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Researching sustainable forest landscapes

Programme 3 - Harvesting and Operations

Bunching stems in steep slopes for efficient yarder extraction

Mauricio Acuna[1,2], Justin Skinnell[3], Rick Mitchell[1,4] and Tony Evanson[5]

1CRC for Forestry
2 University of Tasmania
3 Oregon State University
4 WA Plantation Resources (WAPRES)
5 SCION Research, New Zealand

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Outline

- Technology in steep terrain
- Objectives and study layout
- Equipment and data collection
- Results Feller buncher
- Results Swing yarder
- Conclusions

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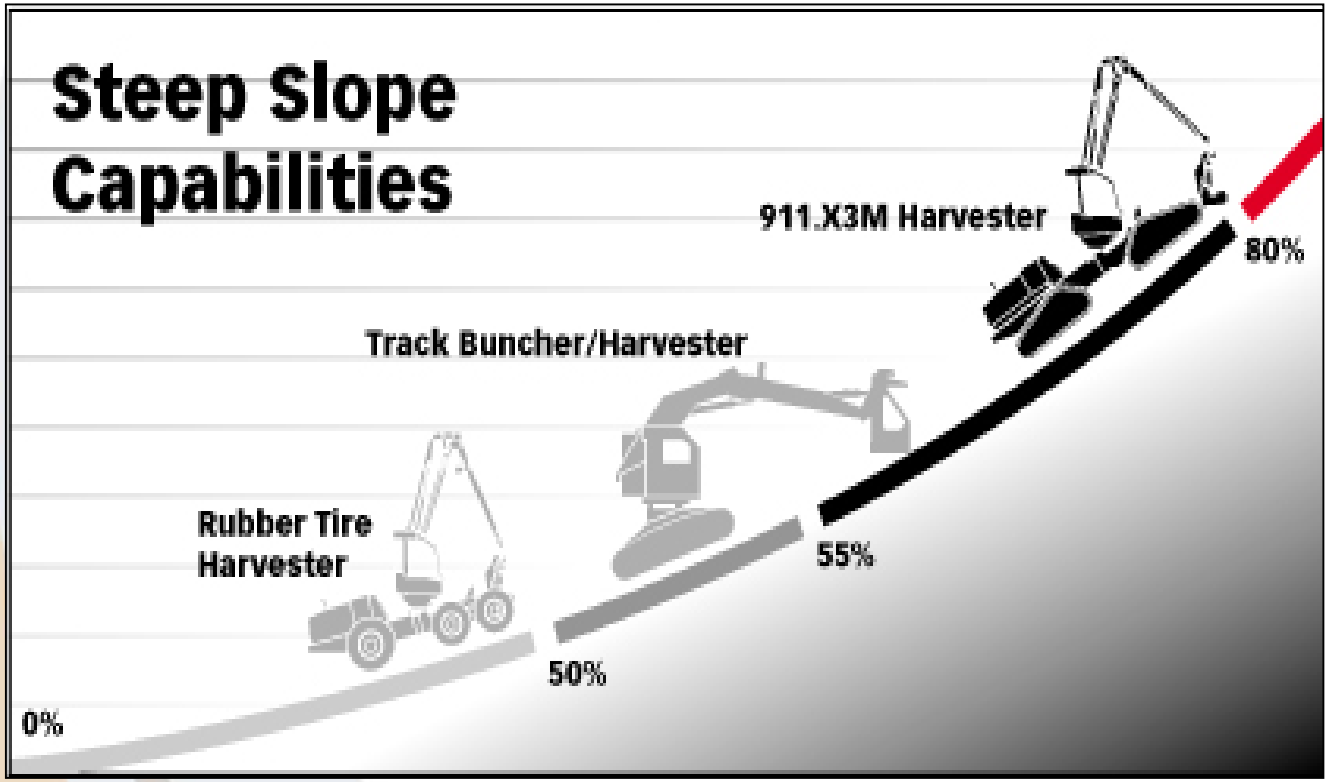
Technology in steep terrain



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Technology in steep terrain

(Amishev & Evanson 2010)

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Trial objectives

- Analyse productivity and costs of a self-levelling feller buncher and swing yarder related to operational factors
- Investigate the effect of pre-bunching on the extraction phase
- Develop production and cost predictive equations

