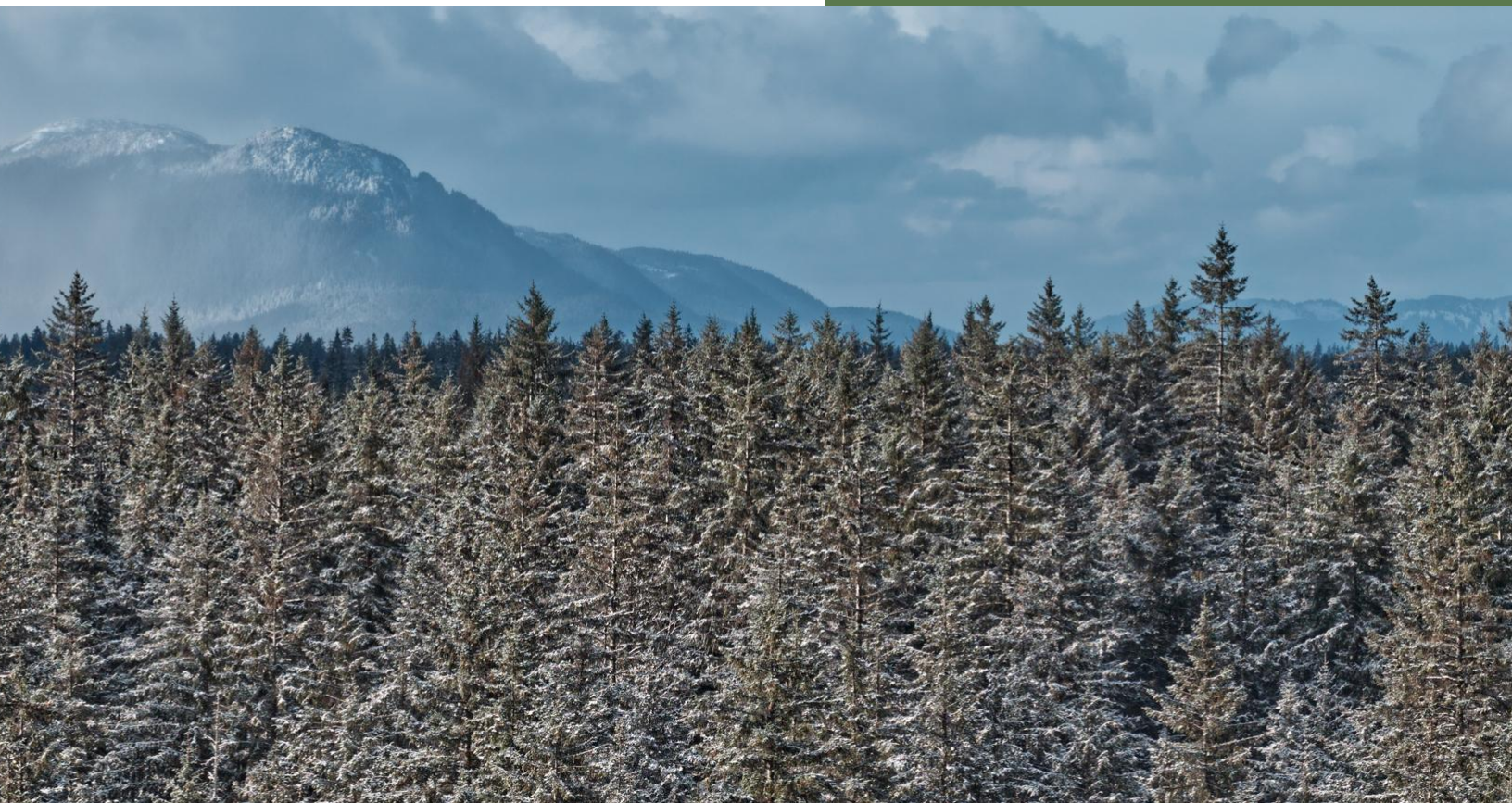


Sustainable Aviation Fuel

Biomass Assessment: Forests

Prepared for

Alaska Department of Transportation



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Introduction

Over half of Alaska is covered by forests, woodlands, or shrublands. These lands provide potential sources of biomass that may be relevant to certain SAF production pathways. This memo evaluates these resources as potential SAF-related resources. It does not establish these resources as a feedstock for the ANSyR Fischer–Tropsch pathway or as a material supply source for the modeled ANSyR production scale.¹

