Utilizing forest residues for biochar production:

Lessons learned from the Waste to Wisdom project

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Forest Residues

Logging Slash

Small-diameter Trees and Tops

Forest Residues

Production of Quality Feedstock

In-woods Biomass Conversion

Biochar

Briquettes

Torrefied chips

- ✓ Increase product values
- ✓Improve transportation efficiency

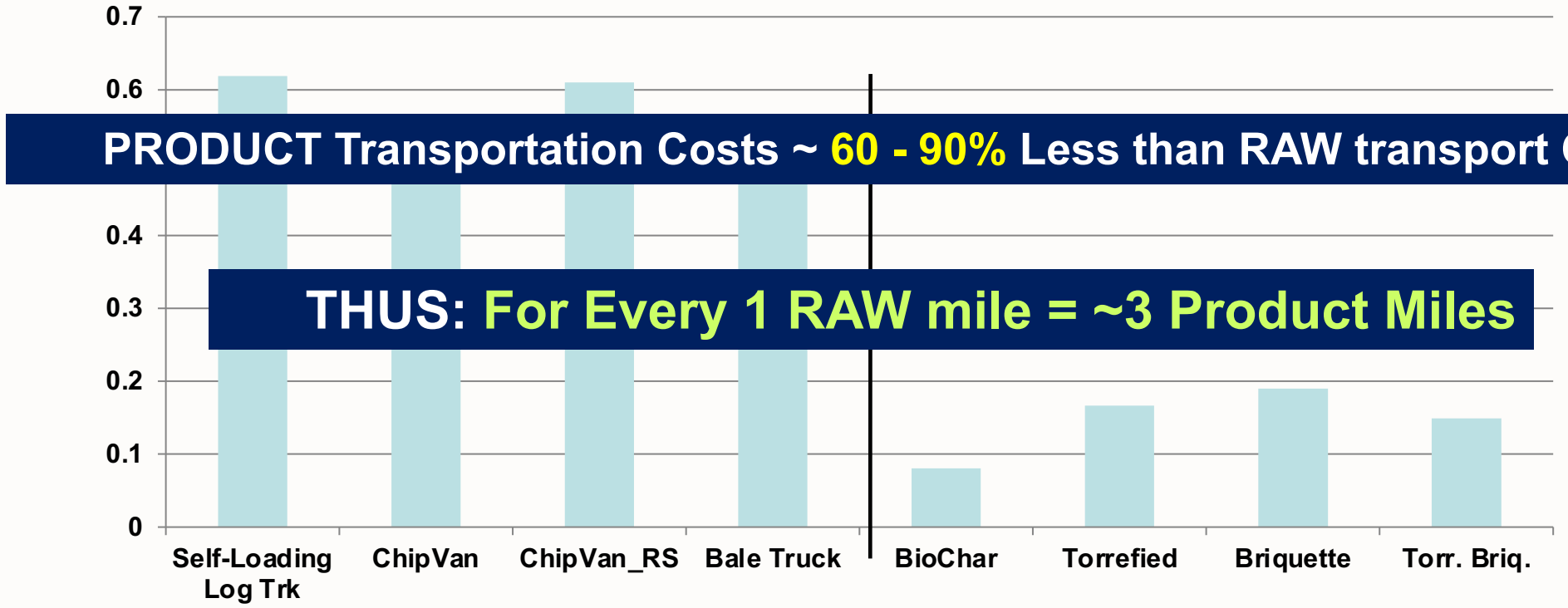
WASTE TO WISDOM

2024 NORTH AMERICAN BIOCHAR CONFERENCE USBI

Transportation Costs : RAW vs. PRODUCT Comparison

RAW Transportation Costs (0.50- 0.62 $/ BDT-mile)

PRODUCT Transportation Costs (0.08-0.19 $/BDT-Mile)



PRODUCT Transportation Costs ~ 60 - 90% Less than RAW transport Costs

THUS: For Every 1 RAW mile = ~3 Product Miles

(Source: Berry and Sessions 2018)

Feedstock Quality

		Desired feedstock specifications	
Biomass Conversion Technology	**Product**	**Particle size** (inch)	**Moisture Content** (% wet basis)
Gasification	Biochar	0.1 - 4	< 25%
Torrefaction	Torrefied chips	0.1 – 1	< 30%
Densification	Briquettes	< 2	4% - 15%

