme weather events, such as severe storms or insect invasions, can result in fluctuations in the volume of available material. This, in turn, can affect both the highest and best use of the material and the value of the material in the marketplace.

The Generate step involves transitioning from the theoretical to the practical. While COUNT involves the theoretical supply, Generate is the actual supply being produced at any given time. As previously noted, urban wood is sourced from activities such as tree care operations, land development, and building removals. Having an understanding of the supply (COUNT) enables better use of the material at the Generate step. However, there is also the need to account for events that can generate large amounts of urban wood waste in a very short period of time. Events may include extreme weather such as severe storms, the invasion of an insect pest such as emerald ash borer (*Agrilus planipennis* Fairmaire), or pathogens such as sudden oak wilt. These pulses of materials can affect markets significantly. An oversupply of materials can greatly diminish the value if there is no capacity to store materials until the pulse of supply returns to normal or the materials cannot be sent to locations outside of the affected area. Bottlenecks in the supply chain can also affect the ability to process wood, which may mean that much of the excess material from a large pulse event ends up being sent to the landfill.

Wood Waste Generation in Baltimore

Wood materials come from two main streams: fresh cut wood and deconstruct wood materials. Fresh cut wood comes from public or private tree care operations and land clearing. [McKeever and Skog reported](#)¹⁵ that the amount of urban tree and woody yard residues generated nationally exceeded the volume of timber harvested from U.S. National Forests in 2000. A [2013 study](#)¹⁶ by a consultant to the USDA Forest Service's Forest Products Laboratory (FPL) estimates that approximately 14,000 tons of fresh cut wood waste are generated in Baltimore City each year. A [2019 study](#)¹⁷ estimates that about 33 million tonnes of dry-weight urban wood are available annually due to tree mortality, with a value ranging between \$89 and \$786 million, depending on the products created.

Deconstructed wood comes from the removal of buildings. [Bratkovich et al. reported](#)¹⁸ that approximately 42 percent of demolition waste wood nationally was available for recovery. In the City of Baltimore, there are at least [16,000 abandoned structures](#)¹⁹ according to the city's Open Baltimore data system, although unofficial estimates suggest the number may be considerably higher. Much of the wood in these structures is available for recovery, making deconstruction a practical alternative to demolition in Baltimore.

In addition, a significant amount of “waste” is generated in both the fresh cut and deconstruct streams. Despite variations in quality, this waste resource provides a range of opportunities for processing and production into materials that can support jobs and markets.

3. SALVAGE

Key Points

- » Retaining the maximum value during the SALVAGE process is crucial for the overall productivity of the urban wood economy.
- » How something is salvaged determines how it can be used later. To repeat: You can make firewood out of timber, but you cannot make lumber out of firewood!
- » Recovering material that has value and using it is better than throwing that value away.

SALVAGE involves the “how” of diverting wood material from the waste stream and is the beginning of the wood utilization process. The way in which the material is salvaged determines how it can be used later. For example, a tree care crew that has a truck with a chip box but no log truck will most likely fell the tree and cut the material into pieces that are small enough to move around the work site and fit into a chip box. This small size limits the potential end use of the wood so that it can only be used for wood chips or firewood. However, if that same material was initially cut into 9-foot sections, it could be sawn into different dimensions of wood lumber or later be cut into firewood or wood chips. Similarly, in the building deconstruction process, flooring, framing, and architectural salvage must be extracted, de-nailed, and handled in such a way that does not damage it or reduce its potential for value-added reuse.

A key component of the SALVAGE process is employing salvage operators who have the training and experience to be able to look at a piece of wood on the stump or in a structure and recognize its potential value and uses. The process also requires having the equipment and ability to salvage the material in such a way that not only supports the highest and best use of the material, but that also provides the widest variety of possible end uses. “Rules-of-thumb for improving log value recovery” by the North Carolina Forest Service is an excellent resource for [assessing log value before bucking](#).²⁰

Baltimore Wood Project Partner Highlight: *DETAILS Deconstruction*

Humanim is a social enterprise and workforce development NGO whose mission is to support and empower individuals who face barriers to employment, often due to incarceration or drug addiction. With many of Baltimore’s communities facing high unemployment rates and an increasing number of vacant buildings, Humanim launched DETAILS Deconstruction to address both issues. For every job created by typical demolition, deconstruction creates six to eight jobs. By salvaging flooring, framing, and architectural elements from buildings being decommissioned, every [DETAILS](#)²¹ project diverts material from the waste stream and creates jobs for people with barriers to employment.