Relationship to ANSyR Design Basis

The ANSyR Technical and Economic Analysis evaluates a large-scale Port MacKenzie-centered Fischer–Tropsch Synfuel Refinery. This memo is a preliminary resource screen and does not modify the ANSyR proposed feedstock slate, production volume, lifecycle carbon-intensity result, capital cost estimate, or pathway selection. Any use of the resource described here would require separate technical, commercial, permitting, lifecycle, ASTM/pathway, and integration analysis before inclusion in the ANSyR design basis.

Description of the Resource

Forests, woodlands, and shrublands cover 206 million acres of Alaska. Commercial and small-scale forestry are practiced across the state. Forestry resources include both hardwood and softwood species. Our analysis evaluates the entire forested area of Alaska for biomass potential. Biomass volumes include stems, branches, and foliage. Analysis does not assess the feasibility of accessing this timber.

Residues from wood products manufacturing are included in a separate memo that includes other biomass sources.

Quantity of the Resource

The total standing forest biomass in the state is nearly 5.3 billion bone dry tons (BDT), of which 4.6 billion BDT is in live trees and 700 million is in dead trees (Table 1). Forest biomass is not evenly distributed across the state. Southeast Alaska has about 15.4 million acres of forest, or 7% of the statewide total, but over 21% of the total tree inventory, with 1.2 million BDT (Maps 1 and 2).

Per acre biomass quantities range from 11 BDT per acre to 95 BDT per acre across the different forest types in the state. The quality varies by region of the state and by forest type. Statewide, biomass is growing by 0.35 BDT per acre per year, for a total of 73 million BDT of growth per year (Tables 2 and 3).

Table 1. Standing timber volume (BDT).

Biomass type	Total (BDT)
Standing live volume	4,603,398,000
Standing dead volume	713,912,000
Total volume	5,317,310,000

¹ This resource assessment memo provides only an overview of resource quantity and price information. It is not an assessment of feasibility to use the resource to produce sustainable aviation fuel.

Table 2. Acres and standing inventory (BDT) by forest type.

