

Harvesting Trials and Coppice Response of Three Hardwood SRWCs

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SRWC 2014
Seattle, WA

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



Source: Biosystems Engineering,
Bionic Beaver

Introduction



Willow Harvester, SUNY



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)



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Initial Coppice Felling

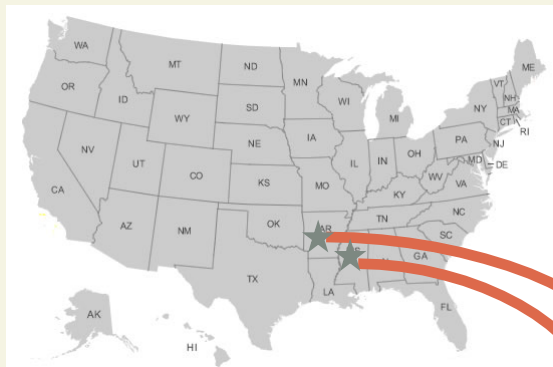
Shear Vs. Saw Study

- 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/in²
- Low cost alternative to larger machines
- Lower rate for Workman's Compensation – worker inside cab – compared to manual felling



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Methodology

Shear Head

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



Fecon 14" Tree Shear

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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

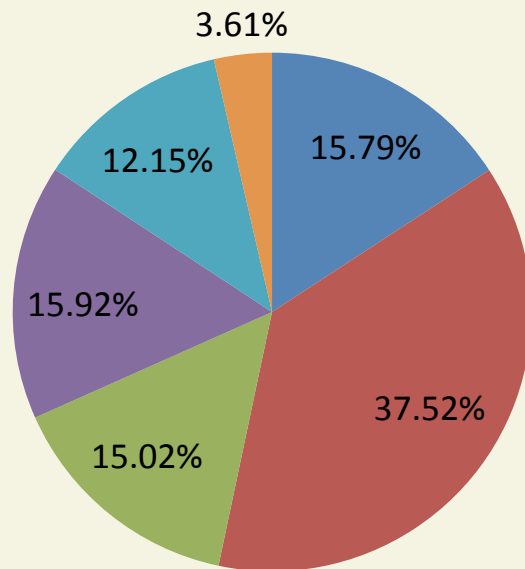
Cycle Elements

- Move to first tree
- Fell/Accumulate
- Move between trees
- Move to dump
- Dump
- Delays

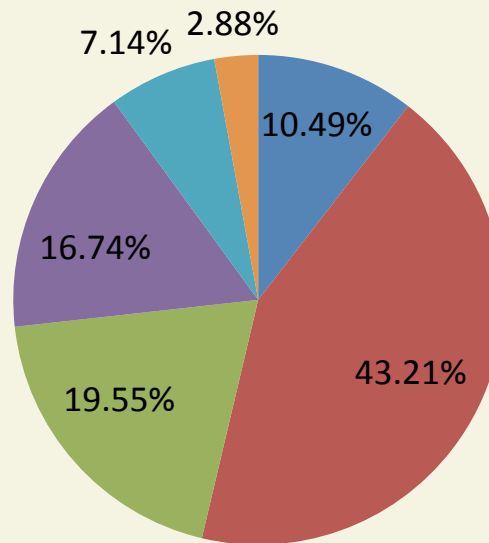


Results and Discussion

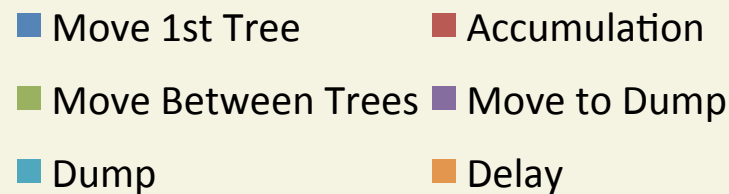
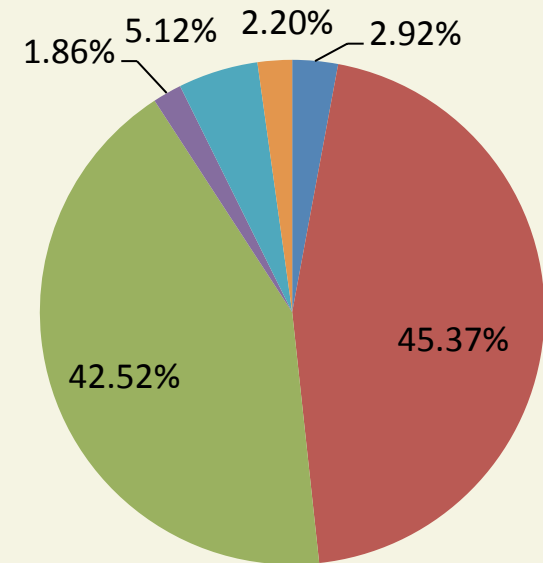
Mississippi Cottonwood
Stand 1



Mississippi Willow
Stand 2



Arkansas Cottonwood
Stand 3



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

Results and Discussion

Production (Total time (min) / tree)

Stand		Total Time (min)	Total Trees	Total Time (min) / Tree
1	Mississippi Cottonwood	56.48	84	0.67 ^A
2	Mississippi Willow	64.28	104	0.62 ^A
3	Arkansas Cottonwood	65.09	188	0.35 ^B

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



Dual row felling – Stand 3

Results and Discussion



Machine Rate Assumptions

Cost Item	CAT 279D
Purchase Price	\$80,000 (USD)
Machine Life	5 years
Fuel Cost	\$3.13/gal
Salvage Value	30%
Utilization Rate (2000 SMH/Yr)	85%
Horsepower	74 hp
Shear Head (8500 PMH Life)	\$10,736
Undercarriage (3000 PMH Life)	\$16,770
Tracks (2500 PMH Life)	\$3,600
Labor (w/fringe benefits)	\$19.50/SMH

Results and Discussion

\$48.36 / SMH
\$56.90 / PMH



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Results and Discussion

Production Rates

Stand	Time/Tree (minutes)	Time/Tree (hours)	\$/PMH	\$/Tree
1 MS Cottonwood	0.67	0.011167	\$56.90	0.64
2 MS Willow	0.62	0.010333	\$56.90	0.59
3 AR Cottonwood (dual row)	0.35	0.005833	\$56.90	0.33

Results and Discussion

Production Rates

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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



Acknowledgements





THANK YOU

Dana Mitchell and Wellington Cardoso
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<http://www.srs.fs.usda.gov/forestops/>