TETHERED LOGGING IN SOUTHWEST OREGON

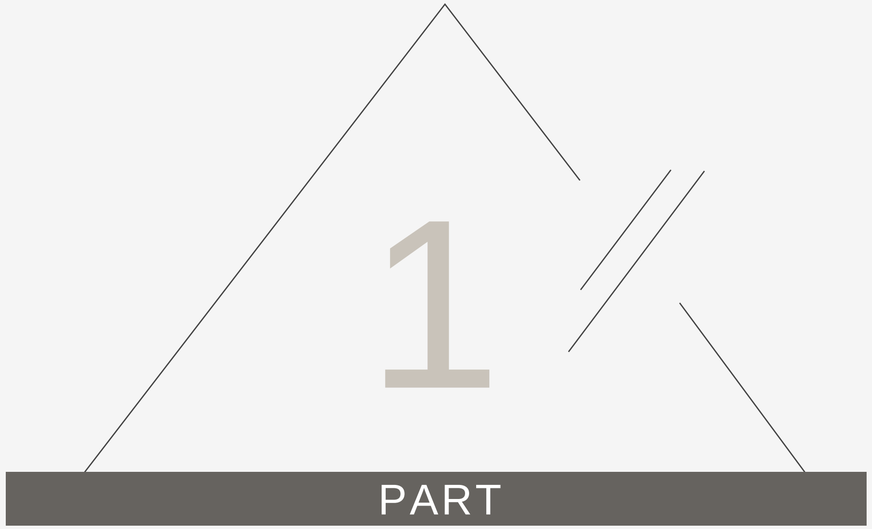
RESEARCH PERSPECTIVE

WOODAM CHUNG & BRENNAN GARRELTS

CONTRIBUTORS: BRETT MORRISSETTE, PRESTON GREEN, BEN LESHCHINSKY, FRANCISCA BELART, KEVIN BLADON, JEFF HATTEN, JOHN SESSIONS, JOHN GARLAND

Oregon State University

LONE ROCK RESOURCES

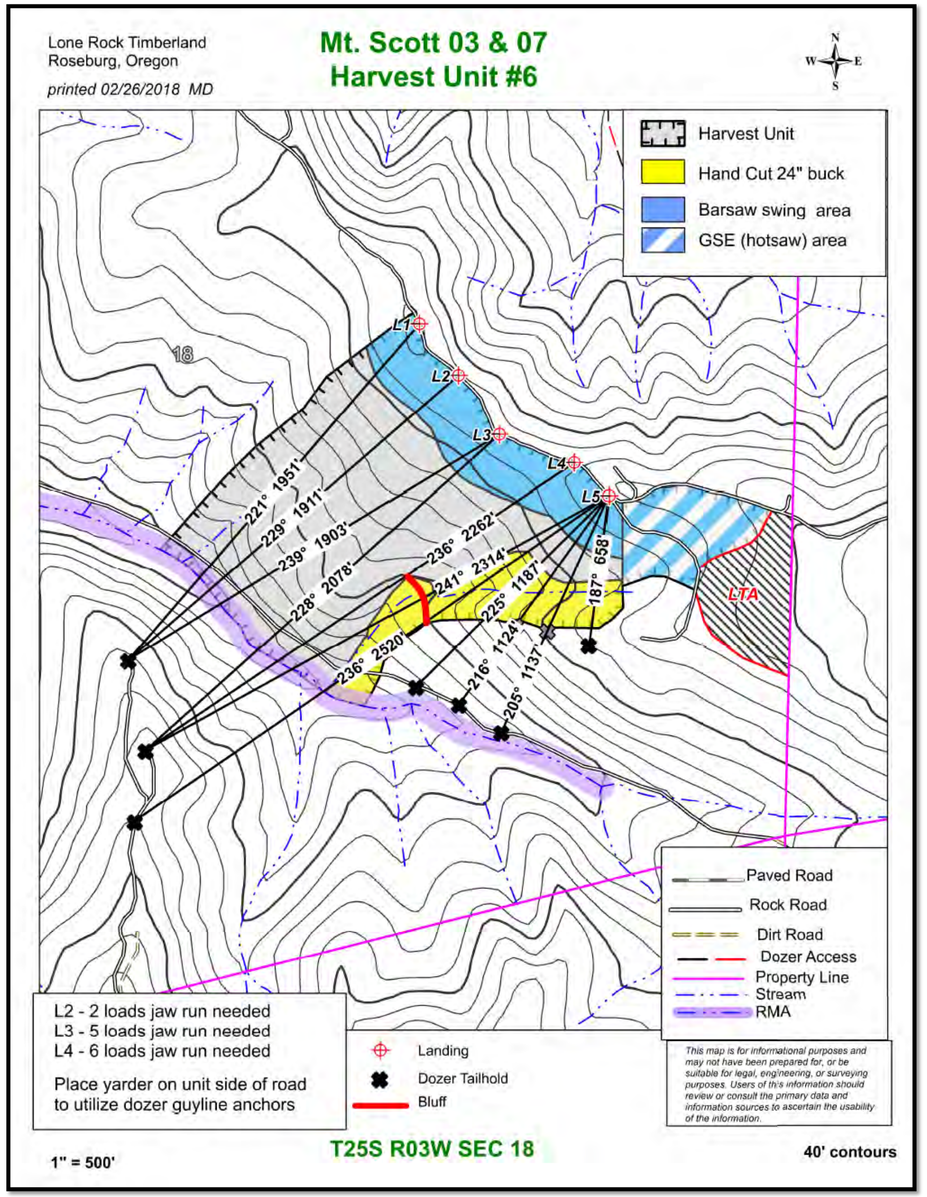


STUDY SITE & OBJECTIVES

STUDY SITES

LONE ROCK RESOURCES

- Study site
  - 35 acres
  - Clear cut (200 trees per acre)
  - Avg. tree size: 220 bf
- Tethered feller-buncher
  - Comparison between mechanized and manual timber falling
- Wet season
  - March – April 2018



A logging site near Sutherlin, OR

STUDY SITES

LONE ROCK RESOURCES

- **Study site**
  - 35 acres
  - Clear cut (200 trees per acre)
  - Avg. tree size: 220 bf
- **Tethered feller-buncher**
  - Comparison between mechanized and manual timber falling
- **Wet season**
  - March – April 2018

OBJECTIVES

Economics

#1: Estimate **CUTTING** productivity and cost (machine vs. hand)

#2: Examine the effects of machine cutting on **YARDING** productivity and cost

Hypothesis #1: Machine cutting has higher productivity and costs than hand cutting

Hypothesis #2: The ability of the machine to swing and pile trees near skyline corridors improve yarding efficiency

OBJECTIVES

Soil Impacts and Sediment Transport

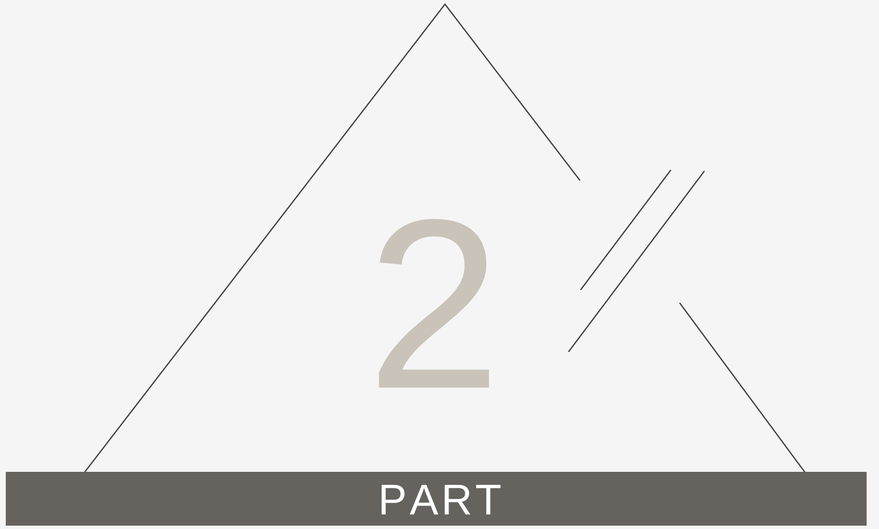
#1: Characterize and quantify soil **IMPACTS**

#2: Evaluate soil **EROSION** and **SEDIMENT** transport potential

M A C H I N E – S O I L – W A T E R

Hypothesis #1: Machine tracks creates a “tillage effect” on the surface soil – loosening surface soils while mixing organic matters with mineral soil materials; increasing moisture holding capacity

Hypothesis #2: Soil disturbance along machine corridors causes an increase in erosion and sediment transport potential



METHODS

METHODS – PROD.