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Study area


SOUTH AUSTRALIA
NEW SOUTH WALES
AUSTRALIAN CAPITAL TERRITORY
VICTORIA
Murray
Mildura
Wodonga
Shepparton
Horsham
Bendigo
Ballarat
Melton
MELBOURNE
Geelong
Sale
Colac
Port Phillip Bay
Wilsons Promontory
Great Australian Bight
Indian Ocean
Bass Strait
Tasman Sea
GREAT DIVIDING RANGE
AUSTRALIAN ALPS
Mt. Bogong
Snowy
38°30'45"S / 146°33'54"E
Image © 2011 GeoEye
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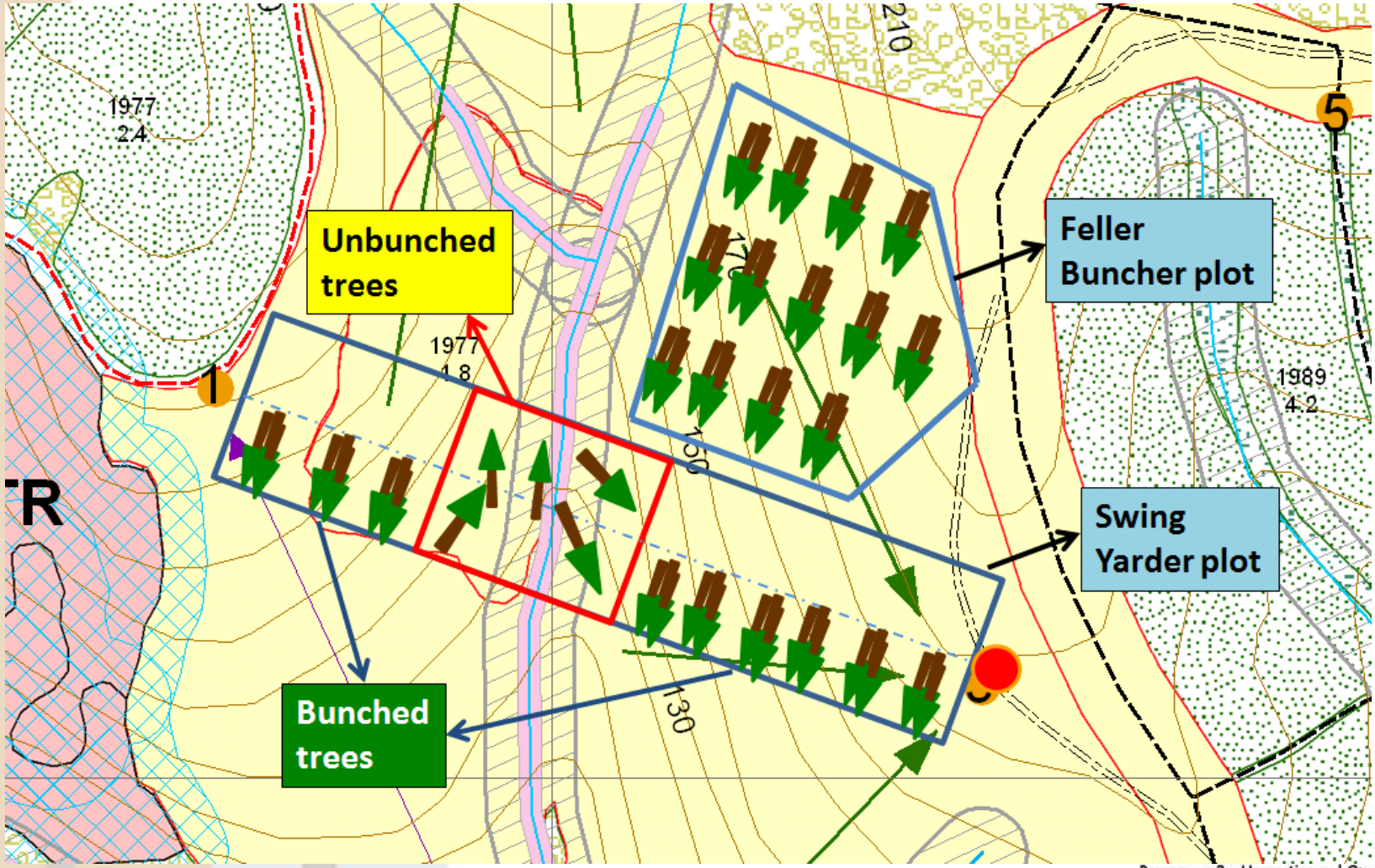
Study layout



