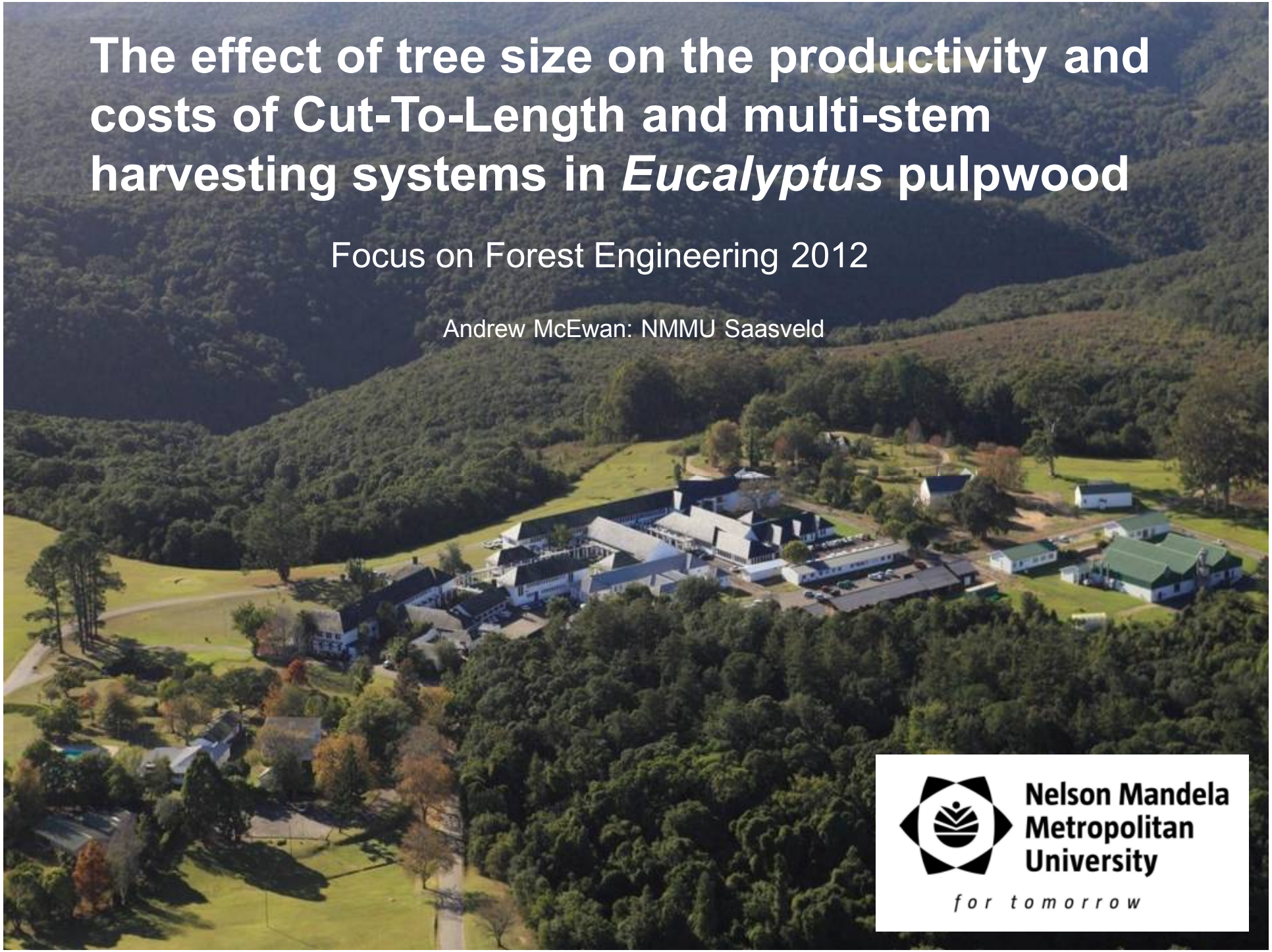
# The effect of tree size on the productivity and costs of Cut-To-Length and multi-stem harvesting systems in *Eucalyptus* pulpwood

Focus on Forest Engineering 2012

Andrew McEwan: NMMU Saasveld



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# The research examined the **processing element** of 5 harvesting systems

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# 1. Chain flail delimber debarker

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# 2. Chain flail delimber debarker chipper

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# 3. Chain flail delimber debarker and chipper

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# 4. Dangle head processor (processing head)

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# 5. Harvester

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# But what systems did they fit into?