Detailed Time Study

Cycle time data collection

GoPro video footage

Timber cruise data

Mill tickets

Delay-free cycle time regression models

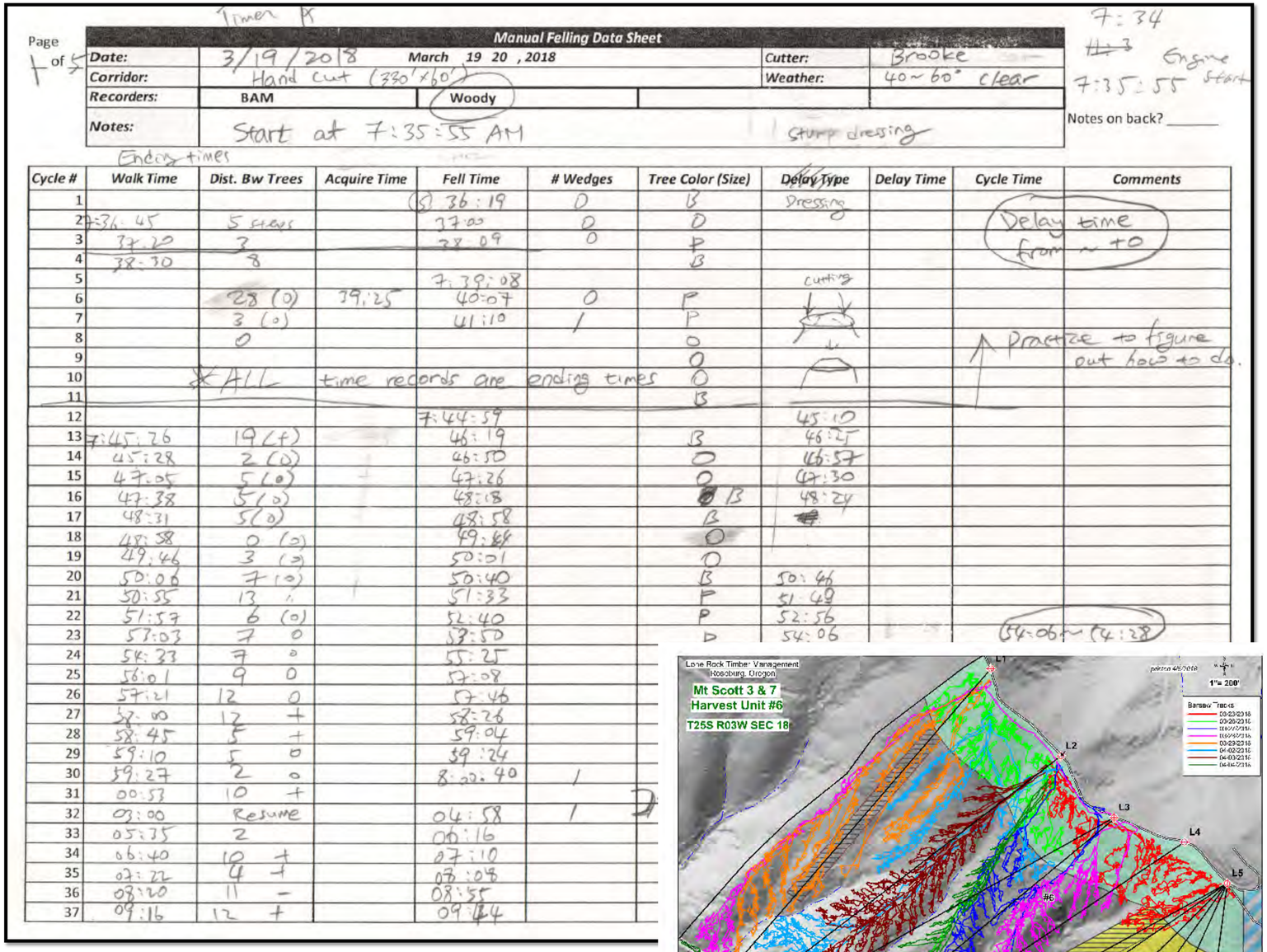
- Hand cutting
- Machine cutting
- Machine swinging
- Yarding after hand-cut
- Yarding after machine-cut

Hourly production rates

Machine Rates

Hourly machine costs

System costs



Manual Felling Data Sheet

Page 1 of 5

Date:	3/19/2018 March 19 20, 2018	Cutter:	Brooke
Corridor:	Hand cut (330'x60')	Weather:	40~60° clear
Recorders:	BAM / Woody		
Notes:	Start at 7:35:55 AM		

Timer K

7:34 Engine start 7:35:55

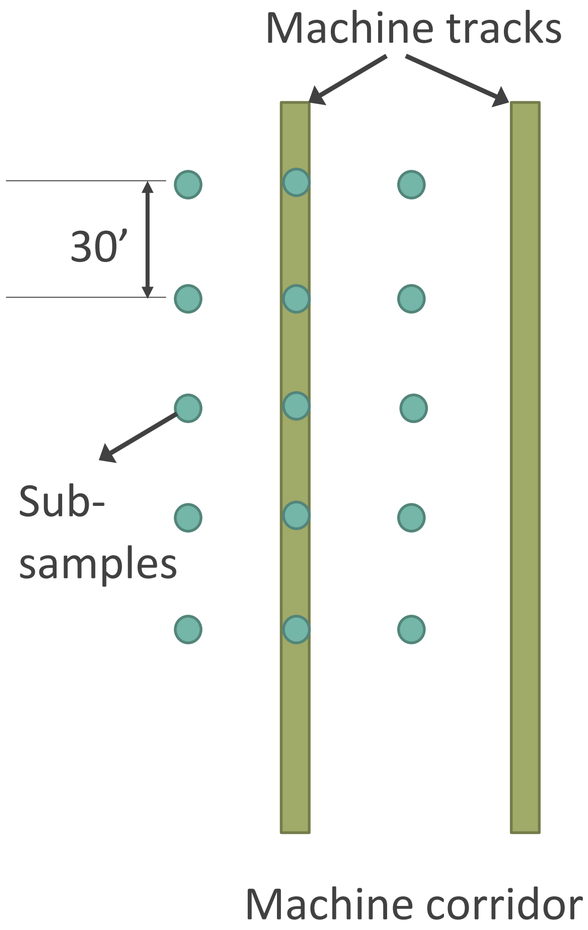
Notes on back? ____

Ending times

Cycle #	Walk Time	Dist. Bw Trees	Acquire Time	Fell Time	# Wedges	Tree Color (Size)	Delay Type	Delay Time	Cycle Time	Comments
1				(5) 36:19	0	B	Dressing			
2	7:36:45	5 steps		37:00	0	O				
3	37:20	3		38:09	0	P				
4	38:30	8				B				
5				7:39:08			cutting			
6		28 (O)	39:25	40:07	0	P				
7		3 (O)		41:10	/	P				
8		0				O				
9						O				
10		*ALL time records are ending times				O				
11						B				
12				7:44:59			45:10			
13	7:45:26	19 (f)		46:19		B	46:25			
14	45:28	2 (O)		46:50		O	46:57			
15	47:05	5 (O)		47:26		O	47:30			
16	47:38	5 (O)		48:18		B	48:24			
17	48:31	5 (O)		48:58		B				
18	48:58	0 (O)		49:44		O				
19	49:46	3 (O)		50:01		O				
20	50:06	7 (O)		50:40		B	50:46			
21	50:55	13		51:33		P	51:49			
22	51:57	6 (O)		52:40		P	52:56			
23	57:03	7 O		53:50		P	54:06		54:06~(4:28	
24	54:33	7 O		55:25						
25	56:01	9 O		57:08						
26	57:21	12 O		57:46						
27	57:00	12 +		58:26						
28	58:45	5 +		59:04						
29	59:10	5 O		59:24						
30	59:27	2 O		8:00:40	/					
31	00:53	10 +								
32	03:00	Resume		04:58	/					
33	05:35	2		06:16						
34	06:40	10 +		07:10						
35	07:22	4 +		08:08						
36	08:20	11 -		08:55						
37	09:16	12 +		09:44						

METHODS – SOILS

Pre- and post-harvesting



Between machine tracks, in the tracks, and outside tracks

Soil physical properties

Bulk density
Soil penetration resistance
Rut depth
Infiltration rates
Soil moisture contents

SOIL COMPACTION

MOISTURE CONTENT

Erosion and sediment potential

Soil moisture changes over time
Shallow subsurface runoff
Sediment production rates
Rainfall precipitation

