Biofuel Development Opportunity Zone Rating
Region: Libby, Montana
Date of Issue: July 6, 2022

BDO ZONE Rating: 'A'

Biofuel Development Opportunity Zone Rating

'A'

The Libby, Montana BDO Zone is rated "A". Long-term outlook on feedstock availability, cost, and quantity of Forest Residuals and Pulpwood is deemed stable. Limited access to Sawmill Residuals at market prices.

Rating Parameters

Feedstock quantity	Feedstock Type	Feedstock Price	BDO Zone
225,000 - 275,000 gt/year	Forest Residuals	$30 to $35 /gt	80-mile drive distance ex. Libby, MT
	Pulpwood	$25 to $35 /gt	
	Sawmill Residuals	$15 to $55 /gt	

BDO Zone Assets

- **225,000 to 275,000 green tons per year (gt/yr) of woody biomass available in the BDO Zone.**
- **Few operating markets in the Libby BDO Zone for Forest Residuals and Pulpwood.**
- **Reliable anchor supply: 20 producers and 8 sawmills operating within the BDO Zone.**
- **Available forest products labor market.**

BDO Zone Liabilities

- **Strong demand for Sawmill Residuals from existing markets. Limited and competitive access is likely for new markets.**
- **Strong likelihood of material supply chain impacts from externalities: slow lumber markets, periodic wildfires, and extreme weather events have periodically affected Sawmill Residuals and Forest Residuals generation.**
- **Increasing fuel prices stress logging and transportation costs.**

BDO Zone Rating Objective

This Biofuel Development Opportunity (BDO) Zone Rating offers critical insights into the biomass supply chain and infrastructure risk essential to translating biomass feedstock complexity into clarity, so market participants can uncover opportunities and expedite decision-making on new plant development.

Risk Rating Grade

The Libby, MT BDO Zone is rated "A", or *low risk*.

Risk Rating Grades are defined as follows: Aa (*very low*), A (*low*), Baa (*low-moderate*), Ba (*moderate*), B (*moderate-high*), or C (*high*).

In assessing biomass supply chain risk for the Libby, MT BDO Zone, 51 Risk Indicators from the *US Biomass Supply Chain Risk Standards* were applied. These Libby BDO Zone Risk Indicators are the subset of BSCR Risk Indicators applicable to gauging feedstock risk within a BDO Zone.

Feedstock quantity is expressed in green tons. Feedstock cost is expressed in US dollars, at the site of generation. Maximum transport distance is based on an 80-mile drive distance BDO Zone.

Scoring and Rating Methodology

The BDO Zone rating is based on an aggregation of the scores assigned to each BDO Zone Risk Indicator (RI) assessed in this report. First, each BDO Zone Risk Indicator is given a **Raw RI Score** based on the research and analysis conducted on the feedstock supply chain in the region. Raw RI Scores are scaled between 1 (*low risk*) and 10 (*high risk*).

Next, each Risk Indicator is discounted, or "notched", based on the degree to which the uncertainty drivers are deemed to be addressable, and whether there is a reasonable expectation that mitigation measures could be put into place within the price parameters for this rating. The **Notched Salience score** represents this and corresponds to the likelihood of each Risk Indicator's described risk materializing given the implementation of reasonable mitigation measures by a new bio-based plant. To arrive at the Notched Salience score, Raw RI Scores are reduced based on the

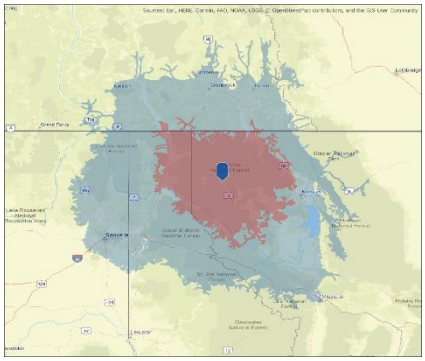
efficacy of the proposed mitigation measures. If applicable, notching occurs at one of 3 levels: 25%, 50%, or 75%.

Finally, the potential impact of each Risk Indicator on the supply chain is assessed and scored on a 10-point **Impact Level** scale, as either *low (3.33), moderate (6.66), or high (9.99).* Impact Level scores reflect the impact on the project from that Risk Indicator should we be unsuccessful in mitigation efforts.

The **Loaded RI Score** for each Risk Indicator is then calculated as the product of Notched Salience and Impact Level scores. For example, if the Raw RI Score for the Risk Indicator *Feedstock Supply Curve* is scored at 4, notched by 25%, and the Impact Level is deemed "low" (i.e., 3.33), then the final Loaded RI is (Raw RI 4 x 1/.25 notch) 3 Notched Salience x 3.33 Impact = 9.99 (out of 100).

Loaded RI scores of 33.33 or less are deemed ***low risk***; scores greater than 33.33 and less than 66.66 are deemed a ***moderate risk***, and scores of 66.66 to 100 are deemed ***high risk***.

Libby, MT BDO Zone



The total risk rating for the BDO Zone is the average of all Loaded RI scores. The BDO Zone score for Libby, MT, is **14.63 *out of 100, resulting in an "A" designation.*** All scoring and Rationale for each Risk Indicator are provided in Appendix B.

Analyst Notes

We estimate the annual generation of woody biomass in the BDO Zone at 809,813 gt/yr[1], defined by an 80-mile drive from Libby, MT, and comprised approximately as follows: 450,819 gt/yr of Sawmill Residuals, 273,088 gt/yr of Forest Residuals, and 85,907 gt/yr of Pulpwood[2]. Of this total, we estimate that approximately 256,479 gt/yr is available from current suppliers. However, we believe that only Forest Residuals and Pulpwood can function as strong levers for new market development.

We note that market demand for Forest Residuals is low: the bulk of potentially available Forest Residuals is currently not utilized by competitors in the BDO Zone. The majority of Forest Residuals are either left in the forest after harvest or burned on site. Assuming a capture ratio of 55%, we believe that approximately 150,198 gt/yr of Forest Residuals are likely available to new bio-based markets in the Libby BDO Zone.

Demand for Pulpwood saw a dramatic decrease in the Libby BDO Zone with the closure of a prominent pulp mill. Without a high level of market demand, harvesting of Pulpwood is being conducted at greatly reduced levels versus previous decades. Pulpwood removal is an important component of forest management: foresters and land managers in the Libby BDO Zone will likely support the development of new market outlets for Pulpwood to aid silvicultural and fuels reduction objectives[3]. At present, removals occur primarily during pre-commercial and commercial thinnings or when written into logging specifications on a job-by-

[1] Forest Inventory and Analysis (FIA) estimates provided by the University of Montana-Bureau of Business and Economic Research. May 2022.

[2] We define Pulpwood in this report as trees 5 to 11 inches in diameter at breast height (dbh).

[3] Verbal communication with Foresters, Land Managers, and Loggers in the Libby Supply Basin. April–May 2022.

job basis (i.e., when a logging contract stipulates that Pulpwood must be removed).

Assuming 85,907 gt/yr of Pulpwood in the Libby BDO Zone, we apply a reasonable capture ratio of 25% to derive an estimate of 21,477 gt/yr of Pulpwood to a new bio-based project in the BDO Zone.

For the purpose of this rating, we see large quantities of Sawmill Residuals as functionally unavailable for new plant development. Currently, Libby BDO Zone sawmills commit nearly all Residuals to existing markets located in the Competition Zone4 or use them internally for kiln drying and facility heating. Estimates for Sawmill Residuals were generated using Forest Inventory and Analysis (FIA) and Timber Product Output data examined by the University of Montana-Bureau of Business and Economic Research in May of 2022. We assume a capture rate of 10% to 20% for Sawmill Residuals based on the fact that we are unable to estimate the ability of current markets to drive price and on reduced haul distances of a new plant versus existing markets. On that basis, we find it reasonable that ~67,623 gt/yr could be available at market prices. We estimate the ranges for current delivered prices in US dollars per green ton as follows:

Forest Residuals: $30 to $35
Pulpwood: $25 to $35
Sawmill Residuals (by category):

- Bark: $25 to $30
- Sawdust: $15 to $20
- Shavings: $32 to $37.50
- Softwood Chip: $50 to $55[5]

The forestry industry in the Libby, MT BDO Zone is strong, with a long history of production and performance. We note a reduction in small sawmills over the last few decades to fewer but higher volume primary wood processors. Currently, the woody biomass supply chain in the Libby BDO Zone is anchored by several key operating feedstock generators: 8 sawmills and at least 20 fiber producers/harvesters[6]. The forestry labor market is stable; we do not anticipate labor or skill shortages.

Salient Risk Indicators

Both suppliers and supply chains in the Libby BDO Zone are subject to material external risk factors including the lumber market, fire, and forest pests and disease. Uncontrollable external impacts can materially reduce output from both local sawmills and producers for long periods of time.

Competitor location and geographical influence on the market pose a moderate risk to all categories of feedstock—with the exception of Sawmill Residuals, where we find material risk.

Thirty-three competitors for Sawmill Residuals were identified within a 160-mile drive distance from Libby, MT: medium-density fiberboard mills, pellet mills, and wood fuel for facility heating all consume Sawmill Residuals in significant quantities[7]. The ability of current markets to drive price is unknown: therefore, we find material risk around the supply of Sawmill Residuals for new bio-based markets in the BDO Zone.

Infrastructure Asset Profile

Libby's infrastructure assets were scored on a scale of 0–10, with scores defined as follows: 0 (*insufficient*), 2 (*poor*), 4 (*fair*), 6 (*reasonable*), 8 (*good*), 10 (*very good*). Among the top-rated assets are landfill access, sewage disposal trunk line, outdoor recreational activities, highway access, and land

[4] Defined by a 160-mile drive from the Libby, MT BDO Zone center point.
[5] Bark, Sawdust, Shavings, and Chips are all Sawmill Residuals.
[6] See Tables C and D in this report for names, addresses, and contact information.
[7] While exact values for biomass consumption by markets is not publicly available, feedback for this rating suggests that they currently account for nearly 99% of Sawmill Residual intake.

cost. Overall, Libby, MT presents a profile of positively rated infrastructure assets, with an average score of **7.2 out of 10**. This score supplements Libby's BDO Zone rating and reinforces its *low-risk* designation. The full infrastructure asset profile is detailed in Table 2. Documentation supporting infrastructure assessment is available upon request.

Figure 1 - Risk Indicators (sorted by risk level)

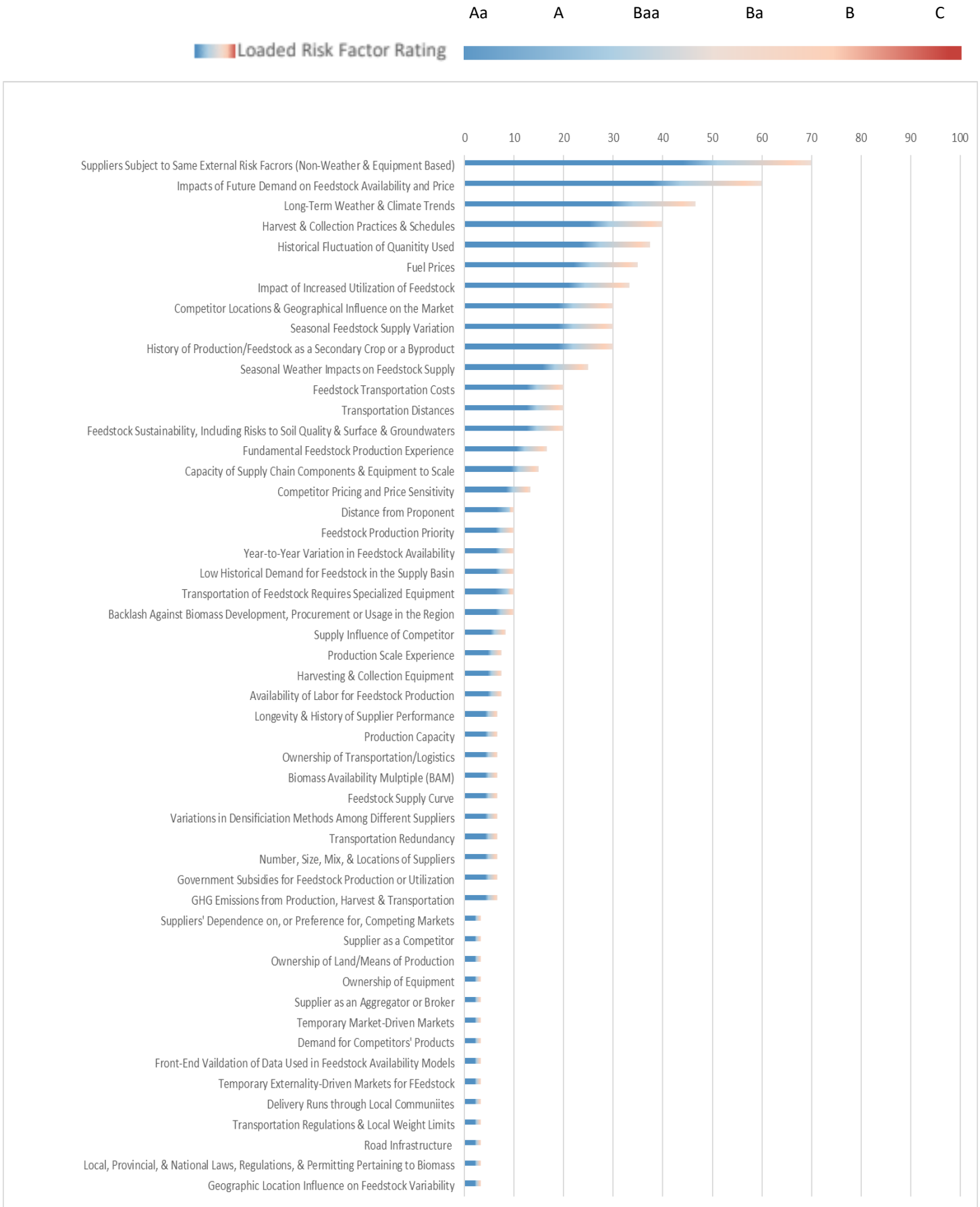


Table 1: Risk Indicators

Feedstock Supply Chain Risk Indicators	Raw RI Score	Notched Salience	Impact Level	Loaded RI Score
Category 1: Supplier Risk				
Longevity & History of Supplier Performance	1	1	6.66	6.66
Production Capacity	1	1	6.66	6.66
Supplier's Dependence on, or Preference for, Competing Markets	1	1	3.33	3.33
Supplier as a Competitor	1	1	3.33	3.33
Ownership of Land/Means of Production	1	1	3.33	3.33
Ownership of Equipment	1	1	3.33	3.33
Ownership of Transportation/Logistics	1	1	6.66	6.66
Supplier as an Aggregator or Broker	1	1	3.33	3.33
Distance from Proponent	3	3	3.33	9.99
Fundamental Feedstock Production Experience	5	2.5	6.66	16.65
Production Scale Experience	3	2.25	3.33	7.49
Feedstock Production Priority	2	1.5	6.66	9.99
Category 2: Competitor Risk				
Competitor Locations & Geographical Influence on the Market	4	3	9.99	29.97
Historical Fluctuation of Quantity Used	5	3.75	9.99	37.46
Competitor Pricing & Price Sensitivity	4	2	6.66	13.32
Impacts of Future Demand on Feedstock Availability & Price	8	6	9.99	59.94
Supply Influence of Competitor	5	1.25	6.66	8.32
Temporary Market-Driven Markets	1	1	3.33	3.33
Demand for Competitors' Products	1	1	3.33	3.33
Category 3: Supply Chain Risk				
Biomass Availability Multiple (BAM)	2	2	3.33	6.66
Impact of Increased Utilization of Feedstock	5	5	6.66	33.3
Feedstock Supply Curve	2	2	3.33	6.66
Seasonal Feedstock Supply Variation	6	4.5	6.66	29.97
Year-to-Year Variation in Feedstock Availability	1	1	9.99	9.99
Front-End Validation of Data Used in Feedstock Availability Models	1	1	3.33	3.33
Low Historical Demand for Feedstock in the BDO Zone	3	3	3.33	9.99
History of Production/Feedstock is a Secondary Crop or a By-product	3	3	9.99	29.97
Diesel Prices	7	5.25	6.66	34.96
Harvest & Collection Practices & Schedules	6	6	6.66	39.96
Harvesting & Collection Equipment	3	2.25	3.33	7.49
Temporary Externality-Driven Markets for Feedstock	1	1	3.33	3.33
Variation in Densification Methods Among Different Suppliers	2	2	3.33	6.66
Availability of Labor for Feedstock Production	3	2.25	3.33	7.49
Feedstock Transportation Costs	3	3	6.66	19.98
Transportation Distances	6	6	3.33	19.98
Transportation of Feedstock Requires Specialized Equipment	2	1.5	6.66	9.99
Delivery Routes through Local Communities	1	1	3.33	3.33
Transportation Regulations & Local Weight Limits	1	1	3.33	3.33
Road Infrastructure	1	1	3.33	3.33
Transportation Redundancy	2	1	6.66	6.66
Number, Size, Mix, & Locations of Suppliers	2	2	3.33	6.66
Suppliers Subject to Same External Risk Factors (Non-Weather & Equipment Based)	7	7	9.99	69.93
Seasonal Weather Impacts on Feedstock Supply	5	2.5	9.99	24.97
Long-Term Weather & Climate Trends	7	7	6.66	46.62
Government Subsidies for Feedstock Production or Utilization	2	2	3.33	6.66
Local, Provincial, & National Laws, Regulations, & Permitting About Biomass	1	1	3.33	3.33
Backlash Against Biomass Development, Procurement, or Usage in the Region	1	1	9.99	9.99
Feedstock Sustainability, Including Risks to Soil Quality, & Surface & Groundwaters	3	3	6.66	19.98
GHG Emissions from Production, Harvest & Transport	2	2	3.33	6.66
Geographic Location Influence on Feedstock Variability	1	1	3.33	3.33
The capacity of Supply Chain Components & Equipment to Scale	6	1.5	9.99	14.98
				14.63

