

**Biomass Research & Development Initiative  
(BRDI - Department of Energy)**

# **Production of quality feedstock from forest residues**



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# Forest Residues



**Logging Slash**



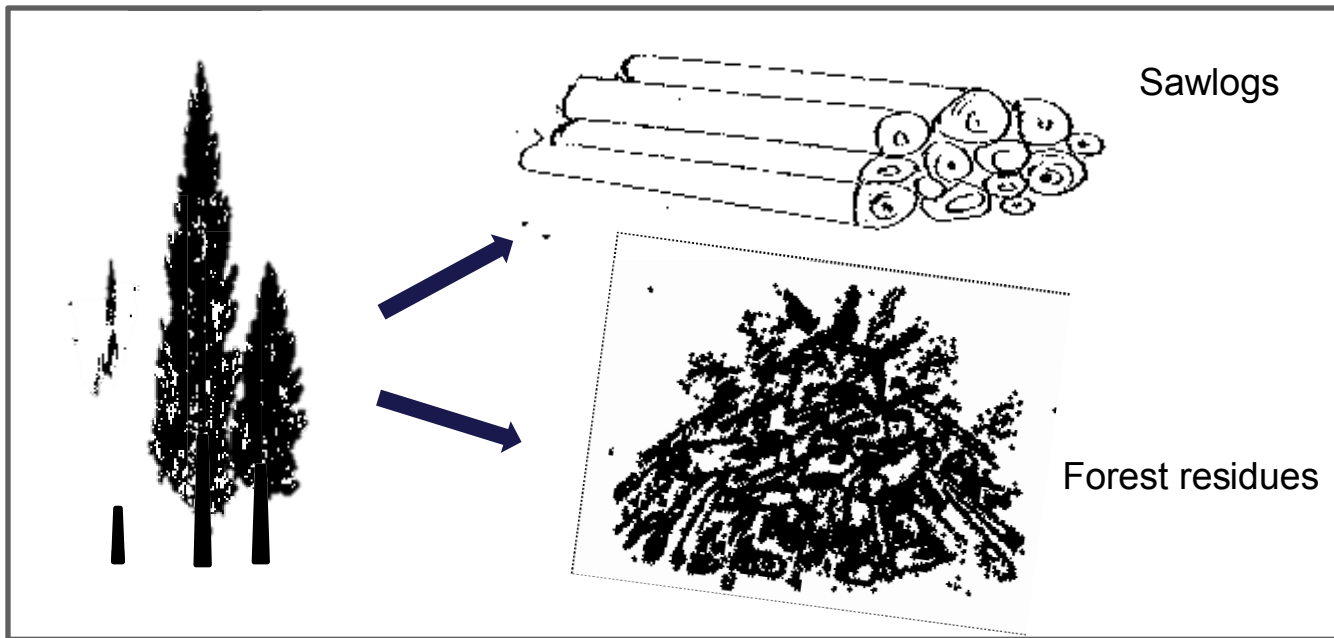
**Forest Thinnings**

# Feedstock Quality – W2W biomass conversion techs

Biomass Conversion Technology	Product	Desired feedstock specifications		
		Particle size (inch)	Moisture Content (% wet basis)	Ash content (%)
Gasification	Biochar	0.1 - 4	< 25%	< 15%
Torrefaction	Torrefied chips	0.1 – 1	< 30%	no limit
Densification	Briquettes	< 2	4% - 15%	no limit
Gasification	Electricity	0.5 - 2	10% - 30%	< 15%