In 2017, DETAILS reused 95 percent of all the materials from approximately 225 buildings that were deconstructed and salvaged approximately 300,000 bricks and 150,000 board feet of lumber. While doing this, DETAILS created over 12,000 hours of green collar, living-wage, full benefits employment.

4. SORT

Key Points

- » You can't sell it if you can't sort it. Converting your wood dump into a sort yard will maximize value.
- » The quantity and quality of supply needs to reach a certain level in order to be practicable. However, this level will vary depending on the needs of your operation.
- » How wood materials are sorted may depend on whether your operation will be wholesale, retail, or both.
- » A sort yard may handle high, medium, and low quality materials. Consider your costs and break-even and profitability points to determine the average price per ton that is needed to guarantee financial success.

The way that wood materials are generated and salvaged often does not allow for them to be sorted in the field. This is particularly true of fresh cut wood waste that is made up of logs, limbs, and brush. These materials need to be sorted into piles of similar material and aggregated for processing. That is, adding the logs to the log pile, the limbs to the pulp pile, and the brush to the brush pile. There may be an additional pile, the compost pile, where material (mostly brush, but possibly other material) is chipped, composted, screened, and sold.

The sort yard is important so the yardmaster—the person in charge of overseeing the sort yard operation—can classify and aggregate the material by type. The efficient processing of materials allows for the market to easily recognize and purchase the sorted wood. For example, if a potential vendor needs 200 cubic yards of screened compost or 400 board feet of red oak, you cannot tell them whether or not you have that material available for sale unless it is organized, inventoried, and accessible for transport.

To maximize the value of your wood materials, convert your wood yard from a dumping site to a sort yard! Sort yards do not have to be huge. Depending on the scale and scope of your operation, a 2-acre facility can work. With a larger sort yard (10+ acres), you can increase your scale or offer more product.

Some helpful resources on sort yards include [“Log sort yard economics, planning, and feasibility”](#)²² and [“Wood residue processing and utilization in southeastern Michigan.”](#)²³

Also consider these important features when setting up a sort yard:

- Access—the ability of large trucks to enter, unload or load, and exit. This may involve a circular road if you only have one entry/exit point. If your yard has an entrance on one end and an exit on the other, you may not need turnaround space.

- Space—the ability to pile, access, and sort the types of material you want to have on site in the quantities needed.
- Basic equipment needs—at minimum, sorting equipment may include a forklift, backhoe, and log loader (see Table 4 in the appendix).
- Processing equipment—depending on the level of processing for your sort yard, additional equipment needs may include a chipper, various sawmills, firewood splitter, and biochar pyrolysis unit (see Step 5—Process and appendix).
- Collection equipment—if the sort yard will also proactively collect wood materials from the community, equipment may include one or more logging trucks of various sizes and capabilities (see appendix).

Baltimore Wood Project Partner Highlight: *Camp Small*

In past years, Baltimore City’s in-house and contract tree care crews brought waste generated from tree care operations to Camp Small, a 5-acre site in the center of Baltimore that is managed by the City’s Division of Forestry. Wood materials accumulated until the pile became unmanageable and the City would contract for a tub grinder to process the material and haul it away. The cycle would then begin again.

In 2016, the Department of Recreation and Parks, in collaboration with the Baltimore Office of Sustainability, began the Camp Small Zero Waste initiative. A yardmaster was hired to oversee operations at the site. Logs, chips, and brush from tree care operations are still brought to Camp Small, but now they are sorted, aggregated, and sold. Camp Small sells compost, chips, and logs (prime, seconds, and thirds) and has now developed into a [self-sustaining, zero waste facility](#)²⁴ by turning a prior liability into an asset. They did this, in part, by making upfront investments in the machinery and capacity needed to enable such a change. In addition, Camp Small’s success has been enabled by those willing to champion an idea and commit to a vision and journey toward sustainability.