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| Locality / Activity | Stand | Extraction route | Roadside landing | Forest road |
|---|---|---|---|---|
| Wheeled or tracked feller buncher | | | | |
| Grapple skidder (and front-end loader - WAPRES) | | | | |
| CFDDC | | | | |

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| Locality / Activity | Stand | Extraction route | Roadside landing | Forest road |
|---|---|---|---|---|
| Tracked feller buncher | | | | |
| Grapple skidder | | | | |
| CFDD | | | | |
| Chipper | | | | |

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| Locality / Activity | Stand | Extraction route | Roadside landing | Forest road |
|---|---|---|---|---|
| Wheeled feller buncher | | | | |
| Grapple skidder | | | | |
| DHP | | | | |
| Slasher loader | | | | |

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# Compartment information

| **Country and Processing Machines** | **Species** | **Tree size ($m^3$)** |
|---|---|---|
| Chile - CFDD | *E. globulus* | 0.190 |
| Australia – CFDDC Site 1 | *E. globulus* | 0.105 |
| Australia – CFDDC Site 2 | *E. globulus* | 0.335 |
| Australia – CFDDC Site 3 | *E. globulus* | 0.272 |
| Australia – CFDDC Site 4 | *E. globulus* | 0.344 |
| Australia – CFDD&C Site 1 | *E. globulus* | 0.236 |
| Australia – CFDD&C Site 2 | *E. globulus* | 0.179 |
| Australia – CFDD&C Site 3 | *E. globulus* | 0.254 |
| South Africa – DHP | *E. grandis* | 0.156 |
| South Africa - Harvester | *E. grandis x camaldulensis* | 0.139 |

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# Cycle times and bundles per cycle

| CFDD, CFDDC and CFDD&C | Mean cycle time (minutes) | Average trees per cycle |
|---|---|---|
| CFDD | 0.68 | 4.33 |
| CFDDC | 0.52 | 1.63 |
| CFDD&C | 0.39 | 2.45 |
| DHP | 0.44 | 1 |
| Harvester | 1.00 | 1 |

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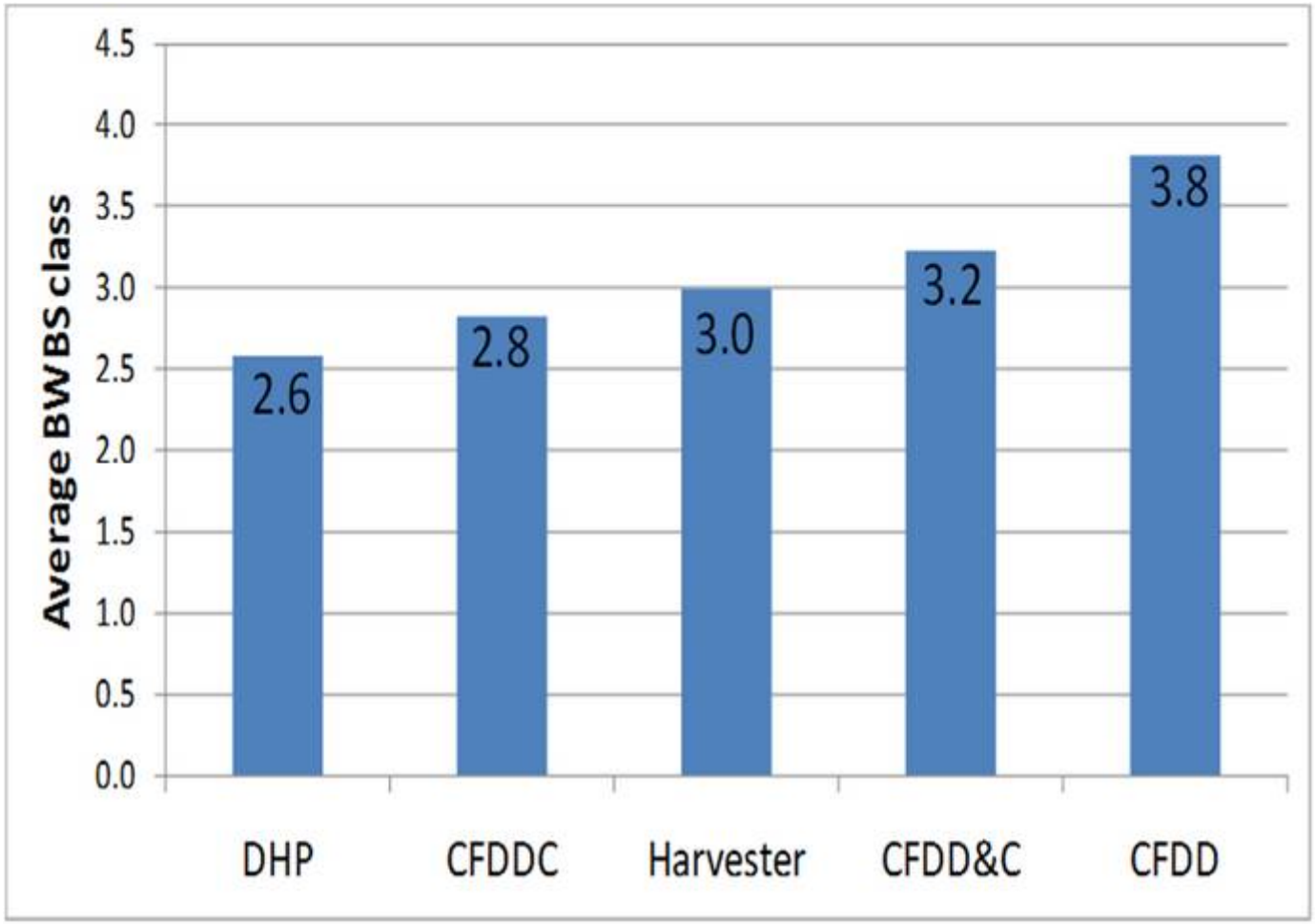
# Bark-wood bond strength (strippability)