SILT FENCES

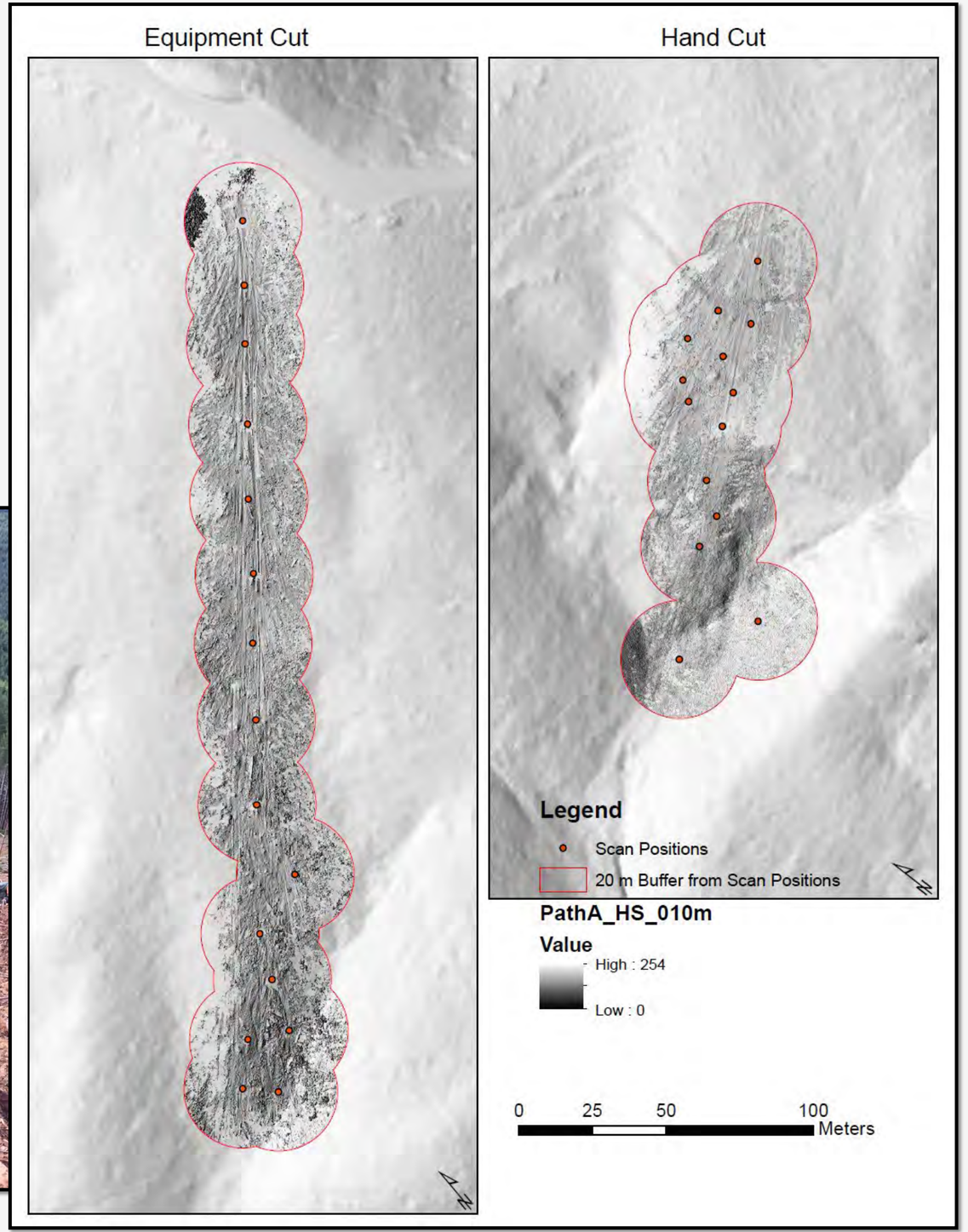
METHODS – SOILS

LONE ROCK RESOURCES

METHODS – SOILS

Machine cut areas – high intensity of disturbance

METHODS – SOILS

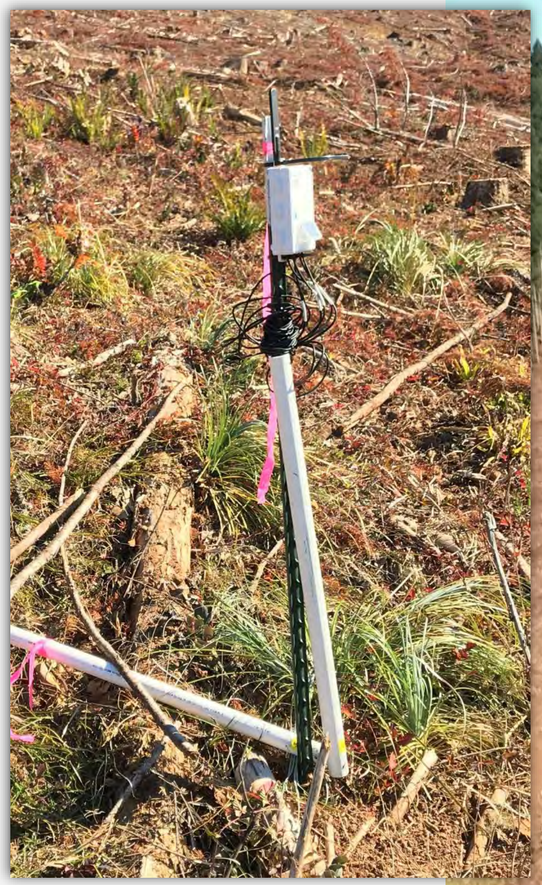


METHODS – SOILS

LONE ROCK RESOURCES

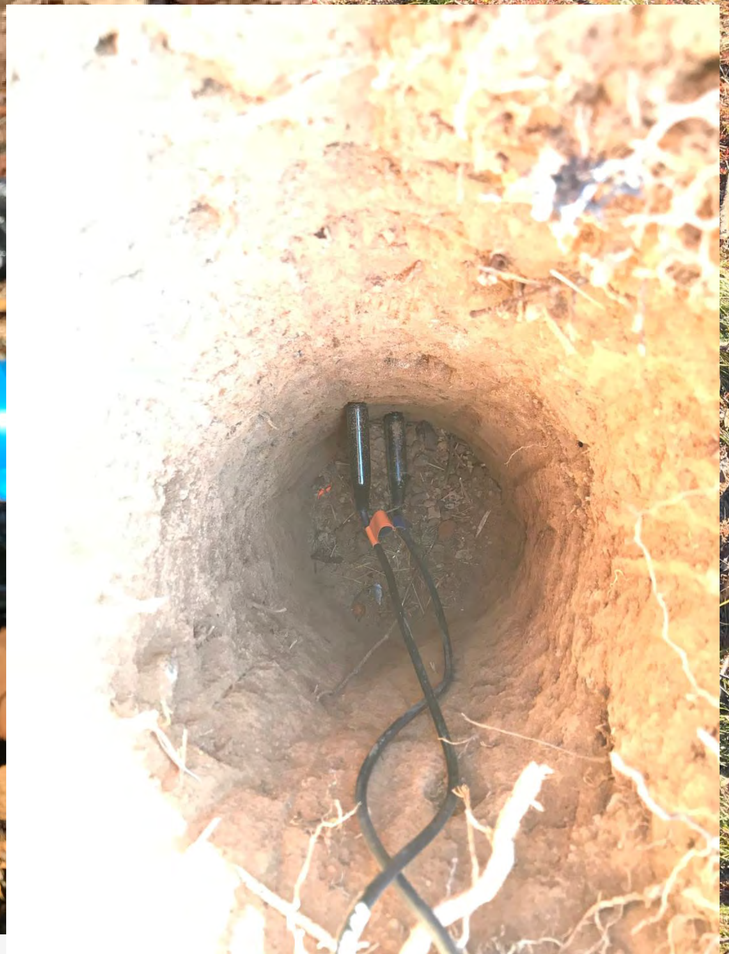
METHODS – SOILS

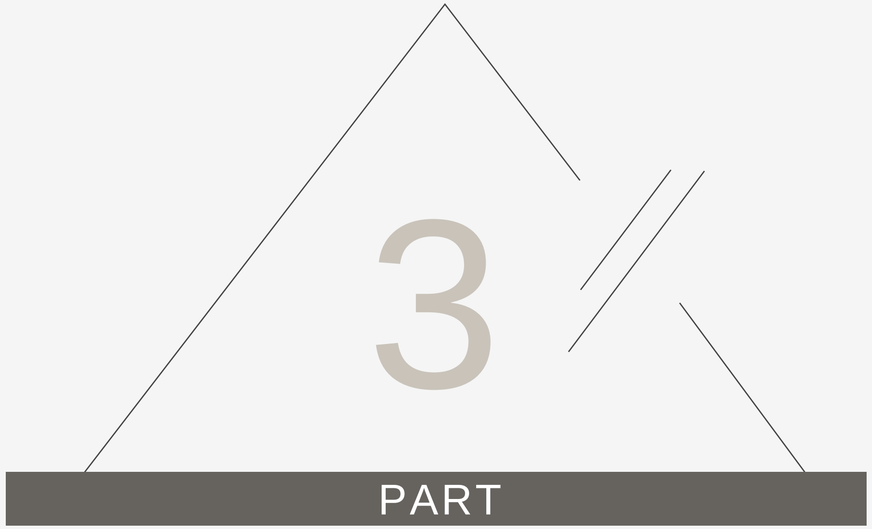
LONE ROCK RESOURCES



METHODS – SOILS

LONE ROCK RESOURCES





PRE. RESULTS

ECONOMICS

Machine costs

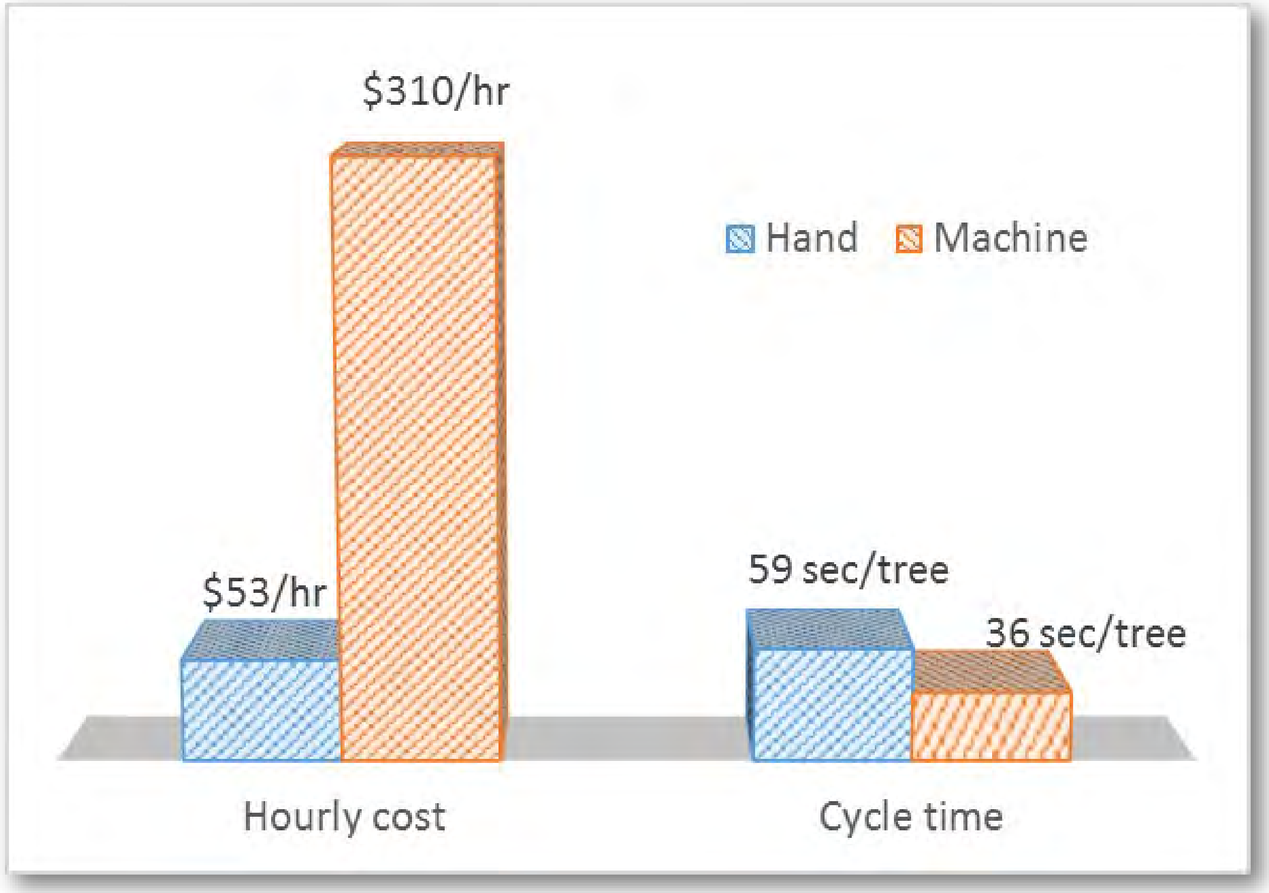
- Hand cutting: $53/hour
- Machine cutting: $310/hour
- Yarding: $390/hour

Productivity

- Hand cutting (delay-free): 59 sec/tree
- Machine cutting (delay-free): 27 sec/tree
- Machine swing: Approx. 30% of total machine hours

- Yarding (hand cut): 4.8 min/turn, 610 bf/turn
- Yarding (machine cut): 3.5 min/turn, 970 bf/turn
- 27% faster, 60% more volume -> 120% higher productivity

