Tethered Logging Briefing

Board of Forestry Meeting
March 5, 2025

Josh Barnard, ODF Forest Resources Division Chief
Scott Swearingen, ODF Field Support Unit Manager
Adam Coble, ODF Water Quality & Monitoring Manager
Guest Panel: Amanda Sullivan-Astor, Woodam Chung, Marc Cannon

Context

"Pursuant to the authority granted by ORS 527.710 and subject to the procedures set forth in ORS 527.714 for rules described in ORS 527.714 (1)(c), not more than three years after the effective date of this 2022 Act, the State Board of Forestry shall initiate rulemaking concerning tethered logging."

\- *Senate Bill 1501, Sec. 7 (2022)*

Tethered Logging

The use of cable winch systems on ground-based equipment to operate on slopes.

Intersection w/ Forest Practice Rules

- A Plan For Alternate Practice (PFAP) is required for the operation of ground-based equipment:
  - when locating skid trails within 100 feet of a stream channel on steep or erosion-prone slopes
  - on high landslide hazard locations (HLHLs), and are only approved when there is no downslope public safety risk

- PFAPs with specific protection measures are subject to approval

- Recent rule updates: Equipment Limitation Zones (ELZs) and increased stream buffers

Scope of Tethered Logging in Oregon

- Preliminary Analysis

- Looking Forward

Guest Panel

- Amanda Sullivan-Astor, Forest Policy Manager for Associated Oregon Loggers
- Woodam Chung, Professor of Forest Engineering at Oregon State University
- Marc Cannon, Willamette Valley Region Manager for Weyerhaeuser

Board Discussion

- Questions on information presented today?

- Does the Board need additional information? If so, what type of information?

- Discuss interest in pathways:
  - Utilize the adaptive management process to gather more information to inform future decision making
  - Direct the Department to gather additional information to inform future decision making

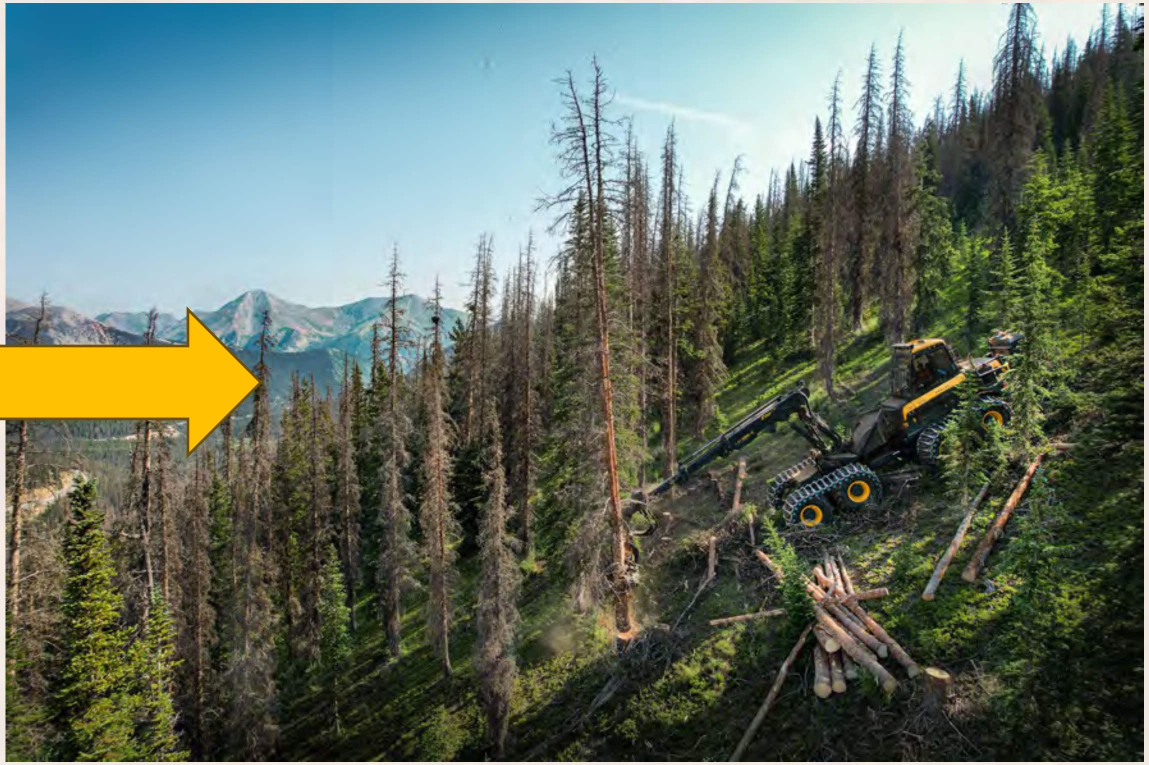
Tethered Logging Operations

Amanda Sullivan-Astor, CF
Forest Policy Manager

Key Takeaways

- Common
- Many Configurations & Use Cases
- Environmental Benefits
- Highly Skilled
- Safe

Technology Adoption



Rude Logging

Mineral Creek Logging

Lone Rock Logging

Huffman & Wright Logging

Dean Logging

Dean Logging

Miller Timber Services

Video

Weber Logging

Dancer Logging

Plikat Logging

Dean Logging

Dean Logging

Tioga Logging

Video

ASSOCIATED OREGON LOGGERS, INC.

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Amanda Sullivan-Astor, CF
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Associated Oregon Loggers
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Tethered Logging Soil Impacts

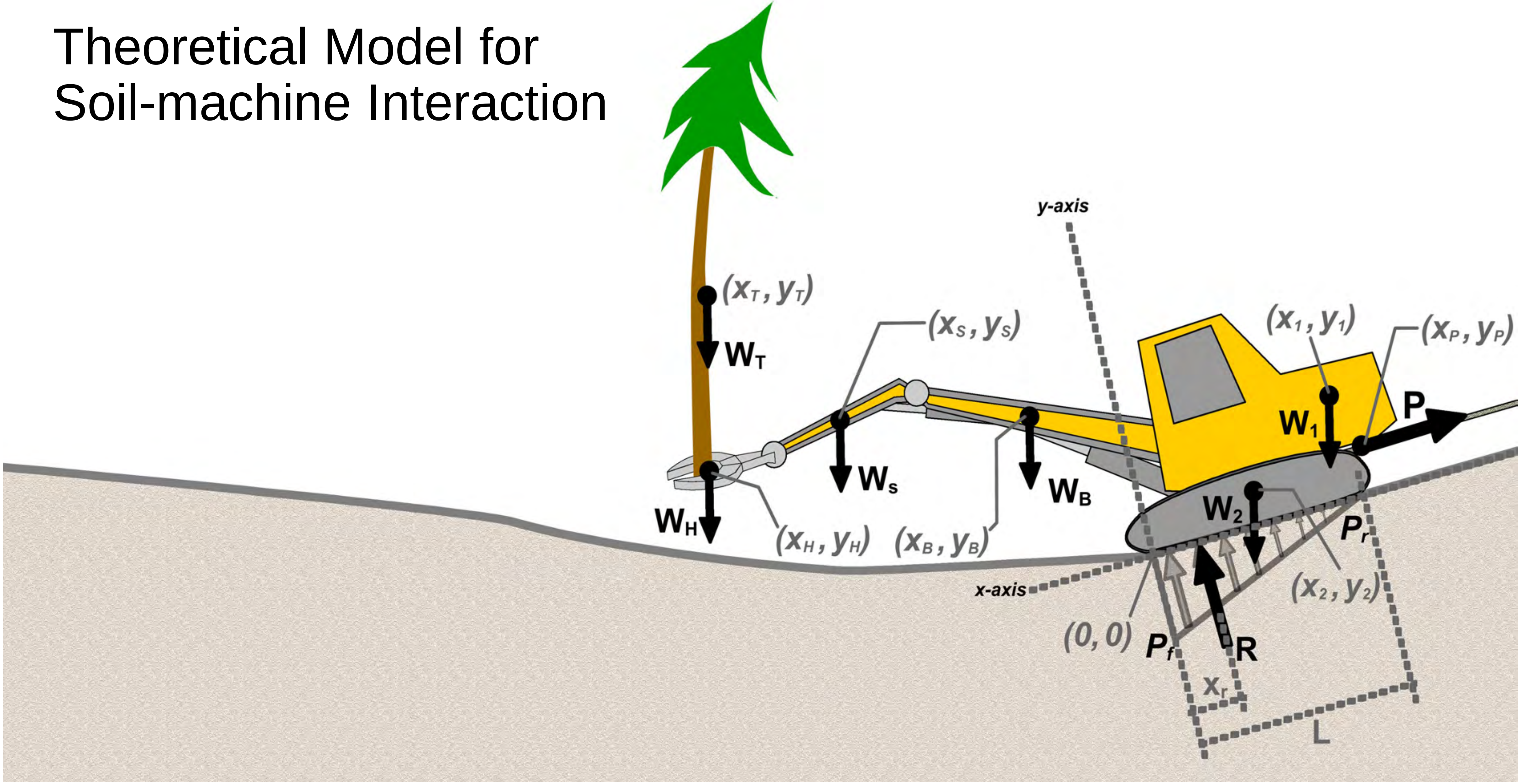
Woody Chung

Oregon State University

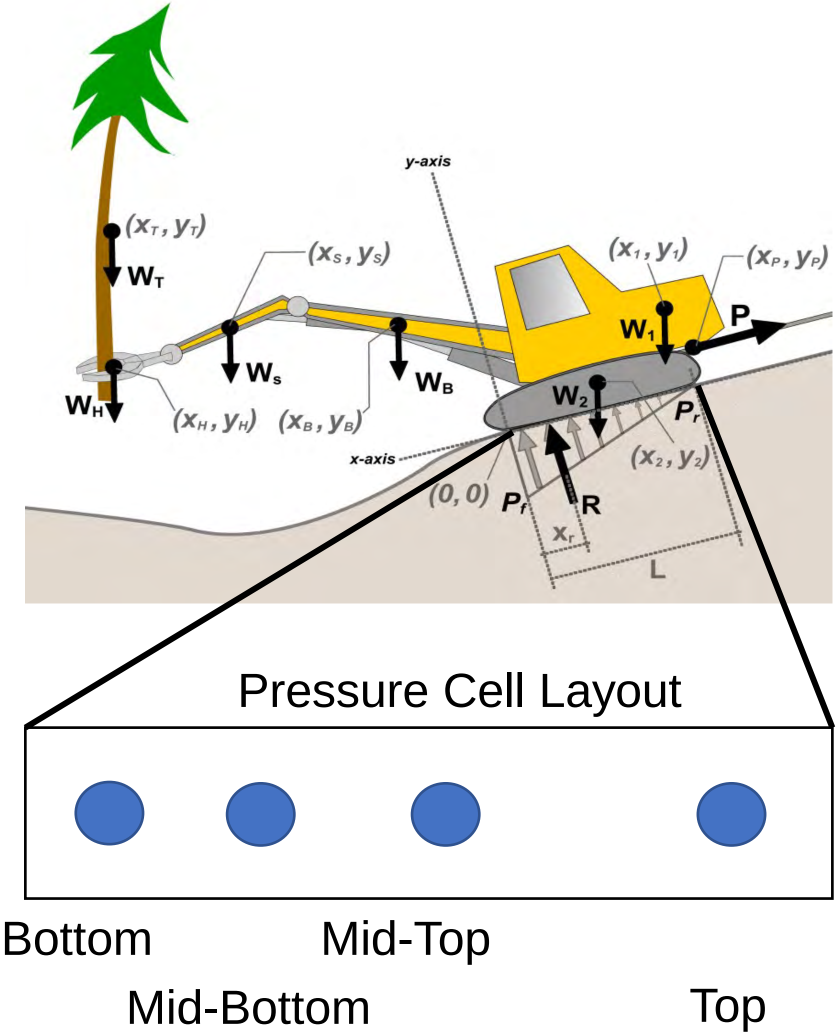
Contents

- Benefits of Tethering on Ground Pressure
  - Field experiment
- Soil Impact Case Studies
  - Cut-to-length system in Western Oregon
  - Whole-tree system in Southern Oregon
  - Whole-tree systems in Northern Idaho