Camp Small has found many markets for its logs, including local portable band saw mills, craftsman and wood turners, artists, and nature play spaces. A firewood collection program allows members to access a separate log pile, where they can obtain firewood rounds on a monthly basis. Camp Small’s wood chips are sold to residents at a unit price, and when available, wood chips are sold in bulk to local mulch suppliers. The chips are also used by the City’s Department of Public Works for construction site access roads and by the City’s Forestry Division and its local nonprofit tree planting partners for tree plantings. Organized annual chip giveaways, scheduled to coordinate with the Mayor’s Cleanup Days in the spring and fall, provide residents with free wood chips during the peak planting seasons.

Using the material within city agencies has provided significant savings, as well as good public relations. By retaining select logs from utility clearings and establishing a contract with a local sawmill, Camp Small has processed 35,000 board feet of lumber for use in City Capital Improvement projects. Camp Small has also supplied logs to a local mill that manufactures tree stakes for the City’s Forestry Division. These wood stakes are used by all of the City’s tree planting partners, which saves the Recreation and Parks Department money and demonstrates the city’s [sustainability values](#).²⁵

Communication has helped the program succeed. In 2016, through a collaboration with Camp Small, the Maryland Department of Natural Resource, and the USDA Forest Service, a [workshop](#)²⁶ was held to provide all of the City’s arborists and tree care experts (both employees and contractors) with information on the program and how to create more marketable materials. Approximately 90 people from the City of Baltimore, ranging from in-house and contract tree maintenance and planting crews, to personnel from a variety of NGO partners involved with tree planting and care, attended the workshop. In addition to these more formal information and training activities, Camp Small has held on-site informational sessions with community groups, schools, local makerspaces, and government agencies.

5. Process

Key Points

- » Recovered wood waste often has to go through some level of processing before it can be reused.
- » Wood material in a raw state may need to be processed by milling, drying, chipping, or some other means before it can be made into something.
- » In a wood economy, primary processing often occurs when logs are processed into primary wood products, like wood slabs, trimmings, and sawdust.

Once material is sorted, it can be processed. Primary processing is the first step in taking salvaged and sorted urban materials and preparing them for use in their current condition or for further processing (secondary processing) into finished products. Deconstructed wood waste has already been through primary processing but may need further processing by sawing, planing, sanding, brushing, or other treatments to restore or alter its finish.

The variety of wood material and the desired product determine the kind of primary processing a material will need to make it usable. Examples of how different materials can be processed and the types of equipment needed for primary processing are shown in Table 1. Additional information on setting up a sort yard and the kinds of equipment that may be helpful for a good urban wood reuse operation is provided in the appendix.

Table 1.—Equipment needs for primary processing of original wood materials into different products

Original material	Primary processing	Required equipment	Product
Logs	Milling; kiln or air drying	Saw(s), sander(s), kiln, forklift	Slabs (for live edge furniture)
Logs		Saw(s)	Logs (2nds or 3rds)
Logs or pieces of logs	Cutting to length; splitting material	Saw, log splitter, axe, wedge	Firewood
Compacted sawdust and other processing and production waste	chipping, mixing, pressing	Press, die	Pellets (for biofuel)
Trees, branches, and other tree parts	Chipping/grinding	Biochar pyrolysis unit	Biochar
Trees, branches, and other tree parts	Chipping/grinding	Chipper	Wood Chips
Decomposed organic material, usually chipped; may be mixed with food waste	Chipping/grinding	Skid steer, pipes, blowers	Compost Mulch
Salvaged urban lumber	Sawing, planing, sanding, or brushing	Saw, planer, sander	Floors, paneling



Deconstructing, rather than demolishing, abandoned rowhomes creates 6-8 more jobs and creates opportunities for material salvage and re-use. Photo by J. Morgan Grove, USDA Forest Service.