Cutting



ECONOMICS

Machine costs

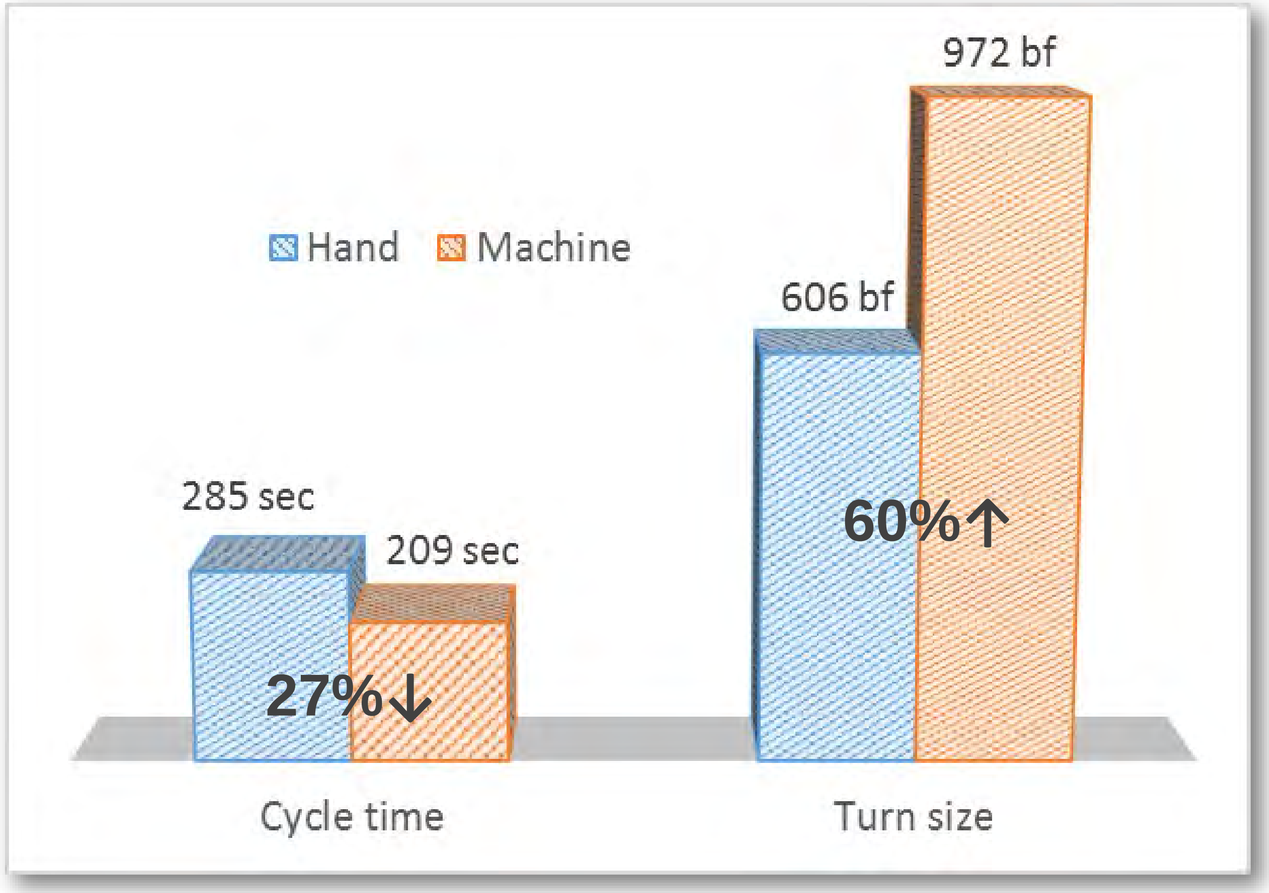
- Hand cutting: $53/hour
- Machine cutting: $310/hour
- Yarding: $390/hour

Productivity

- Hand cutting (delay-free): 59 sec/tree
- Machine cutting (delay-free): 27 sec/tree
- Machine swing: Approx. 30% of total machine hours

- Yarding (hand cut): 4.8 min/turn, 610 bf/turn
- Yarding (machine cut): 3.5 min/turn, 970 bf/turn
- 27% faster, 60% more volume -> 120% higher productivity

Yarding



ECONOMICS

Machine costs

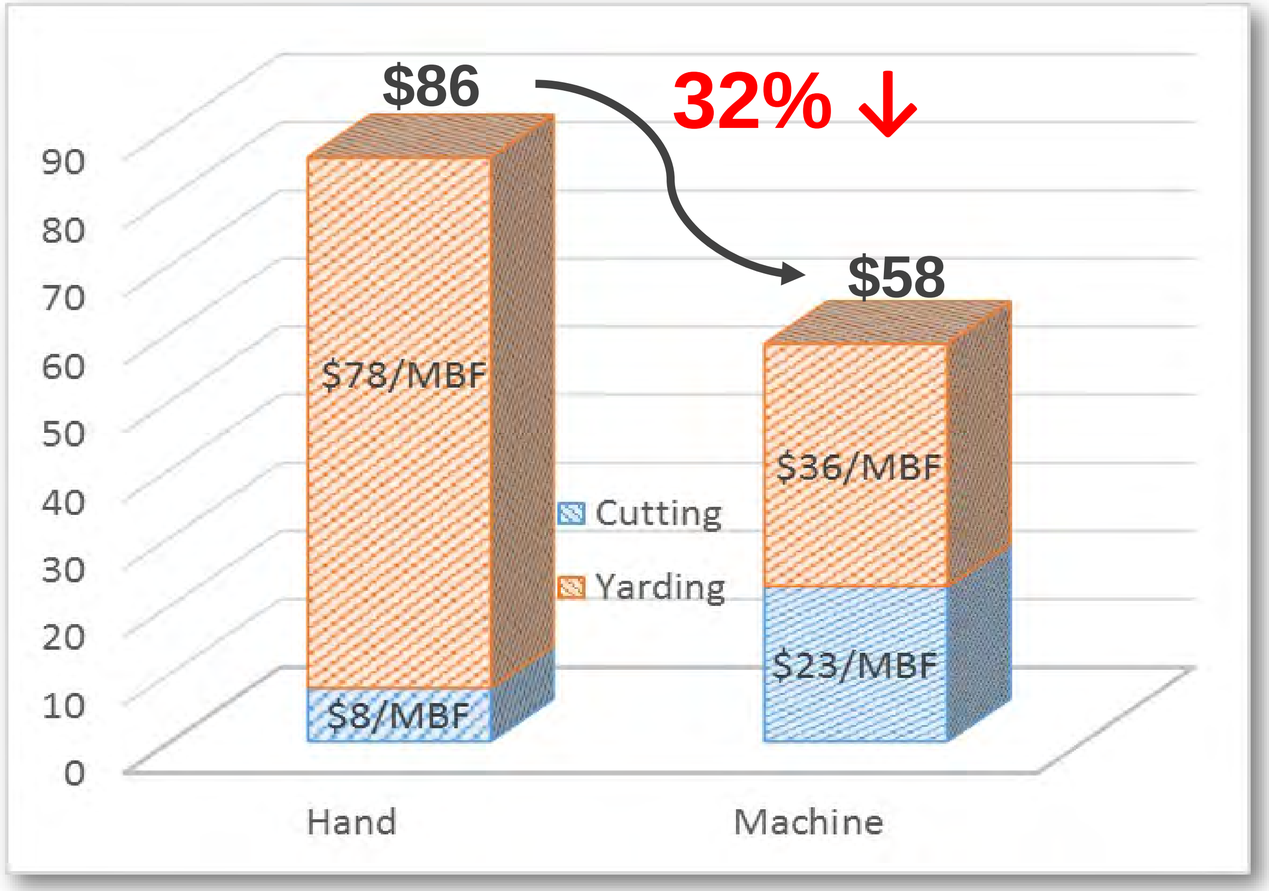
- Hand cutting: $53/hour
- Machine cutting: $310/hour
- Yarding: $390/hour