Table 2: Asset Indicators

Infrastructure Assets	Overview	Score
Category 1: Physical Infrastructure		
1.1 Land Parcel	75% of Lincoln County is in public ownership	8
1.2 Industrial Land Use Zone	over three-quarters of its landmass is in public ownership (73% federal, 3% state) coordination with state and federal agencies is imperative. Efforts are made to attract commercial development including Kootenai Business Park's (KPB)) water system.	8
1.3 Natural Gas Line	The closest natural gas provider is either 52 miles west to Bonner's Ferry, ID, or 89 miles east to Kalispell, MT. No natural gas is available in south Lincoln County.	6
1.4 Electrical	There are two primary electric feeds to the Kootenai Business Park. Electric service in Eureka and northern Lincoln County is provided by Lincoln Electric Co-op. Flathead Electric Cooperative provides electrical service in the City of Libby and in the surrounding area.	7
1.5 Fresh Water Supply Line	Water rights from Libby Creek provide for total available usage of 12,322-acre-feet per year or 11 million gallons per day.	8
1.6 Sewage Disposal Trunk Line	Treatment is provided by two facultative lagoons with a capacity of approximately 13,000 gallons per day.	7
1.7 Drainage	Wastewater treatment systems in Lincoln County are primarily individual septic drain field systems.	6
1.8 Stormwater Management	Lincoln County Implementation Action Plan intends that all commercial, industrial, and residential developments will have adequate stormwater management facilities.	6
1.9 Available ICT Services	The Lincoln County Port Authority will undertake the necessary planning and required infrastructure such as cell towers and additional fiber cable.	8
1.10 Available Land	About 70% of land is owned by the federal government.	8
1.11 Cost of Land - Initial Cost	Land listed at competitive rates.	8
1.12 Cost of Land - Property Tax, Utilities	Because of its large amount of untaxable federal land, Lincoln County receives federal dollars from the Payment In Lieu of Taxes (PILT) program.	6
1.13 Infrastructure - Landfill/waste disposal	Solid waste and wastewater treatment facilities are both available at nearby locations.	10
Category 2: Logistics		
2.1 Highway Access and Intersection	Ample Highway access, the main highway corridors through the County are U.S. Highway 2 (connecting Libby and Troy with Kalispell and Idaho), US Highway 93 (connecting Eureka with Canada and Whitefish), and Highway 37 (connecting Libby and Eureka).	8
2.2 Proximity to Major Markets	Good rail and road transportation. Major markets can be reached through a variety of routes in an efficient and timely manner.	8
2.3 Accessibility to Airport	Lincoln County has airports in Troy, Eureka, and Libby.	7
2.4 Railway Service	The Burlington Northern Sante Fe (BNSF) line in south Lincoln County provides an important freight rail connection for the County.	8
2.5 Logistics - Construction Logistics	Reasonable. Several new construction projects underway.	6
Category 3: Social Infrastructure		
3.1 Quality of Life	Lincoln County's citizens enjoy a rural, friendly, and independent lifestyle.	7
3.2 Education - Elementary & High School	Fair. Education levels in Lincoln County are lower than the statewide average.	4
3.3 Education - Post Secondary	Fair. There is less of an emphasis among???? Lincoln County residents on pursuing a bachelor's degree or a graduate degree.	4
3.4 Local Retail	Retail trade employs 12% of the working class.	8
3.5 Culture and Recreation	Public lands benefit Lincoln County by providing scenic beauty and economic opportunities in recreation, hunting and fishing, restoration work, forestry, and tourism.	9
3.6 Hospital and Doctors	Fair. Health care services provide 18% employment in Lincoln County	6
3.7 Housing Availability	44,640 acres in Lincoln County were converted to single-family housing between 1990 and 2016.	6
3.8 Crime Rate	The crime rate in Lincoln is 18.95 per 1,000 residents per year. People who live in Lincoln generally consider the northeast part of the city to be the safest.	6
	Total	***7.2***



Biofuel Development Opportunity Zone Program Advisory Committee—Libby, MT

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APPENDIX A: RISK INDICATOR SCORING METRICS

CATEGORY 1: SUPPLIER RISK

1.1. Longevity & History of Supplier Performance

Rationale: Number of years in business is a positive indicator of future solvency. Historical performance is an indicator of future performance.	
Raw RI Score: The history of the forest industries in Idaho and Montana dates back to the 1840s. Sawmills have seen a decline since 1981, with numerous smaller mills being replaced by larger capacity mills. The long history of forest industry in the Libby BDO Zone coupled with overall longevity of sawmills present in the area means risk related to longevity and history of supplier performance is deemed low. Raw RI Score is 1 out of 10.	**Score 1**
Notched Salience: No adjustment. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk	**Score Unnotched**
Impact Level: RI Impact Level is deemed *moderate*.	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 6.66 out of 100.	**Score 6.66**

1.2. Production Capacity

Rationale: Supplier production capacity can be a strong indicator of long-term credit worthiness and future solvency. Higher production capacities can denote strength of operational elements, including cash flows, important to future solvency.	
Raw RI Score **Sawmill Residuals:** A smaller number of larger capacity mills have replaced more numerous smaller mills over decades in the BDO Zone. Currently, 8 sawmills generate an estimated 450,818 green tons per year (gt/yr) of Sawmill Residuals in the Zone. Assuming a capturable range of 10% to 20% for Sawmill Residuals and that a new operator can access the fiber, we estimate that ~ 67,623 gt/yr could be available if satisfactory pricing is offered. **Forest Residuals:** Numerous logging companies generate an estimated 273,088 gt/yr of Forest Residuals. Assuming a capture ratio of 55%, research for this rating suggests ~150,198 gt/yr are likely available to new bio-based markets. **Pulpwood:** Pulpwood is currently an untapped resource. Without markets driving a demand for this wood, incentives to remove and utilize it are lacking. Pulpwood in the Supply Basin is estimated at 85,907 gt/yr. Applying a capture ratio of 25%, we estimate 21,476 gt/yr are likely available. Risk associated with supplier production capacity is overall deemed low. Raw RI Score is 1.	**Score 1**
Notched Salience: No adjustment. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk	**Score Unnotched**

Impact Level: RI Impact Level is deemed ***moderate***.	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 6.66 out of 100.	**Score 6.66**

1.3. Suppliers' Dependence on, or Preference for, Competing Markets

Rationale: Supplier may have a vested interest in or preference for supplying specific competitors for biomass feedstock. Preferences may be due to historical, long-term, or personal relationships, less stringent feedstock quality requirements, more flexible operating hours by competing markets, or suppliers' dependences on competing markets to accept or purchase other products/by-products. During periods of feedstock shortage such suppliers may be more likely to allocate the scarce supply to a competitor resulting in supply disruptions for the Proponent.

Raw RI Score **Sawmill Residuals:** In most cases, long term relationships with Sawmill Residual markets are already established in the Libby BDO Zone. Companies operating in the area account for consumption of over 95% of the available Sawmill Residuals produced by primary wood product manufacturers. While we believe that sawmills are likely to seek the most cost effective, logistically feasible, and viable means to sell Residuals they produce and may be receptive to expanded market outlets for their Residuals, we nonetheless find it unlikely that a new market could secure large volumes of Sawmill Residuals without paying a price premium. We find it also unlikely that sawmills would divert significant quantities of Residuals from existing historical markets at any price premium. Because we are uncertain about the ability of current markets to compete on price, and the quantity of Residuals that would be diverted from existing markets at a price premium, we find material risk in Sawmill Residuals for new markets in the Libby BDO Zone. **Forest Residuals:** There is significantly more potential supply than existing demand for Forest Residuals. Suppliers will deliver to any viable market with no inherent preference. Forest Residuals would be available on the open market. **Pulpwood:** The closure of a Pulp Mill in the Libby area within the last 10 years has resulted in a lost market outlet for Pulpwood and consequently depressed production. Currently, incentives to removing it during thinnings or harvests are limited to contractual mandates. We believe that Pulpwood production in the Libby BDO Zone is capable of material increases with sufficient market demand. A facility capable of utilizing this material would be well-positioned to capture a consistent supply of Pulpwood. We deem risks associated with supplier dependence on, or preference for competing markets, to be high for Sawmill Residuals and low for Forest Residuals and Pulpwood. Since we discount Sawmill Residual quantities in the Libby BDO Zone Rating, we include only Forest Residuals and Pulpwood. Raw RI Score is 1 out of 10.	**Score 1**

Notched Salience: De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low*.	**Score 3.33**
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 3.33 out of 100.	**Score**

	3.33

1.4. Supplier as a Competitor

Rationale: The risks of feedstock costs going up and availability going down increase if a supplier is also a competitor to the Proponent. In times of feedstock shortage, the risk that supply commitments will not be met increases.	
Raw RI Score: **Sawmill Residuals** We have noted that Sawmill Residual markets are currently mature and that any new facility looking to source this material can expect barriers to securing it. It is common for sawmills to use Sawmill Residuals, most often Sawdust and Bark, as fuel for internal operations. Most sawmills burn a fraction of the Sawmill Residuals they generate, but some burn most of their Sawdust and Bark. Although not foreseeable in the near future, if natural gas prices increased to a point where mills relied more on their own residuals, this would drive scarcity and put upward pressure on price. **Forest Residuals and Pulpwood** Suppliers do not act as potential competitors for Forest Residuals and Pulpwood. Risks related to suppliers acting as competitors is overall low. Raw RI Score is 1.	**Score** **1**
Notched Salience: Given sufficient price incentive, we believe that sawmills currently using Residuals for heat could consider committing fiber supply and substitute previously utilized Sawmill Residuals with natural gas. However, since the price differential to incentivize switching is high, we do not notch RI 1.4.	**Score** **Unnotched**
Impact Level: RI Impact Level is deemed *low*.	**Score** **3.33**
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 3.33 out of 100.	**Score** **3.33**

1.5. Ownership of Land/Means of Production

Rationale: Suppliers that own land where feedstock is produced, or a production facility, tend to have better control of supply chains and present lower degrees of supply risk.	
Raw RI Score **Forest Residuals** Though neither sawmills nor fiber producers/harvesters typically own the land where they harvest, we do not find this poses a risk to the availability of Forest Residuals. As historical data show, timber in this area is available for harvest continually year-to-year. We deem risks related to ownership of land and means of production as low. Raw RI Score is 1 out of 10.	**Score** **1**
Notched Salience: No adjustment. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk	**Score** **Unnotched**
Impact Level: RI Impact Level is deemed *low*.	**Score**

	3.33
Loaded RI Score: The Loaded RI Score (Notched Salience x Impact Level) is 3.33 out of 100.	**Score 3.33**

1.6. Ownership of Equipment

Rationale: In most cases, suppliers that own or lease equipment for harvest, collection, and processing feedstock are lower risk than those who do not. For example, third-party harvesting equipment may not be available when required. Short harvest windows may be missed if a farmer and contractor cannot schedule harvest times that are convenient and quantity shortages can result.	
Raw RI Score: We see no significant risk pathways through equipment ownership from sawmills or fiber producers. Producers in the BDO region either own the equipment necessary to harvest and collect timber and other forest products, including Forest Residuals, or have easy access to it. Therefore, risk is introduced where new equipment is needed to accommodate new buyer specifications. Anecdotal evidence from conversations with stakeholders suggest a willingness for such investment if buyer commitments are stable. Raw RI Score is 1.	**Score 1**
Notched Salience: No adjustment. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low*.	**Score 3.33**
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 3.33 out of 100.	**Score 3.33**

1.7. Ownership of Transportation/Logistics

Rationale: In most cases, suppliers that own or lease equipment necessary to transport biomass from forest or field are lower risk than those who do not. However, in some circumstances, reliance on third-parties to transport biomass is a common practice and does not contribute to risk.	
Raw RI Score: Woody biomass transport often requires open-top or live-bottom trailers. Fiber producers in the Libby BDO Zone typically handle transportation in their own trucks or, to a much lesser degree, through a contracted third party. We note stable trucking infrastructure with multiple transport companies in the BDO Zone; many of these companies operate a small number of trucks. If outsourced, transportation would likely have to be contracted to a small number of major trucking companies or a large number of smaller ones. Sawmill Residuals are transported in company-owned trucks. In instances where additional hauling capacity is required, no red flag was noted with trucking companies in the area. See Appendix D. Risks associated with transportation/logistics are deemed low. Raw RI Score is 1.	**Score 1**
Notched Salience: Given existing infrastructure of available trucking contractors, we assume that distribution and transportation needs can be adequately met**.** No adjustment	**Score Unnotched**
Impact Level: RI Impact Level is deemed *moderate*.	**Score**

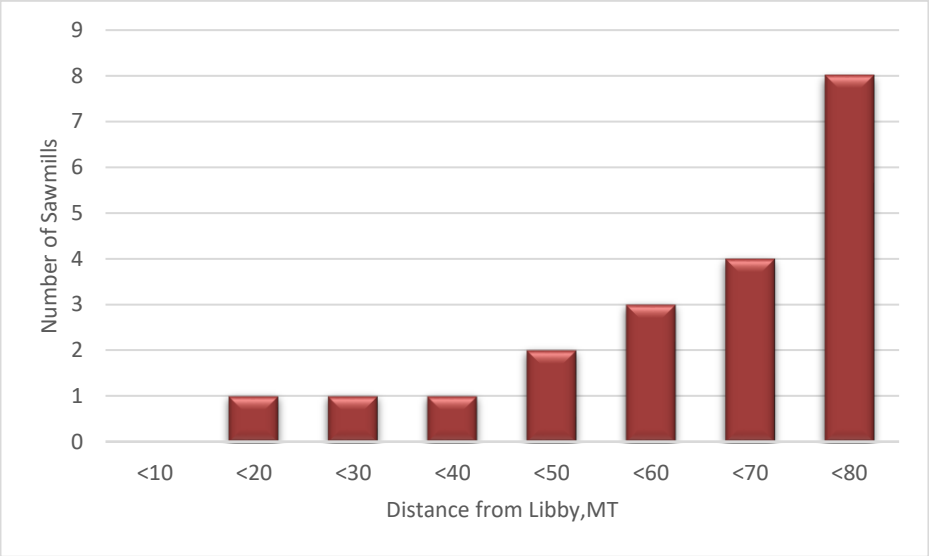
	6.66
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 6.66 out of 100.	**Score 6.66**

1.8. Supplier as an Aggregator or Broker

Rationale: Aggregators may effectively provide supply chain redundancy and eliminate the risk and complexity of dealing with multiple sources of supply by combining supplies into a single master contact. Aggregators can add much needed stability in BDO Zones by increasing offtake stability for both suppliers and markets. An aggregator can be a more reliable long-term offtake for suppliers by virtue of having multiple markets and can be a more reliable long-term supplier for markets by virtue of having multiple suppliers. Further, when a single supplier breaches, the aggregator can source from another.	
Raw RI Score: We know of no current aggregators or fiber brokers in the supply area. Sawmills and other fiber producers deal with markets directly. Risk associated with suppliers as aggregators or brokers is deemed low. Raw RI Score is 1 out of 10.	**Score 1**
Notched Salience: De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low*.	**Score 3.33**
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 3.33 out of 100.	**Score 3.33**

1.9. Distance from Proponent

Rationale: The greater the distance from a supplier to a plant, the more exposure it has to weather and fuel cost risks, and the greater the competitive pressure (to breach) that a closer competitor can exert.	
Raw RI Score: Since individual Sawmill Residual production values could not be obtained, we were unable to create a generation curve. For a proxy, we examined Sawmill distribution in the BDO Zone, shown in the figure below. Eight mills are located within 80 miles of Libby. For reasons described previously, we foresee a low capture rate of Sawmill Residuals and discount the risk of proximity of competition for a new plant in Libby. Risks associated with Forest Residues and Pulpwood are directly related to weather or fire events. In such cases, predictions become difficult. To the extent that harvesting operations occur further in distance from Libby, the greater the corresponding risk in area that may be impacted by these variables. It is reasonable to conclude, however, that due to consistent forest harvesting, weather and fire represent only minor delays at worst case scenario for these fiber sources. Raw RI Score is 3 out of 10. Sawmill Distribution within BDO Zone	**Score 3**



Notched Salience: No adjustment.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low*.	**Score 3.33**
Loaded RI Score: Loaded RI Score (Raw RI x Impact Level) is 9.99 out of 100.	**Score 9.99**