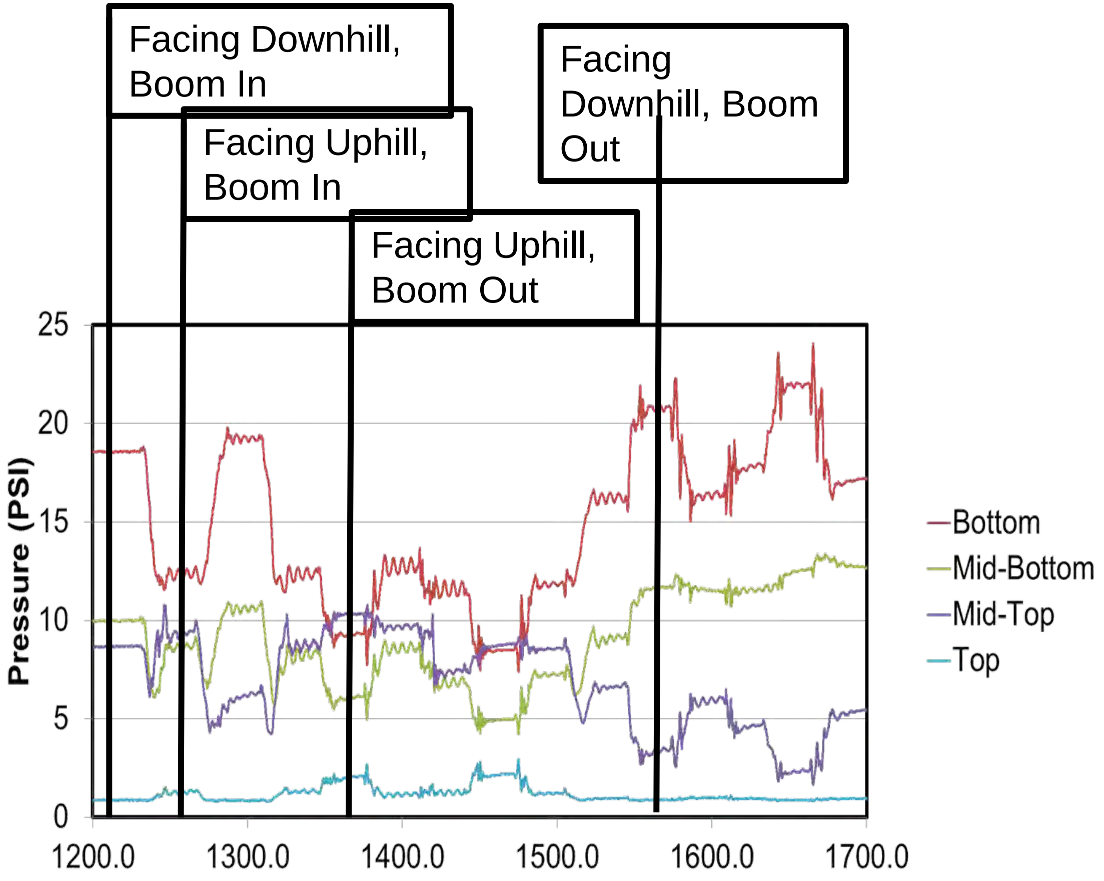
Theoretical Model for Soil-machine Interaction

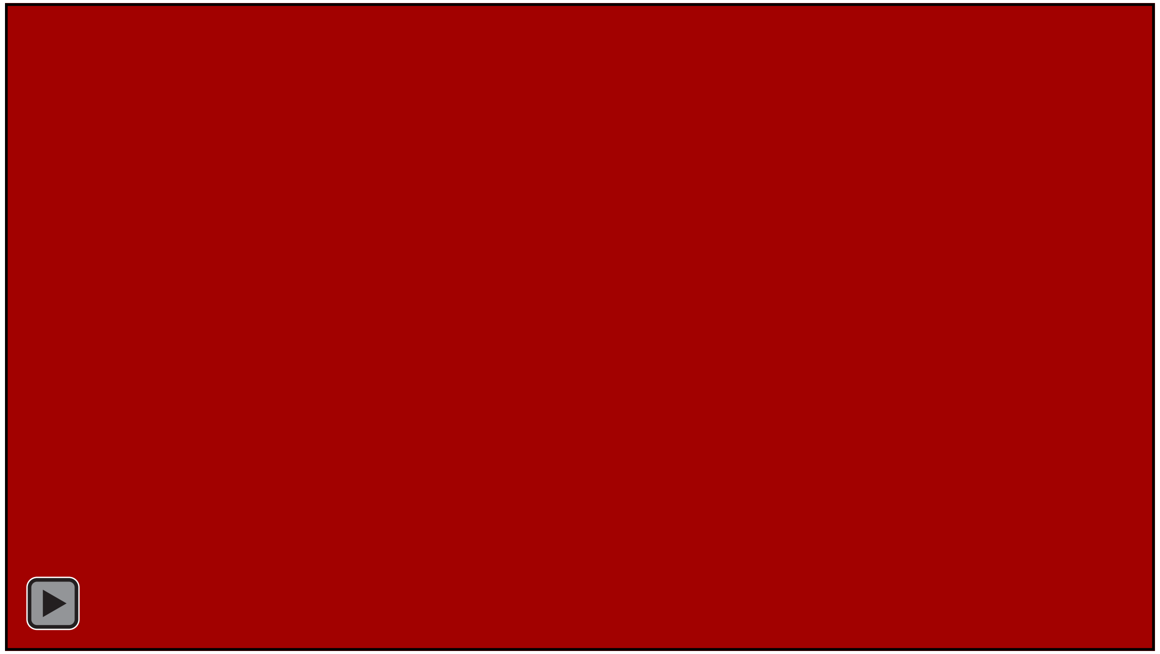


Ground Pressure Field Testing



Ground pressure

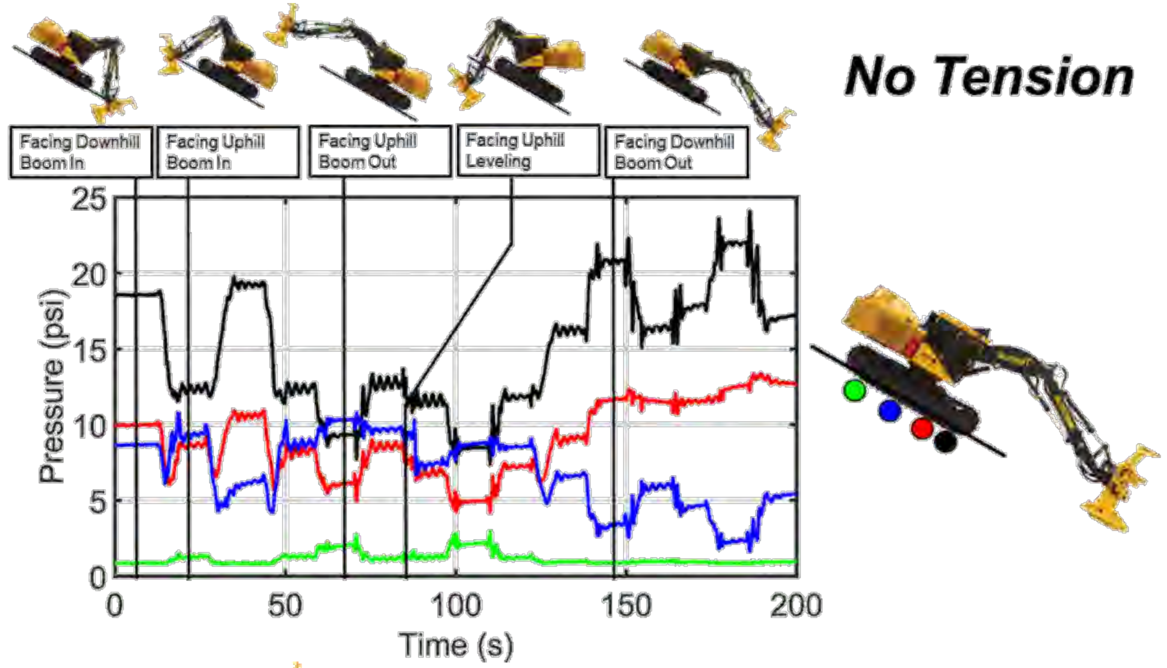


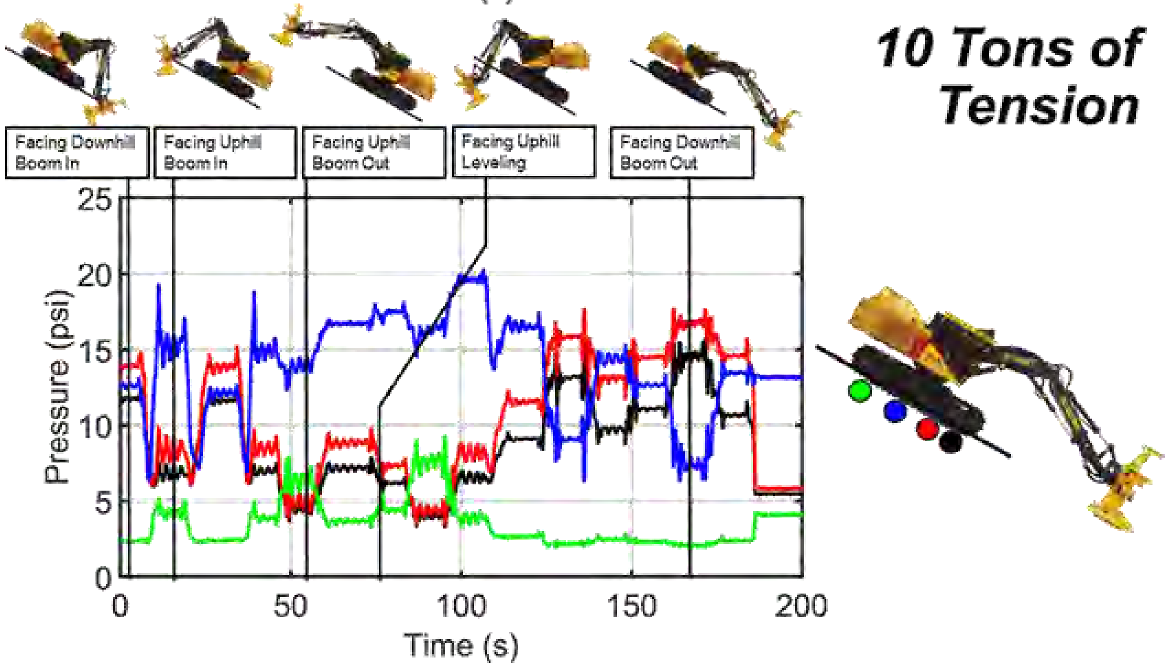


Results

Key Findings

- Better distribution of the load
- Decreased peak pressure – less soil disturbance
- Better engagement of track – Improved traction, more stable