Wood that has been sawn, dried, shredded, split, ground, or processed in some other way can be used as is or further processed, depending on the final product. In the case of a piece of art, this process may be quite complex and can involve multiple steps of drying, sanding, finishing, and assembling. Firewood should be stacked and left to air dry for a certain period of time until it is “cured” or “seasoned” and sufficiently dry for burning. Salvaged urban wood should be handled carefully during processing because this material is likely to have embedded metal, concrete, and other hard objects. For details on urban wood contamination issues and ways to address them, see [“Harvesting Urban Timber, the Complete Guide.”](#)²⁷

Baltimore Wood Project Partner Highlight: *Brick + Board*

As DETAILS Deconstruction looked for new opportunities for jobs and materials, they hit upon an idea: a structure that could serve as a warehouse, a retail outlet, and a workshop for value-added processing. Thus, [Brick + Board](#),²⁸ a new Humanim Social Enterprise, was born. Located on North Howard Street in Baltimore, MD, this former auto center is on a parcel that is just under an acre and has 28,324 square feet of building space.

Brick + Board does not mill raw logs, but they can perform almost any other milling, sanding, or processing needed on deconstructed or fresh cut wood. This newly expanded capacity provides further opportunities for job creation—a cause that aligns with Humanim’s mission—and adds value for potential new wholesale and retail markets.

Currently, Brick + Board primarily works with materials from deconstructed buildings—the organization’s name says it all. Wood materials are finished and aggregated to meet the client’s specifications. Brick + Board has a diverse clientele that may range from a customer who walks in looking for one board to make a coffee table, to an architect in California who wants thousands of board feet of wood with a certain history and character for a construction project.

6. Produce

Key Points

- » Secondary production is the process of manufacturing and assembly where pieces that have gone through primary production are made into items for sale.
- » This step includes the manufacture of furniture, millwork, trusses, wood containers, and pallets. It also includes the wholesaling of items like lumber, millwork, and wood paneling.

Some wood materials are ready for use after primary processing. Other materials require additional processing before they are made into a product. Secondary processing involves taking the urban timber or lumber after it has been through primary processing (sawn, dried, shredded, split, ground) and making it into a product for sale or consumption. Secondary processing is what leads to product creation.

For most consumers, the most familiar items produced by way of secondary production are furniture and art. However, many items are made from the byproducts of production and are used for other purposes. Reclaimed wood from building deconstruction is often re-sawn into new dimensions and run through a brusher or sander to eliminate a finish or to create a patina. Cross-laminated timber (CLT) is made by gluing layers of sawn lumber together at perpendicular angles. Wood biofuel pellets are created from the sawdust and scrap residues of primary production. These same byproducts are also used with adhesive materials to create engineered wood. In addition, chips intended for mulch may be colored and bagged.

Baltimore Wood Project Partner Highlight: *Room & Board*

The USDA Forest Service and its partners sought to build a substantial, reliable supply chain of urban wood and connect to a national-level market and retailer. Room & Board is a modern furniture and accessories retailer based in Minneapolis, MN. The majority of their offerings are manufactured in the United States using local materials, and they are committed to sustainable manufacturing processes. When Room & Board learned of the partnership effort in Baltimore, they quickly decided to visit and observe the operations at DETAILS, Brick + Board, and Camp Small. Corporate visionaries were compelled by the social, economic, and environmental benefits of what they saw—how reclaiming urban wood was also helping to reclaim lives through employment and reclaim neighborhoods by removing blight and regreening with trees and parks. The fact that public agencies and a social enterprise had worked together effectively to build a reliable supply chain of urban wood made the project extremely appealing. These visits and subsequent conversations resulted in a partnership and product line. In 2018, Room & Board launched the “Urban Wood Project: Baltimore” product line, featuring items made with salvaged wood from Baltimore rowhomes. The offerings include a table, cabinet, lamp, bookcase, and shelves, each named after streets in Baltimore. The story of the partnership and the items in the product line are available on the [Room & Board website](#).²⁹ Room & Board has plans to expand their line of Urban Wood Project offerings by connecting with supply chains currently being developed in other locations.

7. Consume

Key Points

- » Tertiary production is the set of commercial services that support production, marketing, distribution, and other aspects of getting goods to market.
- » Consume is a very important aspect of the Urban Wood Flows model. If no one buys a product at a profitable, self-sustaining scale, creating the product is a hobby rather than a business.

Consume, the final step in the Urban Wood Flows model, is where products are bought and used by businesses and customers. How this process occurs depends on the supply chain. Is only one individual or group involved or are there many? Are the individuals or groups public, private, or a mix? Are the products sold wholesale, retail, or both? The communications and marketing needed to support the sale of urban wood products will depend on these things. Some products, such as mulch, may already have established markets. Other products, such as live edge slab tables or arts and crafts items, may be part of an emerging market that requires advertising or spreading the word through social networks.