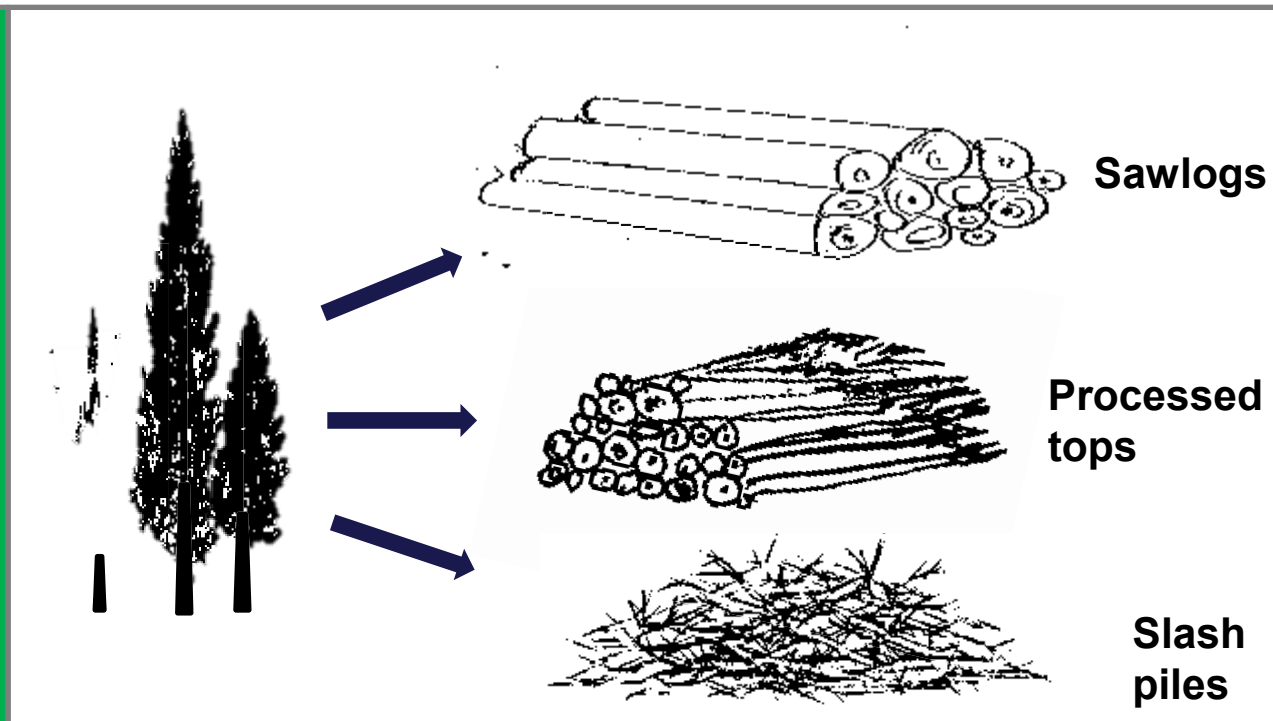
(Schatz Energy Research Center, 2017)