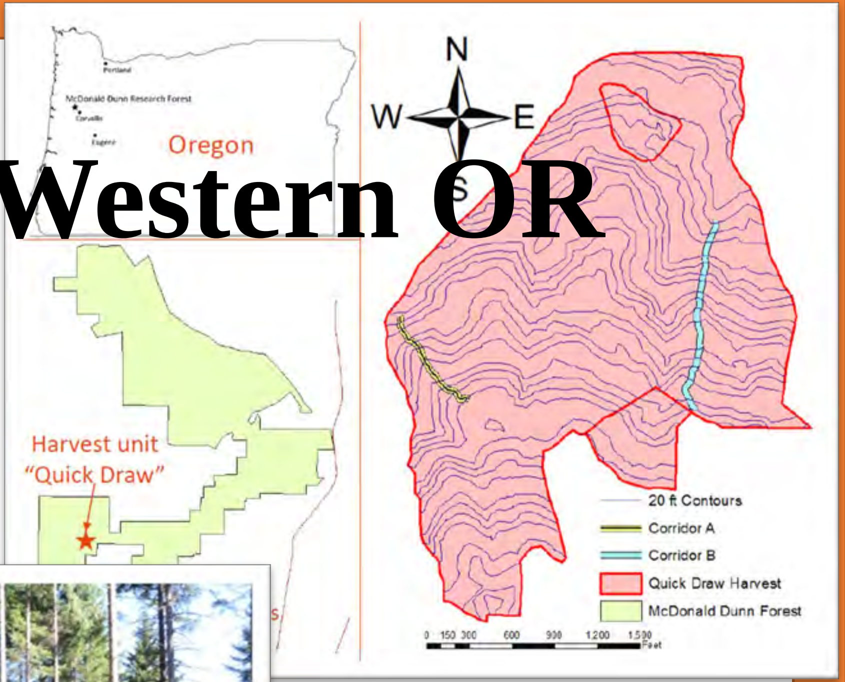


Case Studies

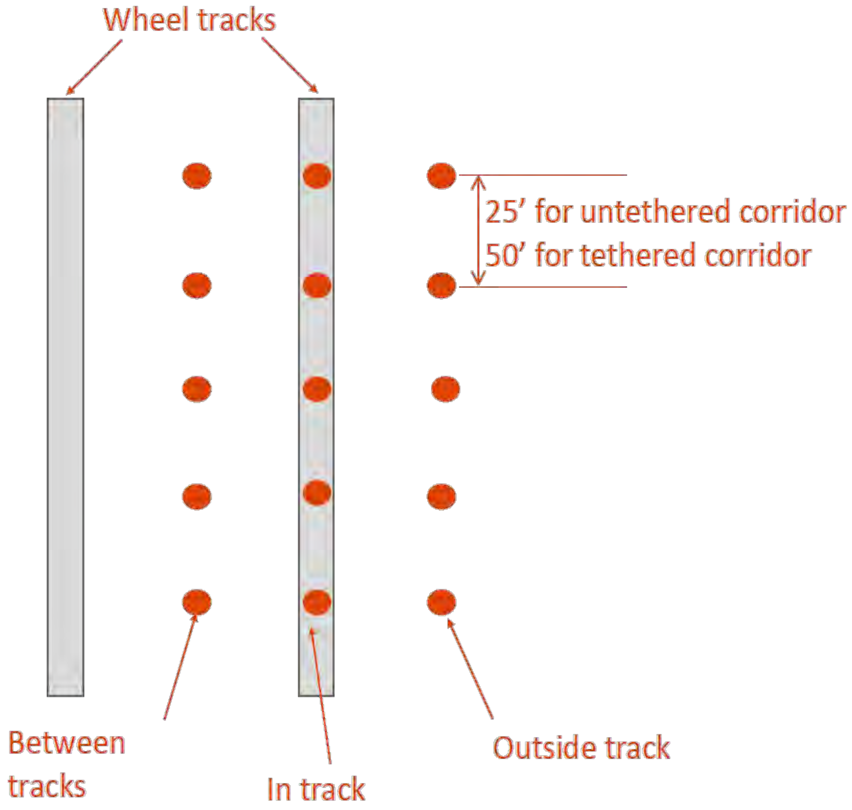
- Cut-to-length system (Western OR)
  - Analyze the effect of tethering on soil compaction by comparing pre- and post-logging soil conditions.
- Whole-tree system (Southern OR)
  - Compare manual timber felling with tethered machine felling.
  - Assess soil compaction, erosion, sediment transport, soil moisture content, and seedling growth
- Whole-tree systems (Northern ID)
  - Evaluate soil compaction from different tethered logging systems.
  - Assess soil compaction, erosion, and sediment transport

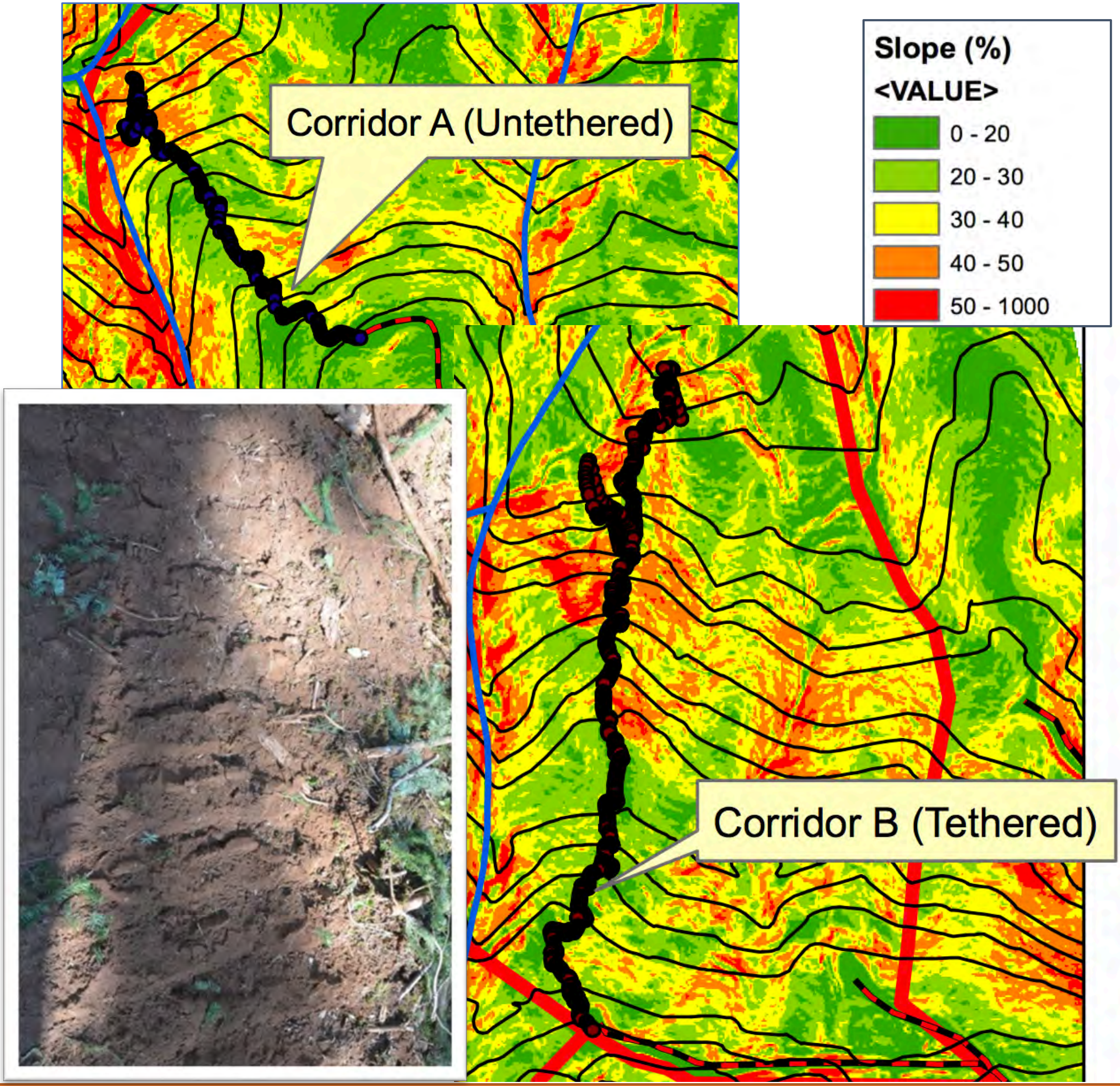
Field Case Study #1 – CTL in Western OR

- OSU Research Forest
- Thinning operations with tethered cut-to-length system (PONSSE Bear and Elephant King)
- 142 acre, 60-year old Douglas-fir stand
- Average 14” DBH, 108” tall
- Clay soils, well drained
- August 2017, dry season
- Tethered vs. untethered comparison



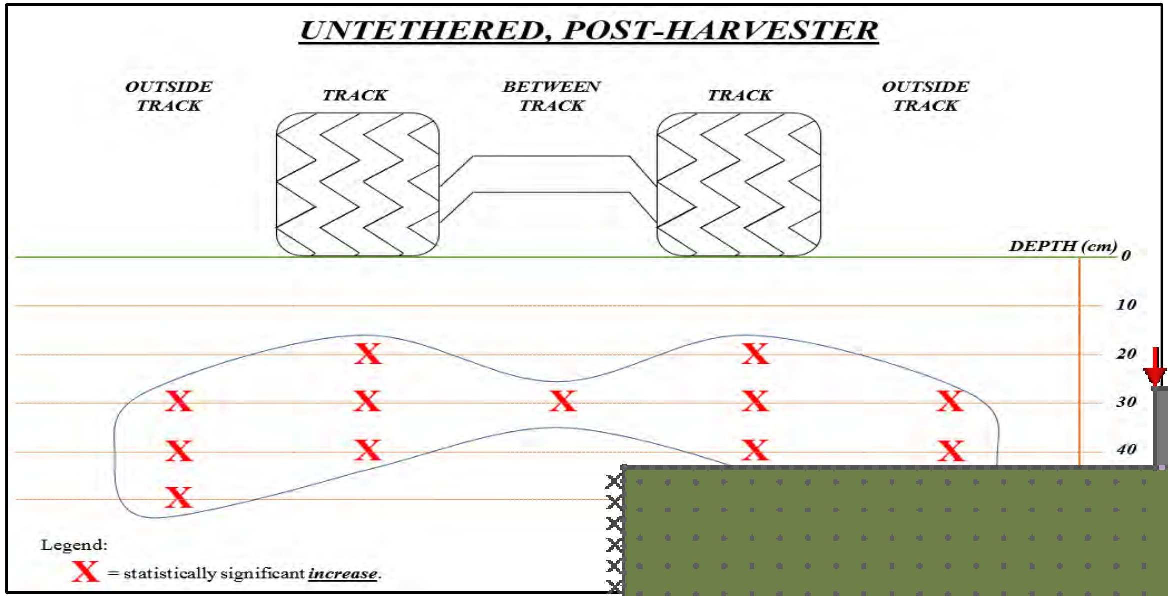
- Soil measurements before harvest, after cutting and after forwarding
- Bulk density, penetration resistance at multiple depths (10-50cm)
- Between machine wheel tracks, in the wheel tracks, and outside tracks