Regardless of whether the initial purpose of the urban wood salvage effort is to avoid landfills, create jobs, or enhance revenue, success revolves around sustainability. That can mean shortening supply chains by minimizing transportation costs from initial generation to final consumption. Knowing that there is sufficient raw material to support production, sufficient primary production to support markets, and a diversity of secondary production, offerings will create a robust urban wood utilization program.

Baltimore Wood Project Partner Highlight: *Quantified Ventures*

[Quantified Ventures](#)³⁰ is an impact investing advisory firm that simplifies the process of financing innovative and evidence-based environmental, health, and educational outcomes. In 2017-2018, the USDA Forest Service, together with Humanim and the City of Baltimore, engaged Quantified Ventures to assess the feasibility of Pay-for-Success financing to help scale an urban wood economy in Baltimore. This analysis focused on two factors: (1) creating a market for fresh cut wood waste from tree care and utility maintenance operations and salvaged wood from the deconstruction of vacant houses, and (2) reclaiming vacant land for beneficial environmental and community purposes.

Quantified Ventures has helped Baltimore partners identify various avoided costs and increased benefits from deconstruction and determine how the costs and benefits can be monetized to attract investment in the process. Presenting a more transparent and holistic picture of potential additional revenues and avoided costs to various actors can help make the case for an intervention (in this case, deconstruction), especially if it is new, different, or untested. Some of the monetary and nonmonetary benefits and the values that may be realized by various sectors are listed in Tables 2 and 3. These are based on research and assumptions made by Quantified Ventures; the full details are available in the [feasibility assessments](#).³¹ In Maryland, capturing these additional benefits and avoided costs was critical to securing the support for a scaling up of deconstruction activities over the next 5 years.

Table 2.—State and municipal benefits (avoided costs and increased revenues) of deconstruction

Benefit	Type	Amount
State.level benefits		
Sales taxes on reclaimed materials	Revenue	\$112,904
Income taxes and avoided welfare costs	Revenue and avoided cost	\$188,662
Reduced recidivism/incarceration	Avoided cost	\$5,590,036
Increased state property state taxes	Revenue	\$23,172,339
TOTAL		\$29,063,941
Municipal.level benefits		
Avoided landfill opportunity costs	Avoided cost	\$59,857
Avoided police and fire service costs	Avoided cost	\$8,237,567
Increased city property taxes	Revenue	\$465,101,946
TOTAL		\$473,399,369

Table 3.—Non-monetized benefits of deconstruction

Benefit	Amount
Avoided carbon emissions	968 tons CO2e
New pervious surface (if not redeveloped)	24 acres
Reduced number of homicides	25
Reduced number of other violent crimes	1,272
Reduced number of property crimes	822
Reduced number of arsons	5
Reduced number of other fires	89

APPLYING THE URBAN WOOD FLOWS MODEL

The Urban Wood Flows model is a tool designed to help in the process of developing an urban wood waste reuse effort. To apply the model, look at the framework (Fig. 4) and identify the items you participate in. Then note the ones you are aware of and the associated actors. For example, if you are a municipal arborist overseeing a public tree care operator, you are a wood waste generator (**Generate**).

Now look upstream and downstream in the model.

- Do you have, or know someone that has, an inventory of trees?
- Do you know of facilities that salvage, sort, or process wood or that make or sell wood products?

Identify these actors and then try to fill in any gaps in the chain between them.

- Are you an artist that makes items out of wood (**Produce**)?
- Where do you sell your wood (**Consume**)?
- Where do you get your wood materials (**Process, Sort, Salvage, Generate**)?

Tracing the network upstream and downstream from your activity may help you find a greater diversity and quantity of materials and increase your sales opportunities.

In the urban wood utilization process, there are substantial opportunities to increase value when the strategic framework for **COUNT**, **SALVAGE**, and **SORT** are identified and implemented.

The first step, **COUNT**, involves creating an inventory of materials and facilities. If you are a municipal, NGO, or commercial entity, you may be interested in tree inventory information or a landfill survey. If you are a tree care company owner, you may need to know how much waste you dispose of each year and what that costs your company and clients.