1.10. Fundamental Feedstock Production Experience

Rationale: Risk is higher when a supplier has limited experience with harvesting/processing and/or collecting biomass. Where experience is lacking, Proponent should show that steps have been taken to ensure proper training, knowledge dissemination, and monitoring.	
Raw RI Score: Supply of Sawmill Residuals in the Libby BDO Zone is well established, as evidenced by the absorption of that material by current markets. Forest Residuals are a by-product of roundwood timber production and fiber and it is clear that producers in the area have deep knowledge and experience of all aspects of generation. Lack of markets for Forest Residuals and Pulpwood means that producers' experiences in processing and handling Forest Residuals is understandably limited. As such, we see a pathway for moderate risk associated with supply Forest Residuals and, to a much lesser extent, Pulpwood feedstock production experience. Raw RI Score is 5 out of 10.	**Score 5**
Notched Salience: We believe that existing producers can fairly easily develop the experience required to gather, process, load, and deliver Forest Residuals and Pulpwood. 50% notch.	**Score 2.5**
Impact Level: RI Impact Level is deemed *moderate*.	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 16.65 out of 100.	**Score 16.65**

1.11 Production Scale Experience

Rationale: Scale-up entails risk. Risk is higher when a supplier has limited experience with the production of the quantity of feedstock required.	
Raw RI Score: Suppliers in the region evidenced an eagerness to capitalize on a potential Forest Residuals and Pulpwood market[8]. Wood growth continues to outpace harvesting in the BDO Zone. Forest managers are eager to have more options for fuels reduction and economical thinnings to promote stand vigor. Pre-commercial and commercial thinnings are a primary means of accomplishing these objectives. The infrastructure for this work is already in place in the BDO Zone. Currently the largest constraint for removing and utilizing Forest Residuals and Pulpwood is a lack of economically feasible outlets- not the harvesting infrastructure or the ability to scale it. . We acknowledge that production scale may require logging, transportation equipment, and tools that some suppliers may not already have in the required quantities (such as chippers and live-bottom trailers). Acquiring this equipment would require fiber producers to incur a capital expense, which may not be economically feasible for some. Risk associated with production scale experience is deemed low-moderate. Raw RI Score is 3 out of 10.	**Score 3**
Notched Salience: Feedstocks that do not require new equipment, only additional time (such as in-woods whole-tree chips) could be prioritized to reduce the risk associated with RI 1.11. As a result, Raw RI Score is notched by 25%: Notched Salience is 2.25.	**Score 2.25**
Impact Level: RI Impact Level is deemed *low*.	**Score 3.33**
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 7.49 out of 100.	**Score 7.49**

1.12. Feedstock Production Priority

Rationale: When biomass feedstock is a secondary or non-core line of business, or when it is a by-product or a residual from a more valuable primary product, then suppliers may not put in sufficient effort to consistently produce it. Risk of breach increases when production and/or delivery of feedstock compromises a supplier's ability to make a primary product.	
Raw RI Score: We do not expect there to be a negative impact on primary forest sector harvesting or production from increasing biomass production. Forest Residuals and Pulpwood production are not a high priority for fiber producers. They are a direct result of their primary product production. Anecdotal evidence from conversations with operators in the area suggests a strong willingness to engage in this activity if it is deemed profitable.	**Score 2**

[8] Verbal communication with area loggers and foresters. April–May 2022.

Sawmill Residuals are a by-product of the timber processing industry and are a small but important part of overall revenue streams. While sawmills may reduce residual generation with technological advances in sawing equipment, the overall impact on total output of fiber is likely to be low.

Raw RI Score is scored 2 out of 10.

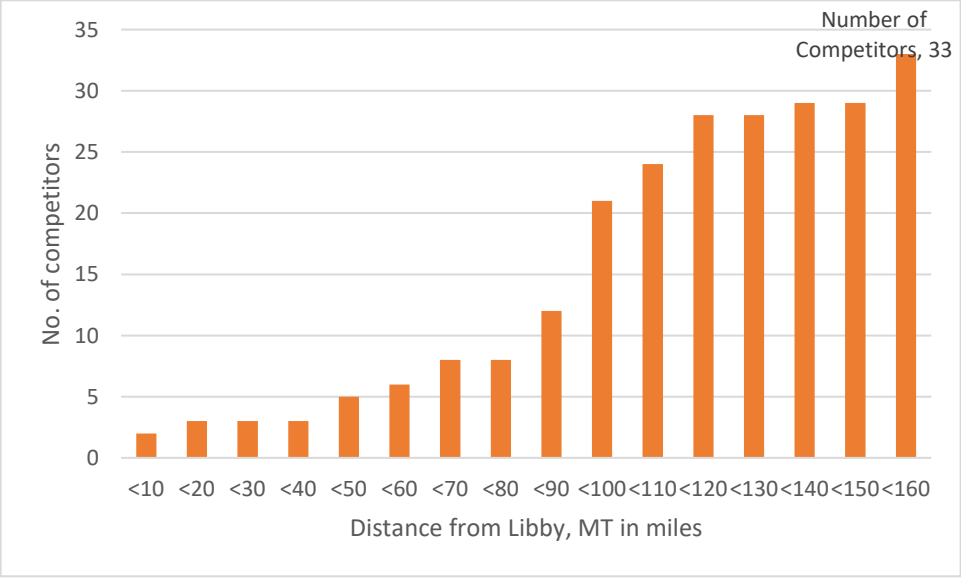
Notched Salience: By increasing competition in the market for woody biomass, we expect that a new bio-based facility would inherently incentivize residual generators to maintain their existing production**.** Biomass markets should incentivize fiber producers to process Pulpwood and larger quantities of logging waste into Forest Residuals feedstock. As a result, Raw RI Score is notched by 25%: Notched Salience is 1.5	**Score 1.5**
Impact Level: RI Impact Level is deemed *moderate*.	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 9.99 out of 100.	**Score 9.99**

CATEGORY 2: COMPETITOR RISK

2.1. Competitor Locations and Geographical Influence on the Market

Rationale: Competitors' locations relative to a Proponent plant can affect the viability of procuring feedstock and the cost of that feedstock. Accurate and detailed competitor mapping provides an understanding of the geographical influence a competitor may have, including competitive advantages such as short-hauling.	
Raw RI Score: A total of 33 major competitors was identified within the 160-mile drive distance Competition Zone. Major competitors include pellet mills, medium-density fiberboard producers, and facilities using wood for heat. Two major entities currently compete for Sawmill Residuals. Distribution of competitors is shown in the figure below.	**Score 4**

Estimated Competitor Distribution



The number of competitors is relatively low to about a 50-mile distance from Libby. Competition becomes more pronounced at >100 miles**.** Importantly, an estimated 95+% of all Sawmill Residuals are accounted for within a 160-mile radius of Libby. Forest Residuals and Pulpwood, as indicated previously, are not utilized, making this material the most logical feedstock choice for a potential proponent. We discount the capture rate for Sawmill Residuals and allocate a Raw RI Score of 4 out of 10.	
Notched Salience: The majority of competitor consumption occurs >100 miles from Libby, MT. In Libby, a potential facility could mitigate some of the risk associated with RI 2.1 through careful inventory planning, facility location, and a competitive pricing strategy. As a result, Raw RI Score is notched by 25%: Notched Salience is 3.	**Score 3**
Impact Level: RI Impact Level is deemed *high*.	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 29.97 out of 100.	**Score 29.97**

2.2. Historical Fluctuation of Quantity Used

Rationale: Clear understanding of key competitors' consumption of each type of feedstock utilized by the Proponent is essential to quantifying the risks associated with each competitor. Understanding historical trends of feedstock utilization can provide valuable information about feedstock price elasticity during shortages and insight into events that may impact future supply conditions. It can also enable more accurate estimates of the sensitivity of feedstock availability to potential future consumption levels or to the impact of external events (e.g., weather events, structural economic changes, seasonality, or policy change).	
Raw RI Score: Limited data on estimated historical competitor feedstock intake is available. However, several observations can be made. Most significant is the current lack of a pulpwood market which disappeared with the closing of a pulpwood using facility near Libby in 2010. This has effectively de-incentivized the consistent removal of this material from forests in the surrounding area. Second, we note that there is no current demand or market for Forest Residuals generated during forest harvesting at this time. Lastly, the market for Sawmill Residuals is mature. This material is currently used for the production of medium density fiberboard. Raw RI Score is 5 out of 10.	**Score 5**
Notched Salience: A potential project could mitigate much of the risk associated with the historical fluctuation of quantity used by sourcing feedstocks that are currently available (Pulpwood and Forest Residuals) given the incentive for loggers to address this material is clearly defined. As a result, Raw RI Score is notched by 25%: Notched Salience is 3.75.	**Score 3.75**
Impact Level: RI Impact Level is deemed *high*.	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 37.46 out of 100.	**Score**

	37.46

2.3. Competitor Pricing and Price Sensitivity

Rationale: Understanding how much competitors pay for different feedstock types is an essential step in determining competitiveness of Proponent. Historical prices paid by competitors provide insight into their procurement behaviors and ability/willingness to pay premiums for feedstock and exert pressure on Proponent's suppliers during times of feedstock shortage. Competitors who are able to offer higher prices for feedstock during feedstock shortages can pose significant risks to Proponent.	
Raw RI Score: The Weyerhaeuser medium-density fiberboard (MDF) facility represents the most immediate competition to a potential project for Sawmill Residuals feedstock. In a bidding war for feedstock, it is likely that the MDF plant could outcompete a new bioprocessing facility for Residuals. We see material competitor pricing risk for Sawmill Residuals. Forest Residuals and Pulpwood are subject to much less intense competitive pressure at the present time. Raw RI Score is 4 out of 10.	**Score 4**
Notched Salience: We see material risk in large mills competing for Sawmill Residuals: these facilities are well established and may be able to tolerate higher prices temporarily in order to exert pressure on new competitors. However, we assume a conservative capture rate for Sawmill Residuals by a new plant and primary supply from the Forest Residues and Pulpwood where competition for feedstock is lower. As a result, Raw RI Score is notched by 50%: Notched Salience is 2.	**Score 2**
Impact Level: RI Impact Level is deemed *moderate*.	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 13.32 out of 100.	**Score 13.32**

2.4. Impacts of Future Demands on Feedstock Availability and Price

Rationale: Future competitors for feedstock, or expansion of feedstock demand by current competitors, can cause feedstock market disruption.	
Raw RI Score: We identified one additional business proposing to operate in the BDO Zone[9] pending a secured line of credit for the out-of-state proponent. If successful, the firm would develop a medium-density fiberboard plant in Libby. The facility could support upwards of 150 jobs and consume an estimated 100,000 DT (135,000 gt/yr).	**Score 8**

[9] https://dailyinterlake.com/news/2021/jul/13/hurdles-remain-bring-mdf-factory-Libby/?msclkid=97a7422fd14311ec82b0e7beb225e6ff.

One chipping operation established in 2012 has experienced intermittent production cycles. When running, the mill utilizes Forest Residuals in insignificant volumes compared to what is available. Raw RI Score is 8 out of 10.	
Notched Salience: Proponents entering into competition for Sawmill Residuals may have to engage in price wars, with uncertain parameters around pricing pressures that existing competitors may be able to exert. Increase in demand from existing competitors over time is a salient possibility. We see a significant first mover advantage to decreasing the risk of future demands on Forest Residuals and Pulpwood (long-term supply contracts are one possibility). As a result, Raw RI Score is notched by 25%: Notched Salience is 6.	**Score 6**
Impact Level: RI Impact Level is deemed *high.*	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 59.94 out of 100.	**Score 59.94**

2.5. Supply Influence of Competitor

Rationale: In some cases, competitors may be able to exert high degrees of pressure on local suppliers, effectively enabling them to control feedstock, especially during periods of shortage. This control can derive from long previous relationships between suppliers and competitors, from verbal or "understood" agreements, or from a competitor being able to assist suppliers in times of surplus by maintaining large inventories that enable suppliers to continue supplying when other markets impose quotas. Understanding and planning around such soft risk factors is important. If such relationships exist in the Proponent's procurement area, they may indicate increased risk of feedstock shortage or pricing changes.	
Raw RI Score: The closest 21 competitors are all within 100 miles of Libby, MT. Existing mills currently utilize the majority of available Sawmill Residuals and are located within the 75-mile BDO Zone. An additional facility is being considered for location in the immediate Libby area and could exacerbate this risk. However, this still leaves Pulpwood and Forest Residuals as viable feedstock sources given this material is currently abundant with little to no demand at this time. Raw RI Score is 5 out of 10.	**Score 5**
Notched Salience: The proponent would have some, albeit limited, means of mitigating the current flow of Sawmill Residuals to key competition in the immediate area, mostly via pricing premiums and distance advantages. Pulpwood and Forest Residuals, on the other hand, represent opportunities for a new proponent to capitalize on. Given that previous demand for Pulpwood has disappeared and that Forest Residuals do not have a stable market, these feedstock sources should be readily available if loggers are incentivized to capture it. As a result, Raw RI Score is notched by 75%: Notched Salience is 1.25.	**Score 1.25**

Impact Level: RI Impact Level is deemed *moderate*.	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 8.32 out of 100.	**Score 8.32**

2.6. Temporary Market-Driven Markets

Rationale: Alternative, non-traditional, market-driven competitors for feedstock can increase feedstock demand in unusual circumstances.

Raw RI Score: No temporary market-driven competitor's markets for either Forest or Sawmill Residuals or Pulpwood were identified. Raw RI Score is 1 out of 10.	**Score 1**
Notched Salience: No adjustment. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low.*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Raw RI x Impact Level) is 3.33 out of 100.	**Score 3.33**

2.7. Demand for Competitors' Products

Rationale: Increased demand for a competitor's product can cause greater demand for feedstock by the competitor. For example, greater demand for biofuels due to a clean fuels policy can cause increased biofuel production by the competitor, thereby increasing demand for feedstock.

Raw RI Score: Sawmills in the area pose no competition to new plant development since new markets in the Libby BDO Zone will not utilize sawtimber. On the contrary, increased production at sawmills would be beneficial to a new plant as additional feedstock would be available to the market. Predicting demand for medium-density fiberboard (MDF), the primary competing product, is difficult. Demand will likely be closely tied to furniture, flooring, and other key markets and could fluctuate. Price pressure on pulpwood is foreseeable at moderate risk. We note that Forest Residuals are not primary feedstocks for MDF manufacture and that this BDO Zone rating is primarily driven by availability of Forest Residuals. **Raw RI Score is 1 out of 10.**	**Score 1**
Notched Salience: No adjustment. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk	**Score Unnotched**
Impact Level: RI Impact Leve is deemed *low.*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 3.33 out of 100	**Score 3.33**

CATEGORY 3: SUPPLY CHAIN RISK

3.1. Biomass Availability Multiple (BAM)

Rationale: Biomass Availability Multiple (BAM) indicates the degree of redundancy in a Proponent's supply chain. BAM is the ratio of biomass feedstock available to a project, at costs, timing, and in quality feasible for the Proponent, divided by the project's feedstock requirements. BAM is a strong indicator of supply chain resilience when stressed by supply shortage and/or supplier breach.	
Raw RI Score: The BAM indicates redundancy of available feedstock within the Libby BDO Zone for a pre-defined project intake capacity. Forest Residuals, Pulpwood, and Sawmill Residuals constitute feedstock in this analysis. We estimate annual generation of woody biomass in the Libby BDO Zone at 809,813 gt/yr10, defined by an 80-mile drive from Libby, MT, and comprised approximately as follows: 450,819 gt/yr of Sawmill Residuals; 273,088 gt/yr of Forest Residuals; and 85,907 gt/yr of Pulpwood[11]. Of this total, we estimate that approximately 256,479 gt/yr is available from current suppliers. However, we believe that only Forest Residuals and Pulpwood can function as strong levers for new market development because demand for Sawmill Residuals in high. We note that market demand for Forest Residuals is low: the bulk of potentially available Forest Residuals is currently unutilized by competitors in the BDO Zone. The majority of Forest Residuals are either left in the forest after harvest or burned on site. Assuming a capture ratio of 55%, we believe that approximately 150,198 gt/yr of Forest Residuals are likely available to new bio-based markets in the Libby BDO Zone. Demand for Pulpwood saw a dramatic decrease in the Libby BDO Zone with the closure of a prominent pulp mill in the area. Absent a high level of market demand, harvesting of Pulpwood is being conducted at greatly reduced levels versus previous decades. Pulpwood removal is an important component of forest management: foresters and land managers in the Libby BDO Zone will support the development of new market outlets for Pulpwood to aid silvicultural and hazardous fuels reduction objectives[12]. At the present time, removals occur primarily during pre-commercial and commercial thinnings or when written into logging specifications on a job-by-job basis (i.e., when a logging contract stipulates that Pulpwood must be removed). Assuming 85,907 gt/year of Pulpwood in the BDO Zone, we apply a reasonable capture ratio of 25% to derive an estimate of 21,476 gt/yr of Pulpwood commercially to a new bio-based project in the Libby BDO Zone. For the purpose of this rating, we see large quantities of Sawmill Residuals as functionally unavailable for new plant development. Currently, Libby BDO Zone sawmills commit nearly all Residuals to existing markets located in the Competition Zone[13] or use them internally for	**Score 2**

[10] Forest Inventory and Analysis (FIA) estimates provided by the University of Montana Bureau of Business and Economic Research. May 2022.