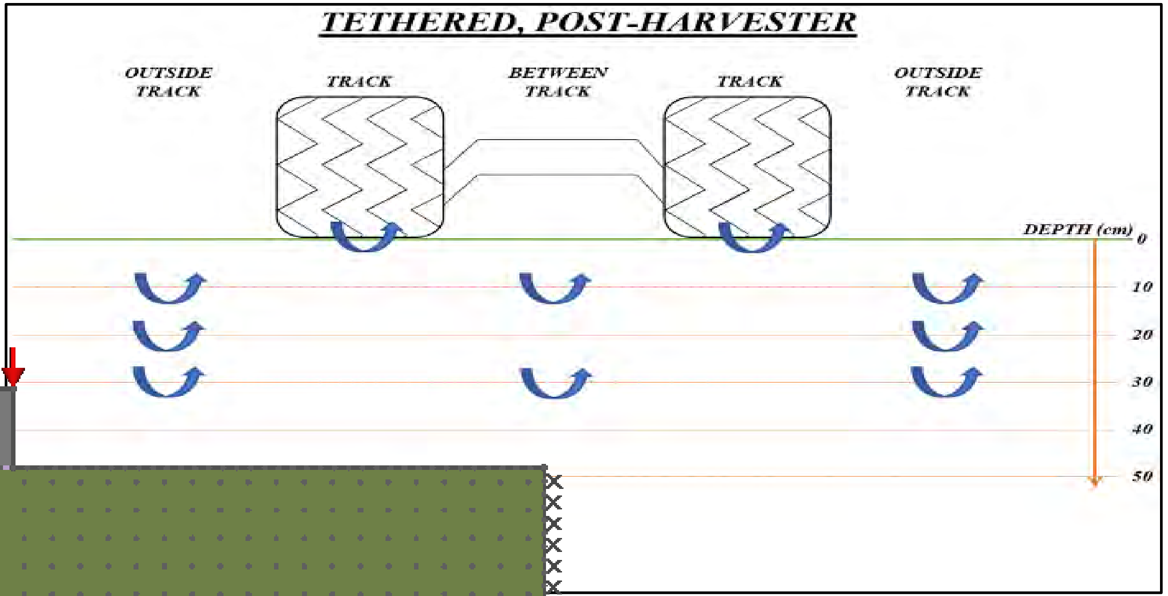


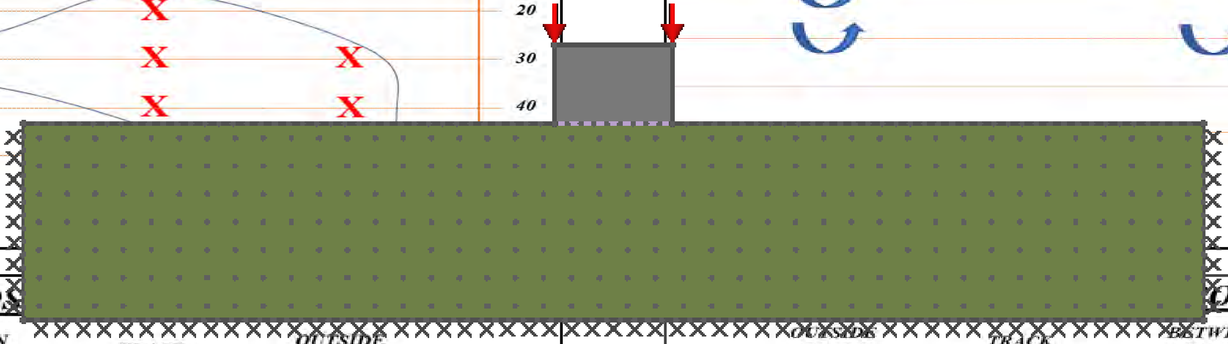


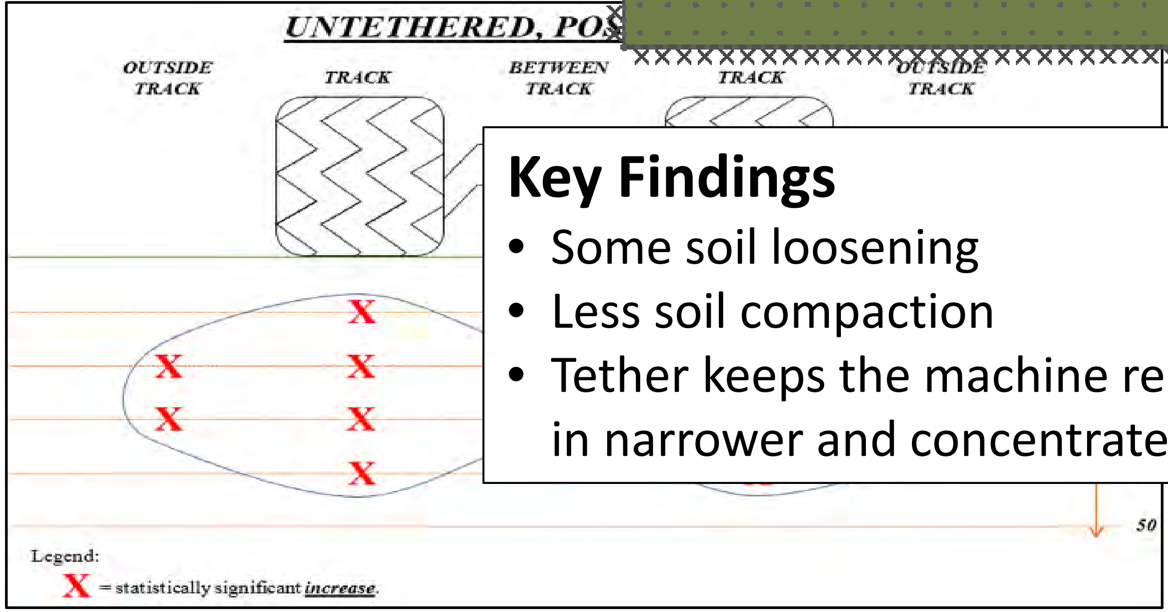
Untethered

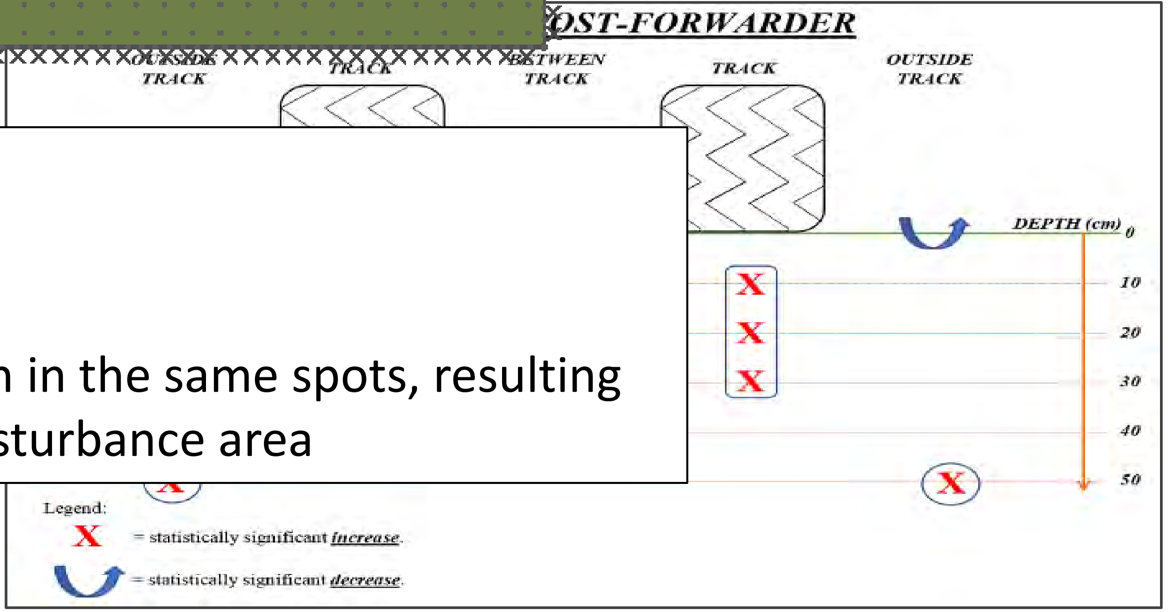
Tethered









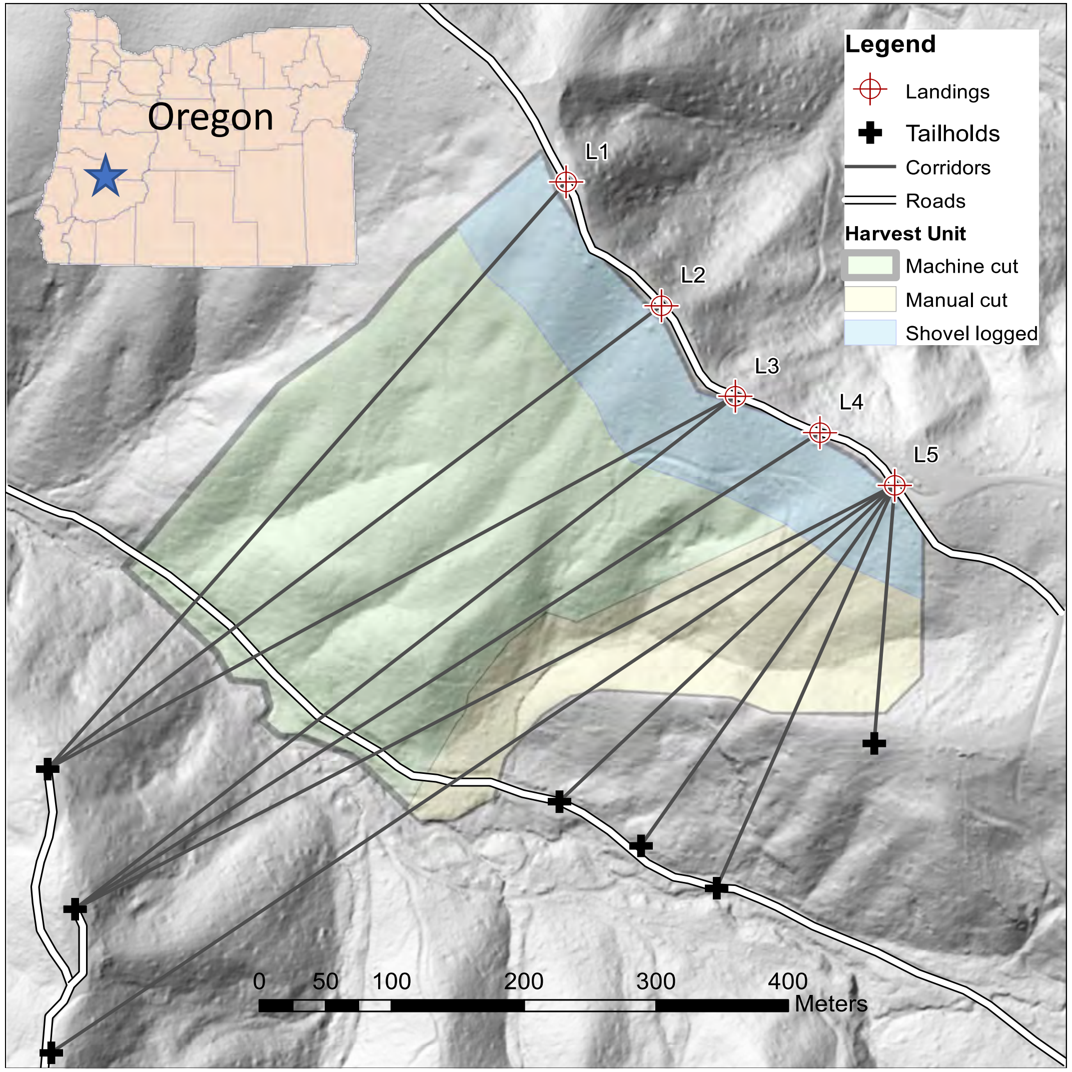


Key Findings

- Some soil loosening
- Less soil compaction
- Tether keeps the machine remain in the same spots, resulting in narrower and concentrated disturbance area