Start with identifying categories of tree waste generators. Then identify specific locations for these entities. You will also want to identify local processing facilities for wood. These may be mills, or they may be people with portable mills and kilns. They may not have stand-alone websites, but many can be found through social media or individual connections. Once you identify one member of the urban wood network, you can usually find out the next one and the next one. Networks are connected!

You will also want to inventory the producers of end use products. Sometimes it is easier to start at the end and trace the materials upstream.

- Where do the companies that sell compost, mulch, firewood, pellets, pallets, live edge slabs, and lumber get their wood?

Consider social and economic aspects for urban wood utilization.

- What are the social and economic problems that need to be solved?
- Who might be a champion and advocate for the program?
- Who might be the key operational partners?
- How can public and private support be developed?

The next step in the strategic process is **SALVAGE**, which looks at how materials are recovered from the waste stream. Where do materials go if they are not diverted? They probably go to a landfill, so a landfill is a good place to start collecting information on what is in the waste stream. Some landfills have information on the volume of wood debris that they take in each year. Some refuse to accept any. Some have a mulch or firewood operation as part of their recycling operation.

The final step in the strategic framework is **SORT**. Sort or collection yards can be public or private, free, or fee-based. Some jurisdictions have sort yards that allow you to drop logs, slash, or timber off for free. The rules will depend on who is operating the yard and what their objectives are.

Identifying or creating locations for distributed drop off of materials is key to aggregation and supply chain management. You preferably want to offer a sort yard location that is closer and cheaper than the landfill or other nonsalvageable disposal options, to incentivize its use. Some operators have a mobile salvage operation. They use a log truck and act as a “circuit rider” on tree removal jobs undertaken by companies that they have a relationship with. Logs are picked up and brought them back to the yard for processing through their mill operation.

Once you have the strategic framework of **COUNT**, **SALVAGE**, and **SORT** identified, you can then work to fill in the opportunistic components of **Generate**, **Process**, and **Produce**. Generators always need a place for their waste, and processors and producers always need material for production, so this is a symbiotic relationship that adds value for all.

QUICK TIPS

Where Can I Get Urban Wood?

As with so many consumer goods today, you may be able to find urban wood online. This may include raw materials or finished products made from either urban fresh cut material or deconstruction wood. The level of product detail available depends on the site and vendor. Provenance, or where the wood comes from, is often important in the urban wood world because urban wood frequently comes with a story about the tree or the building that it came from.

Urban wood networks in the Midwest and Southeast United States can help identify supply chains and outlets. These include southeastern Michigan's [Urbanwood.org](#),³² the [Urban Wood Network](#),³³ the [Southeast Urban Wood Exchange](#),³⁴ and the [Urban Salvage & Reclaimed Wood Network](#).³⁵

Locally, you may be able to obtain urban wood from a tree care company or receiving facility such as a recycling center or a local reclaimed material warehouse. There may also be an urban wood network in your area. If you are able to connect with a player or participant in the network (someone who generates wood waste, receives or processes wood waste, or makes products from wood waste), you can inquire and try to find other connections in the network. Sometimes it is easier to start with the end product and then trace the urban wood material back to where it was processed, where it was sorted, and finally where it was generated. For instance, if you find a reclaimed wood table, you may ask the person who made it where they got the wood, and thus find the entity that processed the material. In turn, the person who processed the wood may be able to tell you where the material was recovered from or where it was purchased. The sourcing facility may let you know what tree care companies, public agencies, deconstruction operations, or other actors bring materials to the facility.

Where Can I Dispose of or Recycle Urban Wood?

To find public and private facilities in your state that dispose of or recycle urban wood, search the phrase “wood recycling in (insert your state name)” on the Internet. The policies of each facility may vary widely regarding green waste such as chips, brush, and logs. Some facilities will not accept them, while others may accept certain volumes, and each may have different policies for residential versus commercial loads.

Some areas provide curbside pickup of small amounts of wood waste. Larger volumes and weights normally have to be brought to a landfill, recycling facility, or transfer station. Disposal fees, also called tipping fees, may apply, even for noncommercial use.

Where Can I Get Urban Wood Processed So I Can Make Something From It?