(Schatz Energy Research Center, 2017)

Grinding

Chipping

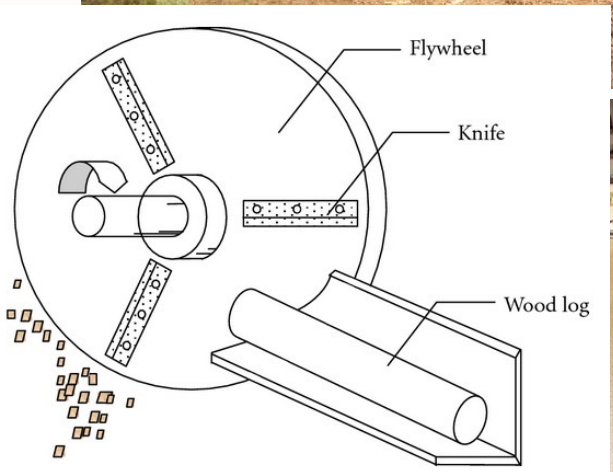
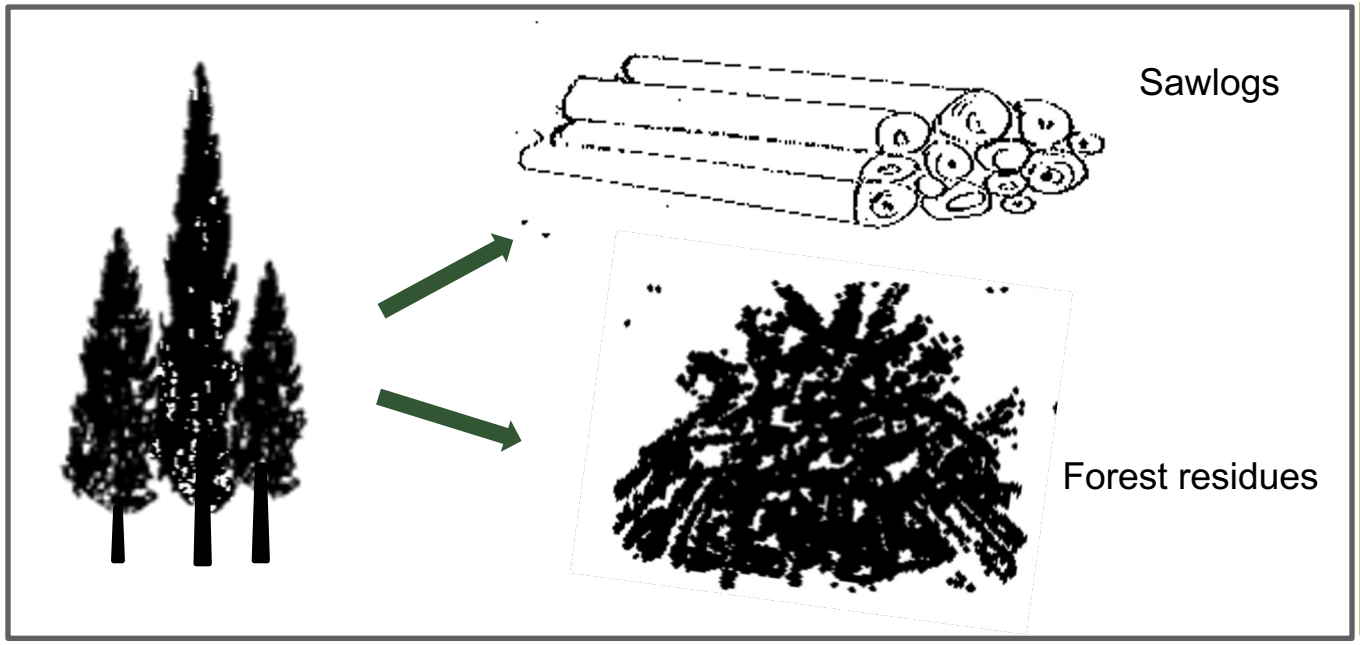


