Options for Transporting Biomass

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Project Partners

- Montana Community Development Corp
- Johnson Brothers Contracting
- Cheff Logging
- Missoula Cartage
- Smurfit-Stone
- Missoula Technology Development Center
- State & Private Forestry, Region 1

Atlanta, ID

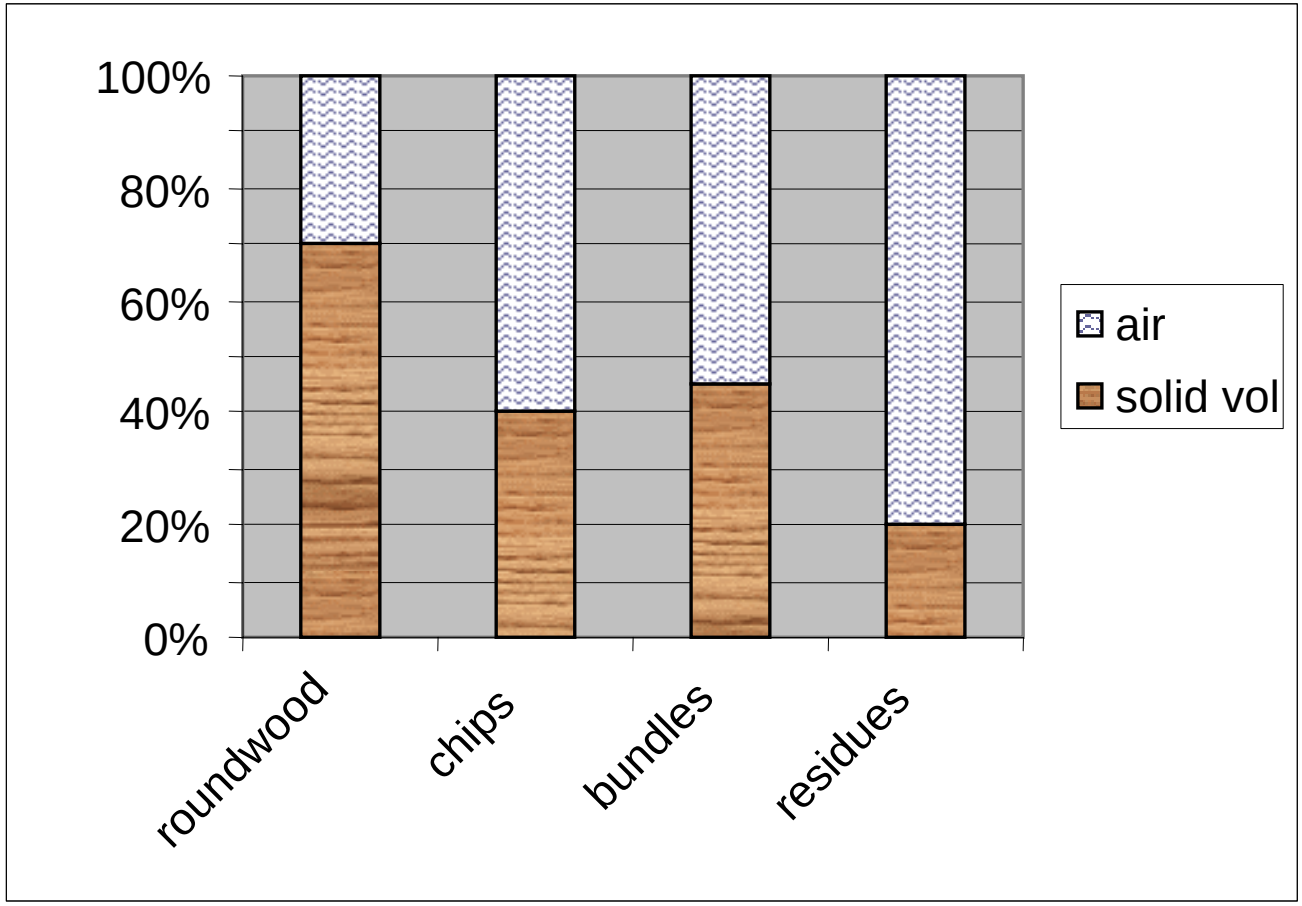
The Problem: Residue Recovery

- Logging residues, activity fuels
- Thinnings
- Inaccessible to roadside chipping