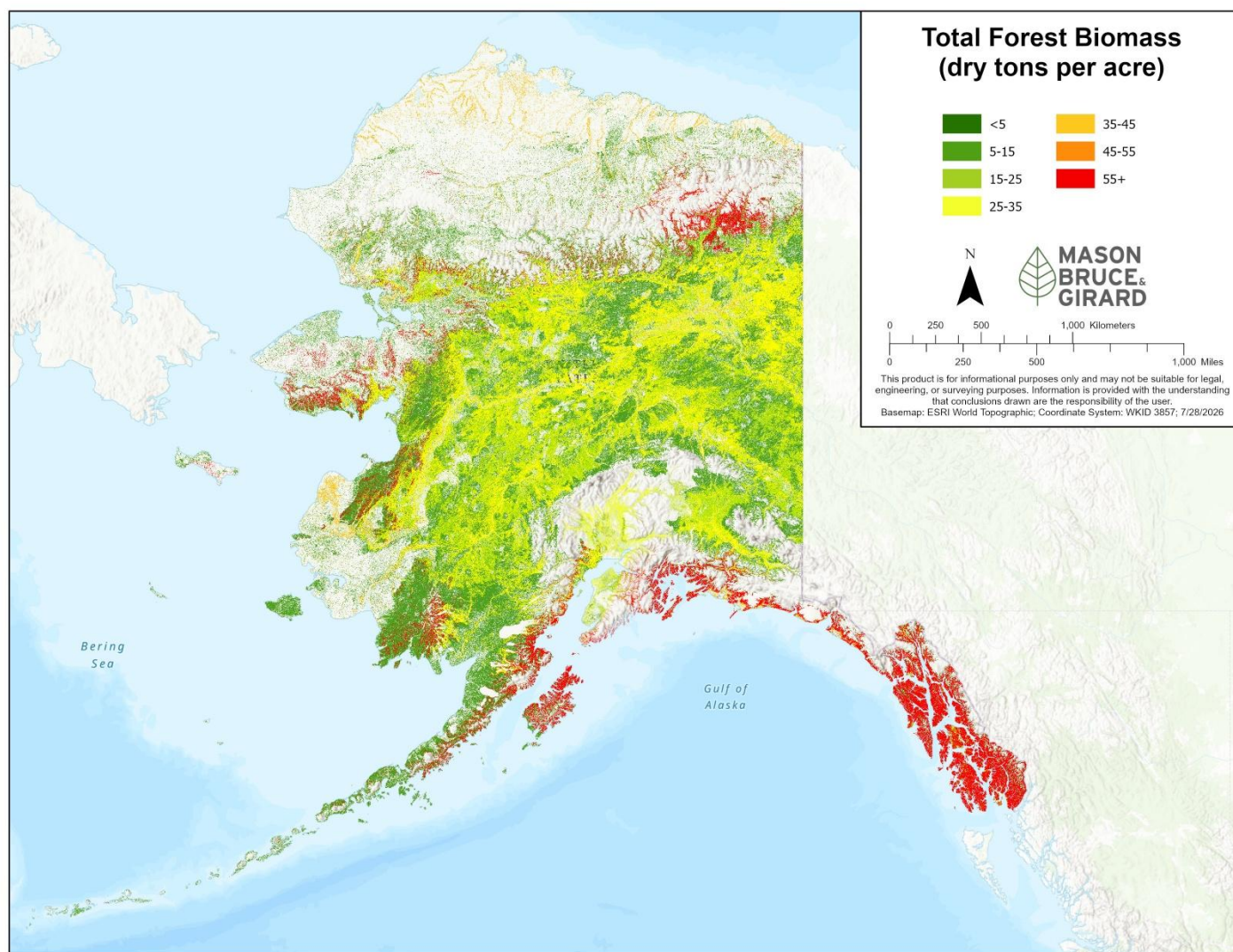
Forest type	Acres	Total inventory (BDT)	Standing inventory per acre (BDT)	Annual growth per acre (BDT/yr)
Alder Shrubland	13,814,000	849,622,000	61.5	0.40
Balsam Poplar-Aspen Woodland	1,410,000	16,980,000	12.0	0.36
Birch-Aspen Forest	7,430,000	245,720,000	33.1	0.38
Black Spruce Forest and Woodland	20,839,000	313,602,000	15.0	0.42
Dry Aspen-Steppe Bluff	40,000	482,000	12.0	0.29
Dwarf Shrubland	39,721,000	445,890,000	11.2	0.29
Floodplain Forest and Shrubland	6,434,000	247,021,000	38.4	0.47
Mountain Hemlock Forest and Woodland	4,406,000	304,226,000	69.0	0.30
Peatland Forests	8,000,000	178,021,000	22.3	0.45
Riparian Stringer Forest and Shrubland	532,000	5,714,000	10.7	0.28
Sitka Spruce Forest	2,328,000	203,022,000	87.2	0.45
Spruce-Lichen Woodland	898,000	10,777,000	12.0	0.29
Western Hemlock-Yellow-cedar Forest	7,063,000	659,407,000	93.4	0.37
Western Red-cedar-Western Hemlock Forest	1,291,000	121,655,000	94.2	0.44
White Spruce Forest and Woodland	4,768,000	78,206,000	16.4	0.32
White Spruce-Hardwood Forest and Woodland	44,011,000	1,163,195,000	26.4	0.40
Willow Shrubland	43,306,000	473,770,000	10.9	0.28
Total	206,291,000	5,317,310,000	25.8	0.35

Table 3. Acres and standing inventory (BDT) by ownership.

