# BIOMASS FEEDSTOCK SUPPLY AVAILABILITY ANALYSIS FOR SELECTED COUNTIES WITHIN AND ADJACENT TO THE SF BAY AREA



**Prepared for:** Earth Foundries



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# **INTRODUCTION**

Earth Foundries (EF) goal is to enable more economical and sustainable forest waste disposal for the purpose of incentivizing more and better forest management. EF seeks to understand the quantity of woody biomass material produced as a byproduct of fuels reduction and forest restoration activities across regional forestlands and woodlands. The primary objectives of this vegetation feedstock analysis is to assist EF by providing a clear understanding of what volumes of woody biomass material are practically available that could be used to produce reliable, green energy and other carbon-negative products (e.g., biochar). Additional co-benefits of this business model include:

- Protecting communities by reducing the risk of catastrophic wildfire.
- Protecting public health by improving air quality through reduction of air emissions from wildfire.
- Supporting forest health improvement activities and providing a long-term market for biomass material generated.
- Diverting green waste from landfills in support of SB1383 requirements.
- Reducing greenhouse gas emissions associated with forest waste disposal activities and sequestering carbon which will have a beneficial impact on global warming.

This report provides the methodology and findings from the biomass feedstock supply availability analysis. Woody biomass feedstock types addressed in this investigation include:

- Fuels reduction and forest restoration residuals including small stems removed as a result of forest and woodlands fuels reduction activities.
- Timber harvest residuals including limbs and treetops generated during commercial timber harvest activities.
- Forest products manufacturing residuals (e.g., bark, sawdust, chips).
- Urban wood waste (e.g., clean construction and demolition wood).
- Tree trimmings.

TSS interviewed land managers, tree service companies, biomass processors, forest products companies, and biomass fuel procurement managers to ascertain current plans to manage woody biomass material generated within the five county Target Study Area (TSA).

#### **ENVIRONMENTAL SETTING**

Woody biomass feedstock availability for any given region is dependent on vegetation cover, topography, land ownership, management objectives, and urban resident population. This biomass supply availability analysis focused on these key factors within the context of the TSA: Alameda, Contra Costa, Santa Clara, San Mateo, and Santa Cruz counties.

#### **Vegetation Cover**

The major vegetation cover classes were mapped (Figure 1) and their acreages calculated using the CAL FIRE, Fire and Resource Assessment Program database. The dominant vegetation cover classes, including conifer and woodland, were broken into subcategories for additional

analysis. The non-forest categories are mostly comprised of herbaceous cover, in particular annual grasslands. As Figure 1 shows, the TSA is highly urbanized.

# Figure 1. Vegetation Cover Map



The TSA includes approximately 1,734,369 acres of vegetation cover. Table 1 provides an acreage summary of the major vegetation cover types found within the TSA. About 46% of the area is made up of conifer (15%) and woodland (31%) dominated landscape and together constitute forestland within the TSA. It is forestland management that is most likely to produce woody biomass material as a byproduct of fuels reduction or forest restoration activities. As noted earlier, grasslands (noted as herbaceous in Table 1) are the dominant vegetation cover type, making up 36% of the landscape.

Vegetation Cover Type	Acres	Percent
Agriculture	100,707	6%
Barren/Other	9,746	1%
Conifer	255,154	15%
Closed-Cone Pine-Cypress	8,051	
Douglas Fir	31,105	
Montane Hardwood-Conifer	84,403	
Ponderosa Pine	1,113	
Redwood	130,482	
Woodland	544,860	31%
Blue Oak-Foothill Pine	16,337	
Blue Oak Woodland	127,052	
Coastal Oak Woodland	314,538	
Eucalyptus	8,764	
Montane Hardwood	54,188	
Montane Riparian	496	
Valley Foothill Riparian	12,425	
Valley Oak Woodland	11,060	
Herbaceous	618,626	36%
Shrub	205,276	12%
Alkali Desert Scrub	354	
Chamise-Redshank Chaparral	57,417	
Coastal Scrub	83,420	
Juniper	190	
Mixed Chaparral	58,547	
Montane Chaparral	1	
Valley Foothill Riparian	5,347	
Totals	1,734,369	100%