[11] We define Pulpwood in this report as trees 5 to 11 inches in diameter at breast height (dbh).

[12] Verbal communication with Foresters, Land Managers, and Loggers in the Libby Supply Basin. April–May 2022.

[13] Defined by a 160-mile drive distance from the Libby, MT BDO Zone center point.

kiln drying and facility heating. Estimates for Sawmill Residuals were generated using FIA and Timber Product Output data examined by the University of Montana-Bureau of Business and Economic Research in May 2022. We assume a capture rate of 10% to 20% for Sawmill Residuals based on the fact that we are unable to estimate the ability of current markets to drive price and on reduced haul distances of a new plant versus existing markets. On that basis we find it reasonable that ~67,623 gt/yr could be available at current market prices.

We assume a potential new bio-based Project in the Libby BDO Zone would have a feedstock intake requirement of up to 100,000 gt/yr. On the basis of the foregoing, we arrive at a BAM of 2.56, which indicates acceptable levels of resiliency and opportunity for the feedstock supply chain in Libby, MT.

Raw RI Score is 2 out of 10.

Notched Salience: No adjustment.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low*.	**Score 3.33**
Loaded RI Score: Loaded RI Score (Raw RI x Impact Level) is 6.66 out of 100.	**Score 6.66**

3.2. Impact of Increased Utilization of Feedstock

Rationale: Feedstock utilization in a Libby BDO Zone can change over time. Existing consumers of feedstock can expand operations or new facilities can enter the market. Increased utilization puts additional pressure on feedstock and can lead to higher prices, feedstock disruptions, shortages, or supplier breach.

Raw RI Score: With a BAM of 2.56, we see space in the market for increased feedstock utilization without risking oversaturation and consequent upward pressure on prices, particularly for Forest Residuals and Pulpwood, which constitute the majority of currently unutilized feedstock. **Score 5**

The increased utilization of Forest Residuals and Pulpwood would likely not impact forest health, as only a small portion of Residuals must be left behind for soil remediation and health. Removal of Pulpwood-sized material often improves forest stand quality and is viewed as beneficial.

Raw RI Score is 5 out of 10.

Notched Salience: No adjustment.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *moderate*.	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 33.3 out of 100.	**Score 33.3**

3.3. Feedstock Supply Curve

Rationale: The greater the feasible transport distance, the more feedstock is accessible to the Proponent, but at a higher delivered cost. The feedstock supply curve is a function of

feedstock availability over its cost, which is primarily, but not exclusively, a function of distance. The feedstock supply curve is used to determine the availability of redundant feedstock at various price points.	
Raw RI Score: An estimated 809,813 gt/yr of feedstock is generated in the BDO Zone. Total feedstock generation can be broken into Sawmill Residual feedstock generation, Pulpwood generation, and Forest Residuals feedstock generation. Sawmill Residuals account for 450,819 gt/yr of feedstock generation (56%), Forest Residuals account for 273,088 gt/yr of feedstock generation (3%), and Pulpwood accounts for 85,907 gt/yr of feedstock generation (11%). Assuming capture rates previously noted, we see no red flags when analyzing the relationship between supply and distance, but some minor uncertainty results from the fact that Forest Residuals and Pulpwood cannot be mapped as accurately as Sawmill Residual generation, due to the manner in which Forest Residuals and Pulpwood data are reported. Raw RI Score is 2 out of 10.	**Score 2**

Notched Salience:	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low.*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 6.66 out of 100.	**Score 6.66**

3.4. Seasonal Feedstock Supply Variation

Rationale: Biomass supply can present significant seasonal supply variations that in combination with limitations associated with longer-distance transportation and storage can lead to regional biomass supply imbalances (Golecha & Gan 2016) and manifest in shortages and higher costs for Proponents.	
Raw RI Score: Minor temporary delays in timber delivery to sawmills can occur during periods of heavy rainfall or major snow events, when fiber producers are unable to clear trees from timberland and/or dirt roads are impassable. These delays can cause variations in Sawmill and Forest Residuals as well as Pulpwood feedstock production. These delays (and therefore feedstock generation variations) typically do not last more than several weeks. However, long-term impact of climate change on this RI are unknown and, as such, represent a minor but material degree of risk. Raw RI Score is 6 out of 10.	**Score 6**
Notched Salience: Potential facilities could mitigate the risk associated with feedstock shortages during periods of inclement weather by maintaining moderate inventories (Two to three weeks) of feedstock reserves on-site. With sufficient inventory, much of the risk associated with delays in feedstock production brought on by weather could be mitigated. Raw RI Score is notched by 25%: Notched Salience is 4.5.	**Score 4.5**
Impact Level: RI Impact Level is deemed *moderate.*	**Score 6.66**

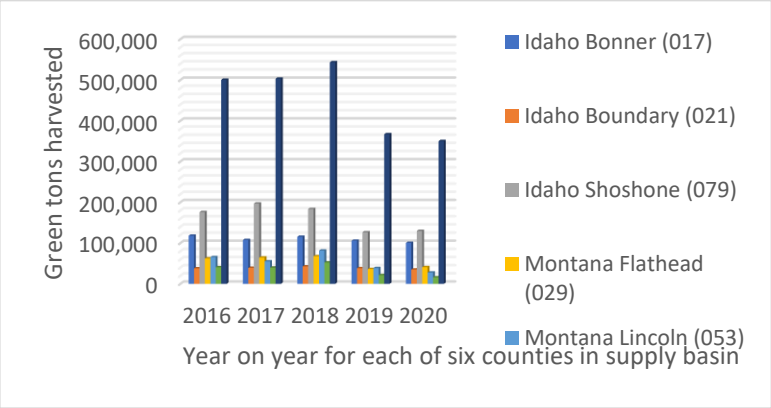
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 29.97 out of 100.	**Score 29.97**

3.5. Year-to-Year Variation in Feedstock Availability

Rationale: Biomass can have significant fluctuations in year-to-year supply due to variability in yield from biomass harvesting operations.

Raw RI Score: Variation in the available forest feedstock is not seen as a significant risk for the purposes of this project. Indeed, anecdotal evidence from stakeholders in this area suggests that recent financial allocations for increased forest stand treatments may lead to increased cutting activity[12]. **Score 1**

Sawmill Residuals track linearly with roundwood timber generation. Roundwood timber production was studied over time to understand year-to-year variations in Sawmill Residual feedstock generation. Historical data suggest minor risk of year-to-year variation in feedstock availability over time.



Forest residues also track to harvesting levels. Given relatively consistent year-to-year harvest data coupled with evidence suggesting harvests may increase rather than trend downward, Raw RI Score is 1 out of 10.

Notched Salience: Forest regrowth outpaces forest harvesting in Montana and Idaho. With a new market for Forest Residuals, Pulpwood, and other woody biomass, it is likely that fiber producers would be incentivized to meet increasing demand for this material. Furthermore, a new market for Forest Residuals—made from chipped wood typically left in the forest—could help offset reductions in any roundwood or pulpwood generation during lower-production years. **Score Unnotched**

No adjustment

Impact Level: RI Impact Level is deemed *high.*	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 9.99 out of 100.	**Score 9.99**

3.6. Front-End Validation of Data Used in Feedstock Availability Models

Rationale: Feedstock supply models can be complex. Lack of clarity about model assumptions and baseline data can result in confusion on the part of the capital markets and

drive financing costs for biomass projects. The adequacy and credibility of assumptions and baseline data is paramount to credible model outputs.	
Raw RI Score: We rely on data provided by the University of Montana-Bureau of Business and Economic Research in relation to the BDO Zone. Staff performing the analysis are well versed in the use and understanding of Forest Inventory and Analysis data. Raw RI Score is 1.	**Score 1**
Notched Salience: No adjustments. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low.*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Raw RI x Impact Level) is 3.33 out of 100.	**Score 3.33**

3.7. Low Historical Demand for Feedstock in the BDO Zone

Rationale: If Proponent does not have a history of developed, large-scale feedstock procurement, suppliers may not have sufficient expertise in feedstock production to ensure reliable supply, especially early on.	
Raw RI Score: A total of 33 potential competitors were identified within the 160-mile drive distance Competition Zone. Major competitors include wood heating facilities, a medium-density fiberboard (MDF) plant, pellet mills, and a proposed new MDF facility in the BDO Zone. Noteworthy is the impact created when a nearby pulp mill closed its operations, creating a gap in demand for roundwood Pulpwood. Pulpwood and Forest Residuals are not currently utilized and available for procurement. The infrastructure and expertise to capture this material exists. Competitors are discussed in more detail in Appendix C of this report. An estimated total of nearly 450,819 gt/yr of Sawmill Residuals are currently consumed by competition. The variety and magnitude of competitor intake is a testament to the fact that feedstock collection practices are well established and at low risk for changing. Raw RI Score: is 1 out of 10.	**Score 3**
Notched Salience: No adjustment.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Raw RI x Impact Level) is 9.99 out of 100.	**Score 9.99**

3.8. History of Production/Feedstock is a Secondary Crop or a Byproduct

Rationale: If feedstock is a new/secondary crop or a by-product, suppliers may either lack sufficient experience to mitigate risk or be unable to react to such risk, and producers may be less likely to prioritize production. If feedstock is a secondary crop, then production can be subject to variables beyond suppliers' control.	
Raw RI Score: Forest and Sawmill Residuals as well as Pulpwood are by-products of sawtimber harvest and production in the BDO Zone. Logging and wood products manufacturing are stable, with a long history of operation in the basin. If these industries	**Score 3**

were subjected to unforeseen crashes, both price and availability of woody feedstocks would be significantly impacted.

Because of this, Raw RI Score is 3 out of 10.

Notched Salience:	**Score Unnotched**
Impact Level: RI Impact Level is deemed *high*.	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 29.97 out of 100.	**Score 29.97**

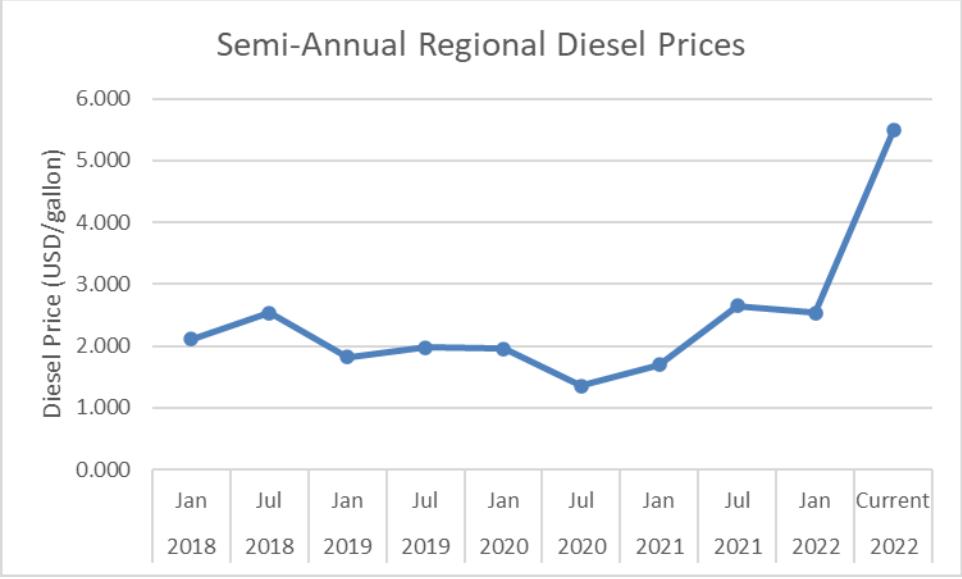
3.9. Diesel Prices

Rationale: Diesel, oil, and PPI can impact feedstock cost of harvest and collection over time. Sensitivities to worst case scenarios should be run.

Raw RI Score. **Score 7**

Regional data from the US Energy Information Administration's Diesel database[14] show that diesel prices are volatile, hard to predict, and currently rising significantly.

Semi-Annual Regional Diesel Prices, 2018–2022



Raw RI Score is 7 out of 10.

Notched Salience: Some of the risks associated with volatile fuel prices could be mitigated by a project engaging in, and favoring, contracts with suppliers located closer to Libby, reducing transportation costs. This would have the added benefit of reducing price pressure from larger and more abundant competition. **Score 5.25**

As a result, Raw RI Score is notched by 25%: Notched Salience is 5.25.

[14] EIA's Monthly Retail Gasoline and Diesel Prices: https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=EMD_EPD2DXL0_PTE_R1Z_DPG&f=M.

Impact Level: RI Impact Level is deemed *moderate.*	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 34.96 out of 100.	**Score 34.96**

3.10. Harvest & Collection Practices & Schedules

Rationale: Differences in harvest timing and practices can create risk to both the quantity and quality of feedstock. For example, feedstock harvested by different suppliers in different windows can undergo varying levels of exposure to sun, wind, and moisture, leading to variations in delivered feedstock quality.	
Raw RI Score: Harvest, collection, and scheduling practices are well established and robust in the supply chain. Foresters and fiber producers have established procedures for forest management practices and the resulting timber harvest. However, risk is introduced when unforeseen factors such as inclement weather or extended periods of impassable roads would occur. Raw RI Score is 6 out of 10.	**Score 6**
Notched Salience:	**Score Unnotched**
Impact Level: RI Impact Level is deemed *moderate.*	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 39.96 out of 100.	**Score 39.96**

3.11. Harvesting & Collection Equipment

Rationale: Different types of harvesting and collection equipment used by suppliers can have a significant impact on the quality and availability of feedstock. Use of different types and combinations of harvesting, collection, and processing equipment can lead to non-homogeneous feedstock. Equipment that is not designed specifically for biomass cultivation, harvesting, and collection can increase feedstock quality risks. Type of equipment should be specified for the sake of product consistency and risk reduction.	
Raw RI Score: It is industry standard that fiber producers own and operate all of their harvesting and collection equipment. However, some suppliers may need to make additional equipment purchases. Raw RI Score of 3 out of 10.	**Score 3**
Notched Salience: If there is a market it is likely that any needed equipment will either be purchased by suppliers or provided by the project. As a result, Raw RI Score is notched by 25%: Notched Salience is 2.25.	**Score 2.25**
Impact Level: RI Impact Level is deemed *low.*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 3.33 out of 100.	**Score**

	7.49

3.12. Temporary Externality-Driven Markets for Feedstock

Rationale: Alternative, non-traditional, externality-driven competitors for feedstock can drive feedstock demand (and cost) in unusual circumstances.	
Raw RI Score: No temporary externality-driven markets for Sawmill Residual, Forest Residual, or Pulpwood feedstocks were identified. Raw RI Score is 1 out of 10.	**Score 1**
Notched Salience: De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low.*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Raw RI x Impact Level) is 3.33 out of 100.	**Score 3.33**

3.13. Variations in Densification Methods Among Different Suppliers

Rationale: The shape and density of the unit in which feedstock is supplied can impact feedstock cost and quality.	
Raw RI Score: Densification methods among different suppliers do not vary significantly. While the quality of the feedstock will vary depending on the wood source and stage in processing, collection methods are typically industry standard. Raw RI Score is 2 out of 10.	**Score 2**
Notched Salience: No adjustment.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low.*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Raw RI x Impact Level) is 6.66 out of 100.	**Score 6.66**

3.14. Availability of Labor for Feedstock Production

Rationale: Skilled labor shortages can be difficult to remedy in the short term. Availability of suitable labor in an area can impact the ability to procure sufficient feedstock quantities on schedule. Labor risks are higher for facilities where supply chains are not yet active; or for Proponent's for whom large feedstock requirements, or development of new (or expanded) supply chains, demand significant additions to the local labor force.	
Raw RI Score: There may be some risk in logistics / transportation suppliers as the market grows**.** Our research indicated no reason that finding labor for feedstock acquisition will be difficult. Raw RI Score is 3 out of 10.	**Score 3**

Notched Salience: De-risking measures would include adequate worker wages and initial investments in training. As a result, Raw RI Score is notched by 25%: Notched Salience is 2.25	**Score 2.25**
Impact Level: RI Impact Level is deemed *low.*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Raw RI x Impact Level) is 7.49 out of 100.	**Score 7.49**

3.15. Feedstock Transportation Costs

Rationale: Transportation can be one of the most significant cost components of biomass supply chains. The average transportation cost and percentage of total feedstock cost attributable to transportation should be known.

Raw RI Score: Transportation costs are primarily a function of fuel cost, distance, and labor cost. We assume operating rates at $115 to $120/hr., legal road weights of 25 to 32 GTs depending on truck size and fiber category, average drive speed of 50 mph, loading and unloading time of 1.3 hours, and average distance of 40–80 miles one-way to derive the following estimates on high/low transportation costs in the BDO Zone. **Score 3**

Transport		
Round trip (miles)	80	160
Truck size (Gtons)	32	25
Total estimated trucking cost ($/ton)	10.65	21.15

Raw RI Score is 3 out of 10.

Notched Salience:	**Score Unnotched**
Impact Level: RI Impact Level is deemed *moderate.*	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 19.98 out of 100.	**Score 19.98**

3.16. Transportation Distances

Rationale: Transport distances of 40–80 miles for biomass feedstocks are typical, but larger distances can be common. Where average transport distance from suppliers to Proponent is high, the supply chain is subject to greater sensitivities to risks, such as increases in diesel cost, weather impacts, mechanical breakdown, and the demand for feedstock from competitors closer to the source.