Field Case Study #2 – WT in Southern OR

- Sutherlin, OR
- 42-acre clearcut
- Average ground slope: 35%
- 200 TPA @ 220 bf per tree
- March - April 2018
- Tethered feller-buncher
  - Comparison between mechanized (25 acres) and manual timber falling (10 acres)
- Immediate soil response after harvesting
- Subsequent impact on soil erosion and plant growth



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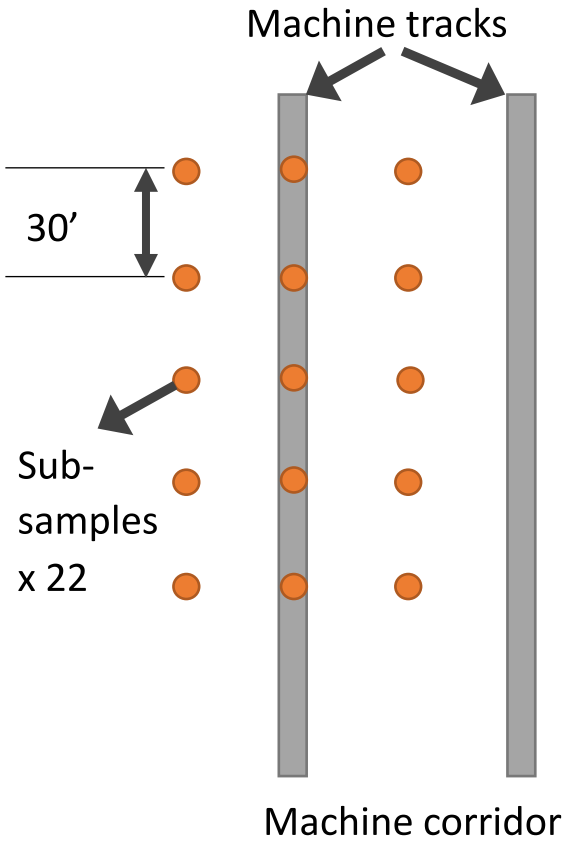
Pre- and post-harvesting



Between machine tracks,
in the tracks, and
outside tracks

Immediate soil response

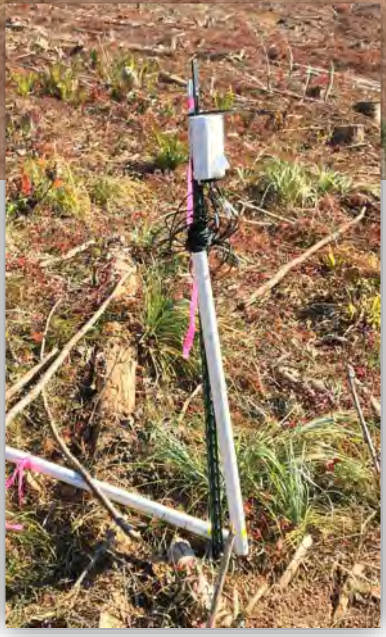
- Bulk density
- Soil penetration resistance
- Soil moisture contents

Erosion and sediment potential

- Erosion fences
  - Potential soil erosion
  - Sediment transport

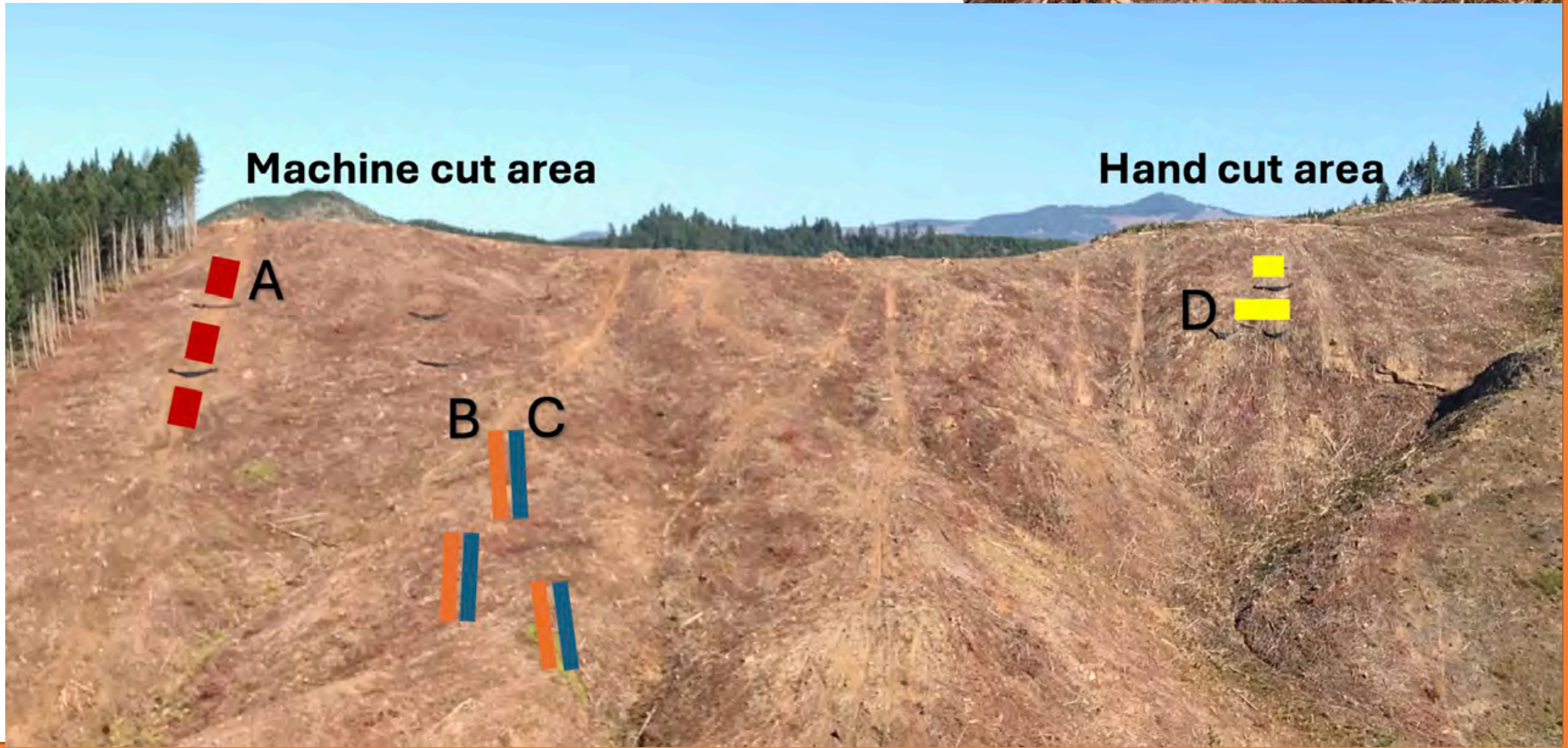
Erosion and sediment potential

- Soil moisture monitoring
  - Track vs. undisturbed (within 10 ft apart)
  - 4 locations, 5 depths (10-50cm)



Seedling growth

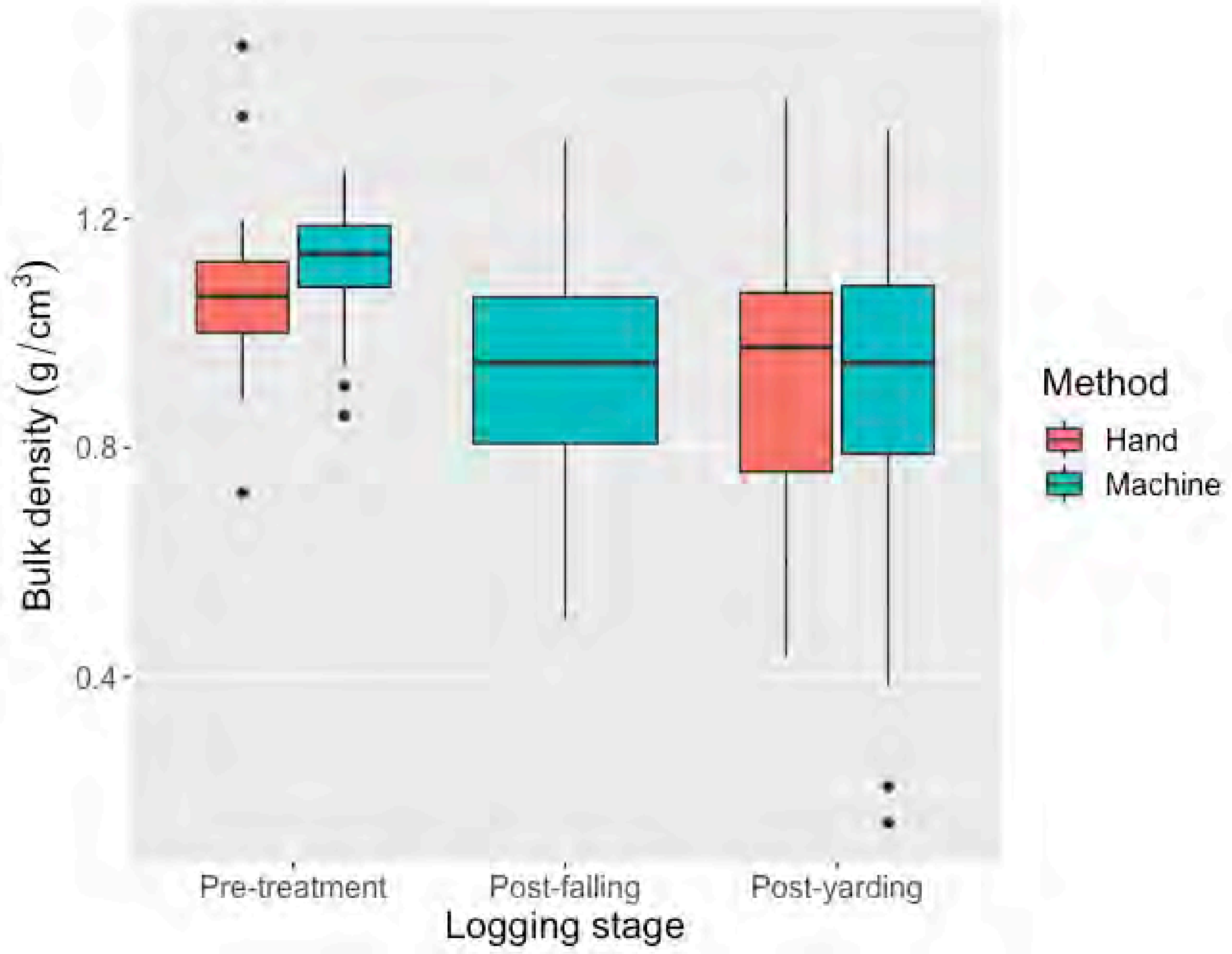
- Planted seedlings
- Machine cut area: 3 blocks (A)
- Hand cut area: 2 blocks (D)
- Track vs. undisturbed: 3 blocks (B and C)
- Pre and post growing seasons in 2019 and 2020
- Measurements
  - Above ground dry mass
  - Shoot volume
  - Root dry mass
  - Root volume
  - Stem length
  - Root collar diameter