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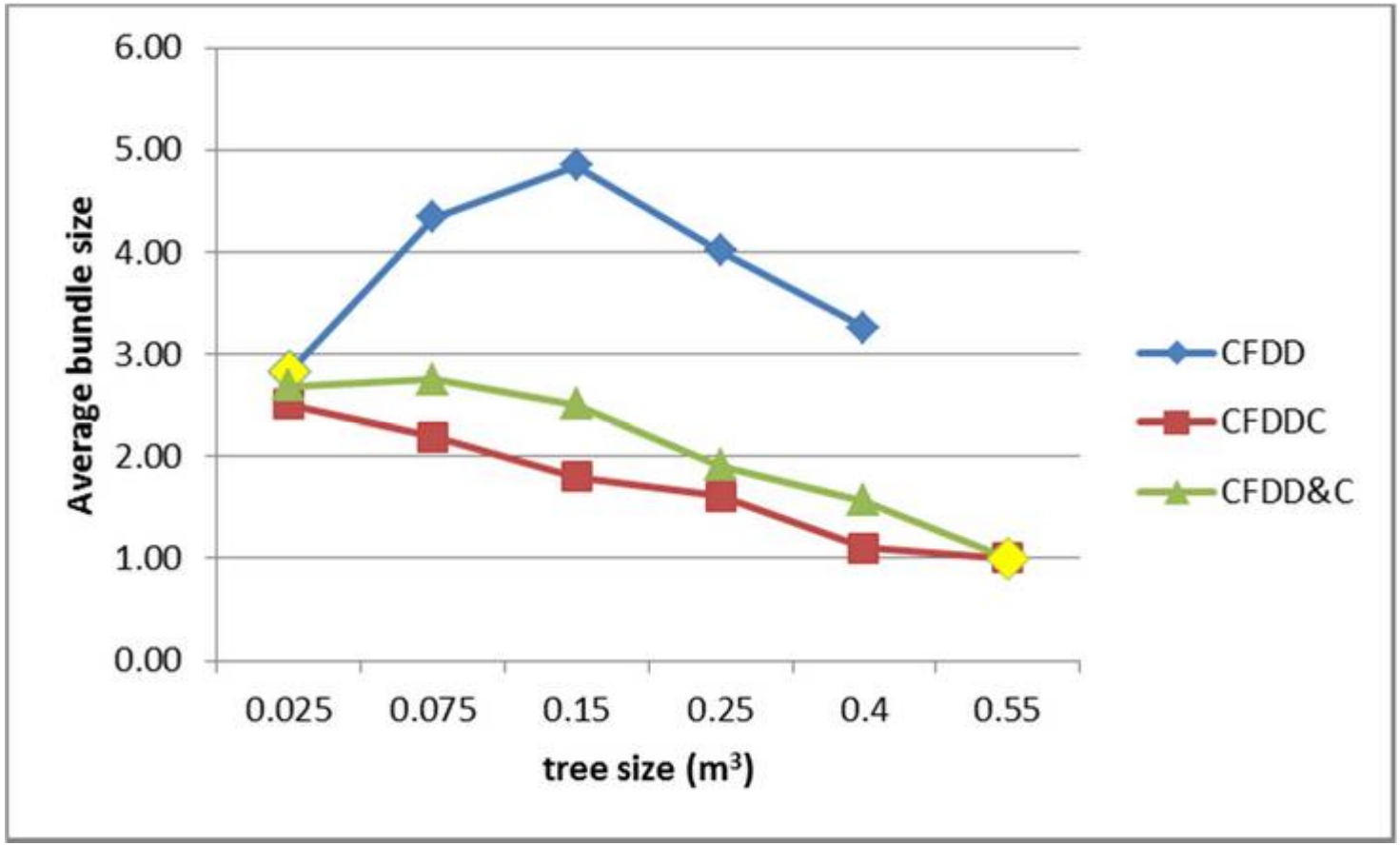
# Trees per cycle versus tree size