Understanding average transport distance can help flag higher-risk suppliers where transport distance materially exceeds the average.

Raw RI Score: The majority of Sawmill Residuals are generated at distances greater than 35 miles, and the spatial distribution of Forest Residuals and Pulpwood generation are difficult to model precisely. Raw RI Score is 6 out of 10.	**Score 6**
Notched Salience: No adjustment.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low.*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 19.98 out of 100.	**Score 19.98**

3.17. Transportation of Feedstock Requires Specialized Equipment

Rationale: Requirements for specialized transport equipment can increase supply chain risk. Where there is low availability in required transportation equipment, equipment owners have increased leverage over transportation prices and supply chain resiliency can be lower.	
Raw RI Score: Transportation of the woody biomass in the Libby BDO Zone does not inherently require specialized equipment. The majority of the feedstock presently moved within the Libby BDO Zone is transported with traditional open-top trailers or live bottom trailers. Anecdotal indications are that capacity to haul residual materials is widespread throughout the BDO Zone[12]. If needed due to road or topography conditions, other forms of transport, such as dump trucks, are available. There may be a slight risk around lead times to accommodate specific transportation. Raw RI Score is 2 out of 10.	**Score 2**
Notched Salience: Notched at 25%. Notched Salience is 1.5	**Score 1.5**
Impact Level: RI Impact Level is deemed *moderate.* While we expect local infrastructure to be able to scale as necessary to accommodate the specific transport needs of a new project, it could take some time to do so.	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 9.99 out of 100.	**Score 9.99**

3.18. Delivery Routes through Local Communities

Rationale: Transportation of biomass can become a nuisance to local communities, especially if a large number of trucks pass through residential and school areas. Local communities often have the power to force regulations regarding truck transport, impeding a Proponent's ability to transport feedstock. This risk is greater in greenfield projects than operational ones.	
Raw RI Score: Preliminary GIS analysis confirmed an effective, intersecting, and expansive network of roads and highways, in and out of Libby, MT. Additionally, should a delivery route traverse a local community, feedstocks do not create unpleasant odors or visuals. Residents in the immediate area were significantly in favor of new projects that can help the local economy.	**Score 1**

For these reasons, Raw RI Score is 1 out of 10.	
Notched Salience: No adjustment.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low.*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Raw RI x Impact Level) is 3.33 out of 100.	**Score 3.33**

3.19. Transportation Regulations & Local Weight Limits

Rationale: In many regions, transportation is regulated based on seasonal road conditions. These regulations (e.g., "frost laws") often take the form of weight restrictions or limits on the number of trucks allowed on roads. Such regulations can impede the project's ability to source sufficient feedstock or increase the cost of doing so at certain times of the year.	
Raw RI Score: Considering the volume and mass of timber currently transported in the BDO Zone, we deem it highly unlikely that transportation regulations could hinder feedstock acquisition or transportation. For these reasons, Raw RI Score is 1 out of 10.	**Score 1**
Notched Salience: No adjustment. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk	**Score Unnotched**
Impact Level: Impact Level is deemed *low.*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Raw RI x Impact Level) is 3.33 out of 100.	**Score 3.33**

3.20. Road Infrastructure

Rationale: Feedstock cost and availability can be a function of the accessibility of road infrastructure**.** Problems with road networks will translate directly to risks to feedstock supply.	
Raw RI Score: Road infrastructure is good (although aged) and maintained at regular intervals. There is a proven track record of supporting the needs of a vibrant forest products and forest management network of activities. Raw RI Score is 1.	**Score 1**
Notched Salience: No adjustment.	**Score Unnotched**
Impact Level: Impact Level is deemed *low.*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Raw RI x Impact Level) is 3.33 out of 100.	**Score 3.33**

3.21. Transportation Redundancy

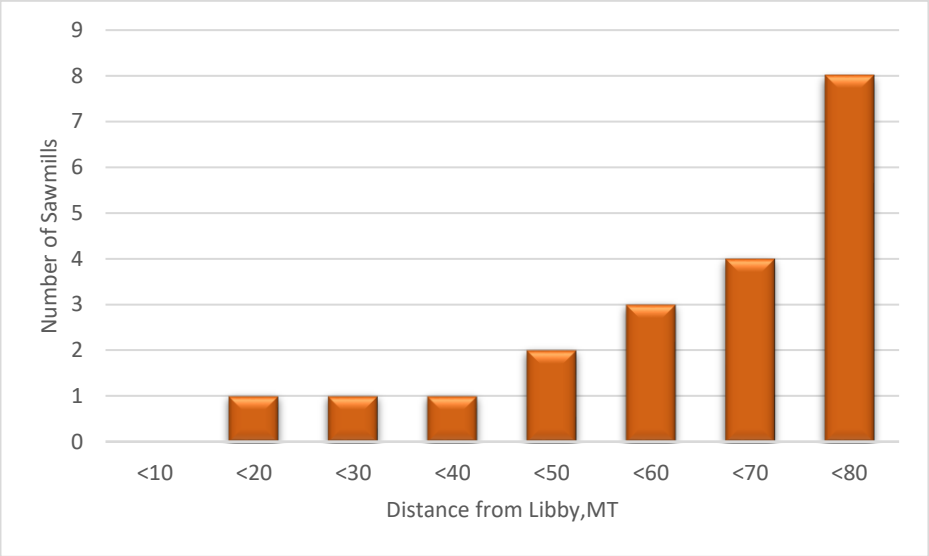
Rationale: Transport equipment redundancy is important for dealing with seasonally variable feedstock supplies, as well as the risk of equipment breakdowns.

Raw RI Score: Within the Libby BDO Zone logging companies typically own their own trucks, although some remove feedstock in combination with a contracted third party. Transportation redundancy in the Libby supply chain is low risk. Raw RI Score is 2 out of 10	**Score 2**
Notched Salience It is expected if there is a good market opportunity either logging companies or third party will be interested to participate. As a result, Raw RI Score is notched by 50%: Notched Salience is 1.	**Score 1**
Impact Level: Impact Level is deemed *moderate.*	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 6.66 out of 100.	**Score 6.66**

3.22. Number, Size, Mix, & Locations of Suppliers

Rationale: In general, a portfolio of multiple suppliers of various sizes is important for ensuring steady and uninterrupted feedstock supply with minimal price fluctuations. If a small number of large suppliers provides a high proportion of total feedstock, a disruption or supplier breach will have greater impact on the supply chain. In such cases the risk of disruption is lower, but the impact of those disruptions is higher. Conversely, a large number of small suppliers is less likely to have the capacity to withstand internal disruptions and may be more likely to breach. Here, risk of disruption is higher, but the likely impact is lower. The number of suppliers and the ratio of small to large suppliers should be optimized. There is no pre-determined number or optimal ratio of suppliers—either too many or too few can pose higher degrees of risk.	
Raw RI Score: Twenty-eight potential suppliers were identified within the BDO Zone: eight sawmills, and 20 fiber producers (of either Forest Residuals and/or Pulpwood). Additionally, fiber producers will typically travel from their home offices to wherever there is work. If they are located within the BDO Zone, their distances from Libby are largely irrelevant and thus were not mapped.	**Score 2**

Estimated Supplier Distribution: Sawmills



The number and mix of potential suppliers in the Libby BDO Zone are advantageous for projects looking to site in Libby, MT. However, the fact that 76% of potential suppliers operate outside of a 35-mile drive distance introduces moderate level of risk of increases in diesel cost.

Raw RI Score is 2 out of 10.

Notched Salience: No adjustment	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low*.	**Score 3.33**
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 6.66 out of 100.	**Score 6.66**

3.23. Suppliers Subject to Same External Risk Factors (Non-Weather & Equipment Based)

Rationale: When a single risk event can impact the feedstock production ability of all (or most) suppliers, then feedstock risk is higher and supply chain resiliency is lower. Resilience is maximized when biomass supply chains exhibit diversity in their locations, production practices, and other elements of supply chain structure such that the impact of single, high-risk events have varying impacts on suppliers.

Raw RI Score: Suppliers in the Libby BDO Zone are subject to many of the same external risk factors. Logging in the Zone is dependent on macroeconomic factors such as the housing markets. Downturns can threaten sawmill viability and consequently impact harvest of sawtimber and Forest Residuals Additionally, most fiber in the Zone is softwood, meaning that supply is also exposed to species-related risks (such as pest infestation) which could impact the Libby BDO Zone in adverse ways. Notwithstanding the foregoing, sawmills in the Libby BDO Zone have shown slight decreases in output from the period 2016–2020. Even so, production has stayed fairly consistent. As housing markets show signs of growth, the estimated demand for lumber rises. We anticipate continued consistent production in the area of interest.	**Score 7**

Raw RI Score is 7 out of 10.	
Notched Salience	**Score Unnotched**
Impact Level: Impact Level is deemed *high.*	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 69.93 out of 100	**Score 69.93**

3.24. Seasonal Weather Impacts on Feedstock Supply

Rationale: Seasonal weather impacts are defined as deriving from natural weather variations (e.g., spring thaws, rainy seasons, or dry seasons) as opposed to singular weather events (like fires, droughts, or hurricanes). Seasonal weather changes can be a significant risk factor affecting feedstock availability, quality, and price.	
Raw RI Score: Temporary delays can occur during periods of heavy rainfall or snows when fiber producers are unable to clear trees from timberland, or dirt roads are impassable. These delays cause variations in all sources of feedstock production, but the delays (and therefore feedstock generation variations) typically do not last more than a few weeks. There can be some seasonal delays in Forest Residual and Pulpwood generation, particularly in the spring, when in-woods chipping and harvesting can be hindered by thawing. Raw RI Score is 5 out of 10.	**Score 5**
Notched Salience: Since seasonal delays typically last days or weeks, having a modest but well-maintained feedstock reserve on site would significantly reduce the risk. As a result, Raw RI Score is notched by 50%: Notched Salience is 2.5.	**Score 2.5**
Impact Level: RI Impact Level is deemed *high.*	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 24.97 out of 100.	**Score 24.97**

3.25. Long-Term Weather and Climate Trends

Rationale: In certain regions, climate trends and significant potential changes to future weather patterns can create feedstock risk.	
Raw RI Score: The greatest climate risk to the Libby area is drought. The predictability of forest fires is based on fuel loads and moisture levels in a given area: severe periods of dry weather subject forests to catastrophic fire events. Approximately 1 million acres burned in Montana wildfires in 2021[15]. This was the largest total since 2017—the state's previous record-setting season. The supply of available timber necessarily goes down during periodic and seasonal wildfire activity. However, the sheer volume of timber available and the wide geographic area of the Zone can somewhat mitigate the effects of wildfire on a plant in Libby.	**Score 7**

[15]https://dailyinterlake.com/news/2022/apr/23/193m-pegged-wildfire-mitigation-kootenai-forest/.

Due to the size of the available forest resource, Raw RI Score is 7 out of 10.

Notched Salience:	**Score Unnotched**
Impact Level: RI Impact Level is deemed *moderate.*	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 46.62 out of 100.	**Score 46.62**

3.26. Government Subsidies for Feedstock Production or Utilization

Rationale: Feedstock that is directly subsidized though government programs can pose greater long-term risk than feedstock that is not. Subsidies may be subject to amendment or repeal, sometimes with minimal notice.

NOTE: This risk indicator refers to direct feedstock subsides only; it does not apply to government subsidies that pertain indirectly to the operations of the Proponent, such as Loan Guarantees, or to the markets for products produced by the Proponent.

Raw RI Score: There are no government subsidies for harvesting fiber in the Libby, BDO Zone. The Federal Infrastructure Investment and Jobs Act recently awarded a portion of Northwest Montana (largely Lincoln County) a $19.3 million grant to conduct forestry work that reduces the risk of catastrophic wildfire[16].	**Score 2**
Notched Salience: No adjustment.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low.*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Raw RI x Impact Level) is 6.66 out of 100.	**Score 6.66**

3.27. Local, Provincial, & National Laws, Regulations, & Permitting Pertaining to Biomass

Rationale: Feedstock production that is directly dependent on local, provincial, or national laws or government regulations can pose greater long-term risk than feedstock that is not, since laws and regulations may be subject to amendment or repeal.

If utilization of biomass requires specific permits (e.g., percentage removal of Forest Residuals or corn stover, allowable cut limits, air emission, storage permits, rights-of-way, overweight permits for trucks, cross-border permitting for shipment of biomass, chain of custody, or certification of sustainability), the likelihood of obtaining such permits and/or complying with permitting requirements should be examined.

Raw RI Score: We identified no pertinent local or state laws or regulations that would prevent or restrict biomass removal from Libby, BDO Zone forests**.** Raw RI Score is 1 out of 10.	**Score 1**

[16] https://dailyinterlake.com/news/2022/apr/23/193m-pegged-wildfire-mitigation-kootenai-forest/.

Notched Salience: No adjustment.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low.*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Raw RI x Impact Level) is 3.33 out of 100.	**Score 3.33**

3.28. Backlash Against Biomass Development, Procurement or Usage in the Region

Rationale: Public backlash against biomass development in the Proponent region can directly impact Proponent's ability to procure, transport, trans-load, store, or utilize feedstock by affecting local policies, regulations, and Proponent's ability to obtain necessary permitting.

Raw RI Score: We have not identified any past negative reaction against the current wood products industry in Libby. Raw RI Score is 1 out of 10.	**Score 1**
Notched Salience: No adjustment.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *high.*	**Score 9.99**
Loaded RI Score: Loaded RI Score (Raw RI x Impact Level) is 9.99 out of 100.	**Score 9.99**

3.29. Feedstock Sustainability, Including Risks to Soil Quality, & Surface & Groundwaters

Rationale: Public concerns about sustainability of feedstock production can jeopardize biomass feedstock operations. Sustainability certification schemes should be utilized where applicable to ensure that feedstock comes from sustainable sources.

Soil sustainability can be defined as management of soil in a way that does not exert any negative or irreparable effects on the soil or any other systems. There is a diversity of approaches to soil sustainability in jurisdictional guidelines for biomass harvesting and production. Different feedstock types have unique thresholds at which feedstock removal causes significant negative consequences on soil.

Excessive nutrient runoff from biomass feedstock production can accumulate in surface waters and result in algal blooms and hypoxia, which can lead to habitat loss for aquatic species higher up the food chain and alter aquatic ecosystem food webs. Damage to aquatic ecosystems can cause social and regulatory backlash. Water intake issues can also increase risk.

Raw RI Score: Fiber harvest in the Libby BDO Zone is carried out according to local regulation which have strong sustainability protocols. Raw RI Score is 3 out of 10.	**Score 3**
Notched Salience: no notching	**Score**

	Unnotched
Impact Level: RI Impact Level is deemed *moderate.*	**Score 6.66**
Loaded RI Score: Loaded RI Score (Raw RI x Impact Level) is 19.98 out of 100.	**Score 19.98**

3.30. GHG Emissions from Production, Harvest, & Transport

Rationale: Understanding a project's overall emissions and the carbon intensity throughout the feedstock supply chain is essential to reducing risks related to carbon pricing mechanisms and related regulations

GHG emissions from production, harvest, and transportation can be a significant challenge to Proponent claims of carbon neutrality for biomass projects. Carbon emissions from harvested soils, as well as emissions from harvesting machinery or delivery trucks, can make it difficult to achievement net-zero GHG emissions. If a Proponent's financial model relies on carbon neutrality/GHG regulatory pricing frameworks, it is essential to investigate the feedstock's carbon emission status.

Raw RI Score: If we assume that: 1) trucks average 6.5 miles per gallon[17]; 2) all feedstocks must be transported 75 miles; 3) trucks can carry 22 tons per delivery; 4) facility intake requirement is 100,000 tons per year; and 5) 19.64 pounds of CO_2 are emitted per gallon of fuel used[18], approximately 1,545 tons of CO_2 would be emitted per year in feedstock transport. However, average CO_2 carbon sequestration for pine trees is approximately 11 tons per acre of new tree growth[19], meaning only 140 acres of new trees would have to be grown per year to sequester all the carbon emitted from feedstock transportation. Given the scale of the forestry industry in the BDO Zone net positive carbon sequestration in relation to transport is deemed likely. GHG emissions stemming from feedstock production and harvest are more difficult to model and will depend on the size of the intake of a new plant in the Zone however, we note the positive growth to drain ratio for fiber in the Libby BDO Zone at the present time. For these reasons, Raw RI Score is 2 out of 10.	**Score 2**
Notched Salience: No adjustment.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low.*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Raw RI x Notched Salience) is 6.66 out of 100.	**Score 6.66**

[17] Arrow Truck: https://www.arrowtruck.com/blog/2016/06/21/manage-your-semi-trucks-fuel-use-with-these-tips/.
[18] US Energy Information Administration: http://www.patagoniaalliance.org/wp-content/uploads/2014/08/How-much-carbon-dioxide-is-produced-by-burning-gasoline-and-diesel-fuel-FAQ-U.S.-Energy-Information-Administration-EIA.pdf.
[19] GoTree Quotes: https://www.gotreequotes.com/how-much-co2-do-trees-absorb/.