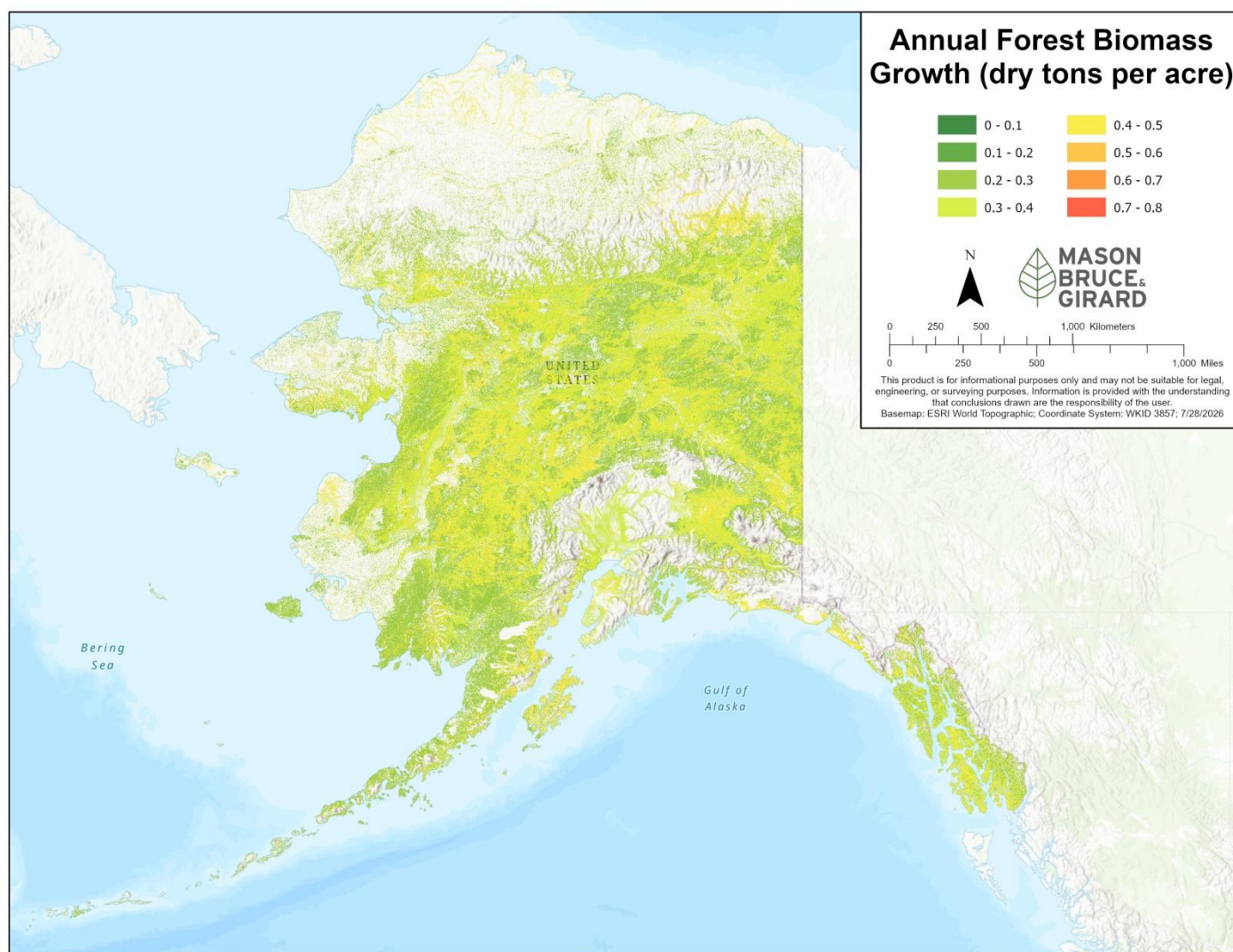
Ownership	Acres	Total inventory (BDT)	Standing inventory per acre (BDT)	Annual growth per acre (BDT/yr)
ANCSA†	16,147,296	403,538,327	25.0	0.36
Federal	123,203,935	3,484,164,509	28.3	0.35
Alaska Native	339,611	8,497,840	25.0	0.37
State/local	65,911,183	1,395,743,227	25.0	0.35
Private	253,793	9,018,492	35.5	0.38
Unknown	434,765	16,347,507	37.6	0.30
Total	208,971,000	5,317,310,000	25.8	0.35

† Alaska Native Claims Settlement Act lands.

Map 1. Distribution of forest biomass.



Map 2. Distribution of forest biomass growth.