Illustration: https://www.researchgate.net

Chipping vs. Grinding

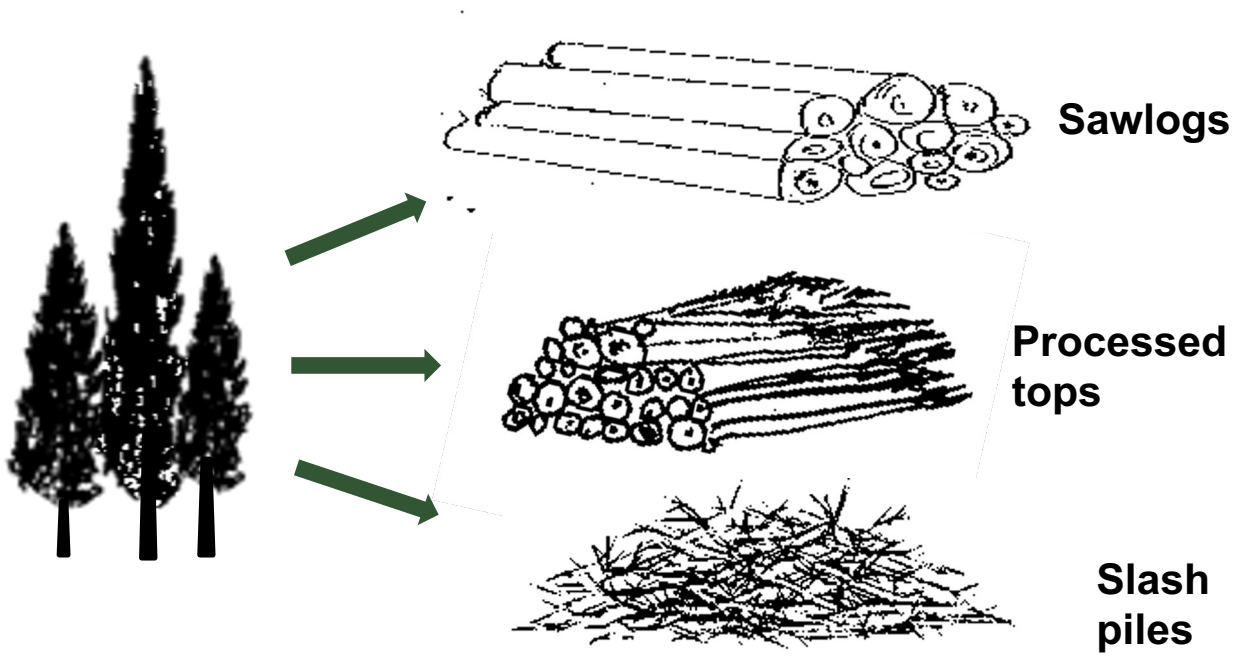
Wood chips

Hog fuel



Current practice

Sorting tree tops



Quality feedstock production:

- Developed a new logistics to produce high quality feedstock for biomass conversion technologies (BCTs): sorting and processing, comminuting, and screening forest residues
- Evaluated the productivity and cost of the machines used
- Evaluated feedstock quality: moisture content, size distribution, bulk density, and ash content

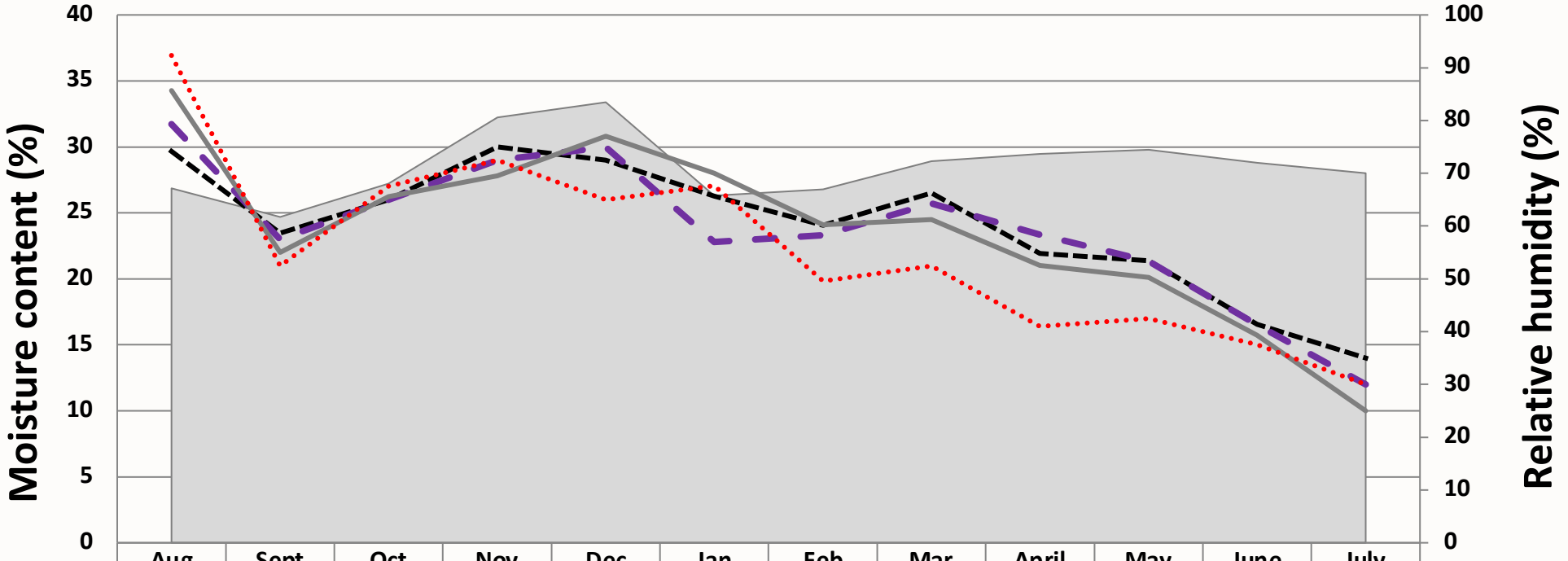
wood chips (<0.75”) micro-chips (<0.25”) sawdust (<0.16”)