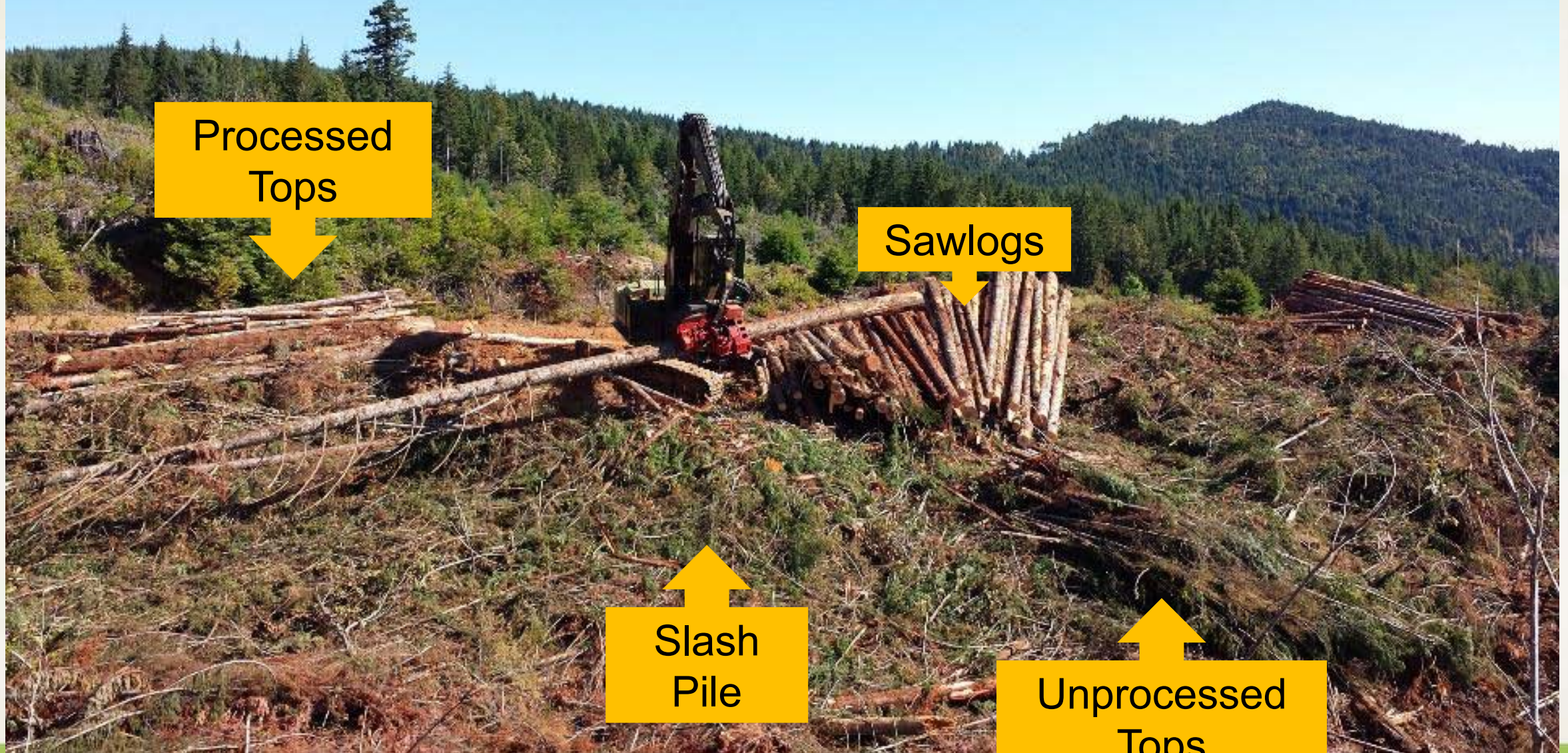
**Current  
practice**

**Sorting tree  
tops**





# Sorting tree tops during timber harvesting





# Forest Residues Sorted and Processed





# Production of quality feedstock from forest residues

- Size distribution:
  - Chipped materials: >95% chips less than 2 inches
  - Ground materials: >55% ground materials larger than 2 inches

Material type		Ave. particle size (inch)	Ash content (%)	Moisture content (%)	Bulk density (lb/ft <sup>3</sup> )
Processed conifer	Chipped	0.68	0.27	26	14.24
Unprocessed conifer		0.72	0.64	27	14.92
Processed hardwood		0.71	1.03	29	20.11
Unprocessed hardwood		0.81	1.07	27	19.34
Slash	Ground	1.87	1.50	19	8.57

**Chipped Materials**



**Ground Materials**



## Various types of feedstock produced from forest residues



wood chips  
( $<3/4$  inch)

micro-chips  
( $<1/4$  inch)

sawdust  
( $<5/32$  inch)