Equipment and data collection

Valmet 445 EXL

Madill 124

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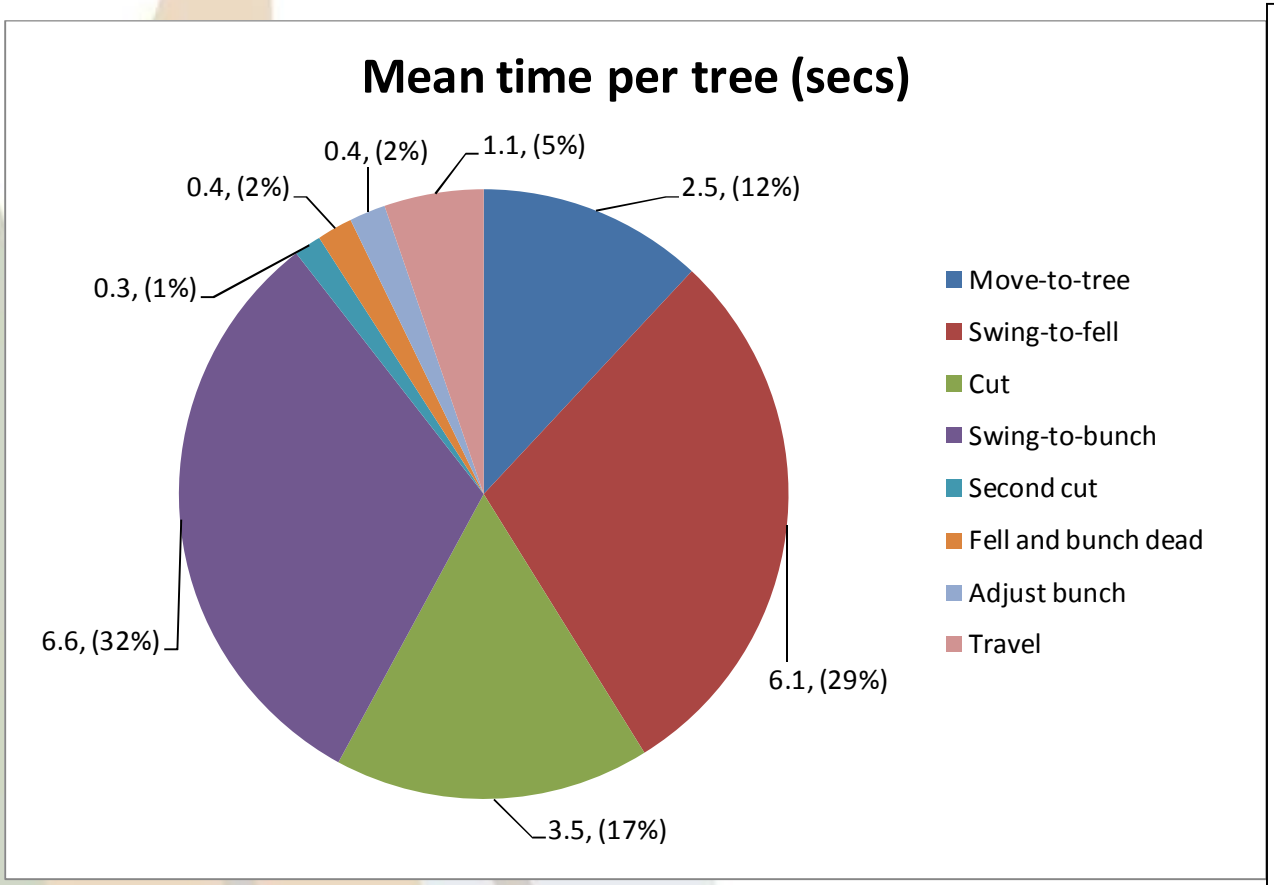
Results – Feller buncher