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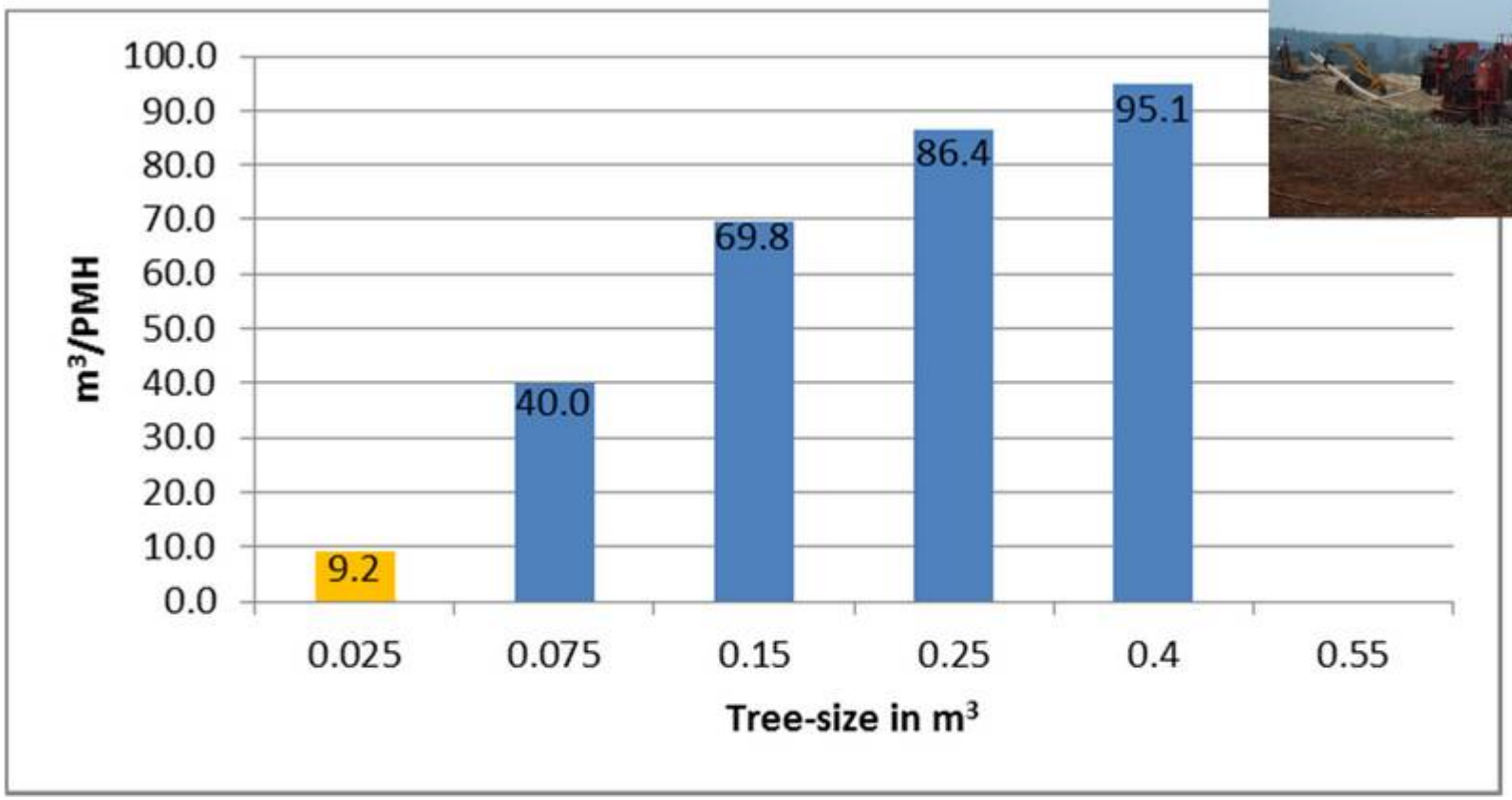
# CFDD productivity