Sort and Process

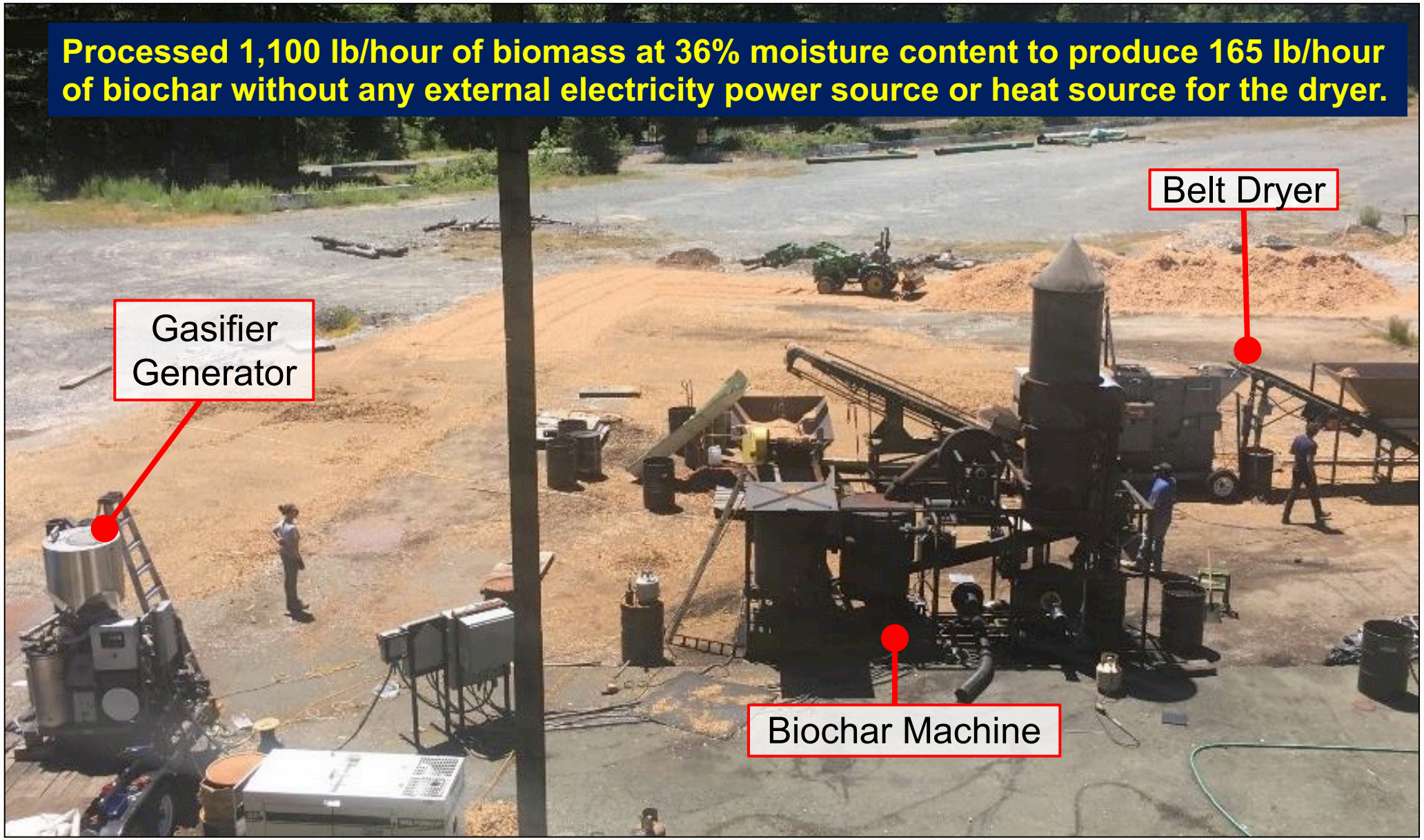
Comminute

Screen

Moisture content in forest residues: Humboldt, CA



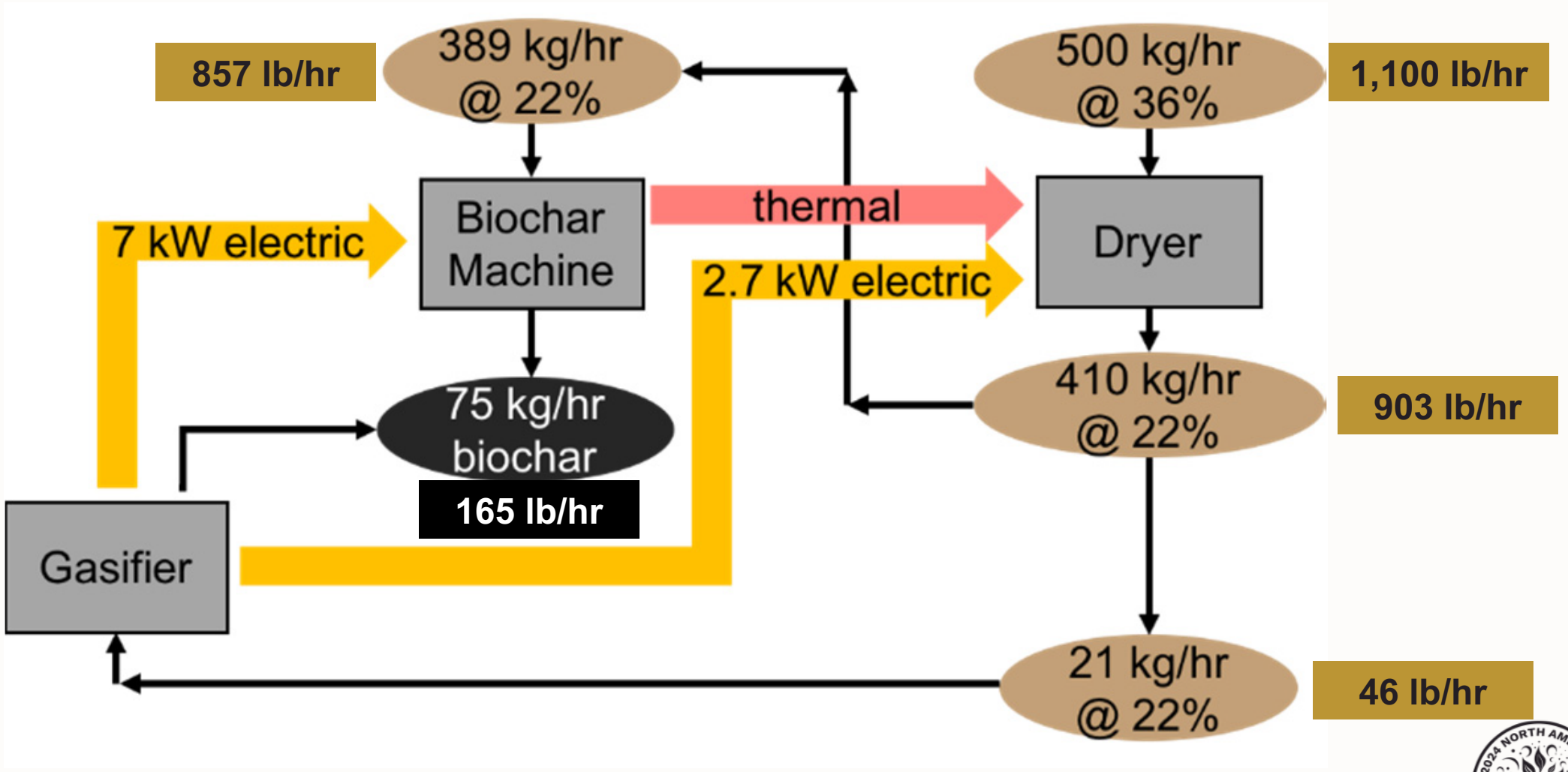
	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	July
Relative humidity (%)	67	62	68	81	83	66	67	72	74	74	72	70
Teepee	30	23	26	30	29	26	24	26	22	21	17	14
Criss cross	32	23	26	29	30	23	23	26	23	21	17	12
Processor pile	34	22	26	28	31	28	24	24	21	20	16	10
Scattered	37	21	27	29	26	27	20	21	16	17	15	12