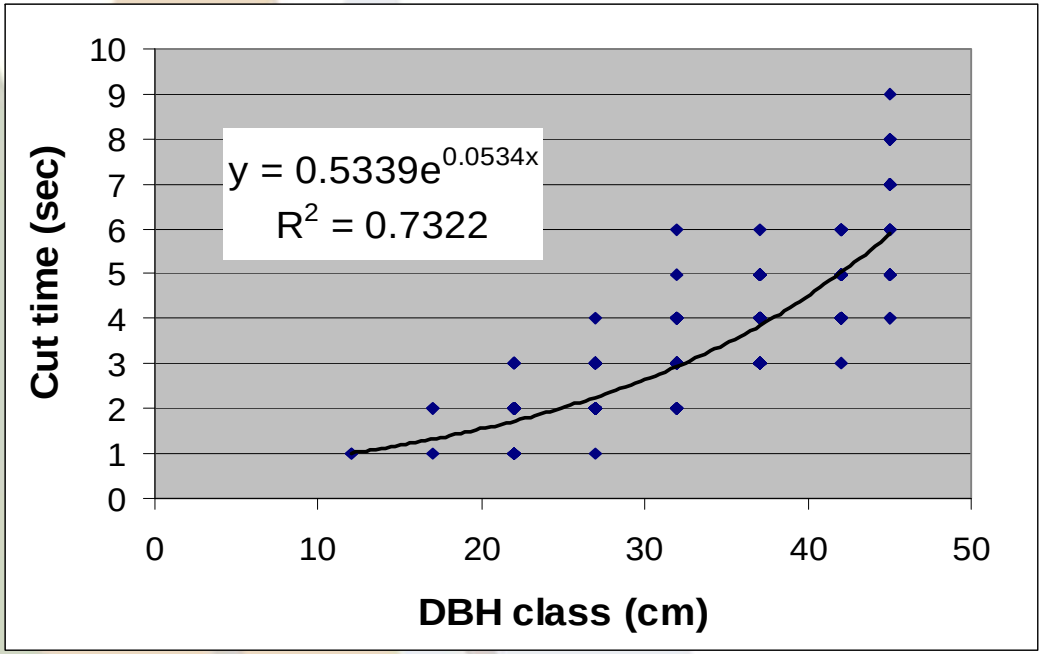


Total = 20.9 sec/tree

***Move-to-tree, Re-position**:* Machine moving uphill in a straight line between successive tree felling and bunching activities, or machine movement laterally, adjusting the move-to-tree line.
***Swing-to-fell**:* Machine slewing and extending the boom to position the felling head to fell a tree.
***Cut** :* Saw operation to fell the tree.
***Swing-to-bunch**:* Slewing the felled tree and lower to the ground or onto a bunch.
***Second cut, Cut stump**:* A second extension of the saw to sever a tree not felled after the first cut, or a cut to lower the height of a stump.
***Fell and bunch dead trees**:* Slewing, cutting and bunching or disposing of a dead tree.
***Adjust bunch**:* Move trees in a bunch to reduce spread of the butts.
***Travel**:* Machine movement (downhill) from the end of a felling swath to the start of the next.

Results – Feller buncher

Effect of diameter on cutting time



Tree diameter class	Mean Cut time (sec)	Significant difference*
17	1.67	a
22	1.78	a
27	2.29	b
32	3.21	c
37	3.81	d
42	4.77	e
47+	6.36	f