Idaho City RD, Boise Nat'l Forest

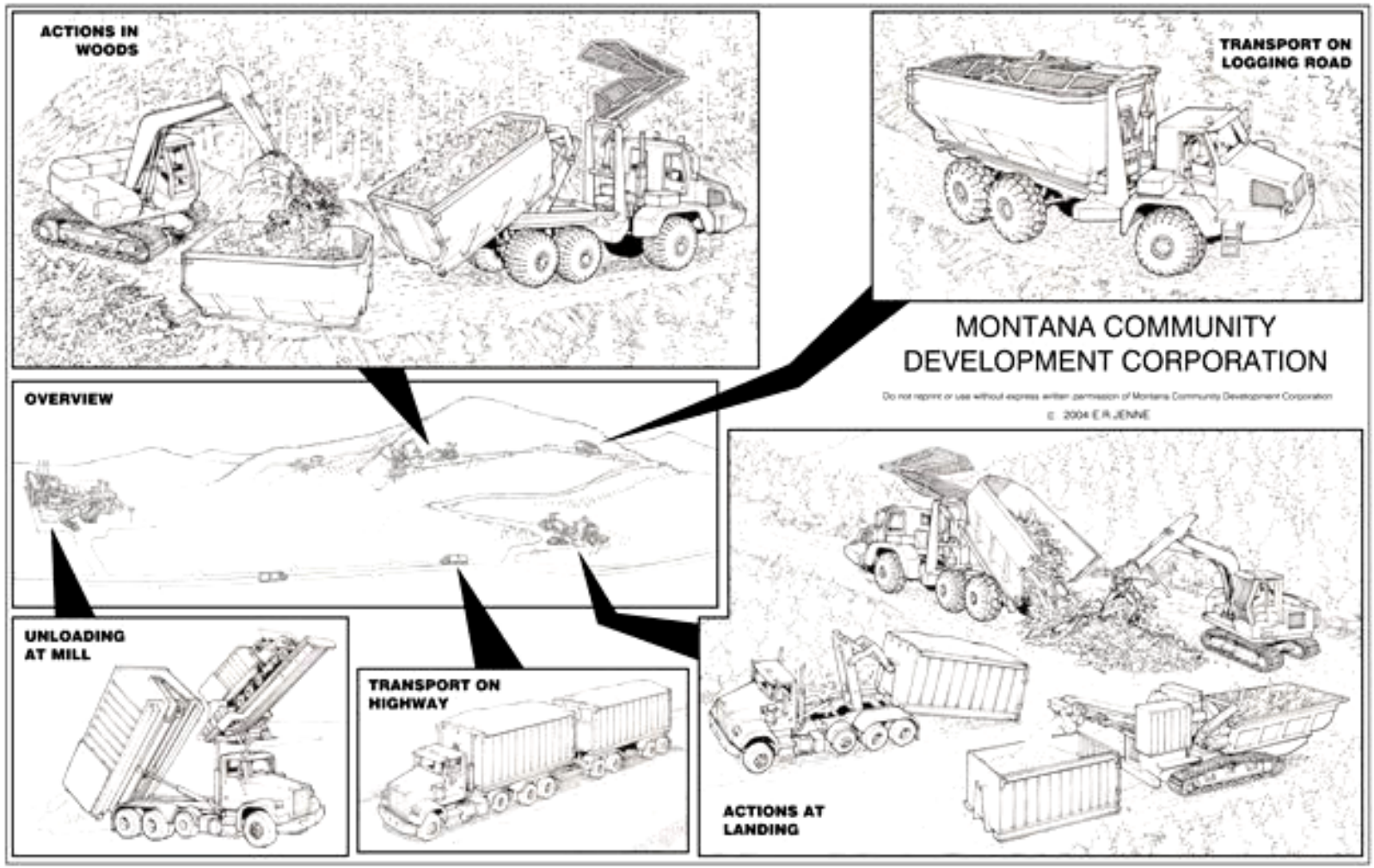
Too much air …

Solid Volume Factors



Existing Applications

Two-stage Transport Concept



DCT Bin Truck

WA STE WO OD
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WA STE WO OD
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Transport Loose Residues