3.31. Geographic Location Influence on Feedstock Variability

Rationale: Feedstock from different regions may differ in quality due to variations in soil quality, topography, harvest practices, weather, fertilizer applied, etc.	
Raw RI Score: Geographic location within the Libby BDO Zone does not impact feedstock variability. While there is topographic variation throughout the forests found in the area of interest, these factors are not expected to impact the overall homogeneity of the categories of feedstock in this BDO Zone rating. Raw RI Score is 1 out of 10.	**Score 1**
Notched Salience: No adjustment.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low.*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Raw RI x Impact Level) is 3.33 out of 100.	**Score 3.33**

3.32. Capacity of Supply Chain Components & Equipment to Scale

Rationale: Scale-up risk increases if supply chain components or underlying feedstock infrastructure necessary for these components cannot scale to handle Proponent feedstock requirements and throughput capacity. Capacity to scale should be demonstrated.	
Raw RI Score: Supply chain equipment is intensive, and scaling capacity would require capital investments from potential suppliers. Raw RI Score is 6 out of 10.	**Score 6**
Notched Salience: Outreach to local suppliers suggested that local suppliers would make this investment given reliable new market for fiber in the Libby BDO Zone that would intake on a consistent basis and pay market prices. Raw RI Score is notched by 75%: Notched Salience is 1.5.	**Score 1.5**
Impact Level: RI Impact Level is deemed *high.*	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Salience x Impact Level) is 14.98 out of 100.	**Score 14.98**

APPENDIX B: BACKGROUND RESEARCH

1. INTRODUCTION

This appendix provides background research conducted for this Libby BDO Zone designation. It sets out the context of the research and discusses results related to supply, demand, and pricing of woody biomass in the Libby BDO Zone.

1.1 BDO Zone, Competition Zone and Included Counties

The Libby BDO Zone is defined as an area within an 80-mile drive distance of Libby, Montana. Supply analysis for this study was conducted on the state and county levels when granular data was available. The six counties included in the Libby BDO Zone are summarized in Table A. Distances in Table A are measured from the center of Libby to the center of the respective county.

The Libby BDO Zone is depicted in Map 1 in blue. A Competition Zone is defined by a drive distance double that of the BDO Zone, or a 160-mile drive distance from Libby, MT.

Map 1: Libby, MT BDO Zone and Included Counties

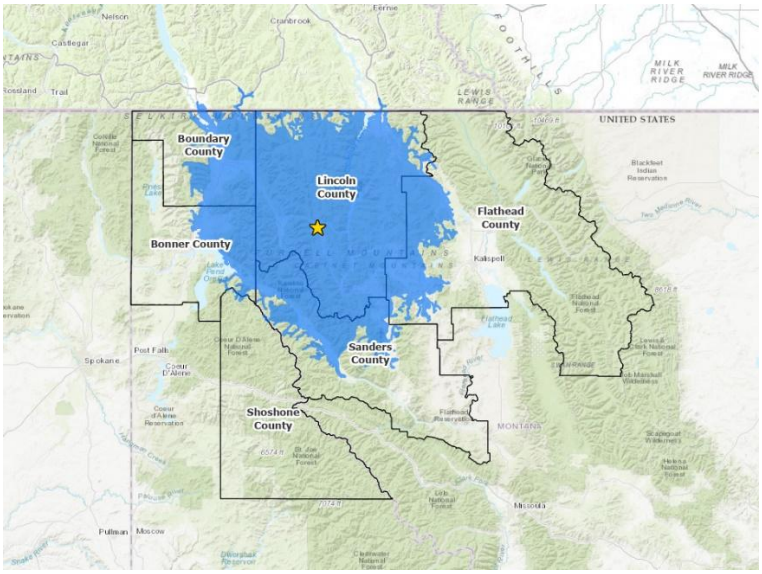


Table A: Counties within the BDO Zone

Sr No.	County FIPS	County Name	State	Distance from Libby (miles)	Approximate Percentage of County in BDO Zone
1	16017	Bonner	Idaho	85	27%
2	16021	Boundary	Idaho	71	50%
3	16079	Shoshone	Idaho	612	1%
4	30029	Flathead	Montana	109	13%
5	30053	Lincoln	Montana	233	87%
6	30089	Sanders	Montana	616	30.63%

1.2 Feedstock Definitions

This Libby BDO Zone designation includes Forest Residuals, Pulpwood, and Sawmill Residuals, defined below.

Note on feedstock type capitalization. Specific feedstock, as defined below, are capitalized (i.e., Pulpwood, Forest Residuals, and Sawmill Residuals).

Forest Residuals

Forest Residuals are by-products of sawtimber and pulpwood harvesting[20]. Forest Residuals include tree crowns, branches, stumps, and unmerchantable stems. Collectively, this material is commonly referred to as "slash." Forest Residuals are: 1) left on site to degrade naturally; 2) aggregated on site and burned; or 3) piled roadside. Material transported off site is loaded in either open-top van trailers or live-bottom trailers. For the defined BDO Zone, the material is seldom chipped or ground on site. This varies by markets as well as the ability of processing equipment to access the site.

Ash content of Forest Residuals can range between 1% and 6%, depending on composition. Where Forest Residuals contain mainly unmerchantable stems, the ash content is low; where Forest Residuals contain higher proportions of branches, or where the harvesting process fails to keep the fiber clean of soil or debris, the ash content is higher. The moisture content of the Forest Residuals is seasonal, ranging between 45% and 50%.

Sawmill Residuals

Montana and Idaho sawmills produce primarily dimension lumber used in construction and a smaller portion of structural timbers and veneer[21]. Approximately 50–55% of the volume of a sawlog processed by a sawmill is converted into primary wood products (e.g., lumber). The rest of the log is classified as co-products (residual material), composed of four main types: chips, sawdust, shavings, and bark (hog fuel). These are not always kept separate; if chips are mixed with sawdust, shavings, and/or bark, they are referred to as Hog Material in this report.

1.3 Methodology for Estimating Feedstock Generation

Sawmill and Forest Residuals, as well as roundwood Pulpwood feedstock generation, was modeled with 2021 data from the FIA's Timber Products Output (TPO) Toolkit and industry-appropriate transfer functions. See Appendix C for details and sources pertaining to generation estimates.

If part of a county landed in the BDO Zone, it was assumed that the approximate percentage of the county within the Libby BDO Zone was the percentage of that county's feedstock generation produced within the Libby BDO Zone and counted towards the BDO Zone's total. For example, approximately 13% of Sanders County, MT, lies within the BDO Zone, so 13% of the estimated residual generation within Sanders County was counted towards the Libby BDO Zone total. The percentage of a county in the Libby BDO Zone was estimated using Geographic Information Systems (GIS) modeling.

Where appropriate, we contacted stakeholders, local experts, and forest industry members to anecdotally contextualize and validate the numeric modeling outputs and assumptions made throughout this report.

2. Supply

2.1 High-Level Supply: Feedstock Generation

To illustrate harvesting and production in the area, consider Montana (statewide) summary data for 2018[11]. Ninety-three percent of that harvest activity went for saw and veneer logs. Other products, including logs for Pulpwood, furniture, fuelwood, cedar products, and posts and poles, accounted for just over 6%[11]. This illustrates the dominance of saw and veneer logs as well as the lack of markets for Pulpwood. While this data is for the entire state, the trend holds for the Libby BDO Zone, which is in northwest Montana where much of the states' wood is produced. The same data source further broke

[20] Sawtimber is large diameter timber processed by sawmills into lumber; pulpwood is small diameter timber processed by pulp mills into pulp and paper.

[21] Steven W. Hayes, Lucas Townsend, Thale Dillon, Todd A. Morgan, and John D. Shaw. 2018. Montana's Forest Products Industry and Timber Harvest. USDA Forest Service, Mountain Research Station, Resource Bulletin RMRS-RB-35. October 2021.

down the flow of timber, noting that 86.7 MMCF of timber was received by sawmills and plywood plants in Montana. Of this, 39.3 MMCF, or 45%, became finished lumber, other sawn products, or plywood. Two percent was accounted for by losses during shrinkage. The remaining 45.8 MMCF was byproducts of sawing and became residue. The Sawmill Residuals were utilized as follows: 1.5 MMCF was sold or used internally for biomass energy; 43 MMCF was used for pulp, particleboard, and medium-density fiberboard; and the remainder went to animal bedding, mulch, or other uses. A much smaller component of timber went to manufacture log homes. We note that only 0.13 MMCF became mill residue, the bulk of which went for energy use. Interestingly, 17% of the residue generated by log home manufacturers went unused[11]. Figure 1 was developed by Hayes et al. (2018) and is presented here to illustrate the timber flow. Full credit for Figure 1 is ascribed to its original authors[11].

If the scope is refined to the Libby BDO Zone, currently an estimated 809,813 green tons per year (gt/yr) of feedstock are generated. Sawmill Residuals account for 450,819 gt/yr (56%), Forest Residuals account for 273,088 gt/yr (34%), and Pulpwood makes up the remainder at 85,907 gt/yr, (11%) (see Figure 2).

Figure 1: Timber Harvest Flow for Montana in 2018[11]

We estimate that 256,497 of the 809,813 gt/yr are available on average in the current market. Assuming that 1) a new competitor entering the market locates in a geographically strategic way within the BDO Zone; and 2) the new competitor can capture access to available fiber, it is reasonable to expect the following availability:

1. For a capture ratio of between 10% and 30%, an estimate of 38,658 gt/yr of Pulpwood[22]
2. For a capture ratio of between 50% and 60%, an average of 150,198 gt/yr of Forest Residuals
3. For a capture ratio of between 10% and 20%, an average of 67,623 gt/yr of Sawmill Residuals

This results, on average, in a potential availability of 256,479 gt/yr of these combined feedstock sources.

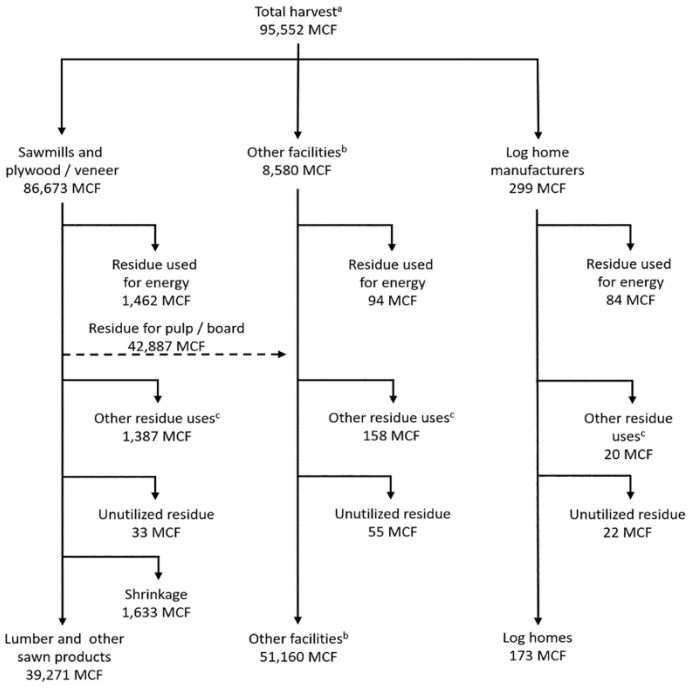
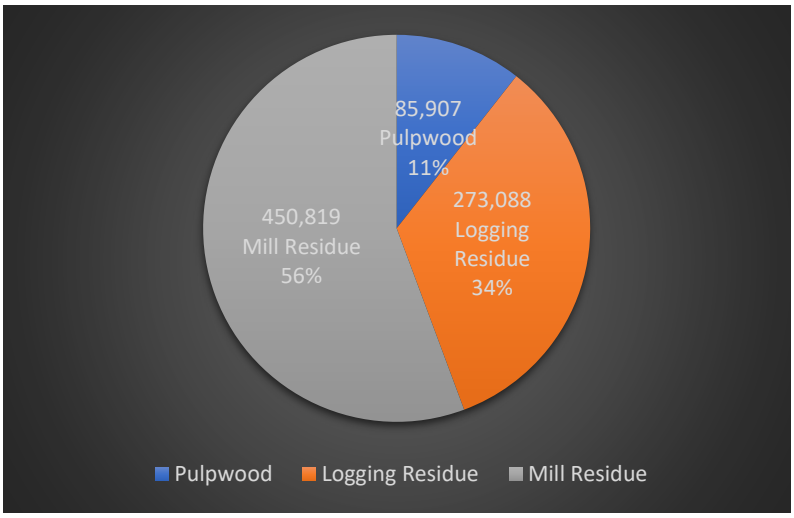


Figure 2: Estimated Feedstock Generation by Type in the Libby BDO Supply Basin

[22] We assume that an even greater proportion of Pulpwood would become available if there were demand for it.

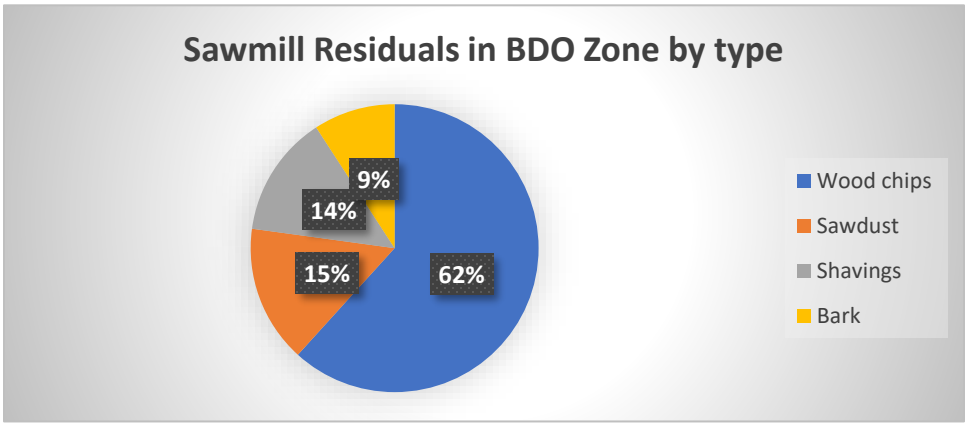


2.2 Sawmill Residual Generation

An estimated 450,819 green tons of Sawmill Residuals are generated annually in the BDO Zone. The Residuals come primarily from mid- to large-sized sawmills and are composed of chips, bark, shavings, and sawdust. The Residuals break down by type and amount as follows:

1. Chips: 278,283.03 gt/yr (61.73%)
2. Sawdust: 69,570.76 gt/yr (15.43%)
3. Shavings: 61,619.81 gt/yr (13.67%)
4. Bark: 41,344.91 gt/yr (9.17%)

Figure 3: Estimated Sawmill Residuals Generated in the BDO Zone



2.3 Year-to-Year Generation Variation

Sawmill Residuals

Since Historical Sawmill Residual generation data were unavailable, we used roundwood production data as a proxy to understand year-to-year variation in Sawmill Residual generation[23]. As shown in Figure 4 and Table B, the year-to-year production of roundwood in the Libby BDO Zone declined between 2016 and 2020. This reflects markets as well as available timber sales. Currently Pulpwood, without a stable market, is cut where mandated during timber harvests and commercial thinnings. There is otherwise little incentive at this time to cut this material, which is seen more as a cost associated with mature timber harvesting. While timber harvests declined from 2016 to 2020 (and thus Sawmill Residuals), stabilizing housing markets post the height of the COVID-19 pandemic in 2020, which are dependent on softwood construction lumber, are likely to turn this trend around. Understanding why these volumes fell would require data on the customers, the products sold, and terms of sale for timber cut throughout the entire period. Unfortunately, this information is not readily available[17]. Increased demand for construction lumber will translate into larger amounts of sawtimber processed by primary wood users and correlates directly to increased Sawmill Residual production. Increased sawtimber demand also generates additional Forest Residuals and Pulpwood.

Timber Harvest data for the six counties over the period 2016–2020 appears in Figure 4. Shoshone and Bonner counties in Idaho have consistently had the highest harvesting levels, and Sanders County the lowest.

Figure 4: Estimated Historical Timber Harvested for Counties Falling in the Libby BDO Zone

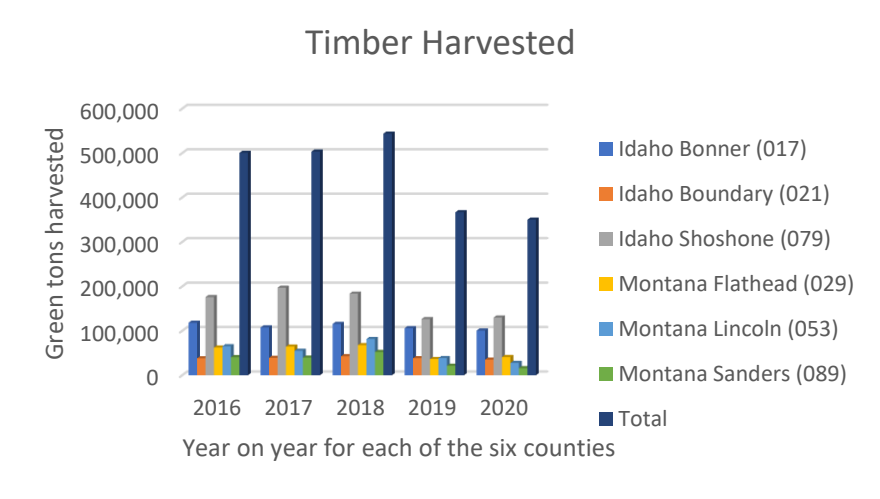


Table B is provided for better resolution of the harvest volumes shown in Figure 4 for each county within the BDO Zone.