**(Values with the same letter are not significantly different at p>0.05)*

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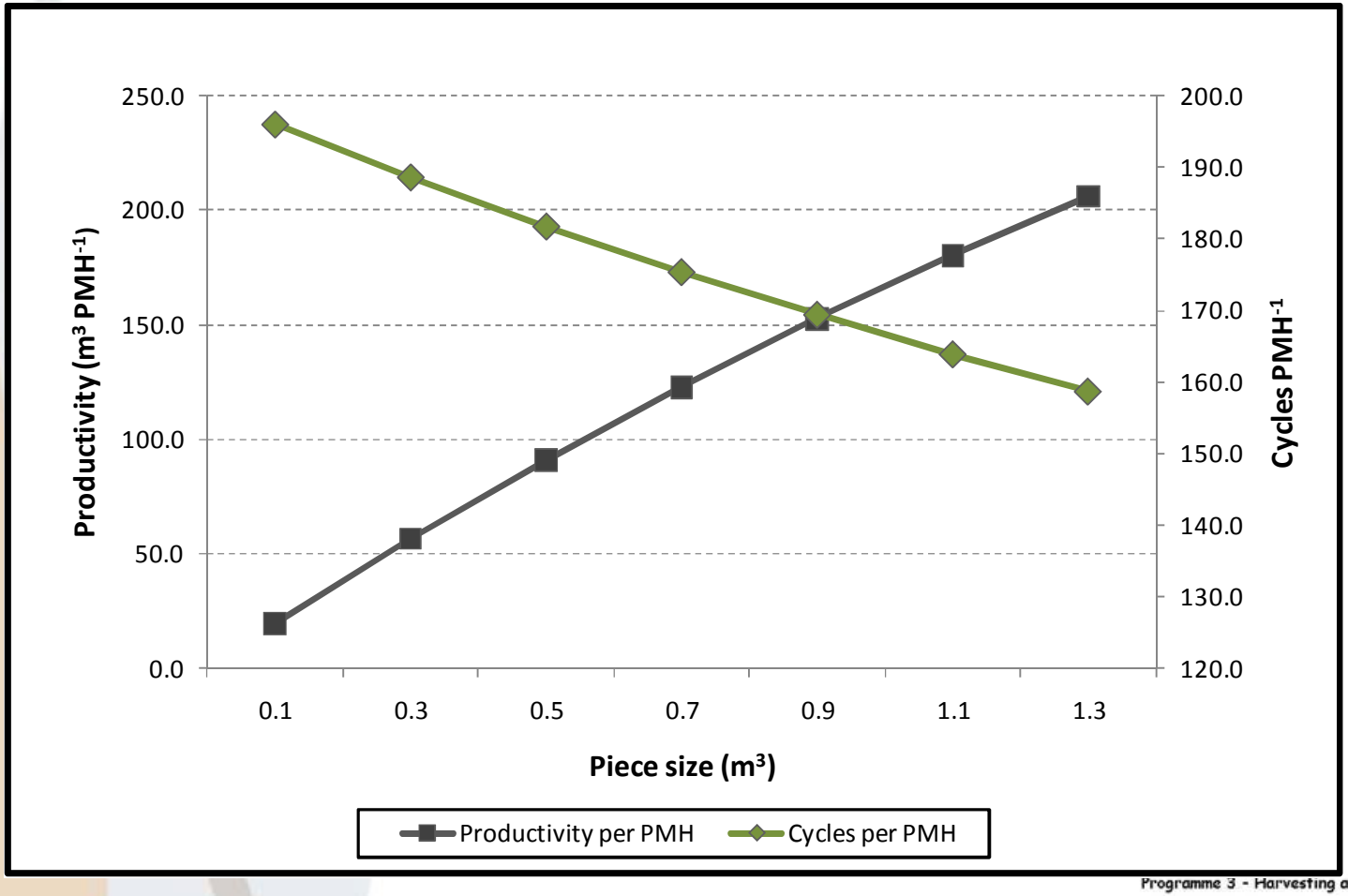
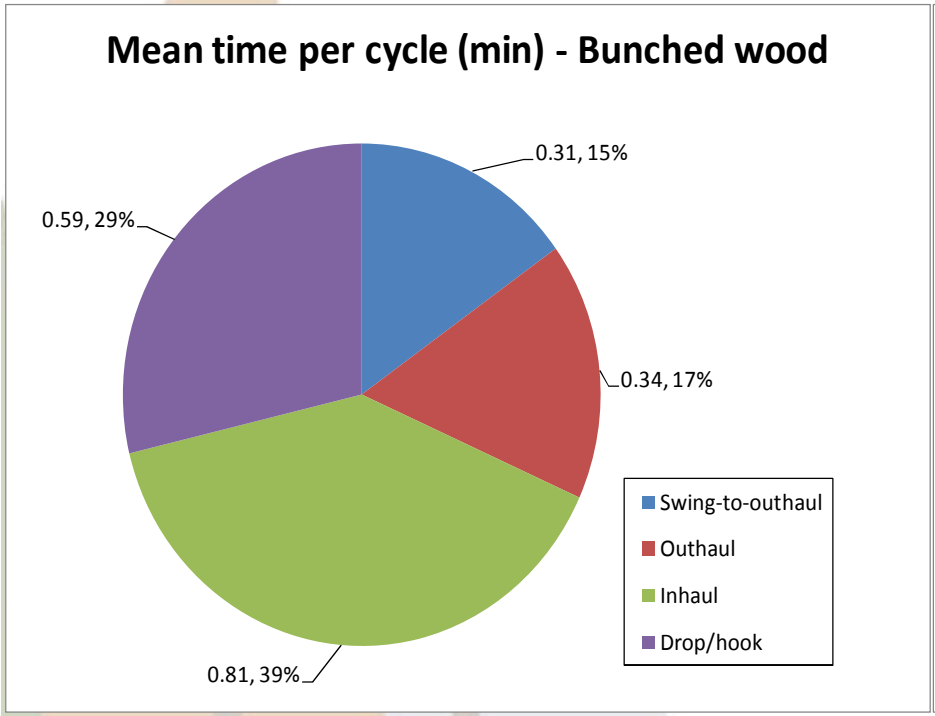
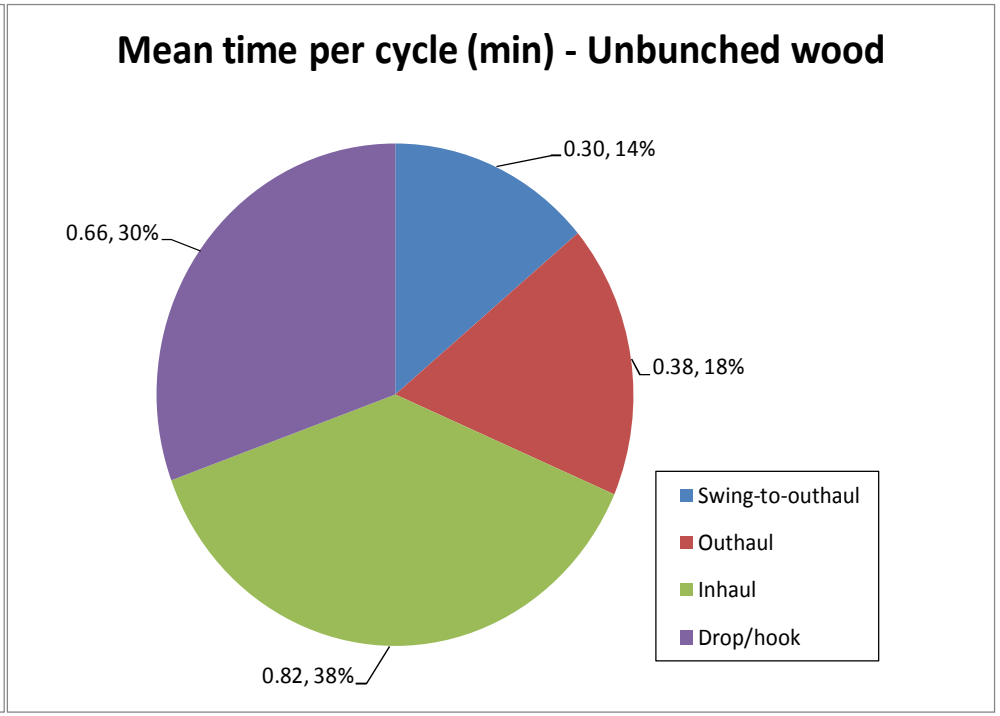
Results – Feller buncher