# Moisture content reduction study

## Objective:

Develop on-site methods  
to lower moisture content

**Processor piled**



**Teepee**



**Criss-cross**



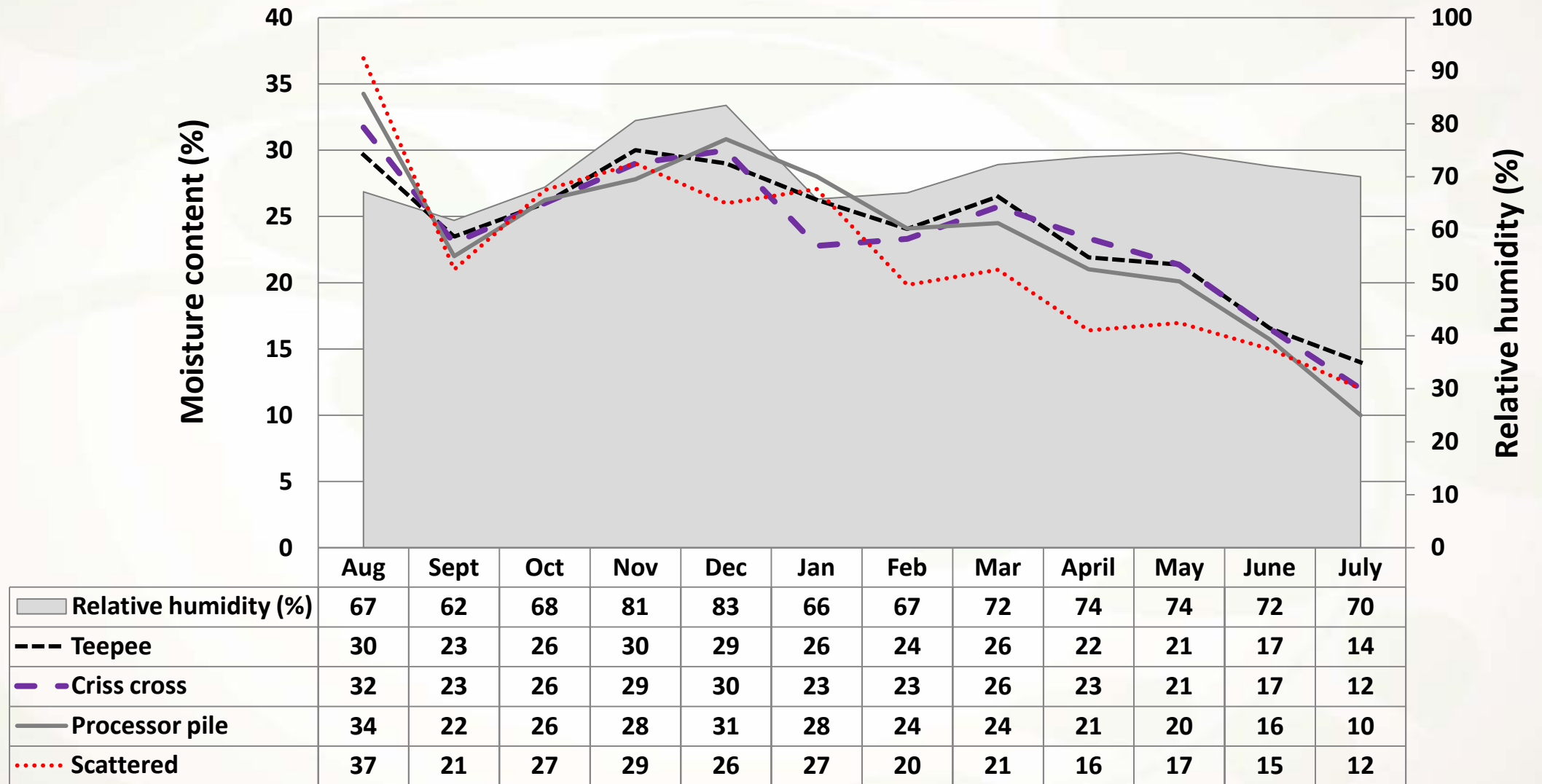
**Scattered**



**Covered vs. Uncovered**



# Moisture content reduction study





# Key messages...

- Sorting stem wood and tree tops from other residues during a timber harvest operation facilitates the use of a chipper.
- Through sorting and chipping of forest residues, we were able to produce various types of quality feedstock.
  - ✓ Small, uniform in size
  - ✓ Low moisture content (<20%)
  - ✓ Low ash content (<1%)
  - ✓ High bulk density



# Thank You!



<http://wastetowisdom.com/>