If the volume of wood is large enough and the quality is high enough, a conventional wood mill may accept fresh cut wood for processing. Take into consideration how you will transport the logs to the mill and then transport the sawn wood from the mill to your site.

If the wood volume is small or there is the possibility of nails or other metal in the wood, you will likely need to seek out a portable sawmill operator. Portable mill operators can often process wood onsite by bringing their mill to you and cutting the wood to your specifications. You can find portable sawmill operators by searching the Internet for “portable sawmill near me,” looking on social media sites such as Facebook

(<https://www.facebook.com>), or in some cases by checking the web pages of mill equipment manufacturers. Some portable sawmill manufacturers such as Wood-Mizer have searches on their websites to help you [find a local sawyer](#)³⁶ and [how to hire local sawmills](#).³⁷ The [Portable Sawmill Finder website](#)³⁸ lists sawyers for hire in all 50 states.

Once the wood is milled, it will need to be dried properly in order to be used successfully. Drying can be done in a kiln, by air drying if the final wood product will not be used indoors, or by a combination of kiln and air drying. A kiln dries the wood more evenly and takes less time than air drying. Both kiln drying and air drying require proper stacking. Portable sawmill owners often are aware of drying options and can provide recommendations.

Baltimore has a number of makerspaces—collaborative spaces that serve as a gathering point for resources such as tools and expertise—where people can make their own products. Currently, Open Works, the Foundery, a Workshop of our Own, and the Station North Tool Library are some examples. Many cities have similar businesses that provide members with the ability to process rough sawn wood into mill finished lumber and products.

Where Can I Find Additional Information?

Check out the following websites for more information:

Baltimore Wood Project

<http://baltimorewoodproject.org/>

Urban Field Station Network

<https://www.nrs.fs.fed.us/ufs/>

Baltimore Urban Field Station

<https://www.nrs.fs.fed.us/baltimore/>

Case Studies and more

<https://www.learnala.com/cases/urbanwood>

<https://www.vibrantcitieslab.com/urban-wood-reuse/>

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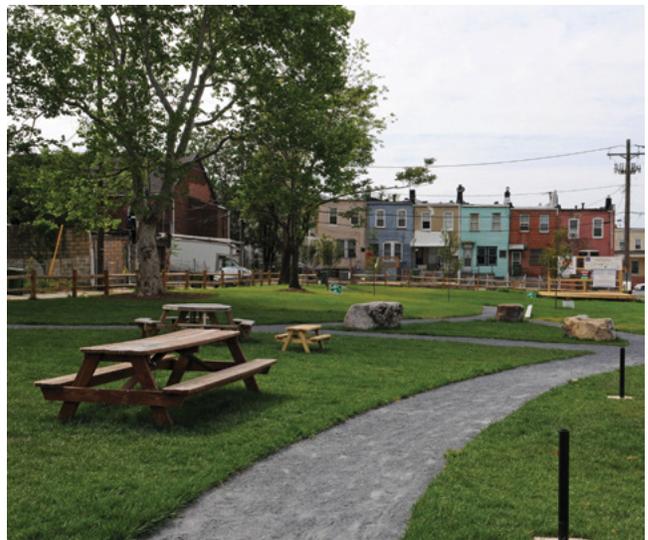
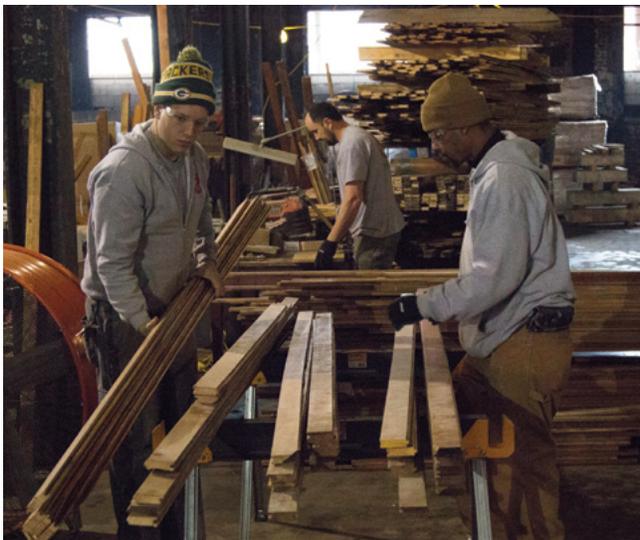
APPENDIX

What Does it Take to Set Up a Sort Yard?