Cycle time and productivity curves



Results – Swing yarder





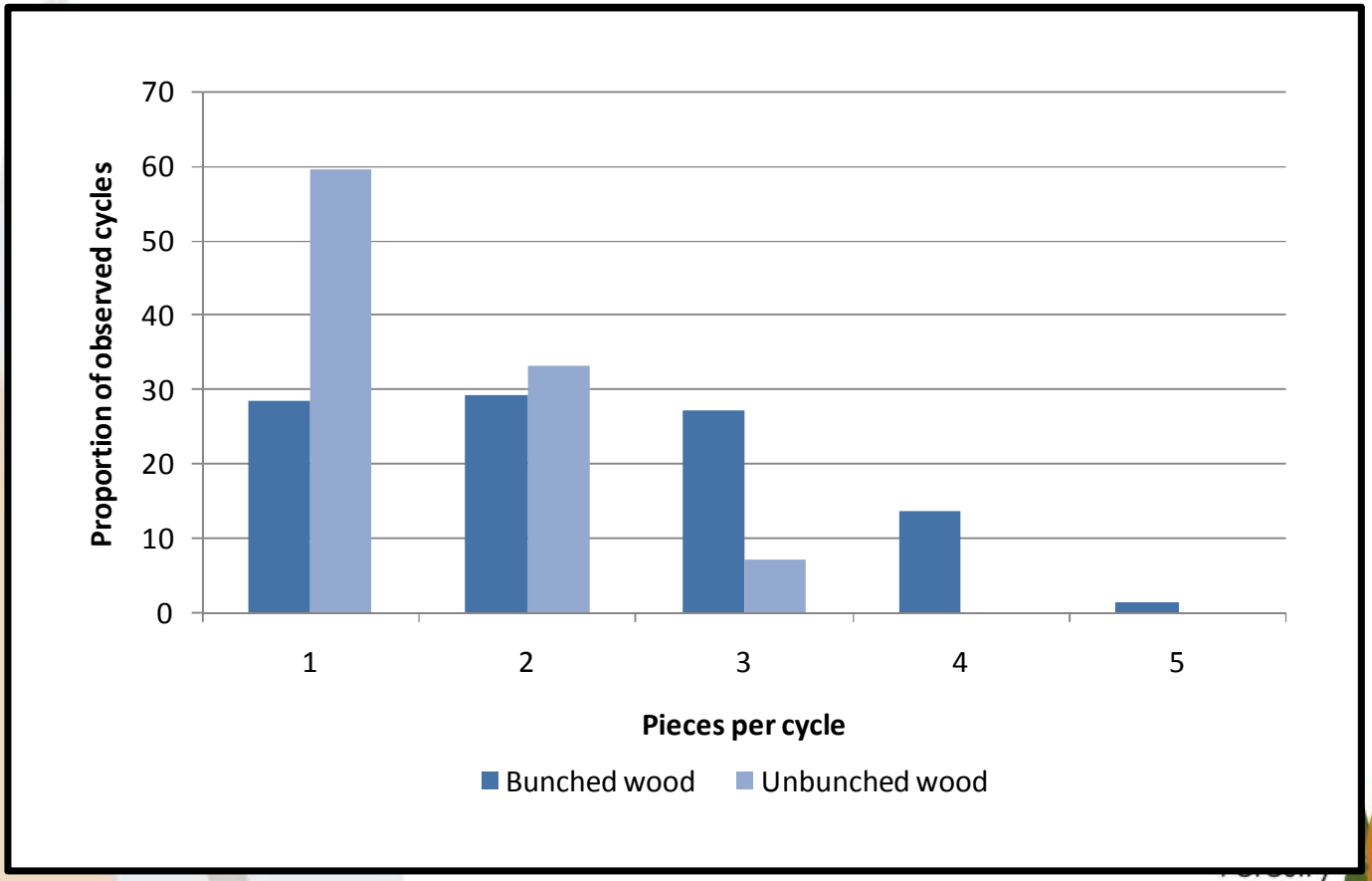
Total = 2.05 min/cycle

Total = 2.18 min/cycle

***Swing-to-outhaul**:* Yarder swing after dropping a load at the landing chute and is ready to start a new outhaul.
***Outhaul**:* Grapple movement downhill (empty) until it is lowered down to get a load.
***Inhaul**:* Grapple movement uphill with a load of logs until the load is dropped at the landing chute.
***Drop/hook**:* Grapple descending towards the ground until the logs have been secured and the grapple starts moving up towards the landing.