Table B: Total Timber Harvested in the Counties Falling in BDO Zone[a]

State	County	Year				
		2016	2017	2018	2019	2020
Idaho	Bonner	118,056	107,586	115,427	105,783	100,501
Idaho	Boundary	38,104	39,219	42,768	38,303	35,145

[23] Residuals are the direct result of processing sawlogs into lumber and veneer. By applying a conversion of logs to lumber, we can estimate the remaining residue created.

Idaho	Shoshone	175,862	196,915	183,469	126,342	129,765
Montana	Flathead	62,377	64,556	67,818	36,362	40,871
Montana	Lincoln	65,283	55,155	81,581	38,577	27,781
Montana	Sanders	40,645	39,732	52,406	21,399	15,992
Total		500,327	503,163	543,469	366,766	350,055

[a]All volumes in MBF (Scribner)

Forest Residuals

Residuals developed in the forest mirror the trends for Sawmill Residuals. Although inherent variation in Forest Residuals generation can be influenced by the logging sectors' ability to access harvest sites, in the Libby BDO Zone it is relatively small and is proxied here by timber harvest. Forest Residuals are the direct result of timber harvesting and likewise saw decreases between 2016 and 2020. In addition to the close association between timber harvest, residual production, and demand for structural lumber, a recent article featured in the *Daily Inter Lake* reports that increased harvesting activity in the Libby BDO Zone will take place by the end of 2022[25]. This is the result of a multi-year project aimed at reducing wildfire risk through the reduction of hazardous fuels in forests. To accomplish this work, just over $19 million has been earmarked for thinning and planting on 7,200 acres of the Kootenai National Forest in Lincoln County, MT, through the federal Infrastructure Investment and Jobs Act [24]. *The Daily Interlake* article further states that additional benefits of this funding will include a supply of logs (associated Forest Residuals and Pulpwood) for the regions' wood products industry.

In addition, state and local agencies are seeking ways to thin the forestland around the region's scattered communities to reduce the urban wildfire interface, which will generate additional forest residues in the Zone.[15]

2.4 Suppliers

Sawmill Residuals

Eight sawmills are located in the Libby BDO Zone (Map 3, Table C). Data from 2018[2], the most recent available, reports a total mill residue generation of 45.8 MMCF, of which 43 MMCF was utilized as furnish for pulp and for medium-density fiberboard manufacturing. Much smaller proportions were used internally by mills or schools for energy (1.5 MMCF), or went to livestock bedding, and mulch (1.2 MMCF)[2].

Through correspondence with industry experts in the Libby area, it is estimated that 95+% of the Residuals produced by these mills are currently accounted for in the marketplace[12]. Due to trade confidentiality in this tight market, sawmills did not disclose quantities or prices. Anecdotal evidence suggests that additional market outlets for residuals could create healthy competition and bolster forest harvesting activity. Currently, a few key players absorb the majority of Sawmill Residuals in the BDO Zone. A more stable strategy for obtaining woody feedstock in the Libby BDO Zone would be centered on the currently underutilized Forest Residuals and Pulpwood.

Map 3: Sawmills in the BDO Zone

[24] https://dailyinterlake.com/news/2022/apr/23/193m-pegged-wildfire-mitigation-kootenai-forest/.

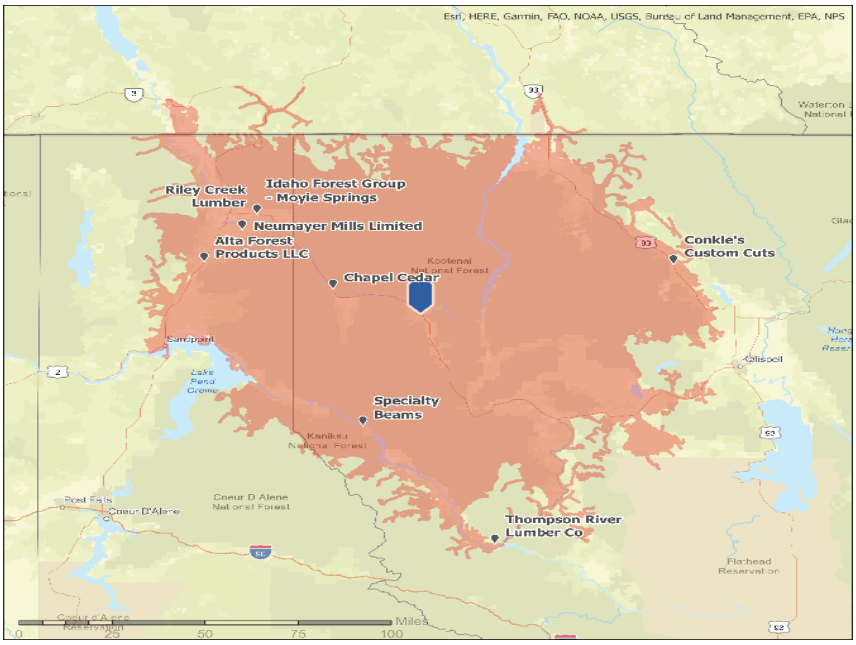


Table C: Mill names, addresses, county of operation, and wood consumption.

Sr No.	Sawmill	Address	City	State	Zip	FIPS State	State	FIPS County	County	Annual timber use Size Category
1	Alta Forest Products LLC	Old Highway 2	Naples	ID	83847	16	Idaho	21	Boundary	5000 MCF or more
2	Chapel Cedar	305 Chapel Flats Rd.	Troy	MT	59935 -0315	30	Montana	53	Lincoln	500 TO 999 MCF
3	Conkle's Custom Cuts	P.O. Box 152	Olney	MT	59927	30	Montana	29	Flathead	<250 MCF
4	Idaho Forest Group - Moyie Springs	3082 East Roosevelt Rd	Moyie Springs	ID	83845	16	Idaho	21	Boundary	5000 MCF or more
5	Neumayer Mills Limited	Rt 1 Box 519	Bonners Ferry	ID	83805	16	Idaho	21	Boundary	<250 MCF
6	Riley Creek Lumber	30 Riley Creek Park Dr.	Laclede	ID	83841	16	Idaho			
7	Specialty Beams	774 Triangle Dr.	Ponderay	ID	83852	16	Idaho	17	Bonner	<250 MCF
8	Thompson River Lumber Co	5332 Hwy 200	Thomson Falls	MT	59873	30	Montana	89	Sanders	1000 TO 4999 MCF

Forest Residuals

We identified 20 logging companies registered in the Libby BDO Zone that could potentially process Forest Residuals and Pulpwood from their harvesting operations to supply a project in Libby, MT (Table D). Because this list is not comprehensive, the first two entries in Table-D are logging organizations that can address questions regarding this industry segment. Very

few logging companies currently process Forest Residuals[25]. Our experience suggests that with additional demand for Forest Residuals and Pulpwood, logging companies will invest in processing equipment to handle that material. Table E shows the breakdown of Forest Residuals resulting from logging practices for the six Libby BDO Zone counties. Roundwood Pulpwood production is shown in Table F.

Table D: List of Companies with Harvesting Operations Registered in the BDO Zone

Sr No.	Company Name	Website	Full Address	Distance From Libby (miles)
1	Montana Logging Association	www.logging.org	2224 Mt Hwy 35 E, Kalispell, Montana, 59901, United States	100
2	Intermountain Logging Conference	www.intermountainlogging.org	PO Box 482, Saint Maries, Idaho, 83861, United States	92
3	Mike Reynolds Logging	www.mikereynoldslogging.com	350 Peterson Rd, Priest River, Idaho, 83856, United States	179
4	Hoo-hoo 187	www.hoo-hoo187.com	PO Box 2316, Kalispell, Montana, 59903, United States	115
5	Dennison Logging	www.dennisonlogging.com	62 Sunrise Dr, Kalispell, Montana, 59901, United States	88
6	Ureco	urecoconstruction.com	1947 9th St W, Columbia Falls, Montana, 59912, United States	92
7	Timberlake Builders	www.skookumtimber.com	144 2nd St E, Ste 102, Whitefish, Montana, 59937, United States	106
8	Potlatch City Hall	www.potlatch.com	PO Box 525, Potlatch, Idaho, 83855, United States	102
9	TH Logging	www.thlogging.com	PO Box 273, Arlee, Montana, 59821, United States	195
10	UTR Land Management Gallery	utrlandmgnt.com	1303 Deep Creek Loop, Naples, Idaho, 83847, United States	164
11	RJK LOGGING	eurekadsl.net	176 Black Dog Cv, Eureka, Montana, 59917, United States	61
12	S BLOOD	mail.sandpoint.net	422 Elm Ave, Ponderay, Idaho, 83852, United States	68
13	Trees R Us	www.idahowholesaletrees.com	511398 Hwy 95, Bonners Ferry, Idaho, 83805, United States	82
14	JEFF GAMET LOGGING	prorate48.com	6277 Mt Hwy 83, Condon, Montana, 59826, United States	48
15	Log Jam	www.montanalogjam.org	PO Box 3193, Kalispell, Montana, 59903, United States	156
16	PAFTI	www.pafti.com	PO Box 190161, Hungry Horse, Montana, 59919, United States	88
17	Shawn Montee Timber	www.shawnmonteetimberco.com	PO Box 2028, Coeur D Alene, Idaho, 83816, United States	110
18	Wild Montana Wood	www.wildmontanawood.com	4440 Farm To Market Rd, Kalispell, Montana, 59901, United States	129
19	RL Timber	www.rltimber.com	524 Callen Crabb Rd, Sagle, Idaho, 83860, United States	94
20	Next Generation Logging	www.nextgenlogging.com	17790 N Jeslon Ct, Hayden, Idaho, 83835, United States	93
21	D & s Logworks	www.dnslogworks.com	1025 Mccaffery Rd, Bigfork, Montana, 59911, United States	119
22	Mid-Mountain Land & Timber	www.midmountainland.com	PO Box 986, Hayden, Idaho, 83835, United States	107

Table E: Forest Residuals from Logging by County in the Libby, BDO Zone

[25] Verbal correspondence with local logger in the Supply Basin indicates a very small fraction currently operates an in-woods chipper or grinder. May, 2022.

Forest Residuals (Cubic Feet)[a]					
State	County	Logging Res in County (Cubic feet)	County Proportions	Logging Res in SB (Cubic feet)	Logging Res in SB (BDT)
Idaho	Shoshone	6,747,831	27%	1,840,764	
Idaho	Boundary	2,242,407	50%	1,138,930	
Idaho	Bonner	7,573,109	1%	42,839	
Montana	Sanders	3,484,621	13%	472,301	
Montana	Lincoln	5,015,172	87%	4,401,574	
Montana	Flathead	3,939,139	30%	1,206,521	
Total		**29,002,281**		**9,102,928**	
CF (GT/MCF)		**30**		**30**	
Green tons		**870,068**		**273,088**	**136,543**
Capture ratio	**55%**			**150,198(Green tons)**	

[a] Forest Residuals include small tops, unmerchantable stems, branches, and stumps. Collectively this is often referred to as "slash."

Pulpwood

Pulpwood production is most prevalent in Shoshone County, only one quarter of which is in the BDO Zone. Sanders County contributes the least Pulpwood in the BDO Zone. Since a major facility sourcing Pulpwood closed in 2010, production in the Libby BDO Zone is now constrained by available market outlets. We assume a moisture content for the Pulpwood of 50% at the time it is cut. It is not uncommon for buyers to specify a moisture content of roughly 35% for feedstock purposes. This is achieved through air drying as the bolts are allowed to reduce moisture by sitting on-site for a period of time depending on air temperature and relative humidity.

Table F: Roundwood Pulpwood by County in the BDO Zone

State	County	Type	Pulpwood (cubic feet)	County Proportions	Pulp in SB (Cubic feet)
Idaho	Shoshone	Pulpwood	7,480,468	27%	2,040,623
Idaho	Boundary	Pulpwood	1,008,300	50%	512,120
Idaho	Bonner	Pulpwood	1,501,708	1%	8,494
Montana	Sanders	Pulpwood	222,222	13%	30,119
Montana	Lincoln	Pulpwood	-	87%	-
Montana	Flathead	Pulpwood	2,758,498	30%	844,901
Total			12,971,199		3,436,260
CF (GT/MCF)			25		25
Green tons			324,279		85,906

3. Demand

3.1 Competitors

The area's largest previous consumer of roundwood Pulpwood closed in 2010, causing decreased roundwood Pulpwood harvesting. A roundwood chipping facility that began operation in Bonner, MT, in 2012 has been through a cycle of periodic closures and operation. The material utilized by the chipping mill relies on material produced by wildfire risk reduction and forest health initiatives and provides a large medium-density fiberboard (MDF) mill with their feedstock. Another chipping operation is located on the site of the MDF mill and feeds that mill exclusively.

Three major categories of facilities consume primarily Sawmill Residuals in the Libby BDO Zone with only minor and inconsistent Forest Residuals: heating facilities, MDF production, and pellet mills. Thirty-three facilities compete for woody residues within the 160-mile drive Competition Zone. Key competitors to an incoming woody biomass operation include MDF production, two firewood/fuelwood processors, a plywood/veneer mill, and two pellet mills. Other users include participants in the Fuels for Schools program. Methodology for estimating competitor woody biomass consumption is provided in Appendix C.

Competitors located at longer distances from the Libby BDO Zone source additional feedstock from areas outside the Zone. We estimate that between 400,000 and 450,000 gt/yr of Sawmill Residuals are currently being used by existing facilities.

Map 4: Competitors within 160-mile Drive Distance

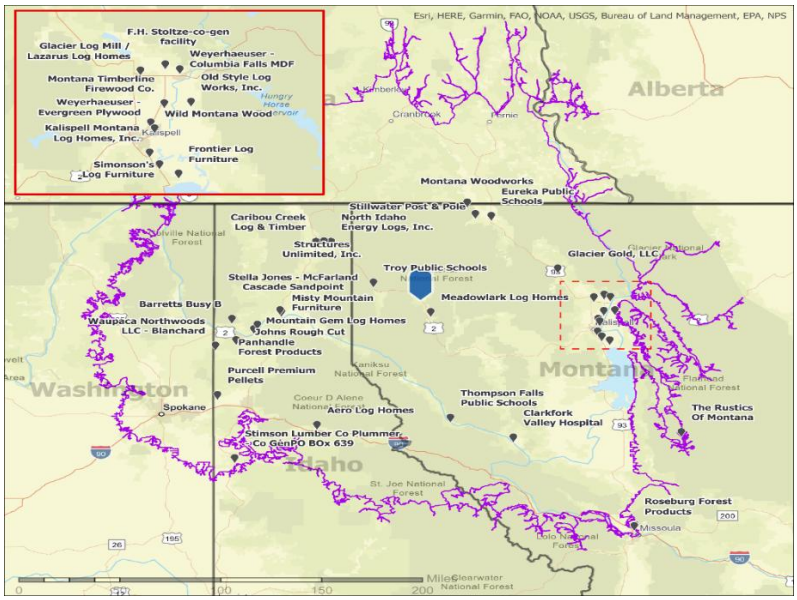


Table G provides a listing of woody biomass competitors within a 160-mile drive distance of Libby. Facility locations and annual wood use characteristics are shown.