Table 1. Vegetation Cover Types Within the TSA

#### Land Ownership

Major public landowners were mapped (Figure 2) and their acreages calculated using the CAL FIRE FRAP database. The public landowner categories are not comprehensive; for example, land ownership by individual city is not included. In other regions of California, the USDA Forest Service and industrial forestland owners manage significant forestland holdings. This is

not the case for the TSA. Public land managers ranging from county parks to open space districts are managing much of the conifer and oak woodlands within the TSA. Each of these ownerships have land management objectives tailored to the agency's mission. Rarely are forest ownerships within the TSA focused on timber outputs for economic gain.





Acreages for public landowners are shown in Table 2. Large public land managers such as East Bay Regional Parks, Midpeninsula Regional Open Space, Santa Clara County Parks and SF Public Utilities Commission make up about 74% (129,198 acres) of the local government woodland and conifer forest holdings. These land management agencies are most likely to actively treat and remove hazardous forest fuels on a regular basis. This is especially the case if there is a disposal option available (e.g., Earth Foundries) as an alternative to pile/burn or landfill disposal techniques.

		Woodland and
Ownershin	Total Acres	Conifer Acreages
Local Covernment	344 841	175 471
Fast Bay Regional Park District	101 725	43 360
SF Public Utilities Commission	59 173	24 389
Midneninsula Regional Open Space District	57.616	33 433
Santa Clara County Parks and Recreation Dent	50 363	28.016
Fast Bay Municipal Utility District	26 758	13 668
Contra Costa Water District	19 001	13,668
Santa Clara Valley Open Space Authority	15,001	8 521
San Mateo County Parks and Recreation Dept	14 952	10 316
State of California	197 777	117 191
California Department of Parks and Recreation	158 779	103 518
California Department of Fish and Wildlife	18 219	6 183
University of California	7 174	5 330
California Department of Water Resources	5 357	21
California State Lands Commission	4 4 3 7	18
California State University	3 811	2 121
Federal Government	54.444	4.940
U.S. Fish and Wildlife	25,289	84
Department of Defense	14.758	345
Bureau of Land Management	7.330	3.007
National Park Service	7.057	1.504
Bureau of Indian Affairs	10	0
Totals	597,062	297,602

Table 2. Ownership and Acreages for Major Public Landowners Within the TSA

TSS completed a GIS analysis to confirm which public agencies are managing forestland (woodland and conifer cover types) within the TSA. Figure 3 is a map showing forestland ownership by public agency.



Figure 3. Major Public Landowners Woodland and Conifer Vegetation Cover

# URBAN WOOD WASTE AND TREE TRIMMINGS

This analysis focused on two types of potential wood waste biomass fuel from urban communities currently available within the TSA:

- Urban Wood (e.g., construction, demolition and pallets)
- Tree Trimmings (also known as green waste)

Wood waste produced within communities in the form of tree trimmings, construction and demolition wood and industrial wood (e.g., pallets) is an excellent and cost effective biomass fuel source. Typically low in moisture content (25% to 35% moisture)<sup>4</sup> and available year round, much of the urban wood and tree trimmings material is currently landfilled (as alternative daily cover) or processed for soil amendments/landscape cover. Some is utilized as wood fuel by biomass power plants in the Central Valley (e.g., DTE Woodland, DTE Stockton, Merced Power).

The five county TSA includes an urban population that produces wood waste all year round in very significant volumes. Urban wood (UW) and tree trimmings (TT) are the most significant and cost effective feedstock available to EF.

#### **State Policy**

Due to State of California legislative mandates, increasing volumes of urban wood waste and tree trimmings are available. Summarized below is recent legislation that impacts how they are managed within the state.

