

# Logging residues: Comparative efficiency by tree diameter and logging methods in three western states

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## Introduction

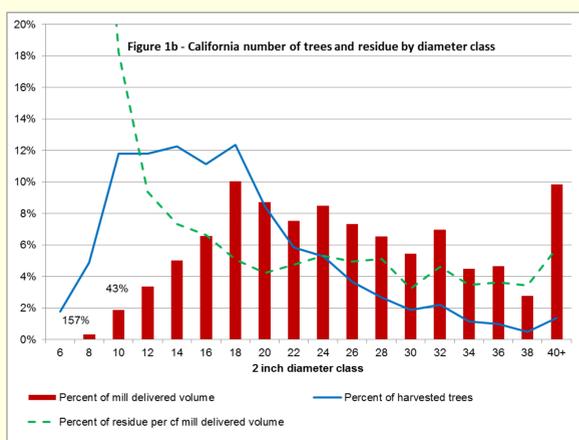
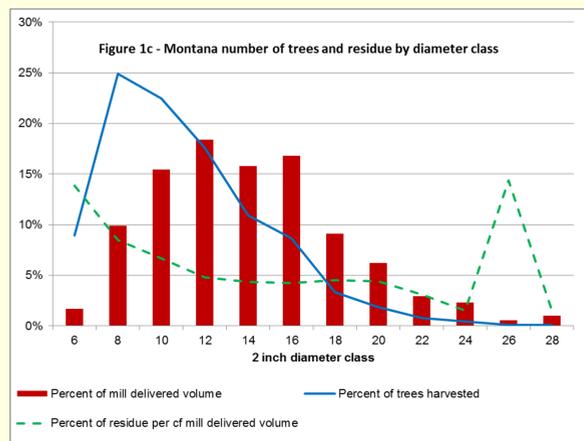
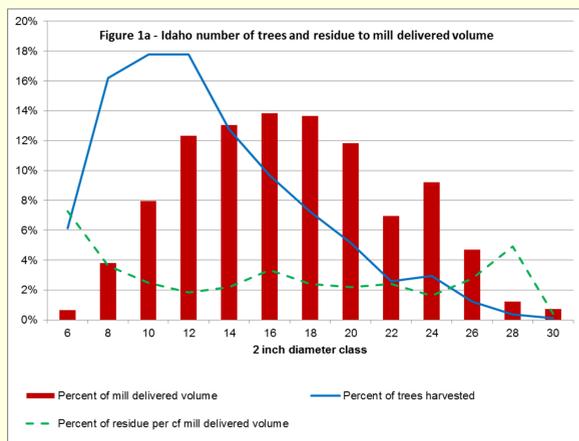
Logging utilization studies provide valuable insights on the efficiency of timber harvesting at the state level. They provide removals factors that quantify the proportions of logging residue relative to mill-delivered volume for a commercial timber harvest. These studies quantify the relationship between logging residue creation and tree diameter. They also characterize logging methods and systems employed.

Studies conducted by the Forest Industry Research Program at the University of Montana for Montana (2002), California (2004), and Idaho (2008-11) found similar trends in the relationship of tree diameter to mill delivered volume and logging residue. However, they also showed significant variability in the efficiency of logging systems relative to logging residue creation.

## Logging residue production relative to tree diameter

- Smaller trees produced proportionally less volume and more residues for every cubic foot (cf) of volume delivered to the mill than larger diameter trees (Figures 1a, 1b, and 1c). Although the measured tree diameter ranges varied among the three states the summary findings in all states were similar.
- In Idaho 71 percent of the trees were less than or equal to 14 inches dbh and accounted for only 38 percent of the mill delivered volume.
- In California 74 percent of the trees were less than or equal to 20 inches dbh and accounted for only 36 percent of the mill delivered volume.
- In Montana 74 percent of harvested trees were less than or equal to 12 inches dbh and accounted for 45 percent of the mill delivered volume.