Integrated Biochar Production System

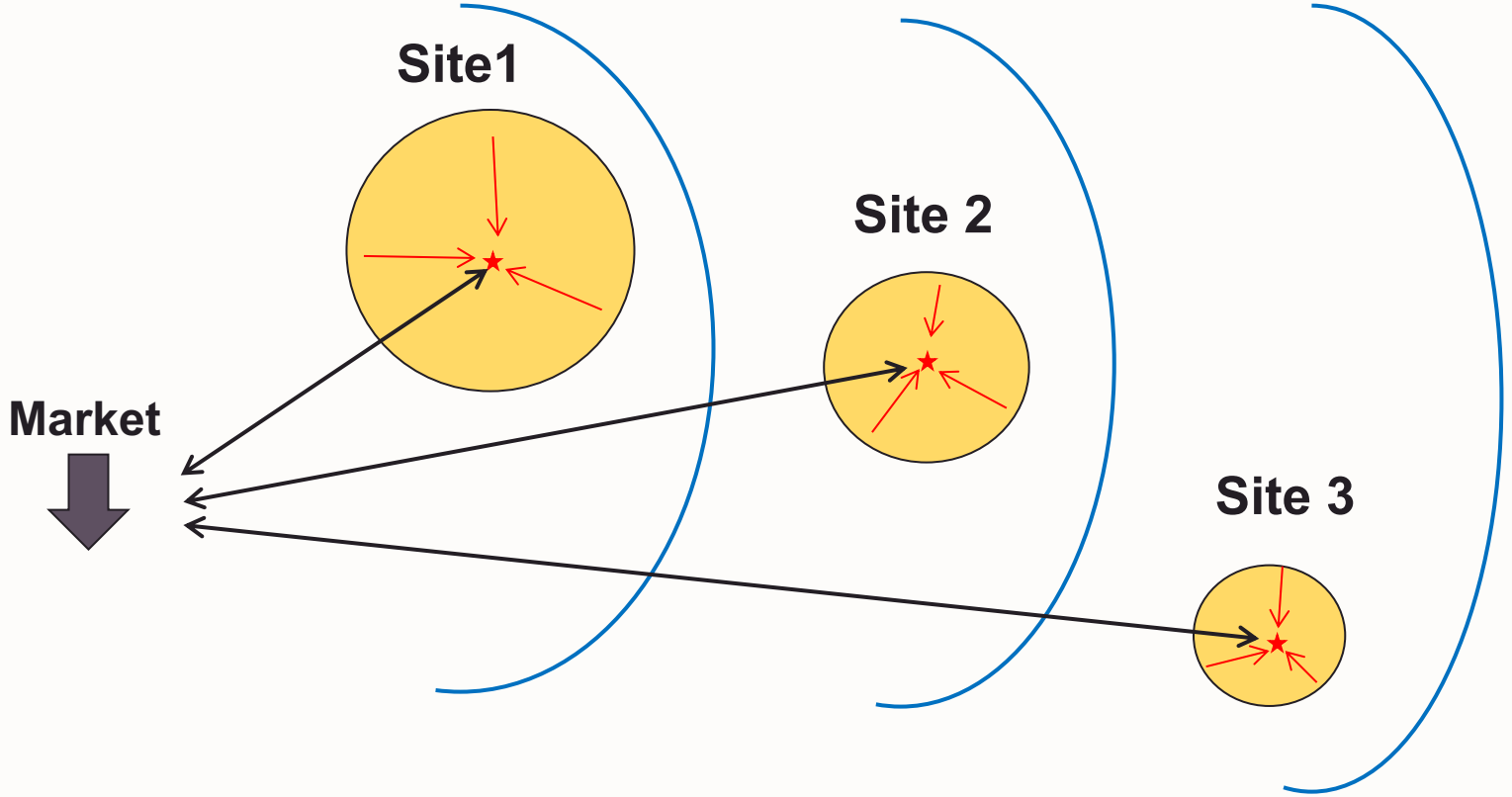
(Source: Eggink et al. 2018)