Results

Surface Soil Bulk Density (g/cm3)

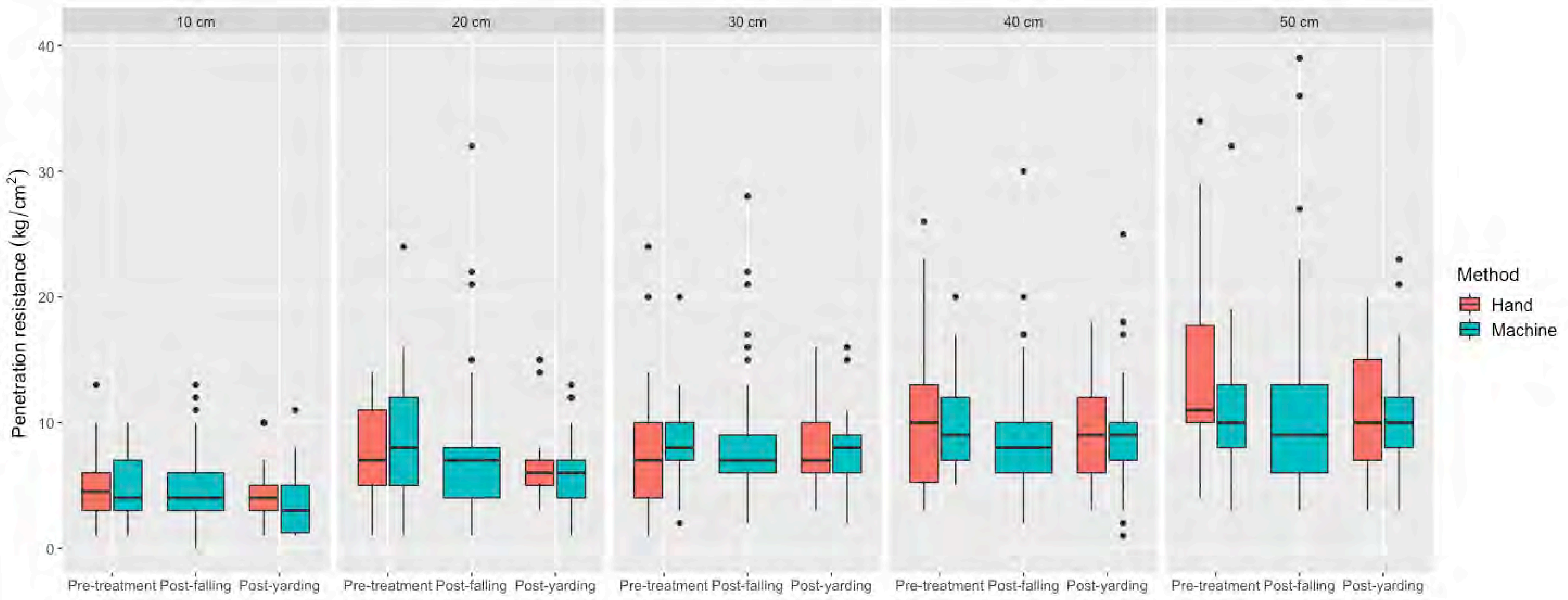
- Minimal to no compaction and possible loosening of soil



Results

Soil Penetration Resistance (kg/cm2)

- Minimal to no compaction and possible loosening of soil
- No significant difference between hand and machine cut



Results

Observed soil disturbance

- More intense soil disturbance in machine cut area
- Less amount of area disturbed in machine cut area

Results

Soil erosion and sediment transport

- No sign of soil erosion or sediment transport observed during the 2-year period after logging

