Harvesting Trials and Coppice Response of Three Hardwood SRWCs

Dana Mitchell and Wellington Cardoso
USDA Forest Service, Southern Research Station
Forest Operations Research Unit, Auburn, AL

Cooperators:
Tom Gallagher & Daniel de Souza, Auburn University School of Forestry and Wildlife Sciences
Overview

- Initial Coppice Felling
- Study Site
- Methodology
- Results & Discussion
- Conclusion
INTRODUCTION

Initial coppice felling
Introduction

Why coppice?

• Coppice management system for biomass, not logs
• Stems re-sprout from stumps/stools
• Several harvests from one planting
  • Reduced planting and establishment costs between harvest rotations
• No site preparation required between harvest cycles
  • Reduced site impacts from equipment
Introduction

Initial coppice felling moves stand from single stem management to coppice management.
Introduction

Equipment for Initial Coppice Felling

• Conventional harvesting equipment
• Specialized harvesting equipment
Introduction

Constraints

- Wet Site / Low Impact / Dormant Winter Operations
- Low cost alternative for low volume initial coppice felling
- Mechanized, no manual labor
Introduction

Coppice Response Study

• Compare the effects of the felling method on coppice response (shear vs. saw)
Initial Coppice Felling

Shear Vs. Saw Study

- Determine if the ability to coppice is affected by the season of year in which the harvest is done (winter harvest vs. summer harvest)
STUDY SITES
Study Sites

Arkansas River

Mississippi River Delta
Study Sites

Mississippi River Delta Site

• Cottonwood (Stand 1)
  • 4 years old
  • Planting Spacing = 5ft x 5ft
  • Average DBH = 3.0 in
  • Average Height = 23 ft

• Willow (Stand 2)
  • 4 years old
  • Planting Spacing = 5ft x 5ft
  • Average DBH = 1.50 in
  • Average Height = 19 ft
Study Sites

Arkansas River Site

• Cottonwood (Stand 3)
  • 4 years old
    (4 growing seasons)
  • Dual rows
  • Planting Spacing
    • Between row = 6 ft
    • Within row = 2 ft
    • Dual Trees = 2.5 ft
  • Average DBH = 1.4 in
  • Average Height = 29 ft
METHODOLOGY
Methodology

Prime Mover

- Tracked skid steer
- Rubber tracks
- Ground pressure w/ shear attached = 4.86 lbs/in$^2$
- Low cost alternative to larger machines
- Lower rate for Workman’s Compensation – worker inside cab – compared to manual felling
Methodology

Shear Head

• Low maintenance compared to saw heads
• Increased safety
  • no manual chain saw
  • no saw shot
Methodology

Operational Characteristics

• Felling – single/dual row
• Bunching
• Dumping
Methodology

Time Study / Production

• Digital video
• TimerPro
• Identified cycle elements
• Dormant season harvest (March 2014)
RESULTS AND DISCUSSION
Results and Discussion

Cycle Elements

• Move to first tree
• Fell/Accumulate
• Move between trees
• Move to dump
• Dump
• Delays
Results and Discussion

Mississippi Cottonwood Stand 1
- Move 1st Tree: 15.79%
- Move Between Trees: 37.52%
- Move to Dump: 15.02%
- Dump: 15.92%
- Accumulation: 12.15%
- Missippi Willow Stand 2
- Move 1st Tree: 10.49%
- Move Between Trees: 19.55%
- Move to Dump: 7.14%
- Dump: 2.88%
- Accumulation: 43.21%
- Arkansas Cottonwood Stand 3
- Move 1st Tree: 2.20%
- Move Between Trees: 1.86%
- Move to Dump: 5.12%
- Dump: 45.37%
- Accumulation: 2.92%

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Results and Discussion

Stand Differences

• The number of trees felled per stand varied
  • Goal = 200 sheared trees/site
  • Mortality
  • Prior research removals

Mississippi Cottonwood – Stand 1

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## Results and Discussion

### Production (Total time (min) / tree)

<table>
<thead>
<tr>
<th>Stand</th>
<th>Total Time (min)</th>
<th>Total Trees</th>
<th>Total Time (min) / Tree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mississippi Cottonwood</td>
<td>56.48</td>
<td>84</td>
</tr>
<tr>
<td>2</td>
<td>Mississippi Willow</td>
<td>64.28</td>
<td>104</td>
</tr>
<tr>
<td>3</td>
<td>Arkansas Cottonwood</td>
<td>65.09</td>
<td>188</td>
</tr>
</tbody>
</table>
Results and Discussion

Dual Row Vs Single Row

- Stand 2 (single row) and Stand 3 (dual row) have similar DBHs
- The overall average time to cut a tree was lower in the dual row (stand 3) than in the single row (stand 2)
- Willow branching patterns in Stand 2 negatively impacted cycle time
- Different number of trees per accumulation
  - 7 trees (Stand 2) Average
  - 23 trees (Stand 3) Average
### Results and Discussion

#### Machine Rate Assumptions

<table>
<thead>
<tr>
<th>Cost Item</th>
<th>CAT 279D</th>
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<tr>
<td>Purchase Price</td>
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<td>Machine Life</td>
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<td>Horsepower</td>
<td>74 hp</td>
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<td>Shear Head (8500 PMH Life)</td>
<td>$10,736</td>
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<td>Undercarriage (3000 PMH Life)</td>
<td>$16,770</td>
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<td>Tracks (2500 PMH Life)</td>
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<td>Labor (w/fringe benefits)</td>
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## Results and Discussion

$48.36 / SMH  
$56.90 / PMH  

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# Results and Discussion

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<td>0.67</td>
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<td>2 MS Willow</td>
<td>0.62</td>
<td>0.010333</td>
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Alternative ways to display costs: $/acre, $/ton = fx (planting density, tree size)
Conclusion

Time and Motion Study
• 3 different stands
• Dual Row and Single Row
• All were 4 years old

Cycle Elements
• Impacted by the distant dumping location (Stand 1 and 2)
• Operational differences for dual row plantings
• Time per tree was lower in dual row stand than in single row stands

Production Influences
• Operator experience
• Presence of lower limbs

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Acknowledgements
THANK YOU

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http://www.srs.fs.usda.gov/forestops/