(Note: spikes in residue in the larger diameter classes were due to a small number of large diameter trees with heavy logging damage in each state)



## Idaho, California, and Montana harvesting methods compared

- Mechanized systems dominated Idaho logging operations. Mechanical felling was employed nearly twice as often as hand felling. Each of the following methods was employed at least four times as frequently as their alternative: ground based yarding, tree length skidding, merchandising at the landing, and merchandising with mechanical processors
- In California, trees were felled by hand three times as often as mechanical felling and merchandising by hand predominated
- The logging methods employed in Montana closely matched those found in Idaho (Table 1).

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Table 1 - Logging methods by number of units sampled

State	Units	Felling			Yarding		Skidding		Merchandising Location		Merchandising Method	
		Hand	Mechanical	Mixed	Ground	Cable	Tree Length	Log Length	In Unit	At Landing	Hand	Mechanical
Idaho	33	11	19	3	29	4	27	6	4	29	5	28
California	42	29	8	5	33	9	9	33	33	9	33	9
Montana	32	11	21	-	25	7	27	5	4	28	8	24

Table 2 - Percent of mill delivered volume and bole residue by logging method

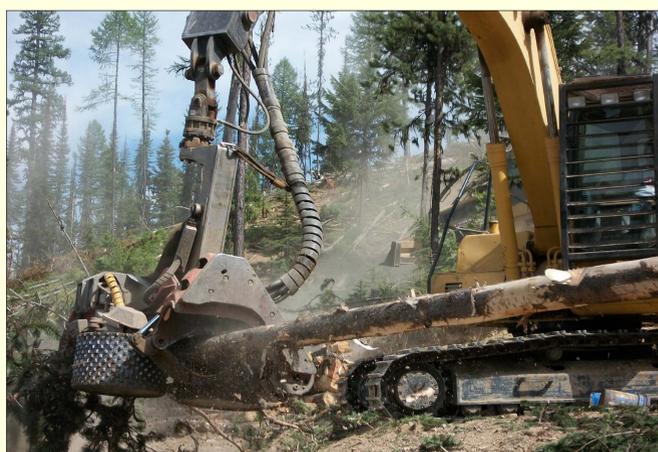
Method Type	Idaho		California		Montana	
	% total mill delivered	% bole logging residue	% total mill delivered	% bole logging residue	% total mill delivered	% bole logging residue
Hand	Felling		Felling		Felling	
	34	50	76	81	37	41
	57	39	15	13	63	59
Mechanical	Yarding		Yarding		Yarding	
	89	86	79	73	77	74
	11	14	21	27	23	26
Mixed	Skidding		Skidding		Skidding	
	84	76	20	17	78	78
	16	24	80	83	22	22
Ground	Merchandising Location		Merchandising Location		Merchandising Location	
	13	17	80	83	15	18
	87	83	20	17	85	82
Cable	Merchandising Method		Merchandising Method		Merchandising Method	
	16	28	88	90	28	31
	84	72	12	10	72	69

Table 3 - Percent of bole logging residue per cf of volume delivered to the mill by logging method

Method Type	Idaho	California	Montana
	% total bole residue per cf	% total bole residue per cf	% total bole residue per cf
Hand	Felling		
	4	6	6
	2	5	5
Mechanical	Yarding		
	3	4	0
	2	5	5
Mixed	Skidding		
	3	4	0
	2	5	5
Ground	Merchandising Location		
	2	5	5
	3	7	6
Cable	Merchandising Method		
	2	5	5
	4	6	6

## Variation of logging residue creation by logging systems

- In Idaho mechanical felling produced half the residue relative to the mill delivered volume as hand (chainsaw) felling (two percent vs. four percent)(Tables 2 and 3).
- Mechanical merchandising and tree length skidding produced half the residue of their counterparts (hand merchandising and log length skidding) in all three states.
- In California and Montana mechanical felling and merchandising produced about twenty percent less residue than hand (chainsaw) methods.
- Logging sites harvested with ground-based yarding equipment (vs. cable) and skidded tree length (vs. log length), yielded approximately twenty percent less residue.



**Contact us**

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