- Assembly Bill 1594 Signed into law in 2014, this legislation eliminates the waste diversion credit for landfills to use organics (including wood waste, tree trimmings) as alternative daily cover (ADC) effective 2020. Federal law requires landfills to be covered at the end of each workday to prevent odors, vermin and insects. While landfills have traditionally utilized soil as ADC, many states allow the use of alternative materials (including organics such as wood waste) for cover. Commencing in 2020, most landfills are utilizing other techniques to cover landfills (such as tarps) on a daily basis.
- Senate Bill 1383 Signed into law in 2016, this legislation seeks to mitigate shortlived climate pollutants (e.g., methane) by diverting organic wastes (including wood) away from landfills. It requires a 50% reduction in organic waste disposal from 2014 levels by 2020 and a 75% reduction by 2025. Cal Recycle is the state agency tasked with providing oversight to make sure that jurisdictions (primarily counties) adopt an ordinance or other similarly enforceable mechanism by January 1, 2022, to mandate that organic waste generators, haulers, and other entities subject to the requirements of SB 1383 regulations and subject to the jurisdiction's authority, comply with SB 1383 regulatory requirements.

<sup>&</sup>lt;sup>4</sup> Per TSS experience.

Due to these legislative mandates and an increased level of interest to extend the service life of landfills, UW/TT material supply produced and potentially available as feedstock has been increasing in recent years.

#### Urban Wood Waste

Urban wood waste generated by a community or region is directly proportional to population. The higher the population within a given area, the more urban wood waste is produced. TSS utilized 2019 data (latest available) from the US Census Bureau to estimate current population for all five counties within the TSA.

Within the TSA there is an estimated population of 5,792,493 residents. Note that Santa Clara County has the highest population of the five counties at 1,927,852. This represents approximately 33% of the entire population residing within the TSA.

Solid waste characterization studies are conducted sporadically throughout the U.S. A particularly comprehensive study was conducted in 2016 by the Oregon Department of Environmental Quality (ODEQ). Using the 2016 ODEQ solid waste characterization study<sup>5</sup> and a 2018 ODEQ solid waste generation report,<sup>6</sup> TSS utilized the findings to calculate UW generated within the TSA. As noted in the 2018 waste generation report, approximately 7.4 pounds of waste are produced daily per person. The 2016 characterization study found an estimated 10.6% of the solid waste stream generated as clean wood (paint free, no treated wood). Using this waste generation estimate, it was calculated that approximately 621,910 BDT/year of UW are potentially available within the TSA. TSS experience with UW confirms an average moisture content of about 25%.

TSS experience confirms that in regions such as the SF Bay Area, approximately 80% of this volume is recoverable as clean wood meeting biomass fuel specifications, resulting in 497,528 BDT/year of UW as practically available. Table 3 summarizes UW produced within the TSA on an annual basis by county.

		Potentially Available Urban Wood Fuel	Practically Available Urban Wood Fuel
County	Population	(BDT/Year)	(BDT/Year)
Alameda	1,671,329	179,442	143,553
Contra Costa	1,153,526	123,848	99,078
San Mateo	766,573	82,303	65,842
Santa Clara	1,927,852	206,983	165,587
Santa Cruz	273,213	29,333	23,467
Totals	5,792,493	621,910	497,528

Table 3. Urban Wood Potentially and Practically Available Within the TSA

<sup>&</sup>lt;sup>5</sup> <u>https://www.oregon.gov/deq/mm/pages/waste-composition-study.aspx</u>

<sup>&</sup>lt;sup>6</sup> 2018 Oregon Material Recovery and Waste Generation Rates Report, Oregon Department of Environmental Quality.

#### **Tree Trimming Material**

As with UW, tree trimming material volume produced within a community or region is proportional to population. Based on the 2016 ODEQ waste characterization study,<sup>7</sup> it is estimated that approximately 89 dry pounds of TT suitable for fuel are generated annually per person. Employing the data and methodology above yields about 257,766 BDT/year of TT as potentially available. TSS experience confirms that in regions such as the TSA, approximately 80% of this volume is recoverable as clean wood meeting biomass fuel specifications, resulting in 206,213 BDT/year of TT fuel as practically available. Table 7 summarizes TT fuel produced within the TSA on an annual basis by county.