Results

Soil moisture machine track vs. undisturbed

Oct. 2018 – Jun. 2020

Machine Track

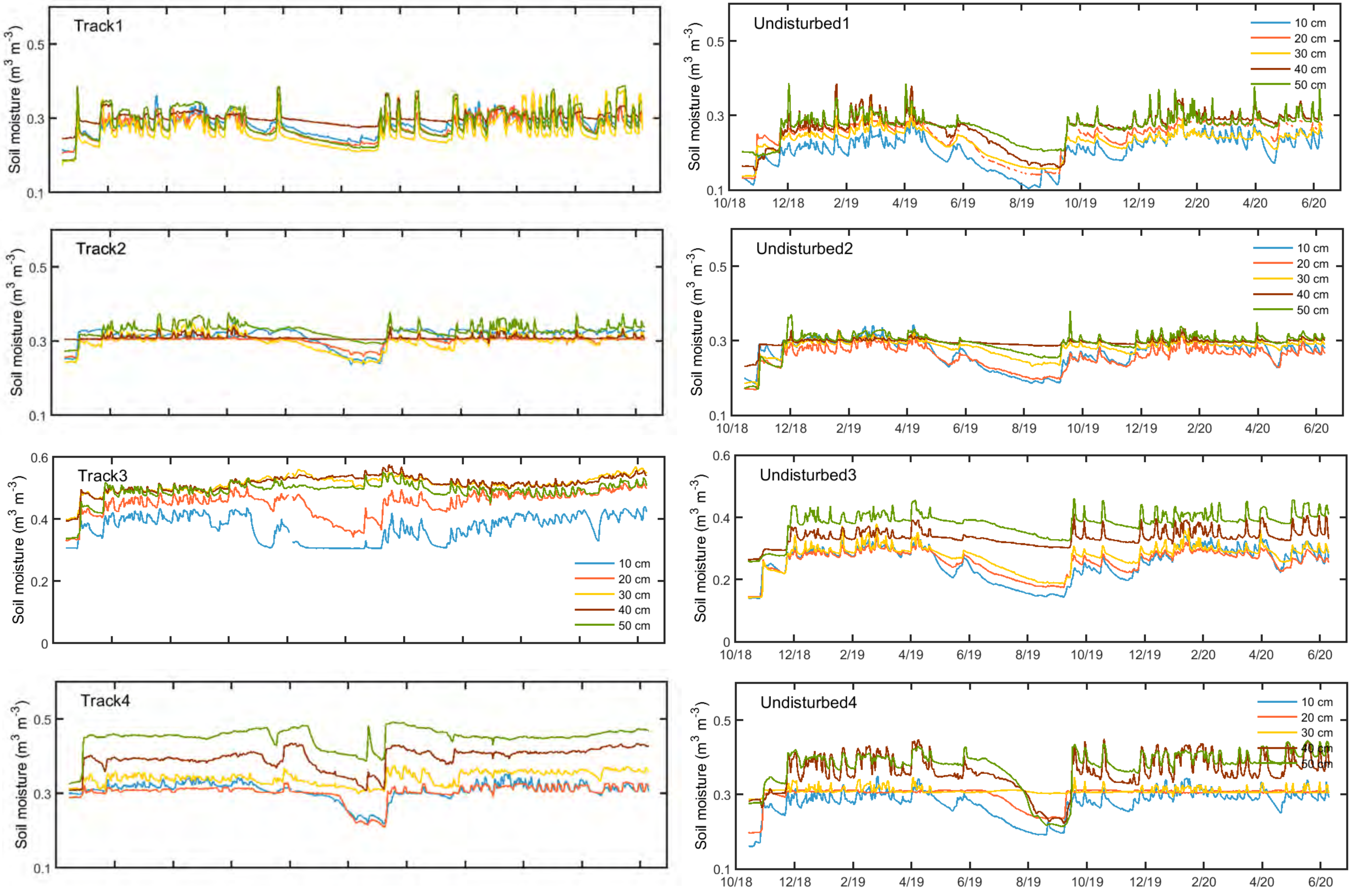
Undisturbed

Location #1

Location #2

Location #3

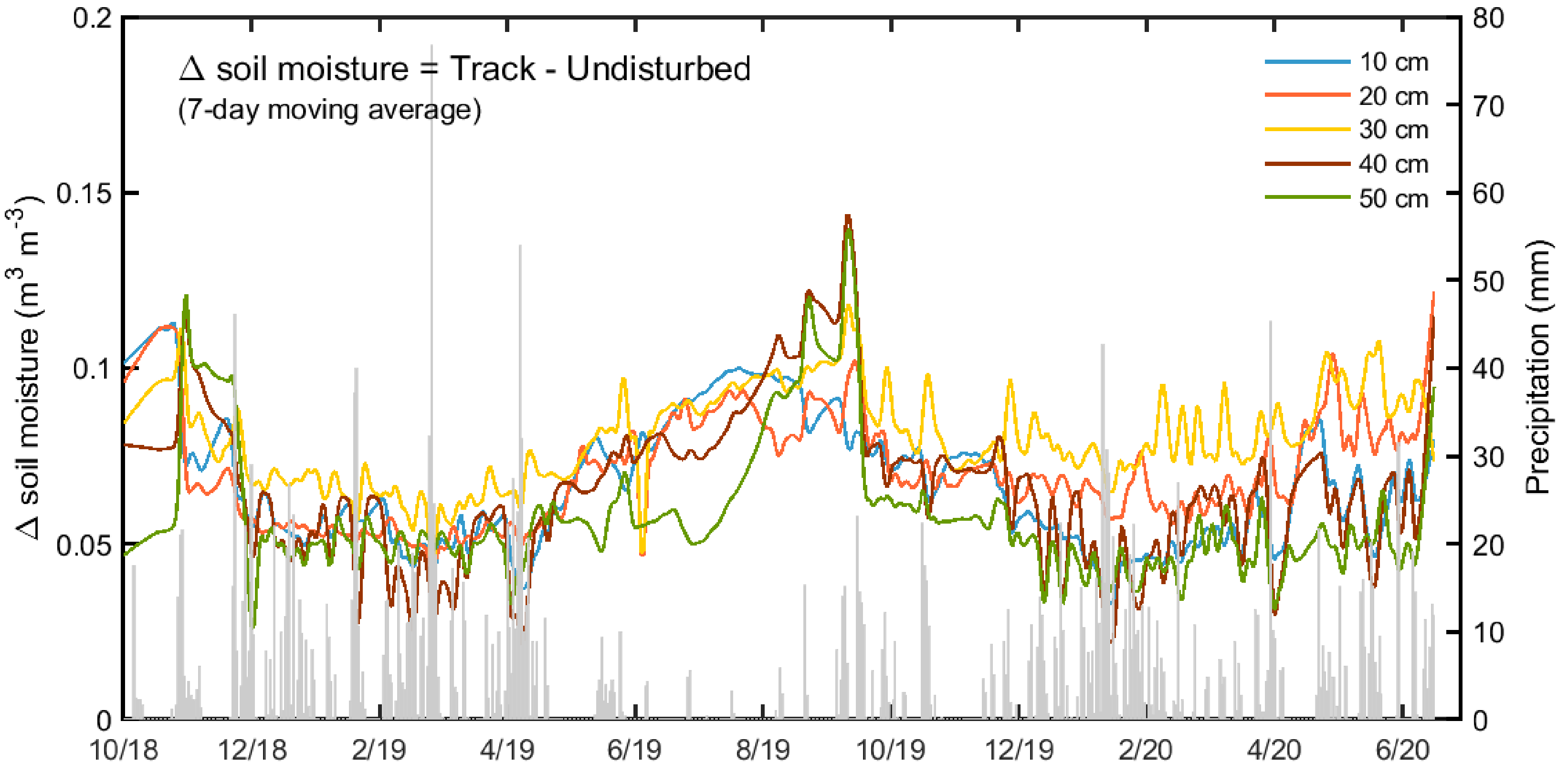
Location #4



Results

Soil moisture track vs. undisturbed

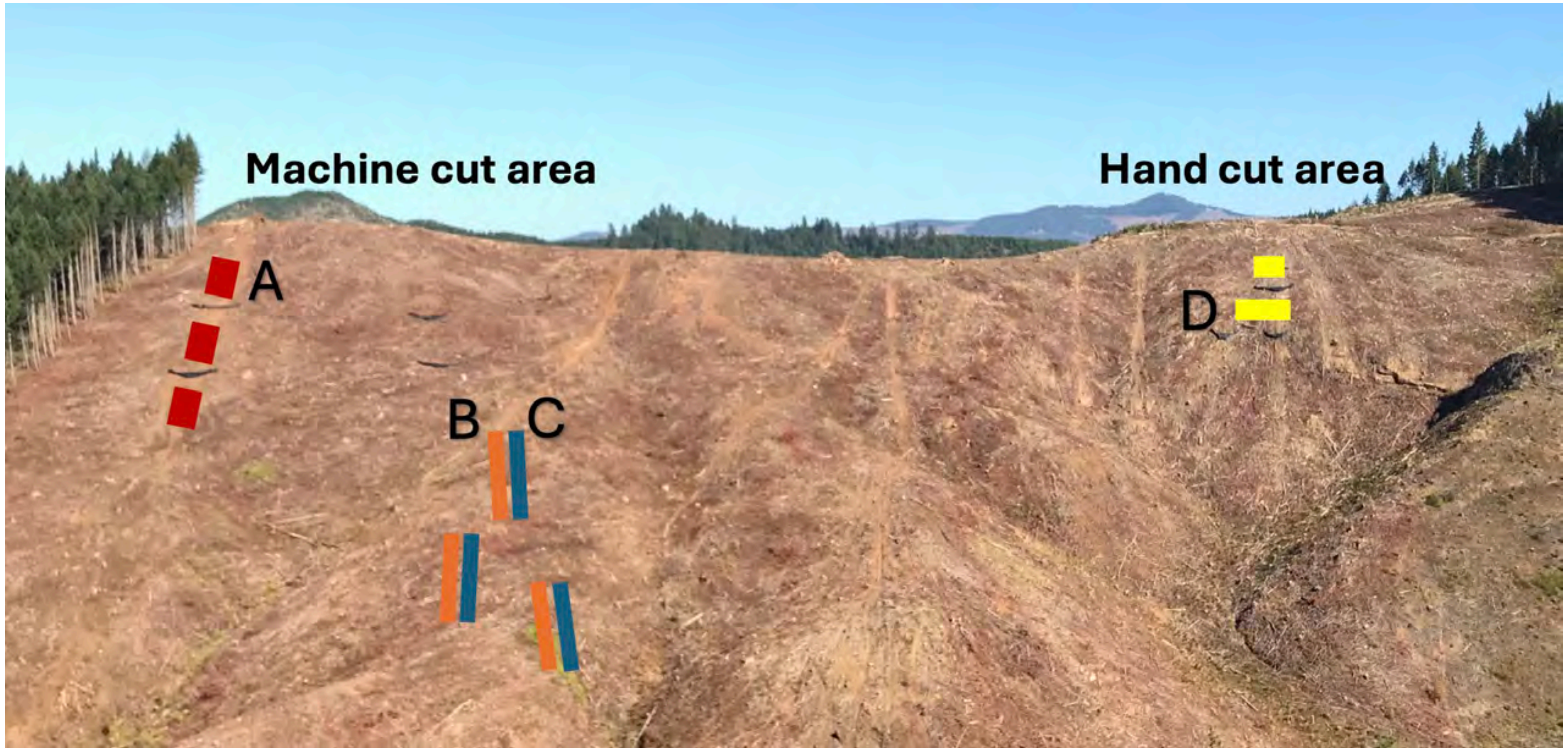
Oct. 2018 – Jun. 2020

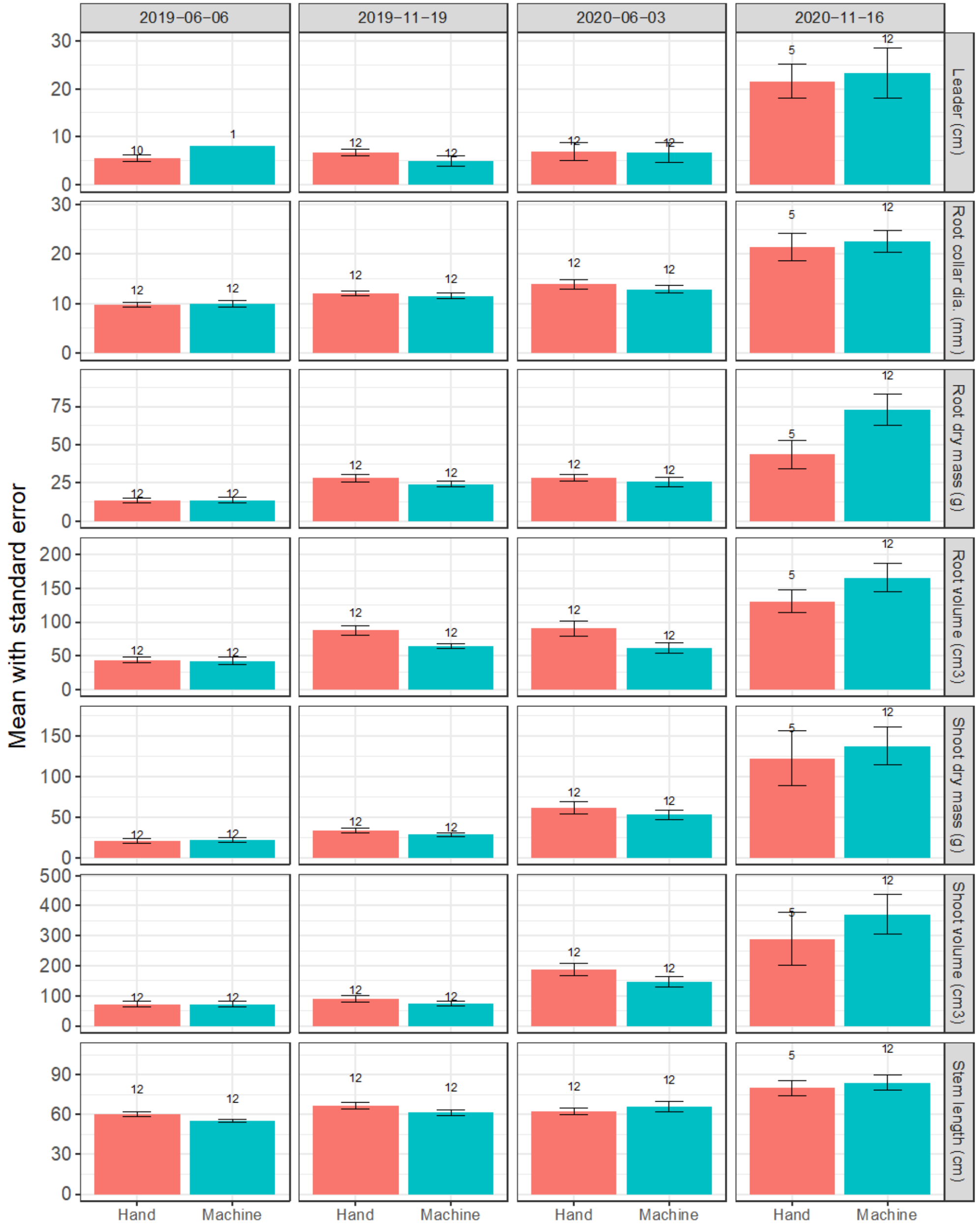


Results

Seedling growth

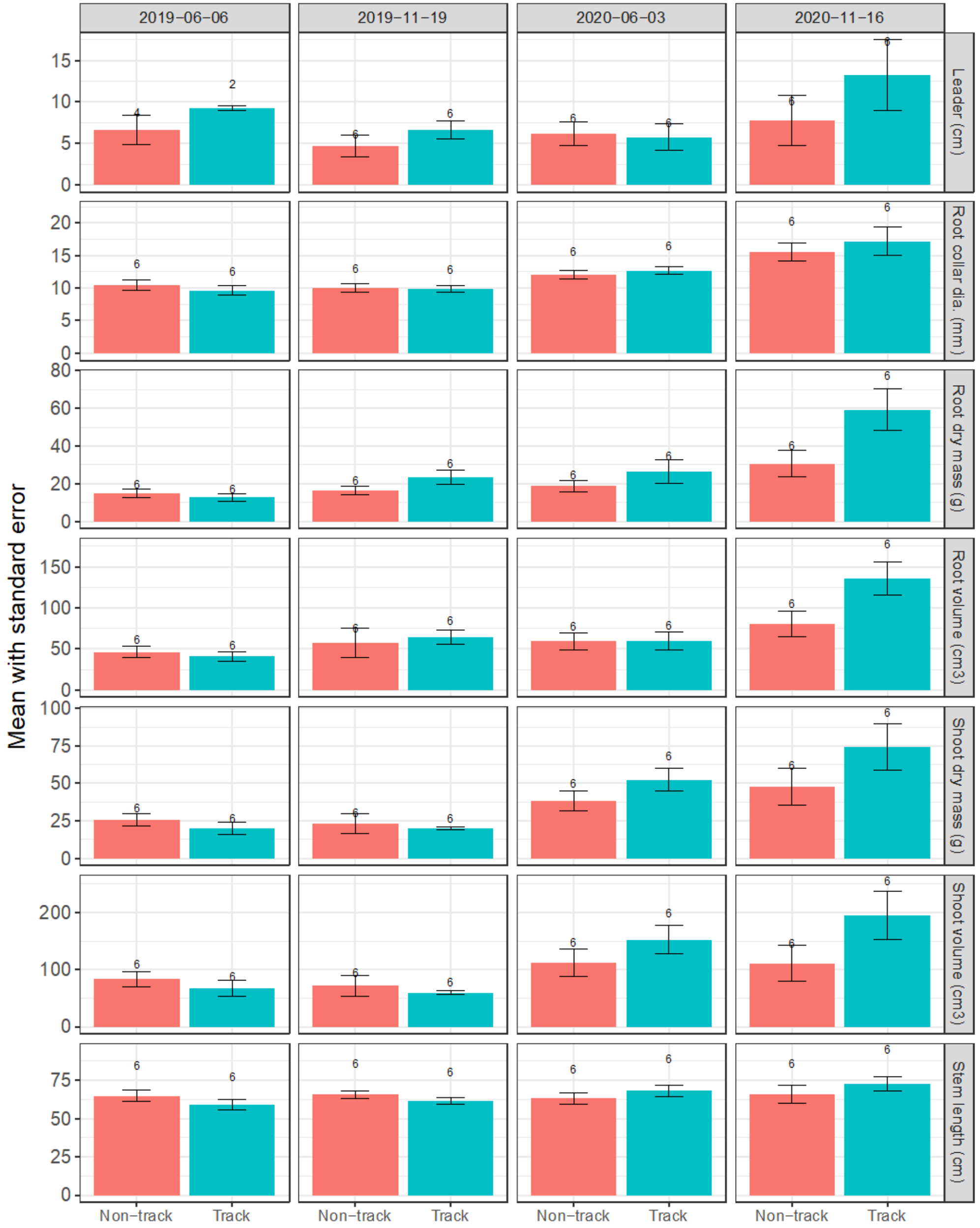
- Machine vs. hand cut
- Track vs. undisturbed