Results – Swing yarder

Pieces per cycle



Results – Swing yarder

Performance measurements for a haul distance of 180 m

Performance measurements	Bunched wood	Unbunched* wood
Observed haul cycles	142	42
Average pieces per cycle	2.3	1.5
Average pieces per PMH	68.1	41.6
Average time per cycle (min.)	2.7	2.3
Cycles per PMH	21.9	26.1
Average volume per cycle** (m^3)	1.9	1.3
Average volume per PMH (m^3)	41.6	33.9

* All unbunched wood was manually felled

** Based on an average piece size of 0.81 m^3 for the bunched wood and 0.87 m^3 for the unbunched wood

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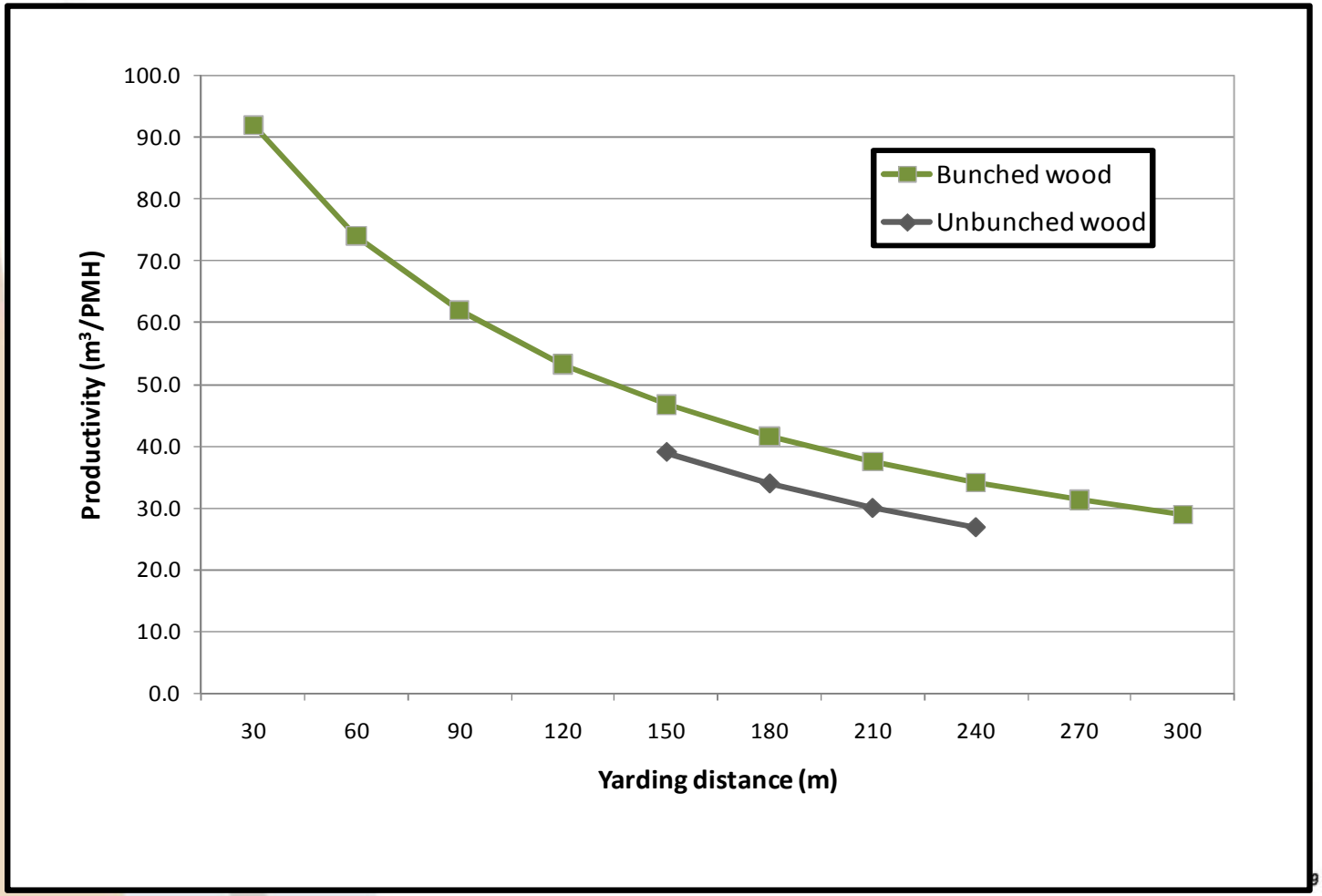