County	Population	Potentially Available Tree Trimming Fuel (BDT/Year)	Practically Available Tree Trimming Fuel (BDT/Year)
Alameda	1,671,329	74,374	59,499
Contra Costa	1,153,526	51,332	41,066
San Mateo	766,573	34,112	27,290
Santa Clara	1,927,852	85,789	68,632
Santa Cruz	273,213	12,158	9,726
Totals	5,792,493	257,766	206,213

Tabla 1	Tree Trimming	Matarial Datantial	wand Draatiaally	u Awailahla	Within the	TCA
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Santa Clara county is clearly the significant UW (497,528 BDT/year) and TT (206,213 BDT/year) feedstock procurement opportunity for EF.

#### Summary of Urban Wood Waste and Tree Trimming Feedstock Availability

Utilizing findings from this analysis, TSS summarized UW and TT feedstock potentially and practically available. Posted in Table 5 is a summary of UW and TT feedstock availability within the TSA.

	Urban Wood Feedstock (BDT/Year)	Tree Trimming Feedstock (BDT/Year)	Totals (BDT/Year)
Potentially Available	621,910	257,766	879,676
Practically Available	497,528	206,213	703,741

#### **Fuels Reduction and Forest Restoration Residuals**

Interviews with land and natural resource managers representing major land ownerships within the TSA yielded data regarding acres targeted for treatment over the next five years. TSS issued a data request and project overview (Appendix A). Interviews with natural resource managers confirmed that all would like to actively treat forest and woodlands at a scale that would improve

<sup>&</sup>lt;sup>7</sup> <u>https://www.oregon.gov/deq/mm/pages/waste-composition-study.aspx</u>

fire resiliency across their ownerships. Interviews confirmed the key issues that deter these resource managers from treating forest fuels at landscape scale include:

- Access to funding in support of sustained fuels management.
- Sustainable markets for excess woody biomass produced.
- Concern regarding the fate of carbon throughout the collection, processing, transport and utilization cycle.
- Road systems will not always support log or chip transport.
- Contractor availability to collect, process and transport woody biomass feedstock.
- Additional truck traffic required to transport woody biomass feedstock to market. Neighboring property owners are concerned about increased truck traffic.
- Pile/burn or mastication is a known and dependable option.

In addition to large landowners conducting fuels reduction, there are entities such as Cal Trans, PG&E and Santa Clara Valley Water District that regularly manage vegetation along roads, powerline corridors, and water delivery infrastructure. Table 6 summarizes TSS best estimate for fuels reduction residuals generated by agency, utility, or landowner.

Agency, Utility, or Landowner	Acres Targeted for Treatment Per Year	Biomass Volume Targeted for Removal (BDT/Year)
Cal Trans	300	3,000
East Bay Municipal Utility District	50	750
East Bay Regional Parks	266	4,400
Midpeninsula Open Space	200	3,000
PG&E	N/A	20,000
San Jose Water Company	20	300
Santa Clara Valley Water District	N/A	250
SF Public Utilities Commission	100	1,500
UC Berkeley	50	1,000
Totals	986	34,200

Table 6.	Fuels	Reduction	Residuals

Note that Table 6 is not a complete list. It is based on responses from land managers at the time of reporting. Available feedstock from fuels reduction is likely to be larger upon their inclusion.

The most significant source of forest biomass material is PG&E. This is due to ongoing vegetation management along transmission and distribution powerlines. In recent years, the California Public Utilities Commission has directed investor-owned utilities (PG&E, SCE, SDG&E) to increase vegetation management activities in an effort to mitigate wildfire ignitions along powerlines. Known as the Enhanced Vegetation Management Program (EVM) this is an effort to increase hazard tree trimming and removals in recognition of increased tree mortality and drought conditions.

PG&E has retained Mason, Bruce & Girard, Inc. (MBG) to help monitor and manage wood material removed as part of the EVM and Routine Vegetation Management (RVM) programs conducted along PG&E powerlines. Discussions with MBG foresters confirmed a high level of interest to find local wood waste utilization and disposal options rather than transport forest biomass material to distant biomass power plants or to landfills. TSS has asked MBG to facilitate a meeting with PG&E staff to commence more detailed discussions.