Integrated Biochar Production System



(Source: Eggink et al. 2018)

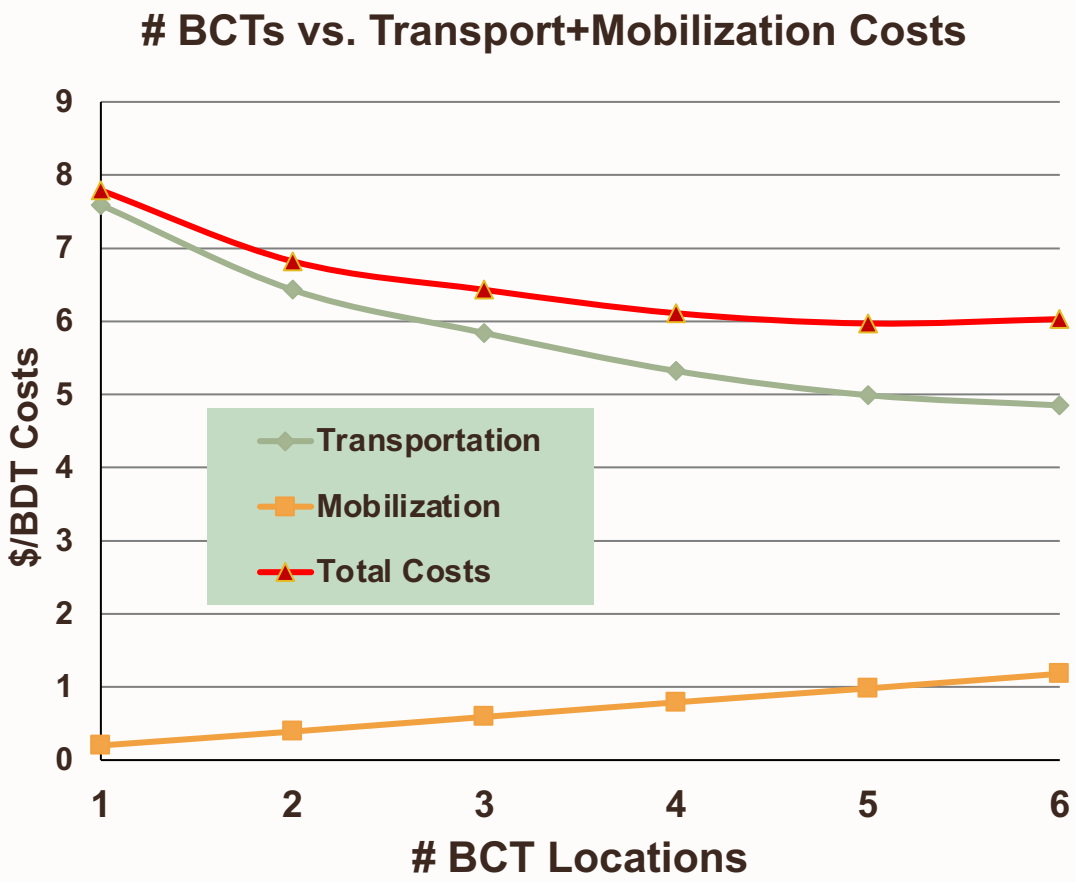
Economics of Biomass Logistics and Conversion Facility Mobility