Estimated Cost of Delivery

Forest biomass can be delivered to Port MacKenzie either as logs or chips. If delivered as logs, onsite chipping is required. Chipping logs at or near logging sites and transporting chips to Port MacKenzie requires a network of chipping locations or mobile chippers. However, chips can be more efficiently transported than logs, lowering delivery costs.

The cost of delivery of forest biomass to Port MacKenzie varies greatly depending on transport distance, mode, and the infrastructure required to reach timber. The lowest cost biomass is that which can be harvested using ground-based logging equipment at logging sites near roads (e.g., less than ¼ mile), and within a short haul distance of Port MacKenzie.

Logging costs vary by logging type (ground-based or cable) and stand volume. Logging costs are primarily a factor of the equipment used, the difficulty of logging, and the volume harvested per acre. Stands with higher per acre volumes are more cost effective to harvest. In the Pacific Northwest, the area most comparable to the analysis area that has known costs, logging costs range from \$43 to \$68 per BDT for ground-based logging and \$70 to \$123 per BDT for cable-based logging, depending on the variables stated above (Table 4).

Table 4. Ground and cable logging cost per ton.

Harvest volume (BDT/acre)	Cable (\$/BDT)	Ground (\$/BDT)
15	\$123	\$68
30	\$103	\$58
45	\$91	\$53
60	\$82	\$49
75	\$75	\$46
90	\$70	\$43

Timber harvests in locations that require road construction to access will incur road construction costs. These costs range from \$25,000 per mile for temporary seasonal roads (dirt surface), to \$31,000 per mile for permanent seasonal roads (dirt surface), to \$100,000 for all-weather rock-surfaced roads, assuming appropriate surface rock is available near the road. In coastal areas with high rainfall, all-weather roads are needed. The cost of roads per ton of biomass delivered depends on the quantity of biomass that a road accesses and the length and type of the road needed. The higher the biomass volume accessible by a given road, the lower the cost of the road construction per ton of delivered biomass. Additionally, road density (miles of road per square mile) is generally higher in mountainous areas compared to flat lands. In managed forests in the Pacific Northwest, average road densities are approximately 3 miles of road per square mile. Assuming this density, all weather road construction would add about \$5 per ton to the cost of delivering material from Western Redcedar-Western Hemlock Forests, the forest type with the highest biomass per acre in Alaska. For interior forest types, such as White Spruce-Hardwood Forest and Woodlands with lower biomass per acre, assuming seasonal roads are constructed, road constructions costs are similar at \$5.50 per ton.

Chipping logs into wood chips increases the amount of biomass that can be delivered by truck or barge, since chips can be packed more compactly than logs. Chipping logs using mobile log chippers would cost an estimated \$11 per BDT.²

Haul cost depends upon the mode of transport. For truck delivered wood chips, every mile of haul increases delivery cost by about \$0.25 per ton. For delivery of material from Southeast Alaska and areas with poor road connections to Port MacKenzie, material could be delivered by barge. Based on 2025 rates for ocean-going barges on the U.S. west coast, the cost to barge biomass from southeast Alaska to Port MacKenzie is about \$36 per BDT, assuming a 4-day transit time. Additional costs for loading and unloading would be incurred at an estimated \$1 per BDT. Both of these estimates are likely low, as the cost of fuel and equipment is generally higher in Alaska than on the West Coast as a whole. These costs are in addition to the cost of delivering biomass to a port facility for loading onto a barge. Investments in biomass handling equipment and adequate port facilities to host ocean-going barges would likely be required.

Cost examples

Since the cost of biomass delivery will vary by a number of factors, we provide examples of possible scenarios and estimated delivery costs (Table 5). These costs do not include the purchase price of the timber from the landowner.

² Based on MB&G forester input from California and values from a 2007 study from Alabama adjusted into 2025 dollars per BDT.
https://www.srs.fs.usda.gov/pubs/rn/ja_mitchell013.pdf

Table 5. Cost to deliver 1 BDT chipped logs to Port MacKenzie under several scenarios.