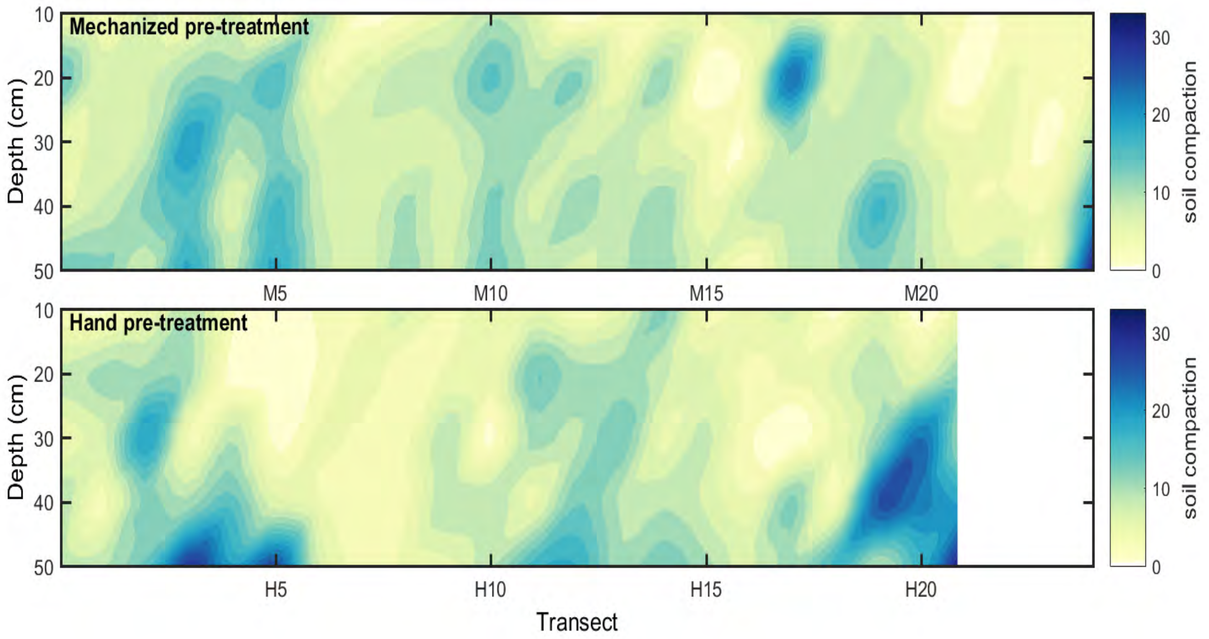
Productivity

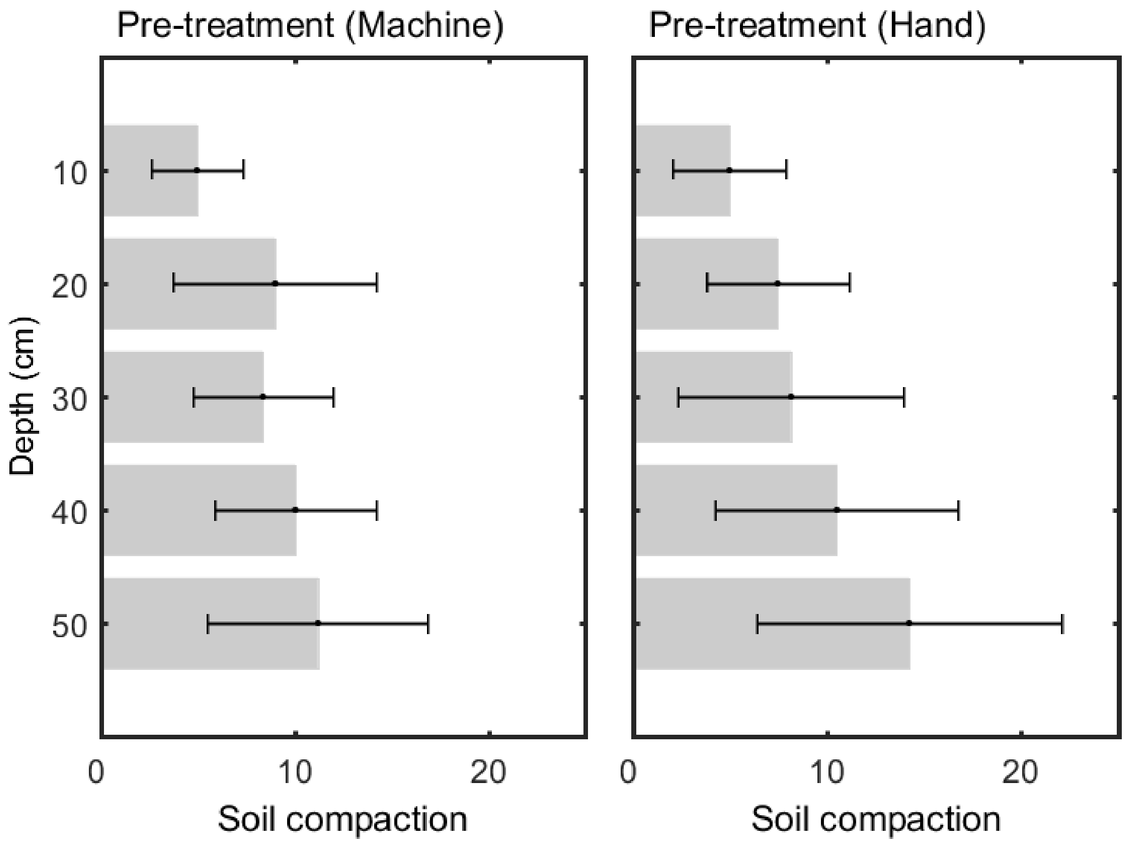
- Hand cutting (delay-free): 59 sec/tree
- Machine cutting (delay-free): 27 sec/tree
- Machine swing: Approx. 30% of total machine hours

- Yarding (hand cut): 4.8 min/turn, 610 bf/turn
- Yarding (machine cut): 3.5 min/turn, 970 bf/turn
- 27% faster, 60% more volume -> 120% higher productivity

Unit production costs





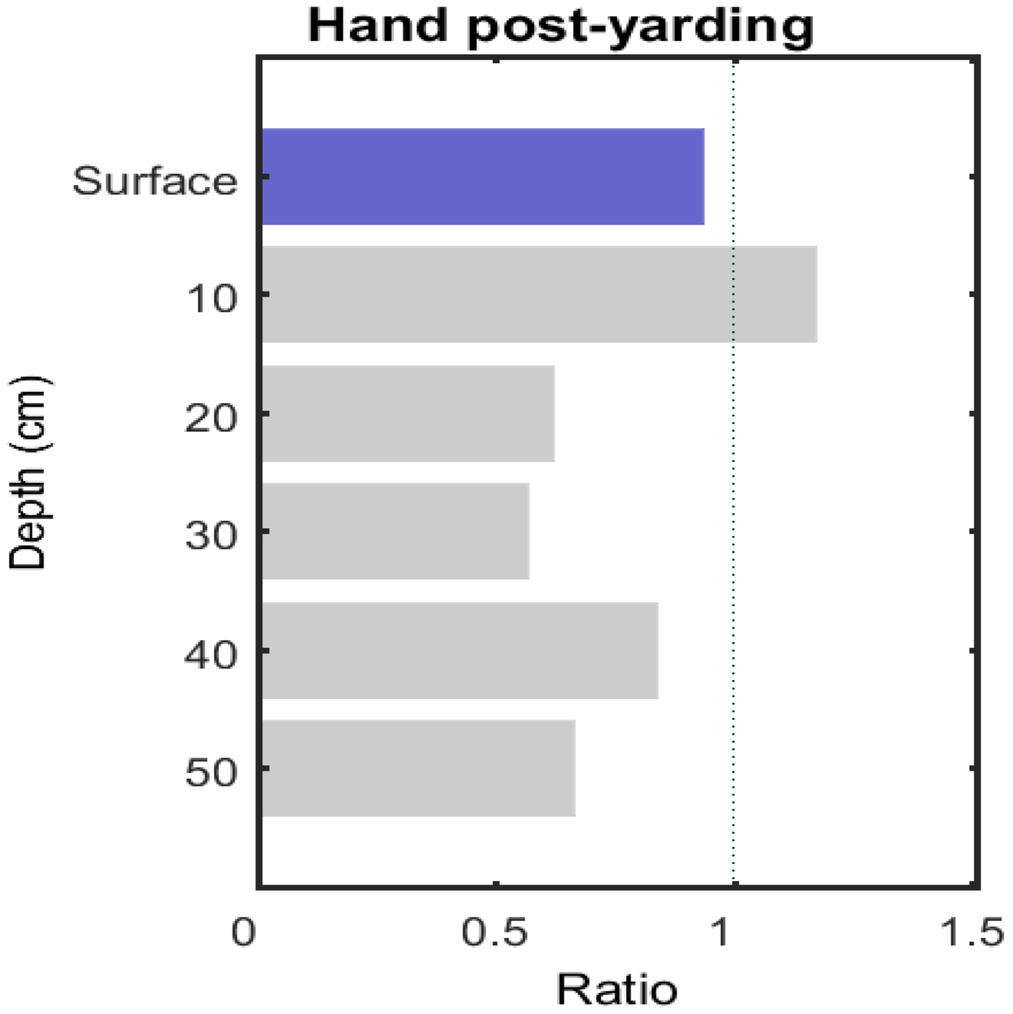


Pre-harvesting soil conditions

- A total of 22 sample stations located in each of machine and hand cut corridors
- No difference in the average soil penetrometer measurements between machine and hand cut areas prior to harvesting