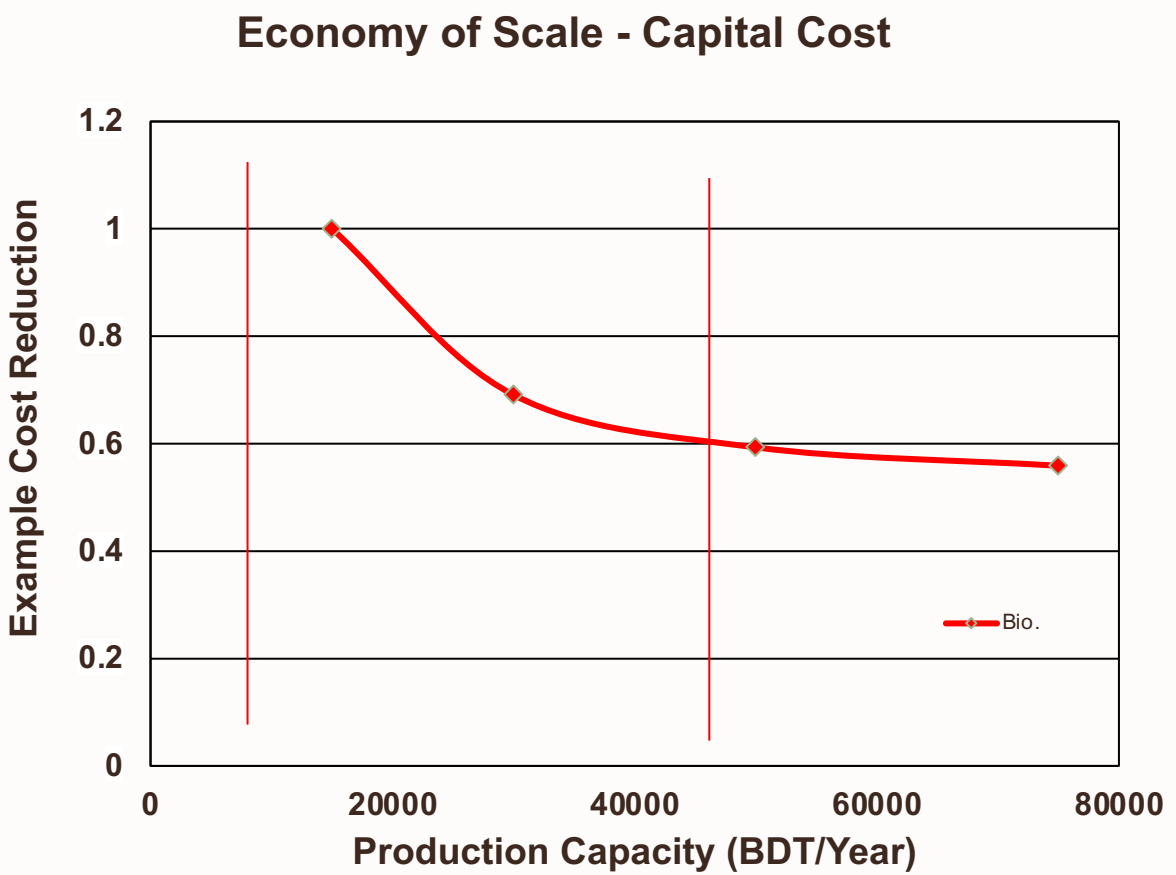


As product travel cost from a biomass conversion technology (BCT) site INCREASES, Maximum allowable travel cost for unprocessed biomass is REDUCED

(Source: Berry and Sessions 2018)

Economics of Biomass Logistics and Conversion Facility Mobility





(Source: Berry and Sessions 2018)

Ecological impacts and life cycle assessments

- Biochar application improved water holding capacity, carbon sequestration, and water quality in damaged soils while reducing invasive species.
- Remediated old mine soils and reduced lead contamination with biochar.
- Lowered carbon impacts by 63%-70% when a biomass gasifier is substituted for a diesel generator.
- Showed that utilizing forest residues can significantly alleviate the adverse local and regional air quality impacts from pile burning.

Biochar on old mining site

(Photo: Page-Dumroese)

W2W: Conclusion and Lessons

- In-woods biochar production utilizing forest residues shows an economic promise with high biochar market values.
- Controlling feedstock size and moisture content for efficient biomass conversion is an important aspect of in-woods biomass operations.
- Biomass conversion technologies can be used in combination at integrated plants to help ease the feedstock requirements and diversify product outputs.
- Value capture is an important issue due to reduced site preparation costs as well as non-market benefits such as reduced wildfire risk, improved air quality, and carbon sequestration.

Thank you!

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