B-E Cable loader

Off-highway Dumper

Strokeboom Processor

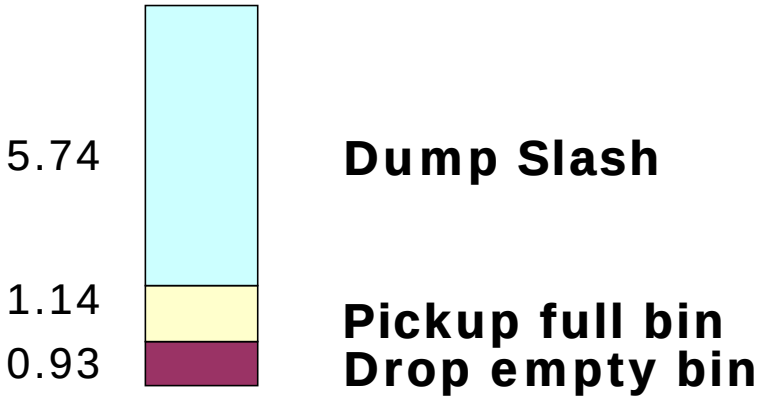
Transport Hog Fuel

WASTE WOOD
SALVAGE

PIERCE

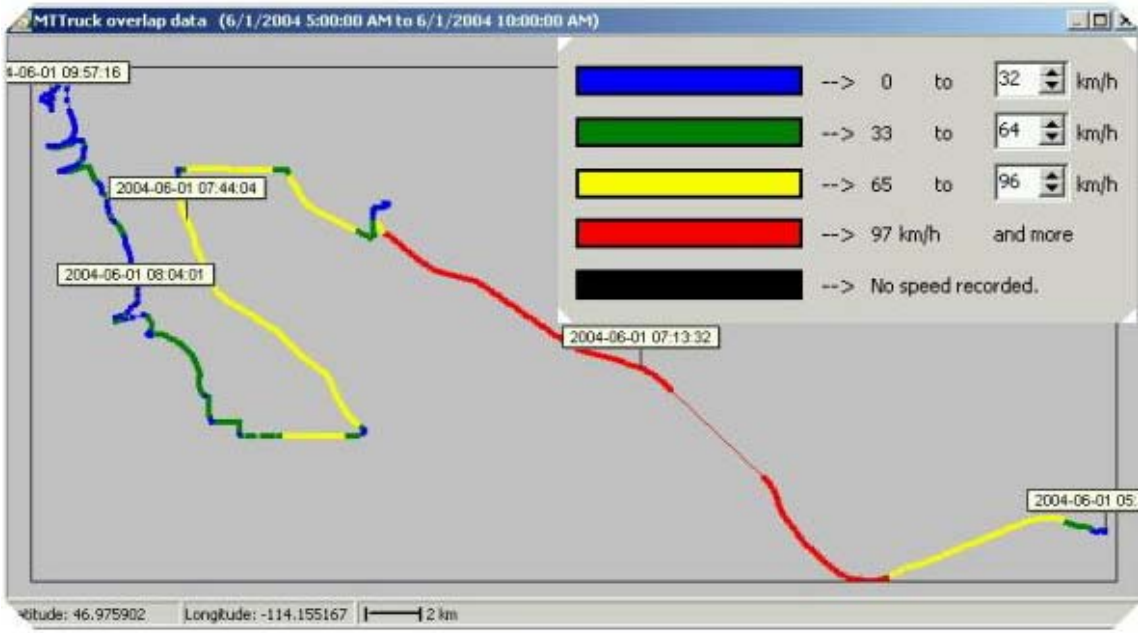
Results

- Residue payload 9.5 gt (6 bdt)
- Hog fuel 12 gt (7.5 bdt)
- Cat 769 dumper 4 bdt