Machine vs. hand cut

Track vs. undisturbed

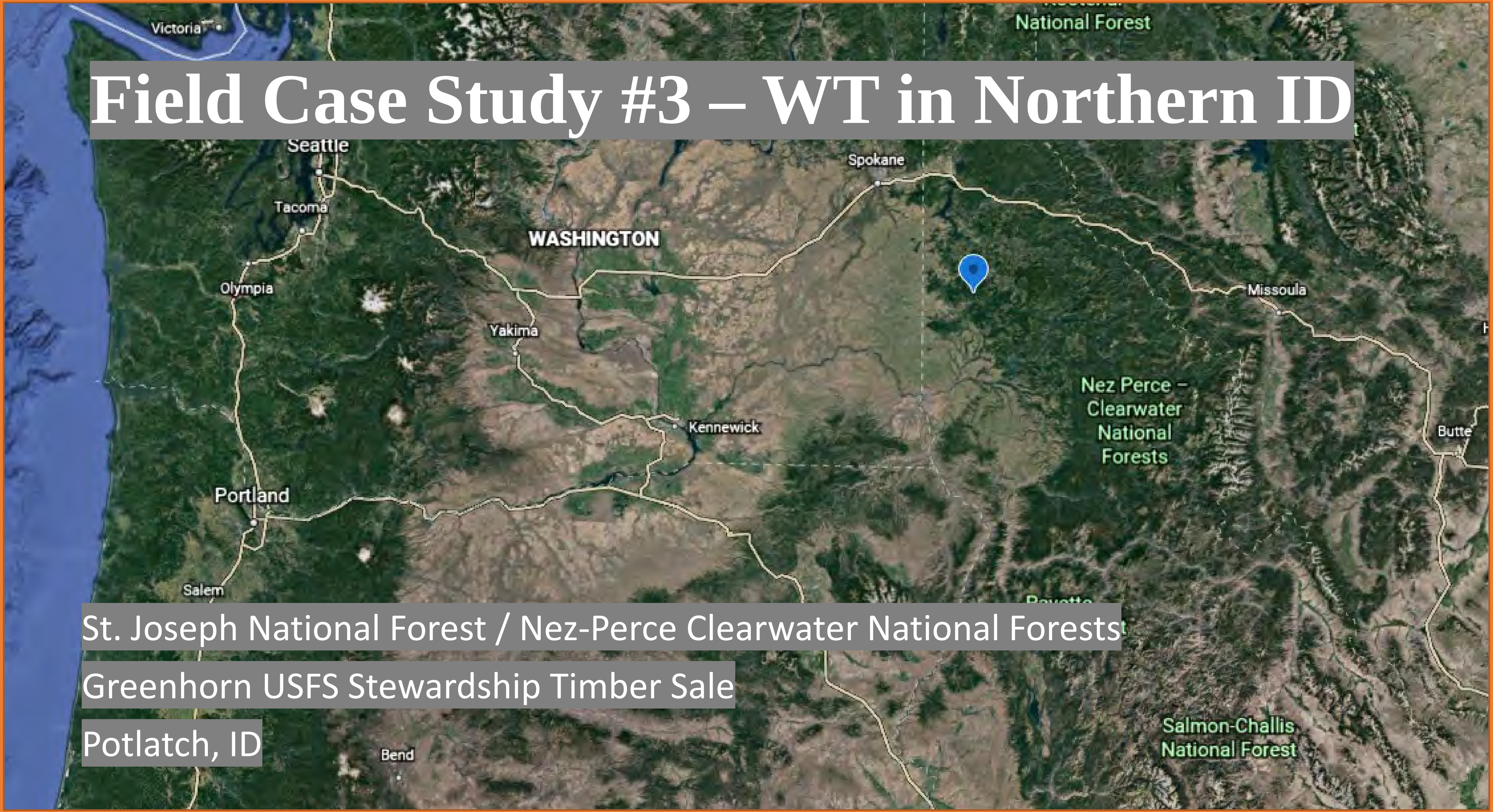


Results – WT in Southern OR

Key Findings

- No significant difference in soil compaction between conventional hand falling and tethered falling/bunching
- More intense disturbance vs. larger area of disturbance
- No soil erosion and sediment transport
- Higher soil moisture in the machine tack, benefiting seedling growth

Field Case Study #3 – WT in Northern ID



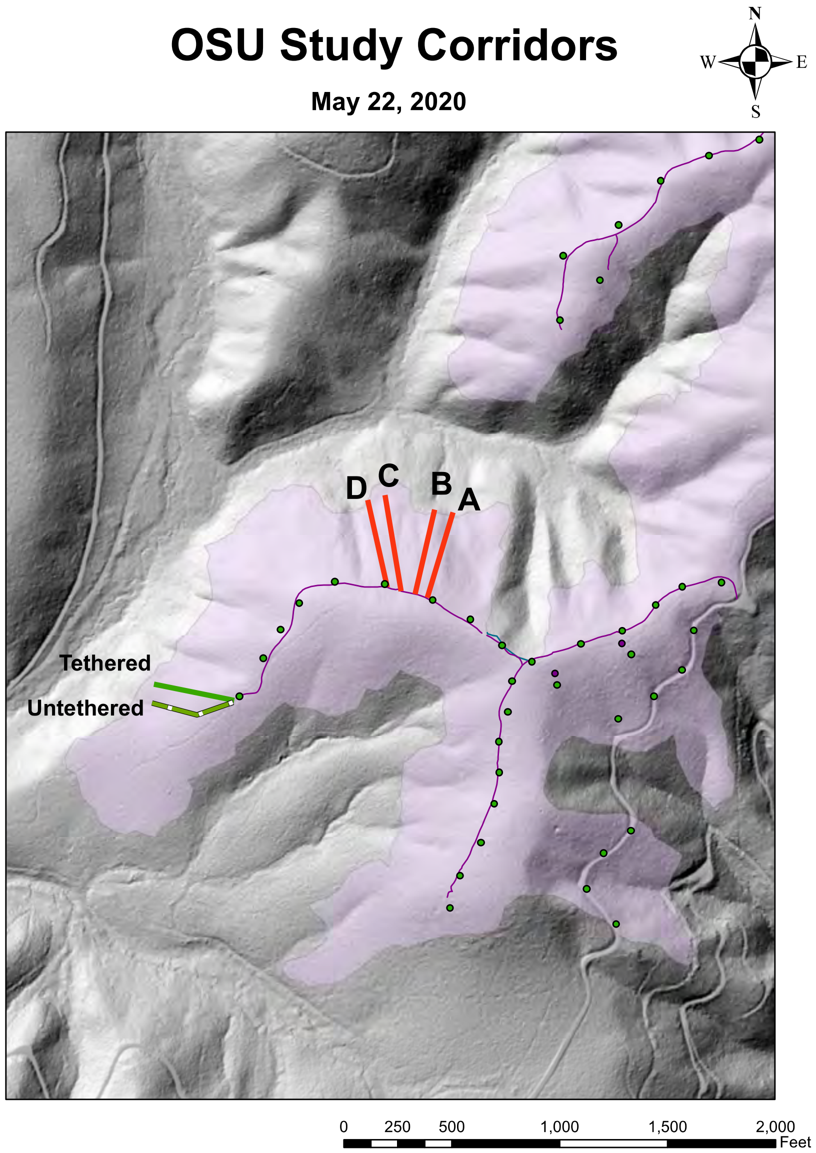
St. Joseph National Forest / Nez-Perce Clearwater National Forests

Greenhorn USFS Stewardship Timber Sale

Potlatch, ID

OSU Study Corridors

May 22, 2020



Corridor	Falling	Yarding	Length (ft)	Width (ft)	Avg Slope (%)
A	Tethered FB	Tethered Skidder	427	60	39
B	Tethered FB	Tethered Shovel	421	60	38
C	Hand Falling	Cable Logging with Chokers	512	60	37
~~D~~	~~Tethered FB~~	~~Cable Logging with Grapple Carriage~~	~~501~~	~~60~~	~~39~~

Results: Pre vs. Immediate Post

Key
↑ : Increased Compaction
↓ : Decreased Compaction
* : P-Value < .05
** : P-Value < .01
***: P-Value < .001

	Corridor A Tethered Cut Tethered Skidder	**Corridor B** Tethered Cut Tethered Shovel	**Corridor C** Hand Cut Yoder & Chokers
0cm-6cm (BD)	↓	↓ *	↓ ***
10cm	↑ **	↓	↓
20cm	↑ ***	↑ **	↓
30cm	↑ ***	↑	↓
40cm	↑ ***	↑	↓
50cm	↑ ***	↓	↓

Results: Multi-Year Monitoring

Soil erosion and sediment transport (October 2020 – July 2023)

All photos were taken in July 2023

Corridor A

Corridor B

Corridor C

Results – Northern ID

Key Findings

- Post-harvest Soil Impacts
    - **Surface Soil Loosening**: Observed in most corridors, as indicated by changes in bulk density
    - **Tethered Skidding**: Caused the largest increase in penetration resistance (PR) across all soil depths, likely due to multiple machine passes, the use of rubber tires with metal chains, and log dragging
- Multiple-Year Monitoring
    - **No Erosion and Sediment Movement**

Concluding Remarks

- **Reduced Soil Impacts**: Tethering can potentially reduce negative soil impacts compared to untethered operations.
- **Limited Impact on Soil Compaction**: In our three case studies, changes in soil density associated with tethered operations were not significantly different from those observed in currently accepted harvesting practices, with the exception of tethered skidding.
- **Applicability**: The study findings, based on case studies, may not be universally applicable.
- **Future Research**: More case studies are needed to better understand machine-soil interactions under diverse soil types and site conditions.