Activity	Scenario 1	Cost per BDT
Logging	30 BDT/acre, ground based	\$58
Chipping	Chipped	\$11
Road construction	None	\$0
Road haul	50 miles	\$12.50
Barge haul	None	\$0
Total		\$81.50
Activity	Scenario 2	Cost per BDT
Logging	15 BDT/acre, ground based	\$68
Chipping	Chipped	\$11
Road construction	None	\$0
Road haul	200 miles	\$50
Barge haul	None	\$0
Total		\$129
Activity	Scenario 3	Cost per BDT
Logging	30 BDT/acre, ground based	\$58
Chipping	Chipped	\$11
Road construction	3 miles, seasonal	\$16.50
Road haul	50 miles	\$12.50
Barge haul	None	\$0
Total		\$98
Activity	Scenario 4	Cost per BDT
Logging	90 BDT/acre, ground based	\$43
Chipping	Chipped	\$11
Road construction	None	\$16.50
Road haul	20 miles	\$12.50
Barge haul	4-day passage	\$36
Total		\$95

Capital Investments

Increasing timber harvest in Alaska will require capital investments in equipment. Equipment needed includes feller bunchers for ground-based harvesting, skidders for moving cut timber to roads, chippers, chip vans (container boxes) and trucks to transport chips. Current prices of new and used models of these equipment types in the lower 48 states are in Table 6. Additional costs would be incurred by transporting the equipment to Alaska.

Table 6. Equipment purchase costs.

Equipment	Cost per Unit (Used)	Cost per Unit (New)
Chipper	\$525,000	\$850,000
Chip container +truck	\$300,000	\$390,000
Feller buncher	\$416,000	\$910,000
Skidder	\$318,000	\$560,000

Methods

Quality Estimates

Our forest biomass estimates are based on three data sources. For Alaska Department of Natural Resources (DNR) managed lands, we used inventory data from the department, including a 2025 inventory for lands on the Kenai Peninsula, and 2021 data for Moose Range and Matanuska-Susitna Valley (Mat-Su) lands.

For DNR lands not included in these data sets and all other lands, we used data from the United States Forest Service (USFS) Inventory and Analysis (FIA) Program,³ and from the most current (2023) edition of LANDFIRE Existing Vegetation Type (EVT), a vegetation type GIS layer developed by the USFS and The Nature Conservancy.⁴

We used forested FIA plots located in the project area, based on GIS data from the FIA.⁵ We then assigned FIA plots to an EVT group by location. We developed acre-weighted average volumes for each EVT group, based on sample weight data provided in FIA. For continuity in reporting, we assigned DNR-managed inventory data to EVT groups as well. The result is an estimated average volume per acre by metric (e.g., total standing biomass) for each EVT group. This produces a robust estimate of forest biomass volume at a landscape scale. At small scales (e.g., individual stands), scale estimates are less robust.

We estimated forest growth by using the Alaska variant of Forest Vegetation Simulator in a “grown only” simulation. For this analysis, we projected growth of trees in FIA plots and multiplied average per acre growth by the acres within each EVT group.

Future management of forests may result in improved growth rates.

Cost Estimates

Trucking costs for residuals are based on an EPA estimate of the cost of biomass haul costs.⁶ Prices for residuals and barging are from a report on the fiber and residual market in the Pacific Northwest by Mason, Bruce & Girard, based on data from Forisk and market interviews. This report⁷ is available from the Clallam County Economic Development Council. The report considered the market for residuals from southern Oregon to southeast Alaska.

Logging and chipping costs are operational costs based on information from MB&G foresters, propriety contract data, and published reports.⁸ Equipment costs are based on publicly available data collected from equipment sales websites in summer 2025.

³ Plot data were downloaded from the FIA datamart on February 7, 2025

⁴ <https://landfire.gov/>

⁵ Exact FIA plot locations are not reported by FIA to protect individual landowner privacy. Instead, plot locations are offset by an unknown amount up to approximately 1 mile. We used these offset locations to determine whether a plot was or was not in the analysis area. At the scale of the analysis area, potential errors from a plot being reported as within the analysis area but is actually located outside the analysis area are minor.

⁶ <https://www.epa.gov/sites/default/files/2016-03/documents/r02002.pdf>

⁷ North Olympic Peninsula Fiber and Residuals Report, June 2025.

⁸ Chipping cost data specifically is from MB&G forester input from California and values from a 2007 study from Alabama adjusted into 2025 dollars per BDT. https://www.srs.fs.usda.gov/pubs/rn/ja_mitchell013.pdf