Truck Speeds

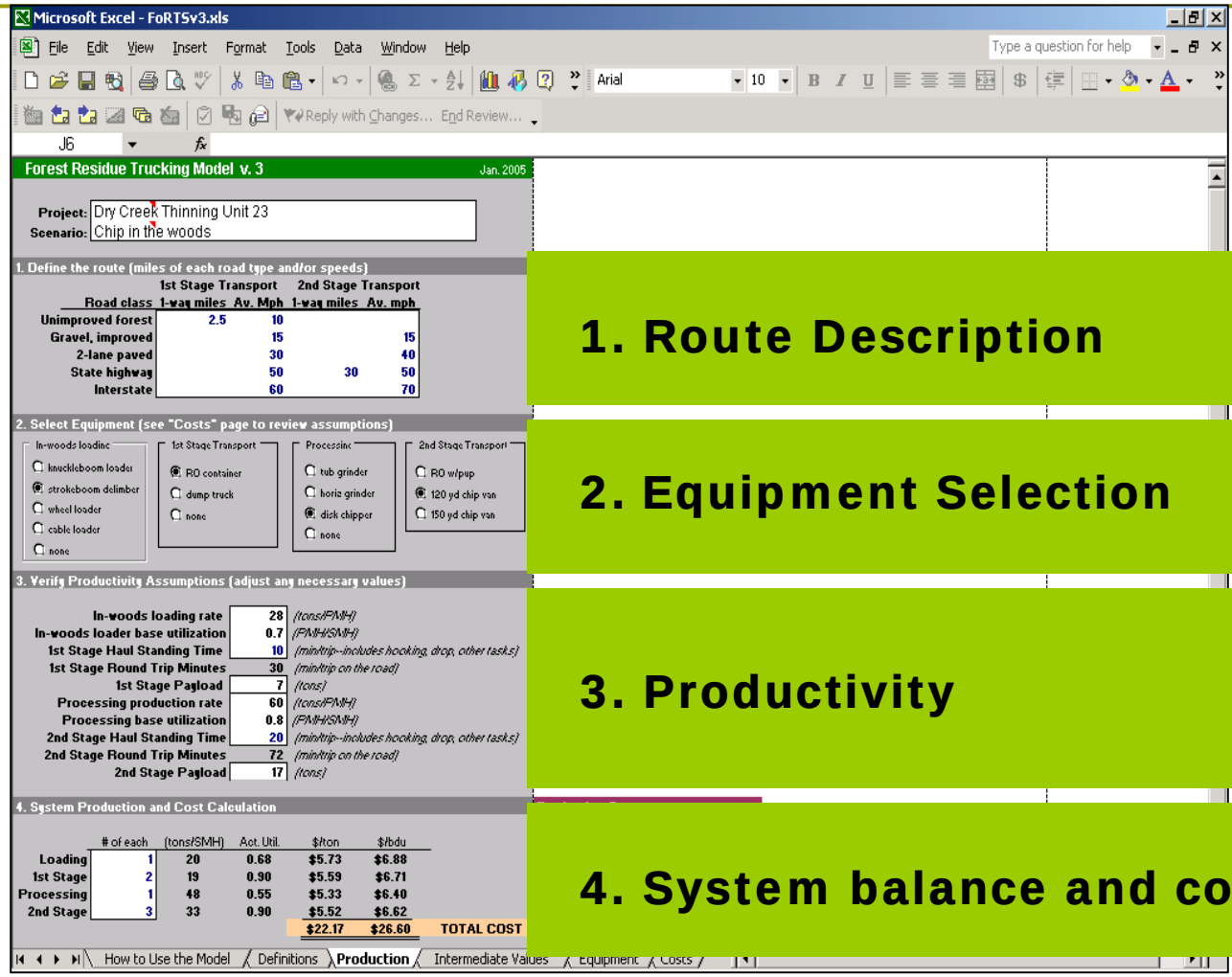
- 60 mph interstate
- 50 mph 2-lane paved
- 30 mph gravel
- 10.5 forest road



Loading

- BE cable loader: 33 minutes (10.5 bdt/hr)
- Strokeboom: 12 minutes (28 bdt/hr)
- Knuckleboom: un-measured

Residue Trucking Model



1. Route Description

2. Equipment Selection

3. Productivity

4. System balance and cost

Microsoft Excel - FoRTSv3.xls

File Edit View Insert Format Tools Data Window Help

Reply with Changes... End Review...

Forest Residue Trucking Model v. 3

Jan. 2005

Project: Dry Creek Thinning Unit 23
Scenario: Chip in the woods

1. Define the route (miles of each road type and/or speeds)

Road class	1st Stage Transport 1-way miles	1st Stage Transport Av. Mph	2nd Stage Transport 1-way miles	2nd Stage Transport Av. mph
Unimproved forest	2.5	10		
Gravel, improved		15		15
2-lane paved		30		40
State highway		50	30	50
Interstate		60		70

1. Route Description

2. Select Equipment (see "Costs" page to review assumptions)

In-woods loading
- knuckleboom loader
- (•) strokeboom delimber
- wheel loader
- cable loader
- none

1st Stage Transport
- (•) RO container
- dump truck
- none

Processing
- tub grinder
- horiz grinder
- (•) disk chipper
- none

2nd Stage Transport
- RO w/pup
- (•) 120 yd chip van
- 150 yd chip van

2. Equipment

3. Verify Productivity Assumptions (adjust any necessary values)

In-woods loading rate	28	*(tons/PMH)*
In-woods loader base utilization	0.7	*(PMH/SMH)*
1st Stage Haul Standing Time	10	*(min/trip--includes hooking, drop, other tasks)*
1st Stage Round Trip Minutes	30	*(min/trip on the road)*
1st Stage Payload	7	*(tons)*
Processing production rate	60	*(tons/PMH)*
Processing base utilization	0.8	*(PMH/SMH)*
2nd Stage Haul Standing Time	20	*(min/trip--includes hooking, drop, other tasks)*
2nd Stage Round Trip Minutes	72	*(min/trip on the road)*
2nd Stage Payload	17	*(tons)*

3. Productivity

How to Use the Model | Definitions | **Production** | Intermediate Values | Equipment | Costs

File Edit View Insert Format Tools Data Window Help

Type a question for help

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Reply with Changes... End Review...