HAND CUT

- Post-yarding

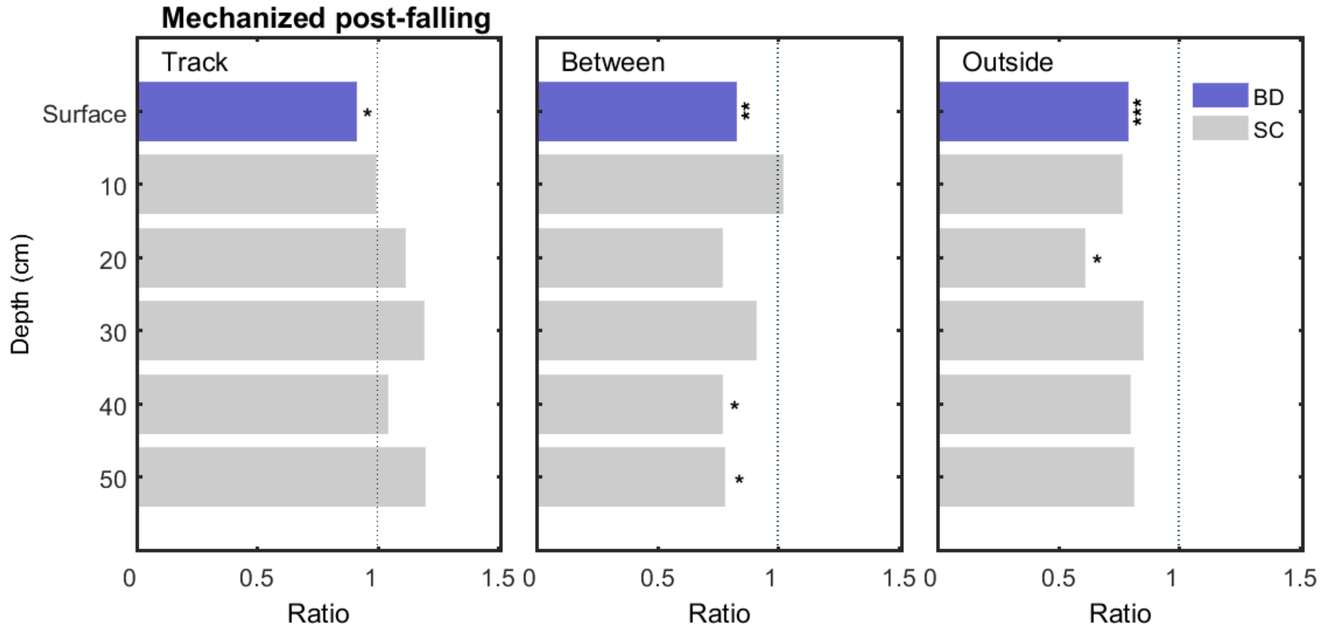


- Ratio > 1; Compacted soil
- Ratio = 1; No change
- Ratio < 1; Loosened-up soil

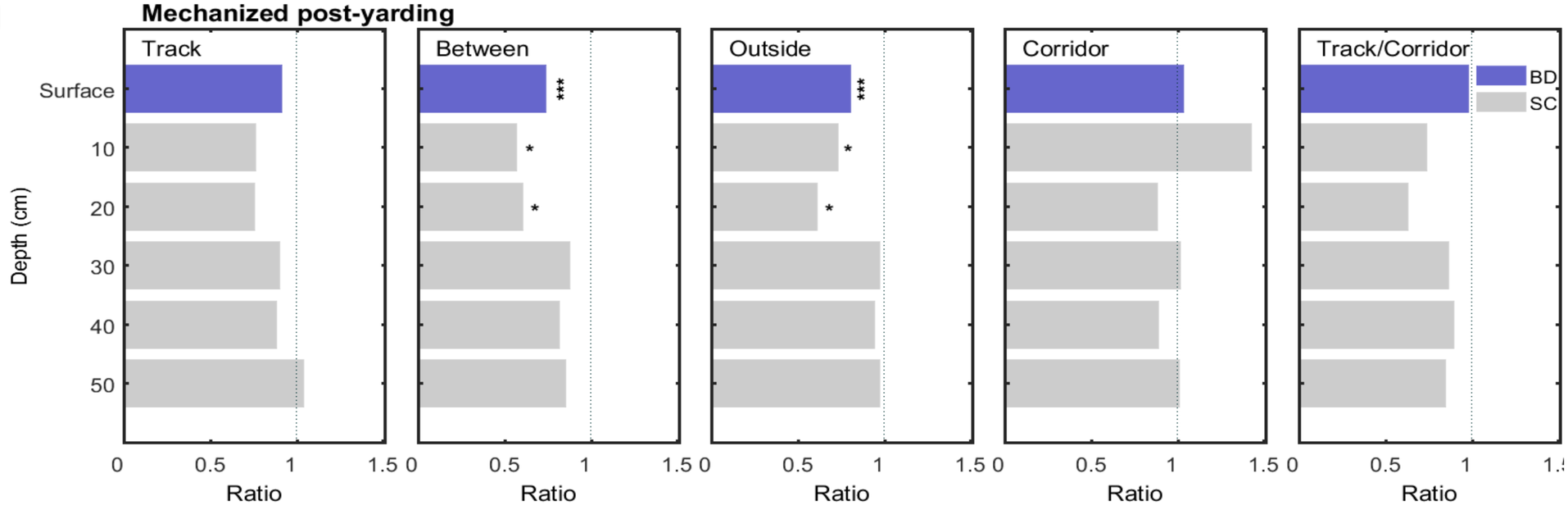
* significant at p < 0.05; ** significant at p < 0.005; *** significant at p < 0.001

* significant at p < 0.05; ** significant at p < 0.005; *** significant at p < 0.001