Table G: Competitors within 160-mile Drive Distance

Sr No.	Facility Name	Facility type	Address	City	State	County	Annual timber use Size Category
1	Aero Log Homes	log home	41657 Riverview Drive	Kingston	Idaho	Shoshone	<250 MCF
2	Barretts Busy B	cedar products	109 Barrett Mill Rd	Priest River	Idaho	Bonner	<250 MCF
3	Caribou Creek Log & Timber	log home	HCR 85 Box 3	Bonners Ferry	Idaho	Boundary	<250 MCF
4	Clarkfork Valley Hospital	biomass/energy	10 Kruger Rd	Plains	Montana	Sanders	No Roundwood
5	Eureka Public Schools	biomass/energy	335 6th Street East	Eureka	Montana	Lincoln	No Roundwood
6	F.H. Stoltze-co-gen facility	biomass/energy	600 Half Moon Road	Columbia Falls	Montana	Flathead	No Roundwood
7	Frontier Log Furniture	log furniture	815 Hwy 82	Somers	Montana	Flathead	<250 MCF

8	Glacier Gold, LLC	bark products	255 Good Creek Rd.	Olney	Montana	Flathead	No Roundwood
9	Glacier Log Mill / Lazarus Log Homes	log home	5088 Whitefish Stage	Whitefish	Montana	Flathead	<250 MCF
10	Johns Rough Cut	log furniture	125 Blue Spruce Ln	Laclede	Idaho	Bonner	<250 MCF
11	Kalispell Montana Log Homes, Inc.	log home	3250 U.S. Hwy. 93 South	Kalispell	Montana	Flathead	<250 MCF
12	Meadowlark Log Homes	log home	50 Meadowlark Lane	Libby	Montana	Lincoln	<250 MCF
13	Misty Mountain Furniture	log furniture	502 Cedar St Station	Sandpoint	Idaho	Bonner	<250 MCF
14	Montana Timberline Firewood Co.	firewood (fuelwood)	1960 Helena Flats Rd.	Kalispell	Montana	Flathead	<250 MCF
15	Montana Woodworks	log furniture	250 Whitetail Drive	Rexford	Montana	Lincoln	<250 MCF
16	Mountain Gem Log Homes	log home	16793 Hwy 2 W.	Laclede	Idaho	Bonner	<250 MCF
17	North Idaho Energy Logs, Inc.	fuel pellet/presto logs	1270 Roosevelt Rd	Moyie Springs	Idaho	Boundary	No Roundwood
18	Old Style Log Works, Inc.	log home	1790 Hwy 206	Columbia Falls	Montana	Flathead	<250 MCF
19	Panhandle Forest Products	post/pole/piling	Hoodoo Mt. Road	Priest River	Idaho	Bonner	250 TO 499 MCF
20	Purcell Premium Pellets	fuel pellet/presto logs	16620 W Prairie Ave	Hauser	Idaho	Kootenai	No Roundwood
21	Roseburg Forest Products	particleboard/MDF/ hardboard/composite panel	3300 Raser Drive	Missoula	Montana	Missoula	No Roundwood
22	Simonson's Log Furniture	log furniture	4124 Hwy 93 South	Kalispell	Montana	Flathead	<250 MCF
23	Stella Jones - McFarland Cascade Sandpoint	post/pole/piling	975 Baldy Mtn. Rd.	Sandpoint	Idaho	Bonner	250 TO 499 MCF
24	Stillwater Post & Pole	post/pole/piling	335 Country Lane	Olney	Montana	Flathead	250 TO 499 MCF
25	Stimson Lumber Co Plummer - Co GenPO BOX 639	biomass/energy	733 10th St	Plummer	Idaho	Benewah	No Roundwood
26	Structures Unlimited, Inc.	log home	P.O. Box 613	Bonners Ferry	Idaho	Boundary	<250 MCF
27	The Rustics Of Montana	log home	HC 83	Condon	Montana	Missoula	<250 MCF
28	Thompson Falls Public Schools	biomass/energy	307 3rd Ave.	Thompson Falls	Montana	Sanders	No Roundwood
29	Troy Public Schools	biomass/energy	236 Spokane Avenue	Troy	Montana	Lincoln	No Roundwood
30	Waupaca Northwoods LLC - Blanchard	bark products	Hwy 41 MileMarker 30	Blanchard	Idaho	Bonner	No Roundwood
31	Weyerhaeuser - Columbia Falls MDF	particleboard/MDF/ hardboard/composite panel	500 12th Ave. W.	Columbia Falls	Montana	Flathead	No Roundwood
32	Weyerhaeuser - Evergreen Plywood	plywood/Veneer Mill	75 Sunset Drive	Kalispell	Montana	Flathead	5000 MCF or more
33	Wild Montana Wood	firewood (fuelwood)	4440 Farm to Market Rd	Kalispell	Montana	Flathead	<250 MCF

3.2 Future Competitors

Future competition for any area is difficult to predict. We identified one additional business proposing to operate in the BDO Zone[26] pending a secured line of credit for the out-of-state proponent. If successful, the firm would develop a medium-density fiberboard plant in Libby in a structure on port authority property commonly referred to as the Stinger building.[15] The new facility would use machinery from a former plant in Dubuque, IA, and create upwards of 150 jobs. Data on the amount and type of residues this plant will use are not available.

One chipping operation established in 2012 has experienced sporadic production cycles. When running, the mill utilizes Forest Residuals in insignificant volumes compared to what is available.

4. Pricing

4.1 Current Pricing

Specific price points for woody biomass in the Libby BDO Zone were not accessible. Therefore, the following values represent ranges that can vary +/- several dollars. The values were corroborated by review from industry experts in the BDO Zone[27].

The current delivered price range estimates (in US dollars) by feedstock type (per green ton) are:

Forest Residuals: $30 to $35
Pulpwood: $25 to $35
Sawmill Residuals (by category):

- Bark: $25 to $30
- Sawdust: $15 to $20
- Shavings: $32 to $37.50
- Softwood Chip: $50 to $55

4.2 Historical Pricing

Historical pricing trends for all residual types are not publicly available and manufacturing facilities in the area were not willing to disclose them. Therefore, our analysis focuses on production and current pricing estimates. Conversations with industry experts in the Libby BDO Zone suggest that historical wood pricing trends in the past five years are similar to those in today's markets. Thus, we assume that historical residue prices have not deviated radically from those estimated in today's markets.

Year-to-year variation in Sawmill Residual generation is the result of mill production and lumber markets. To estimate Sawmill Residual generation variation, we use Roundwood as a proxy. Between 2016 and 2021 an overall decrease in timber harvest was observed across the six counties in the BDO zone. The decreased timber harvest meant fewer logs available for lumber and veneer manufacturing. Decreased production of those wood products means fewer Sawmill Residuals are produced from the initial breakdown of logs into lumber. We expect this trend to reverse in the coming years with housing starts and financial commitments to forest stand improvement work aimed at forest fires fuels reduction.

[26] https://dailyinterlake.com/news/2021/jul/13/hurdles-remain-bring-mdf-factory-Libby/?msclkid=97a7422fd14311ec82b0e7beb225e6ff.

[27] Correspondence with local stakeholders in the Libby, MT Supply Zone. May, 2022.

5. TRANSPORTATION

Sawmill Residuals and Forest Residuals are transported primarily in open-top or traditional van trailers. Live-bottom trailers are available, but are not the norm. Conversations with local stakeholders revealed that most Sawmill and Forest Residuals are currently transported with standard open-top trailers. New bioprocessing facilities may have to design around the open-top trailer infrastructure or be prepared to invest in the acquisition of more specialized equipment. Pulpwood is transported in a similar fashion to sawlogs.

SAWMILL RESIDUALS

Transportation of Sawmill Residuals is most commonly done by sawmills, which own and operate trucks and trailers used for delivery. When sawmills do not have enough equipment for deliveries, transportation is outsourced to third-party hauling companies. We identified 21 trucking companies operating in the Libby BDO Zone that could be potentially used for Sawmill Residual transportation (See Appendix D).

FOREST RESIDUALS

Equipment used to transport Forest Residuals is owned and operated either by logging/harvesting companies or by third-party trucking companies. We identified 20 logging/harvesting companies (Table 5) and 21 trucking companies (Appendix D) operating in the BDO Zone.

PULPWOOD

Equipment used to transport Pulpwood is owned and operated either by logging/harvesting companies or by third-party trucking companies. These companies are listed in Table 5 and Appendix D.

6. INFRASTRUCTURE

6.1. ROADS

Lincoln County is distant from major metropolitan areas. There is rail service but no access to an interstate highway. The road infrastructure consists of a network of county roads, city streets, state highways, and Forest Service roads. US Highway 2 connects Libby and Troy with Kalispell and Idaho. Highway 37 connects Libby to Eureka, Whitefish, and Canada. Most of the roads are paved or chip-sealed. Twelve bridges are maintained year-round within the Troy District, with repaving and repair in the summer months and plowing during the winter season[28].

The majority of Lincoln County roads are old. The county has not built new roads since 1993. Instead, roads rely on consistent maintenance to remain operable and safe. To this end, they are surface coated every five years. The relatively small population in the Libby BDO Zone means that traffic congestion is generally not a problem, although periodic congestion on Highway 93 results in temporary backups and delays.

Because of the Kootenai National Forest there are thousands of miles of Forest Service roads within Lincoln County. These roads are subject to seasonal closures and can be unreliable.

The combined road systems in the region have accommodated the active forest products and logging industry for decades. Distance from a forest harvesting site to a road and the slope encountered on those roads are factors in financial and logistic

[28] Lincoln County Growth Policy 2019 Update. A report prepared for Board of County Commissioners Lincoln County, Montana by Land Solutions, LLC and KMR Consulting, LLC. Adopted December 4, 2019.

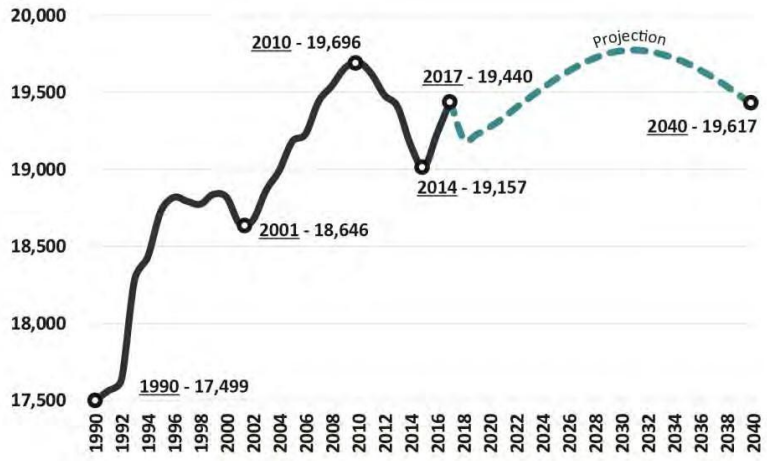
feasibility for Forest Residuals supply.[29] In his report for the Forestry Assistance Bureau Forestry Division Montana Department of Natural Resources and Conservation Missoula, Montana, Morgan states that: "about 20% (148 MDT) of live tree woody biomass on timberlands in Montana is located within 1,000 feet (ft.) of a road, while about 40% (295 MDT) is located more than 1 mile from a road (Table 3). Nearly 65% (468 MDT) of the live tree biomass on Montana timberlands is located on land with slopes of less than 40%, and 29% (210 MDT) is located on land with less than 20% slope. These figures suggest that substantial volumes of live tree biomass are accessible to ground-based harvesting systems, which are substantially less costly than cable or helicopter logging, and likely would not require new forest roads to be built."[29]

6.2. Availability of Labor

The forest products industry in Montana has employed as many as 6,973 people and contributed $869 million to the state's economy. Historically, labor participation rates around Libby, MT, have been nearly 80%[30].

Lincoln County's population has grown steadily since 1990 with minor fluctuations[16] and is projected to increase slightly in the current decade and level off by 2030, as outlined in Figure 5[31] (the Y-axis of the figure is in thousands of people, and the X-axis denotes years).

Figure 5: Population Characteristics of Lincoln County 1990–2040



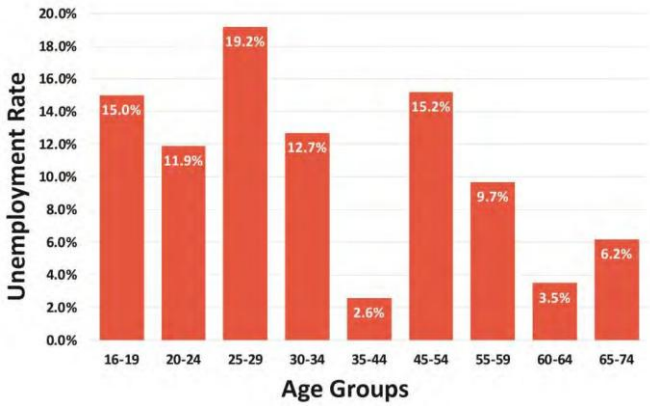
We assume a stable workforce in the Libby area given current population growth, high labor participation rates, and project a slight increase in population. Combining growth with unemployment data by age group (Figure 6), we expect ample workers potentially seeking employment in the area.

[29] Todd A. Morgan, CF Research Assistant Professor Director, Forest Industry Research Bureau of Business and Economic Research. The University of Montana Missoula: Forestry Assistance Bureau Forestry Division Montana Department of Natural Resources and Conservation Missoula, Montana. April, 2009. Accessed online. April, 2022 at: http://www.bber.umt.edu/pubs/forest/biomass/MT_DNRC_Biomass_Report_B&W.pdf.

[30] A Review of Economic Conditions in Lincoln County, Montana by Clint Oster, Lincoln County Port Authority, October 29, 2017.

[31] Lincoln County Growth Policy 2019 Update. A report prepared for Board of County Commissioners Lincoln County, Montana by Land Solutions, LLC and KMR Consulting, LLC. Adopted December 4, 2019.

Figure 6: Population Ages and Rates of Unemployment in Lincoln County



7. POLICY

7.1. LOCAL, FEDERAL & NATIONAL LAWS, REGULATIONS AND PERMITTING PERTAINING TO BIOMASS

Historically, Lincoln County's economy has been anchored by natural resource extraction, primarily mining and the harvesting and manufacturing of forest products. Policy governing these activities are well established. No pertinent local, state, or federal laws or regulations pertaining to biomass were identified. A new wood utilization facility would be subject to current regulations governing existing wood-using entities. Prospective businesses looking to site in the Libby BDO Zone are advised to contact the Department of Environmental Quality and the Industry Development Program-Montana Office of Tourism and Business Development for information regarding air quality and other aspects of potential impacts to the environment.

APPENDIX C: COMPETITION FEEDSTOCK CONSUMPTION

Note: All estimates were obtained from the most recently available data summary (2009) and, with the exception of biomass facilities and a proposed new medium-density fiberboard facility, are credited to T. Morgan[29].

1. FACILITY HEATING COMPETITION ESTIMATION

The most recent available data is from 2009 but provides a sense of consumption. Together, the 11 Fuels for Schools facilities can consume approximately 8,000 DT of Montana woody biomass (10,725 gt/yr at 35% moisture content)[29].

2. PELLET MILL COMPETITION ESTIMATION

The most recent available data is from 2009 but provides a sense of consumption. Each pellet plant uses 20,000 to 40,000 DT annually (27,000-54.000 gt/yr at 35% moisture content)[29].

3. BIOMASS FACILITY'S COMPETITION ESTIMATION

Biomass Power Competition	Address	Distance from Libby, MT (miles)	Intake Capacity (GT/yr)
Stoltze CoGen1	Flathead, MT (3MW)	60	30,000
Plummer Cogen	Benewah County (5.8 MW)	96	58,000
Total Biomass Power Competition			88,000

4. MDF FACILITIES COMPETITION ESTIMATION

The major MDF plant operating in the Libby BDO Zone uses an estimated 200,000 to 400,000 DT annually (270,000-540,000 gt/yr at 35% moisture content)[32].

Assuming the proposed new MDF facility is completed, its annual consumption is estimated to be 100,000 DT (135,000 gt/yr at moisture content 35%)[32].

[32] Anonymous. Verbal communication. May, 2022.

APPENDIX D: TRUCKING COMPANIES OPERATING IN THE LIBBY, BDO ZONE

Sr No.	Company Name	Website	Full Address	Distance From Libby (miles)
1	Jones Brothers Trucking	www.jonesbrotherstrucking.com	6681 Commercial Ln, Missoula, Montana, 59808, United States	184
2	Davis Transport	www.davistransport.com	216 Trade St, Missoula, Montana, 59808, United States	189
3	Western Automotive Transport	www.westernautomotivetransport.com	2341 US Highway 93 S, Kalispell, Montana, 59901, United States	92
4	Savasort	www.savasort.com	300 Windmill Dr, Ste B, Columbia Falls, Montana, 59912, United States	101
5	Three Jokers	www.threejokersinc.com	59494 S Hwy 97, Saint Maries, Idaho, 83861, United States	173
6	High Country Carriers	www.highcountrycarriers.com	PO Box 124, Arlee, Montana, 59821, United States	165
7	PALMER EXPRESS	www.palmerexpress.com	1726 Peggio Ln 3, Missoula, Montana, 59802, United States	192
8	TeCe Trucking	www.tecetrucking.com	8686 Aluminium Dr, Missoula, Montana, 59808, United States	188
9	H&H Express	www.hhexpress.net	PO Box 709, Rathdrum, Idaho, 83858, United States	124
10	Northwest Pony Express	www.nwponyexpress.com	415 Sherman Ave, Coeur D Alene, Idaho, 83814, United States	129
11	J. Gelormino	www.jgelorminoinc.com	95 Park Ave, Kalispell, Montana, 59901, United States	91
12	Second Chances Transport	www.secondchancestransport.com	49 Klister Ln, Trout Creek, Montana, 59874, United States	76
13	Eby Transport	www.ebytransport.com	1348 W Hayden Ave, Hayden, Idaho, 83835, United States	124
14	Royal Trucking	www.royaltrucking.us/	9000 Cartage Road, Missoula, Montana 59808	182
15	Wilson Logistics	www.wilsonlogistics.com/	9730 Derby Dr, Missoula, Montana 59808	183
16	John Jump Trucking, Inc.	www.johnjumptrucking.com/	2780 US Hwy 2 E Kalispell, MT, 59901 United States	94
17	Lj Logistics LLC	No Website	1718 Cedar St Sandpoint, ID, 83864-2045 United States	85
18	EBY Transport LLC	No Website	1348 W Hayden Ave Hayden, ID, 83835-9756 United States	124
19	Wink, Inc.	www.winkincproductions.com	493 Scenic Dr Bonners Ferry, ID, 83805-7039 United States	54
20	Shane Campbell Trucking	No Website	2336 Poirier Rd Blanchard, ID, 83804-6024 United States	127
21	Bill Farrell Trucking	No Website	200 Cedar St Sandpoint, ID, 83864 United States	84