H4 fx Disk

ult Values These numbers are loaded into the cost page when equipment is selected

Ref. No.	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
Label	Knuckleboom Loader	Strokeboom Delimber	Cable Loader	Wheel Loader	Tub Grinder	Horizontal Grinder	Disk Chipper	Container Truck	Dump Truck	120 cy Chi Truck
Purchase Price	$181,030	$355,500	$50,000	$205,000	$350,000	$580,000	$610,000	$138,000	$300,000	$125
SMH/yr	2000	2000	2000	2000	2000	2000	2000	2000	2000	2
Life (yrs)	5	5	5	5	5	5	5	5	5	
age (% of new)	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	
Interest rate	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	
nsurance ($/yr)	$3,600	$7,000	$1,000	$4,000	$9,000	$12,000	$12,000	$6,000	$6,000	$6
Taxes/tags	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
tal Tire Cost ($)			$2,000	$6,000				$2,500	$20,000	$3
Tire life (yrs)			4	4				2	2	
Fuel cost ($/g)	$1.80	$1.80	$1.80	$1.80	$1.80	$1.80	$1.80	$1.80	$1.80	$
Oil cost ($/g)	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00	$
Horsepower	174	225	250	190	500	860	1000	430	340	
l Cons (g/hp-hr)	0.022	0.039	0.030	0.021	0.032	0.028	0.030	5	0.012	
l use (% of fuel)	0.37	0.37	0.37	0.10	0.15	0.13	0.15	0.1	0.1	
R&M (% of dep.)	0.90	0.90	1.00	0.80	0.80	0.75	0.75	0.6	0.75	
. oper. ($/PMH)					$15.75	$9.28	$30.00			
Base Utilization	0.8	0.7	0.65	0.8	0.8	0.8	0.8	0.9	0.8	
e-dry tons/PMH	60	28	11	60	15	40	60	7	4	

	In-woods load	1st Trans	Process	2nd Trans
Depreciation/yr =	$56,880.00	$22,080.00	$97,600.00	$20,000.00
tal Rec Factor =	0.2638	0.2638	0.2638	0.2638
Salvage Value =	$71,100.00	$27,600.00	$122,000.00	$25,000.00
Cons (g/PMH) =	8.85	1.50	30.00	6.52

Intermediate Calculations From Costs Page
Do NOT change these values

14	Payload of container w
0.9	Base utilization of 1st s
0.9	Base utilization of 2nd s

ult Data References

[1] Tigercat T240B tracked knuckleboom log loader. Brinker et al. 2002. Machine rates for selected harvesting machines.

How to Use the Model | Definitions | Production | **Intermediate Values** | Equipment | Costs

1st Stage Round Trip Minutes	30	(min/trip on the road)
1st Stage Payload	7	(tons)
Processing production rate	60	(tons/PMH)
Processing base utilization	0.8	(PMH/SMH)
2nd Stage Haul Standing Time	20	(min/trip--includes hooking, drop, other tasks)
2nd Stage Round Trip Minutes	72	(min/trip on the road)
2nd Stage Payload	17	(tons)

4. System Production and Cost Calculation

	# of each	(tons/SMH)	Act. Util.	$/ton	$/bdu	
Loading	1	20	0.68	$5.73	$6.88	
1st Stage	2	19	0.90	$5.59	$6.71	
Processing	1	48	0.55	$5.33	$6.40	
2nd Stage	3	33	0.90	$5.52	$6.62	
				$22.17	$26.60	TOTAL COST

Production Comments

In-woods loading is limiting

2nd stage haul is limiting

Processing and 2nd stage haul exceed capacity of 1st s

To comment on this tool, please contact:
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4. System balance and cost

How to Use the Model | Definitions | **Production** | Intermediate Values | Equipment | Costs

Ready

Conclusions

- Two-stage transport has an application
  - Low-volume biomass sources
  - Inaccessible sites
  - Complement to logging operations
- Applications must be carefully considered
  - Alternative biomass procurement
  - Cost of removal for fuel reduction
  - Tradeoff in access construction

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