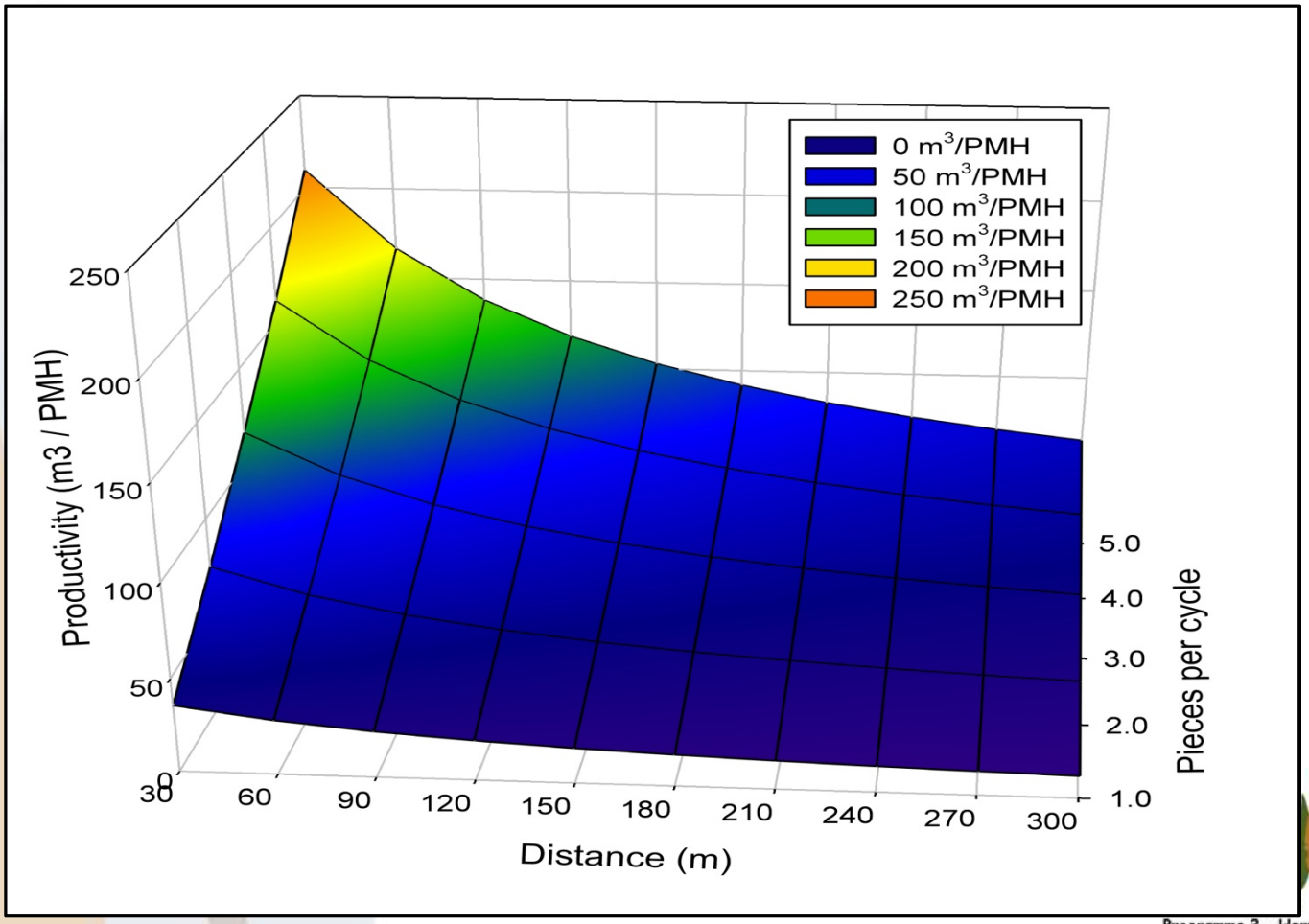
Results – Swing yarder

Productivity curves



Results – Swing yarder

Effect of yarding distance and pieces per cycle



Conclusions

- In good clearfell conditions in steep terrain a tracked self-levelling feller buncher can achieve a high rate of productivity
- Bunching the trees increased the productivity of the swing yarder by 25% (19% reduction in costs)
- Mechanized felling improves safety and value recovery

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