Machine post-falling

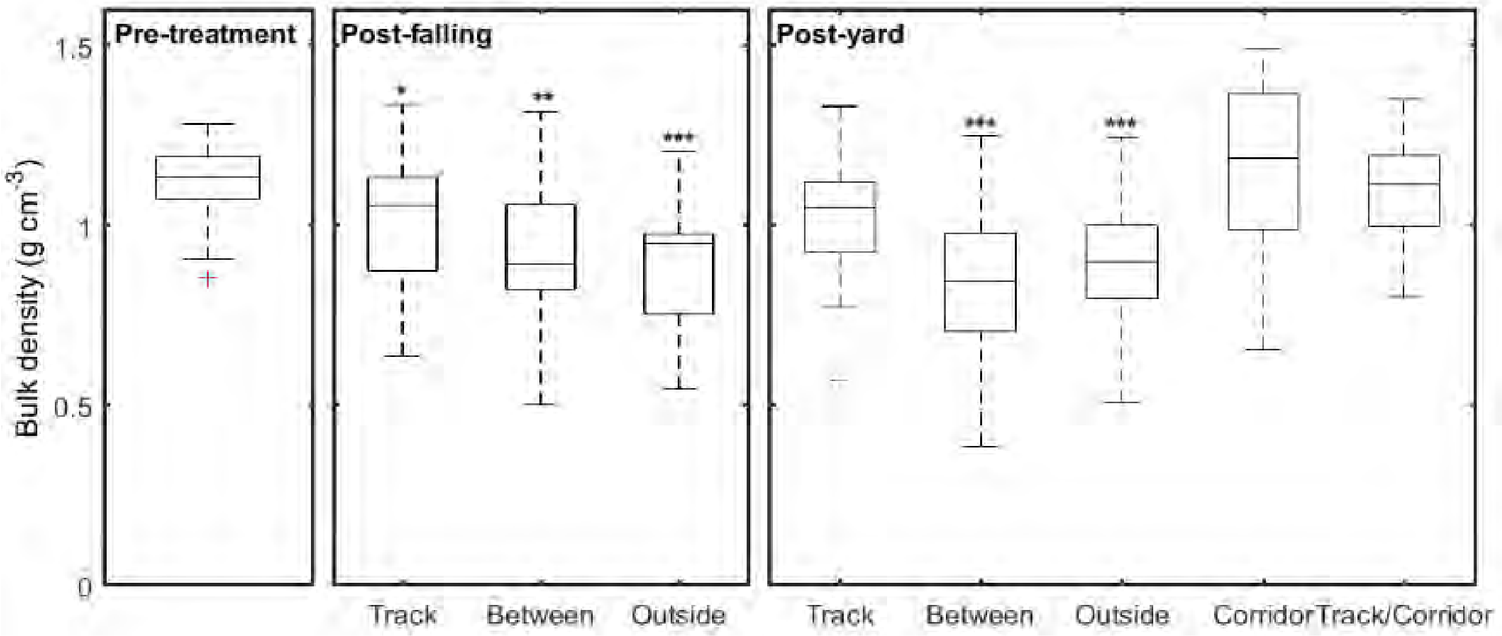


Machine post-yarding

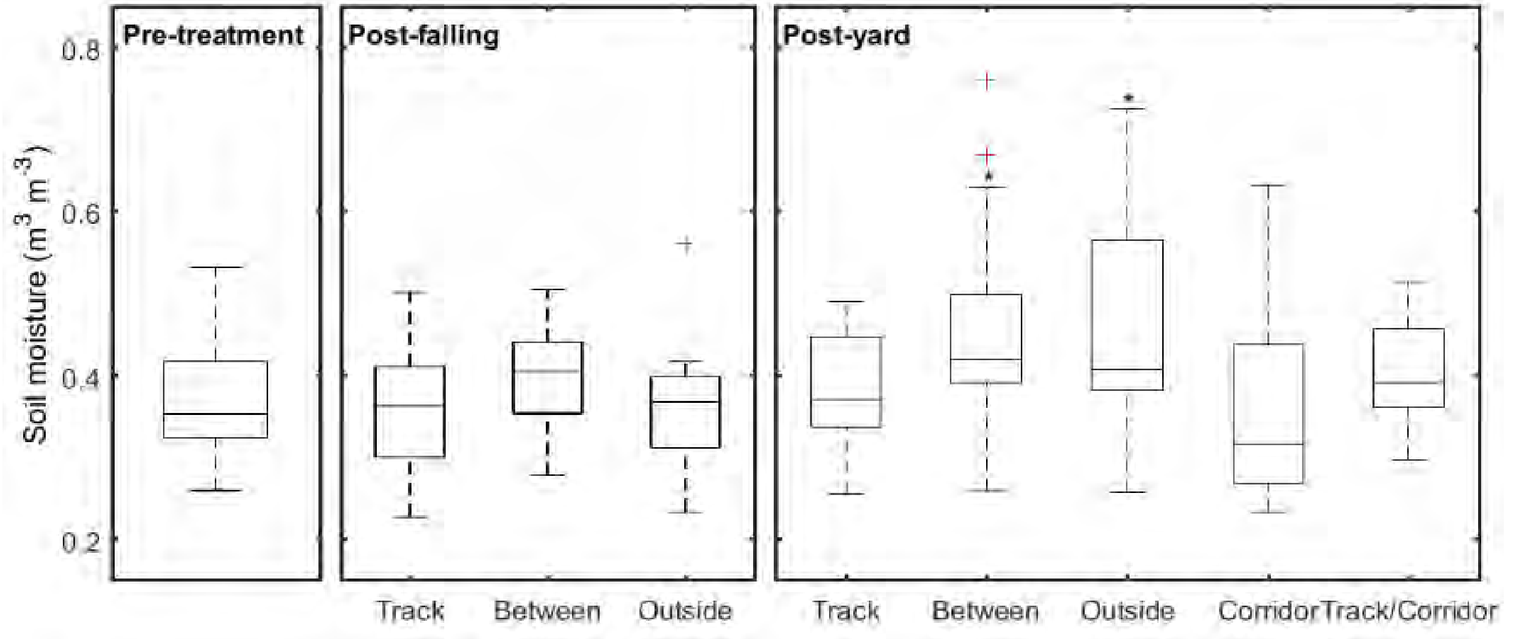


ENVIRONMENT

- Bulk density

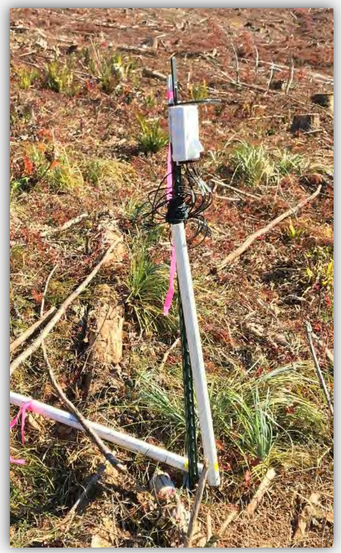


- Soil Moisture Contents

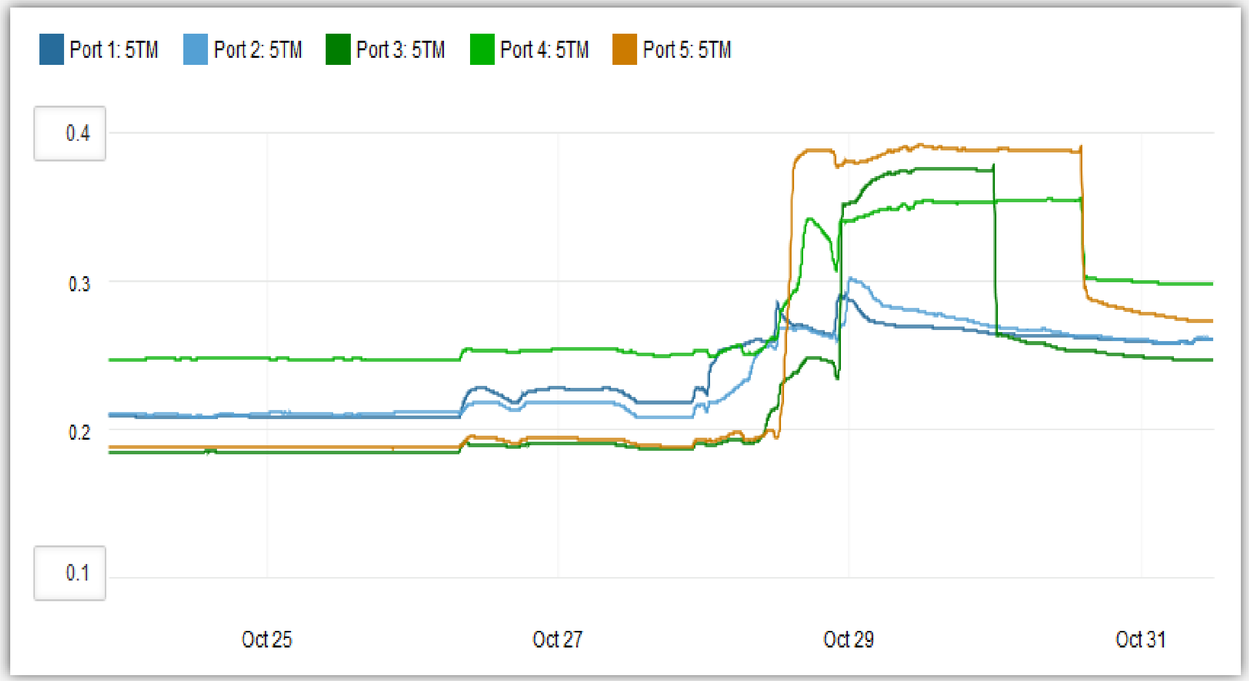


* significant at p < 0.05; ** significant at p < 0.005; *** significant at p < 0.001

