Logistics of supplying woody biomass long distance using railroad transportation

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Presentation overview

• Forest restoration challenges in the US
• Can railroad transportation help solve the issue?

Arizona “Chip & Ship” pilot project:
How we started…and what we learned!
Challenges to forest restoration in Arizona

- Northern Arizona is dominated by single species: ponderosa pine
  - Less desirable wood properties (strength & knots)
Let's look at the problem

Tops and limbs: Biomass
*Needs a biomass facility

Logs <6”: Chips & Biomass
*Seasonal landscape markets
*Chipped for biomass or pellets
*Post & Pole markets

Logs 6”-12”: Low Value Sawlog
*Pallet material
*Post & Pole markets

Logs >12”: Higher Value Sawlog
*Higher value boards
No place to take the logs…#1 issue!

A lot of logs in decks waiting to be delivered
Limited industry in Arizona...Can someone far away use it?

https://www.hmm21.com
If only there was a way to deliver the chips…

Camp Navajo
Difference between intermodal and manifest trains

Intermodal: Full unit trains do not stop/load/unload until they reach their destination

Manifest: Trains stop/load/unload many different types of railcars (can deliver single or multiple)

Intermodal and manifest typically do not mix!
Can we PLEASE have some intermodal containers?
Camp Navajo Army Weapons Storage Depot
Let the roller coaster ride begin!
Logistic observations....not a productivity study

Things that cause variability in productivity studies:

- **Operator experience**

- **Known work methods**

- **Length of study**

Focus is on basic data including:

- Movement of containers
- Filling containers
- What works....what needs improvement!

How many chips can a wood chipper chip if a wood chipper could chip wood?
Time to deliver logs!
Bring in the equipment...NOT a typical mobilization!

Rough terrain container handler (RTCH)
Setting up the RTCH

20 minutes to setup and offload!
Operations logistics

Original plan to use the rail spur next to chipping site did not work out due to rail switch repair needs.

New plan:
Offload train with RTCH and transport ~1000 feet to chipping site.

Concern heavy load may compromise container floor (weakest part of container).
Train arrives! Mix of double stack and single containers

One time ONLY!!!!~ 2 hours to deliver containers
Lets move some containers!
Building bulkheads
Getting containers in place

That shoot looks a bit high!

Too high…

Too low…

Just right!

~ 7.35 minutes to set container on trailer
Chipping!

34 – 96 minutes to fill
~24 tons per container

2 loaders?
Chipper loader did not work well
Move loaded containers back to railcars
What does all this mean?

<table>
<thead>
<tr>
<th>Element</th>
<th>Tons/hr</th>
<th>Containers/hr</th>
<th>Containers/ 10 hr day</th>
<th>Balancing system 22 containers/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loading logs</td>
<td>10.2</td>
<td>0.4</td>
<td>4.3</td>
<td>5.2</td>
</tr>
<tr>
<td>Hauling logs</td>
<td>10.2</td>
<td>0.4</td>
<td>4.3</td>
<td>5.2</td>
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<tr>
<td>Unloading logs</td>
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<td>1.1</td>
<td>10.8</td>
<td>2.0</td>
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<td>Moving empty containers</td>
<td>144</td>
<td>6</td>
<td>60.0</td>
<td>0.4</td>
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<td>Building bulkheads</td>
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<td>7.5</td>
<td>75.0</td>
<td>0.3</td>
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<tr>
<td>Setting containers for chipping</td>
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<td>8.1</td>
<td>81.3</td>
<td>0.3</td>
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<tr>
<td>Chipping logs/filling containers</td>
<td>26.7</td>
<td>1.1</td>
<td>11.1</td>
<td>2.0</td>
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<tr>
<td>Loading containers on train</td>
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<td>4.7</td>
<td>46.8</td>
<td>0.5</td>
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</tbody>
</table>

Full scale = 220 containers bi-weekly (22 containers/day)
Infrastructure improvements

8000’ of track  2 electronic switches  = $5 million investment
~$40/ton to chip/load containers + RR transportation = <$80/ton
CONCLUSIONS

- We will definitely need to ramp up to make Chip & ship operational
  - Need forest equipment operators, truck drivers, and other workers

- Land and infrastructure improvements will be needed
  - $5 million in rail improvements + site improvements (concrete pad for chipping)

- 220 containers every other week is significant
  - 26 weeks * 220 = 5720 * 24 tons = 137,280 tons per year!

- Keep the idea moving! Working with:
  - Local economic development
  - BNSF (Railroad)
  - Hyundai Merchant Marine
  - Chipping contractor
  - JA International

= 1 Acre
Thank you to our partners…collaboration!