Not all fuels treatment residuals will be accessible for removal. Topography, road systems, and onsite biomass retention standards will impact the net volume of forest biomass removed. Discussions with natural resource managers confirmed that challenging road systems and steep slopes impact the practicality of collecting and removing forest feedstock such that 70% of the volume targeted for removal (as shown in Table 6) is considered practically available. Using this metric, TSS found that approximately 23,940 BDT/year is practically available. Note that this figure will rise and fall based on a variety of factors including funding availability to support fuels treatment/forest restoration.

A common observation provided by a number of natural resources managers was that tracking the carbon footprint through collection, processing, transport, and utilization of forest biomass material will be a determining factor in whether forest biomass is removed for utilization. Managers were quite clear that excess forest biomass will not be removed if there is not a compelling carbon beneficial outcome.

#### **Timber Harvest Residuals**

Timber harvest residuals in the form of limbs, tops and sub-merchantable stems (small trees) are generated on a regular basis as a byproduct of commercial timber harvest activities within the TSA. Once collected and processed, these residuals are an excellent fuel (low moisture, high heating value). Discussions with area foresters confirmed that very little timber harvest residual volume is recovered (post-harvest) for value-added utilization. Most of the residuals (limbs, tops) are left in the forest. Some of the residuals are scattered on skid trails to mitigate potential erosion.

The preferred timber harvest technique is to fall, limb and buck (cut stems into log lengths) in the forest.<sup>8</sup> In other regions of California, trees are transported whole (with limbs and tops attached) to a roadside landing for processing using delimbers.<sup>9</sup> The delimbing process generates piles of limbs, tops and sub-merchantable trees at the roadside landing. This is not the case for most of the timber harvest activities carried out within the TSA.

As a byproduct of commercial timber harvests, the availability of residuals rises and falls with harvest activities. TSS reviewed data provided by the University of Montana<sup>10</sup> (UM) to confirm timber harvest levels in the TSA for the last five years (that data is available), 2016 through 2020. Note that UM records track commercial timber harvest by county and ownership type (private and public). Table 7 provides historic private timber harvest sawlog volumes from the

<sup>&</sup>lt;sup>8</sup> Per discussions with Janet Webb, President, Big Creek Lumber Company, Davenport, California.

<sup>&</sup>lt;sup>9</sup> Commercial-scale equipment designed to remove limbs and tops as well as cut stems to preferred lengths prior to transport to the sawmill.

<sup>&</sup>lt;sup>10</sup> Bureau of Business and Economic Research.

five counties that make up the TSA. The harvest volume estimates are presented in thousand board feet<sup>11</sup> measure (MBF).

County	2016 (MBF/Yr)	2017 (MBF/Yr)	2018 (MBF/Yr)	2019 (MBF/Yr)	2020 (MBF/Yr)	Five-Year Avg (MBF/Yr)
Alameda	0	0	0	12,000	0	2,400
Contra Costa	0	10	0	0	0	2
San Mateo	9,781	5,021	5,661	15,786	1,114	7,473
Santa Cruz	8,173	11,276	12,090	18,864	10,171	12,115
Santa Clara	6	1,961	1,178	1,855	1,661	1,332
Totals	17,960	18,268	18,929	48,505	12,946	23,322

Table 7. 2016 to 2020 Timber Harvest by County Within the TSA

Some counties have historically produced more sawtimber than others, with two counties (San Mateo and Santa Cruz) producing about 84% of the harvest volume between 2016 and 2020. Note that the five-year average timber harvest within the TSA is approximately 23,322 MBF/year. Based upon TSS' experience working with logging and chipping contractors in central California, the recovery factor for biomass feedstock processed from timber harvest residuals is approximately 0.9 BDT/MBF of woody biomass (treetops and limbs) that could be generated from each MBF of timber harvested.

Using the 0.9 BDT per MBF recovery factor and the 23,322 MBF/year (five-year average) harvest estimate, there are 20,989 BDT/year of timber harvest residuals potentially available within the TSA. Not all timber harvest residuals are recoverable, as topography and road systems will impact economic collection and transport. TSS interviewed forest managers regarding topography and road systems that will accommodate chip vans. Interviews and TSS experience in the region confirmed that approximately 20% of the landscape is located on topography with roads that will accommodate chip vans. Using the 20% figure results in a practically available timber harvest residual estimate of 4,198 BDT/year.