An example of the types of equipment that may be used in a fully operational sort yard, their uses, and costs are outlined in Table 4. This table is courtesy of Quantified Ventures based on discussions with Baltimore City Recreation and Parks regarding plans for Camp Small, a five-acre sort yard several miles north of the city center.

Table 4.—List of type, estimated cost, and required maintenance for sort yard equipment needed to process different products

Equipment Type	Capital Cost	Maintenance	Purpose of Equipment
Backhoe	\$65K	Fuel and annual maintenance	Sorting materials
Forklift	\$30K	Fuel and annual maintenance	Sorting materials
Horizontal Grinder	\$400K-\$1MM or rent for \$50K per month	Routine maintenance; complex feeding mechanism can make maintenance more challenging	Loading and hauling materials including whole pallets, wood chips, and slab wood; helps to maintain a consistent processing rate for a variety of raw materials, creating higher valued products
Kiln	\$500-\$3000	Moderate maintenance required	Drying lumber; selling kiln-dried lumber is a simple, cost effective method to increase profits
Logging truck	\$80K-\$250K	Fuel and annual maintenance	Hauling logs; one or more trucks of varying sizes may be required depending on size and scope of sort yard.
Logging grapple truck	\$150K-\$320K	Fuel and annual maintenance	Loading and hauling bulky waste; commonly used by municipal sanitation or public works departments and by waste collection companies
Metal detectors	\$20-\$300 for hand-held metal detectors	Low maintenance	Detecting metal in wood; reduces costly damage to blades, planers, cutter heads, and jointers by detecting nails, screws, staples, or other metal objects
Portable sawmill	\$5K-\$30K depending on capacity	Relatively low maintenance requirement	Processing logs into lumber
Screening Equipment	\$60K or rent for \$10K per month	Relatively low maintenance requirement	Removing plastic film from mulch and compost material
Track log loader	\$150K	\$20K annual fuel and repair costs	Sorting and feeding grinder



Top row: Abandoned rowhomes about to be deconstructed. Photo by J. Morgan Grove, USDA Forest Service. The inside of a Baltimore rowhome that is being deconstructed. Photo by J. Morgan Grove, USDA Forest Service. Middle row: Wood and other materials salvaged from rowhomes. Photo by J. Morgan Grove, USDA Forest Service. Pallets of reclaimed bricks that will be reused in new projects. Photo by J. Morgan Grove, USDA Forest Service. Bottom row: Workers at Brick + Board, where secondary processing of reclaimed materials takes place. Photo by Bill Shewbridge, UMBC New Media Studio, used with permission. McKean Miracle Park located on land where a block of abandoned rowhomes once stood. Photo by Mike Galvin, on behalf of USDA Forest Service.

Galvin, Michael; Grove, J. Morgan; Hines, Sarah J.; Marshall, Lauren. 2020. **The urban wood workbook: a framework for the Baltimore wood project**. NRS-INF-37-20. Madison, WI: U.S. Department of Agriculture, Forest Service, Northern Research Station. 28 p.

The [Baltimore Wood Project](#) is a collaborative effort among the USDA Forest Service, Humanim (Details Deconstruction; Brick + Board), the City of Baltimore, MD, Room & Board, Quantified Ventures, and many other partners. Since 2012, the goal has been to develop and support a diversified regional wood economy that promotes sustainability; creates jobs, especially for people with barriers to employment; and improves lives. The project involves diverting wood that is often wasted and instead capturing its value. Salvaging wood from the deconstruction of abandoned rowhomes and “fresh cut” wood from urban tree operations can create opportunities for employment and neighborhood greening. This workbook shares lessons learned in Baltimore in an effort to provide a framework to develop a sustainable supply and demand for urban wood nationwide.

KEY WORDS: urban wood, urban forest, reclaimed wood, fresh cut, salvage, deconstruction, pay for success, social impact, avoided costs, incarceration, recidivism, sustainability, Baltimore, post-industrial

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