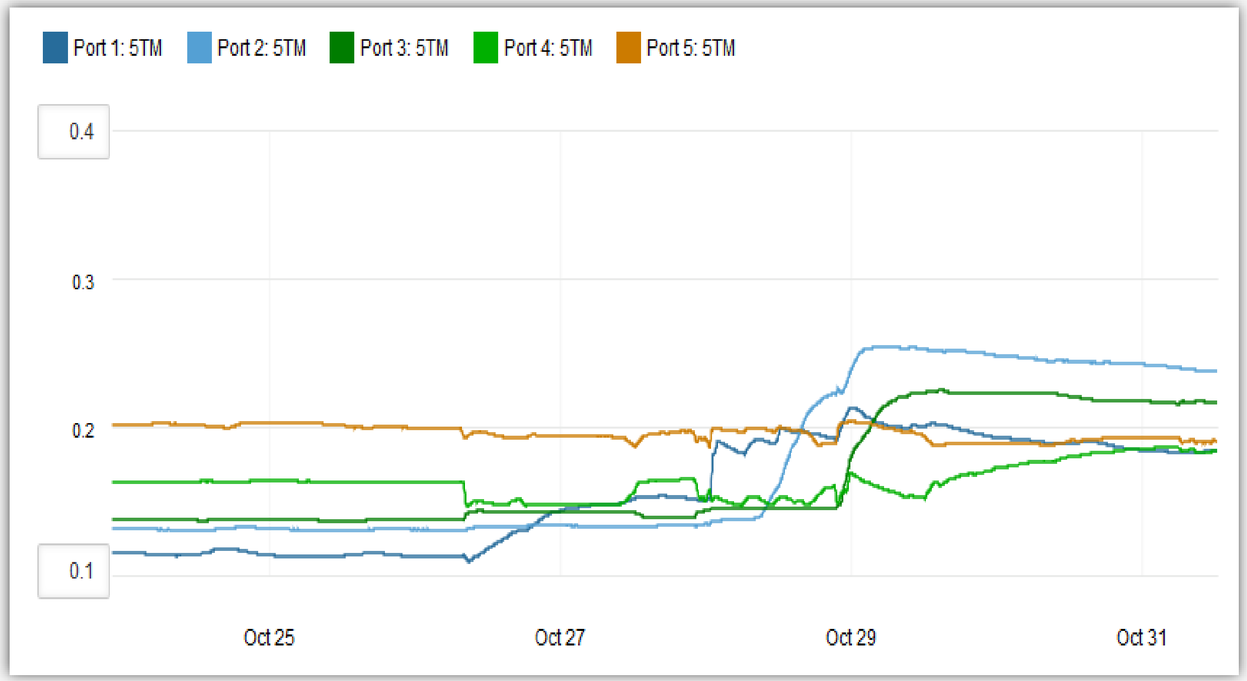
ENVIRONMENT



Machine Track



Non-track

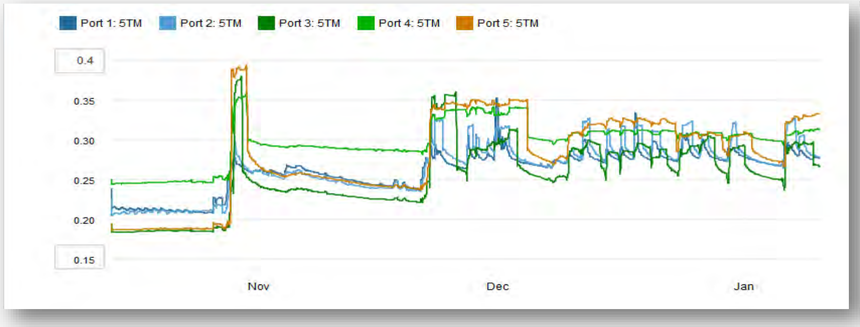


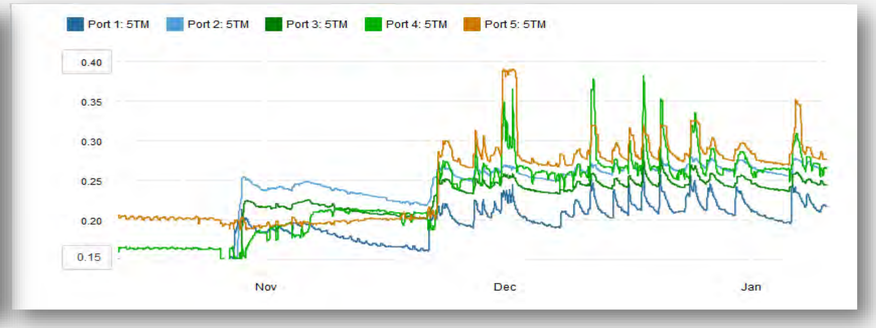
ENVIRONMENT

Machine Track

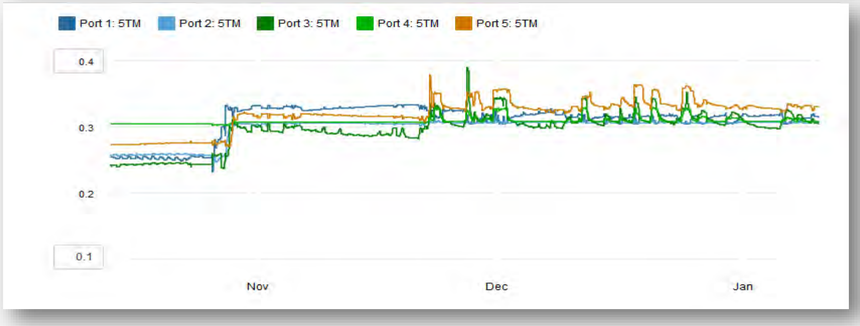
Non-track

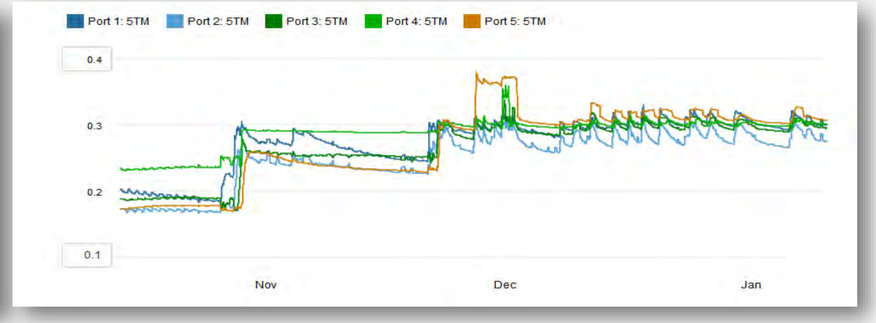
Location #1



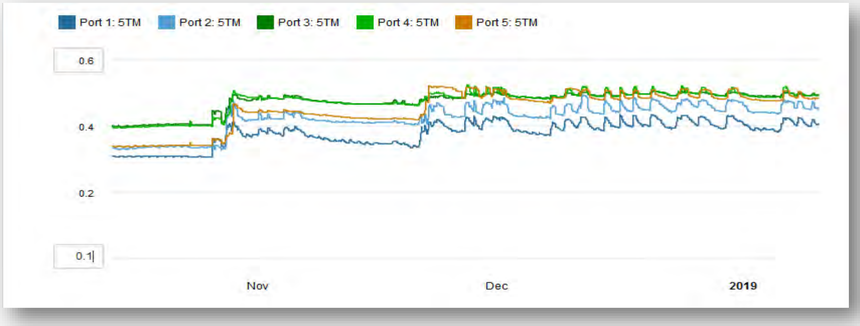


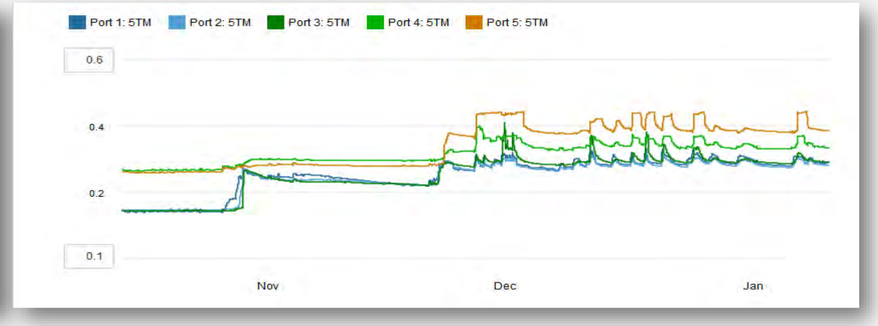
Location #2



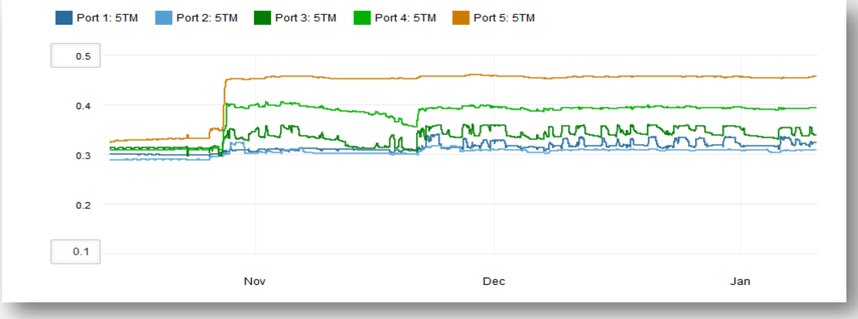


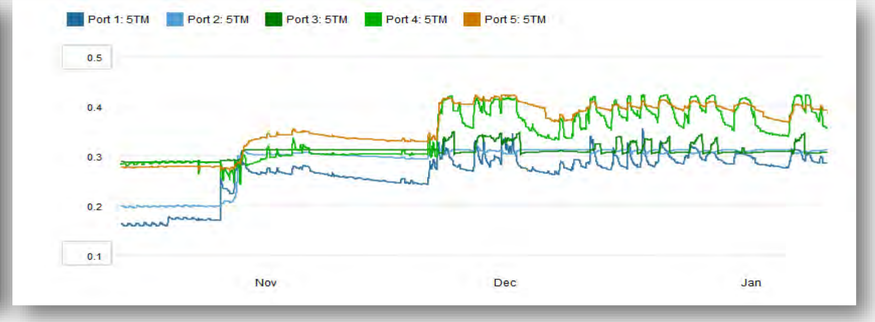
Location #3





Location #4





ENVIRONMENT

LONE ROCK RESOURCES

REMARKS

RESEARCH OUTCOMES

Economic and Environmental Impacts of Tethered Logging

- Understand costs and benefits of cable-assisted steep slope harvesting
  - Productivity and cost
  - Positive and negative impacts
- Understand machine-soil-water interactions
  - Soil disturbance
  - Soil erosion
  - Sediment transport potential

Oregon State University

LONE ROCK RESOURCES

ACKNOWLEDGMENT

Oregon State University

LONE ROCK RESOURCES

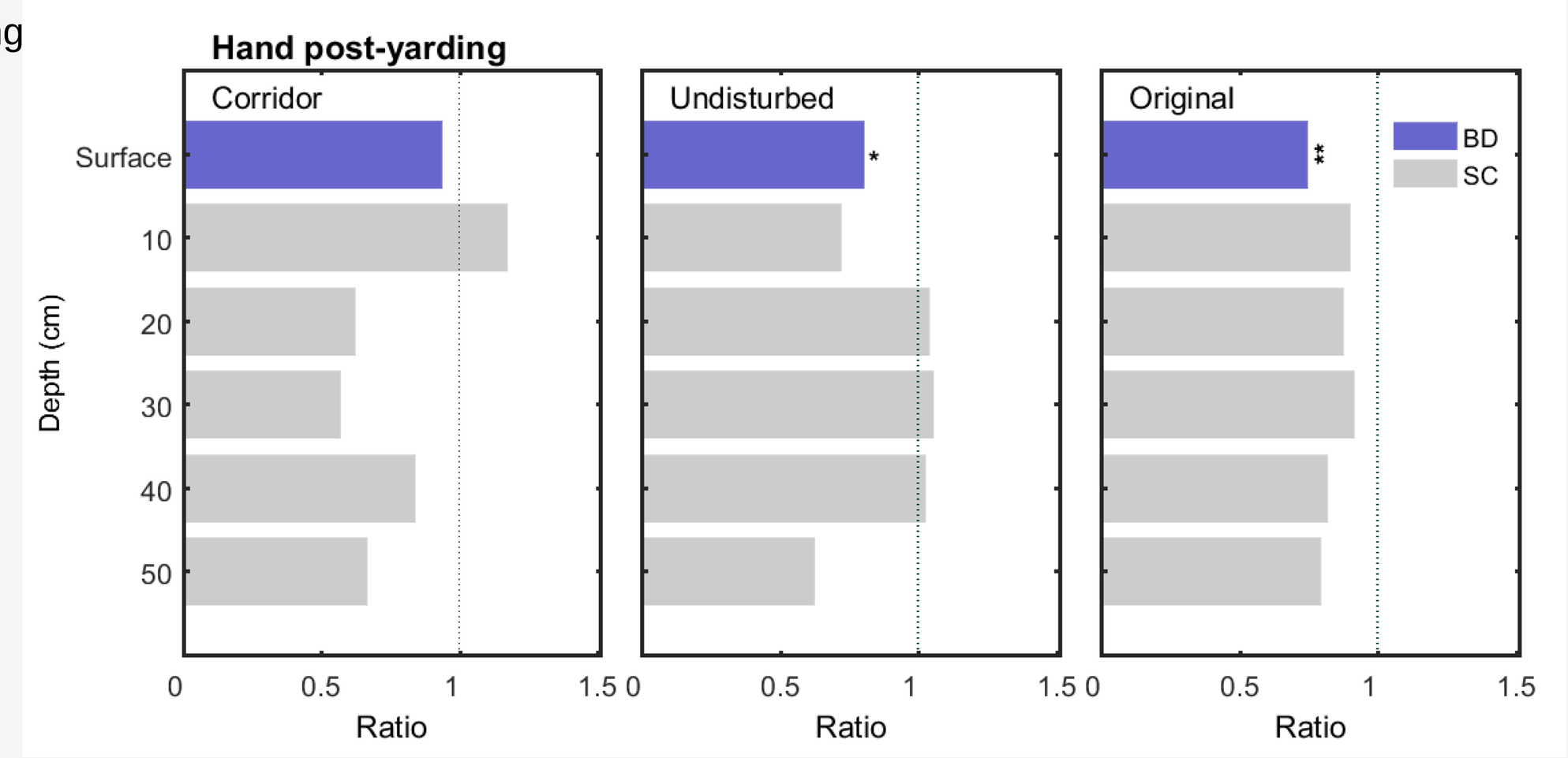
THANKS

WOODY CHUNG

woodam.chung@oregonstate.edu

- Ratio > 1; Compacted soil
- Ratio = 1; No change
- Ratio < 1; Loosened-up soil

Hand post-yarding



* significant at p < 0.05; ** significant at p < 0.005; *** significant at p < 0.001

2019 Western Region COFE Seminar – Improving Forest Harvesting Operations

COFE Western Region

Improving Forest Harvest Operations

January 17, 2019 • Eugene, OR

Agenda

Start Date: January 17, 2019
Location: Valley River Inn, Eugene, OR
THEME: *IMPROVING FOREST HARVESTING OPERATIONS*

Click on any presentation title below to view a pdf of the presentation.

8:15 *Introduction to WR.COFE & Seminar* – **Jeff Wimer**, Chair, WR.COFE & Forest Engineering, Resources and Management Dept., College of Forestry, Oregon State University

SESSION 1: Logging – Steep Slope

8:30 *Tethered Cut-to-length in Western Oregon: A Multi-objective Case Study* – **Preston Green**, Graduate Student, Forest Engineering, Resources and Management Dept., College of Forestry, Oregon State University

9:00 *Tethered logging in Southwest Oregon: A Research Perspective* – **Woody Chung**, Forest Engineering, Resources and Management Dept., College of Forestry, Oregon State University

9:30 *Tethered Logging in Southwest Oregon: A Landowner Perspective* – **Brennan Garrelts**, Lone Rock

10:00 *Peterson Cat update*

10:10 BREAK (Refreshments Provided)

10:40 *Pape' Machinery Update*

10:50 *Grapple Yarding Through the Years* – **Austin Weber**, Weber Logging and Construction Inc.

SESSION 2: Workforce Issues

11:20 *Planning the 2020 Workforce: Growing Our Forest Contract Capacity* – **Rex Storm**, Associated Oregon Loggers

About the Conference

WR.COFE is a regional chapter (western United States and British Columbia) of the COUNCIL ON FOREST ENGINEERING (COFE). COFE is an international professional organization formed to foster the development of forest engineering in industry, government, and education in order to promote the best methods of managing and operating forests, both private and public. COFE serves the forestry profession by disseminating technical information about forest engineering. For more information, see the COFE website at: www.cofe.org

11:50 *Triad Machinery Update*

12:00 LUNCH (Provided)

12:40 *ANNOUNCEMENTS:* Ticket Raffle, OSU Student Scholarship Awards – Jerry Sedlak Memorial Scholarship

13:10 *Blount International Update*

SESSION 3: New Technology

13:50 *Modern Machinery Update*

14:00 BREAK (Refreshments Provided)

14:20 *Fire Fighting on Federal Land* – **Mike Robinson**, Coos Forest Protective Association

SESSION 4: Technological Innovation in Forestry

14:50 *Computer Vision for Real-Time Tree Detection and Measurement* – **Woody Chung**

SESSION 5: Roads

15:20 *Rock Economics* – **Scott Hoffine**, Roseburg

15:50 *Road Construction in Forest Activities: The Safety Issues Related to Road Construction* – **Larry Fipps**, Oregon Occupational Safety and Health Administration

16:20 *Wrap-Up and Evaluation* – **Jeff Wimer**

Upcoming Conferences And Workshops

2020 North American Forest and Conservation Nursery Technology Webinar Series: FREE

Start Date: August 5, 2020
End Date: September 23, 2020
Conference Location: Webinar Series

Western Forestry & Conservation Association
4033 SW Canyon Road
Portland, OR 97221