#### **Forest Products Manufacturing Residuals**

California is home to 25 commercial-scale forest products manufacturing operations (sawmills and veneer mills).<sup>12</sup> A range of sawmill and plywood mill residuals are produced as a byproduct of the forest products manufacturing process, including chips, shavings, bark, sawdust, hog fuel (a blend of sawdust and bark), and plytrim (side cuts from plywood production). These residuals are an excellent source of biomass feedstock, typically available year round.

There is one sawmill currently operating within the TSA. Big Creek Lumber Company operates a redwood mill at Davenport. Initially built in 1964, the mill operates on a one-shift basis and produces about 27,500 BDT/year of chips, sawdust, bark and planer shavings.<sup>13</sup> Interviews with Big Creek Lumber President, Janet Webb, confirmed that all of the sawmill residuals have well-

<sup>&</sup>lt;sup>11</sup> Thousand board feet (MBF) is a common unit of measure used in the timber industry to express relative volume of sawtimber. One board foot measure is approximately equal to a board that measures 12" by 12" and 1" thick.

<sup>&</sup>lt;sup>12</sup> California Forestry Association data.

<sup>&</sup>lt;sup>13</sup> TSS calculations using industry standard residual factors.

established markets, primarily nurseries and soil amendment processors located on the Central Coast.

### FINDINGS

Findings from this investigation are summarized below.

#### **Biomass Supply Availability**

Summarized in Table 8 is the TSS estimate of biomass supply considered practically available on an annual basis from within the East Bay Hills TSA.

Biomass Feedstock Type	Estimated Practically Available Volume (BDT/Year)	Percent of Total
Urban Wood Waste	497,528	68%
Tree Trimmings	206,213	28%
Fuels Reduction and Forest Restoration Residuals*	23,940	3%
Timber Harvest Residuals	4,198	1%
Forest Products Manufacturing Residuals	0	0%
Total	731,879	100%

#### Table 8. Biomass Supply Practically Available

\*Based on responses from land managers at the time of reporting. Available feedstock from this category is likely to be larger upon their inclusion.

# Appendix A. Biomass Feedstock Supply Survey Data Request Form

#### Biomass Feedstock Supply Analysis Data Request

#### Introduction

TSS has been retained by Earth Foundries Inc (EFI) to conduct a biomass feedstock supply review. The Target Study Area is the south Bay Area including Alameda, Santa Clara, San Mateo, and Santa Cruz counties. EFI has asked TSS to focus on woody biomass feedstocks generated as a byproduct of fuels management activities planned over the next five years.

#### **Data Request**

In order to complete this review, TSS is asking resource professionals, Fire Safe Councils RCD's and agency personnel to provide data regarding fuels reduction projects planned over the next five years.

Organization:

Lead contact (with contact information):

Number of acres managed within the Target Study region:

List fuels management and tree removal projects planned for next 5 years:

Project Name	Acreage	Tonnage <sup>14</sup> /Ac Targeted for Removal	Vegetation Disposal Technique	Implementation Schedule

Is any of the vegetation removed likely to be used for a value-added purpose (e.g., firewood, chips for landscape cover, compost, biochar)?

<sup>&</sup>lt;sup>14</sup> Please report tonnage in green tons (actual tonnage not corrected for moisture content).

If so, who are the local value-added utilization enterprises? (please list)

Enterprise Name	<b>Contact Person</b>	Location	Comments

Is any of the vegetation planned for removal destined for pile/burn disposal?

If so, please provide estimates of tonnage that will be burned over the next five years (average tons per year estimate).

Or landfill disposal?

If so, please provide estimates of tonnage that will be sent to landfill over the next five years (average tons per year estimate).

From your experience with vegetation management, are there strategic sites or existing operations that are well suited for collocation of a small-scale biomass power operation?

Other comments or observations?

Thank you for your time and consideration!

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