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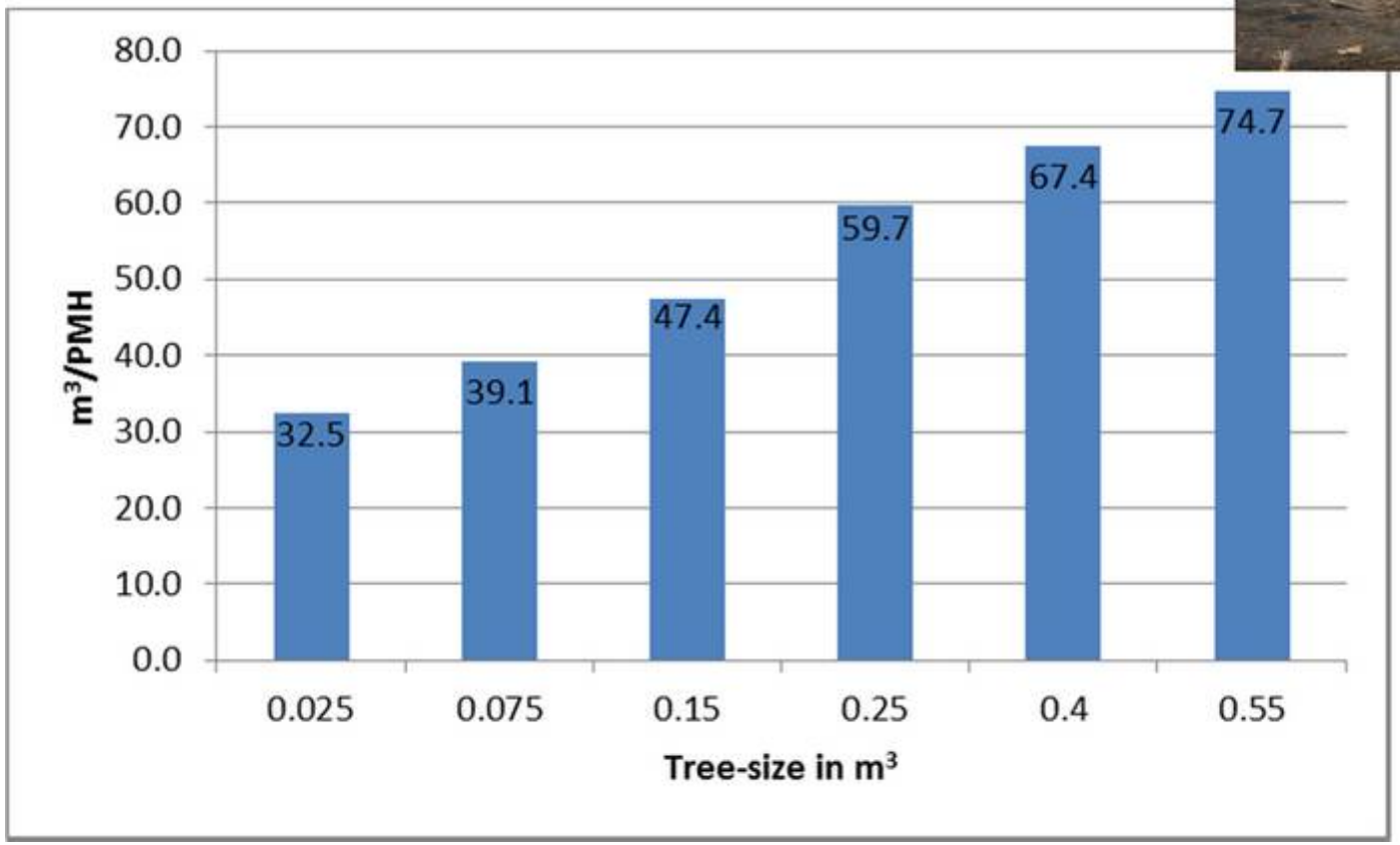
# CFDDC productivity



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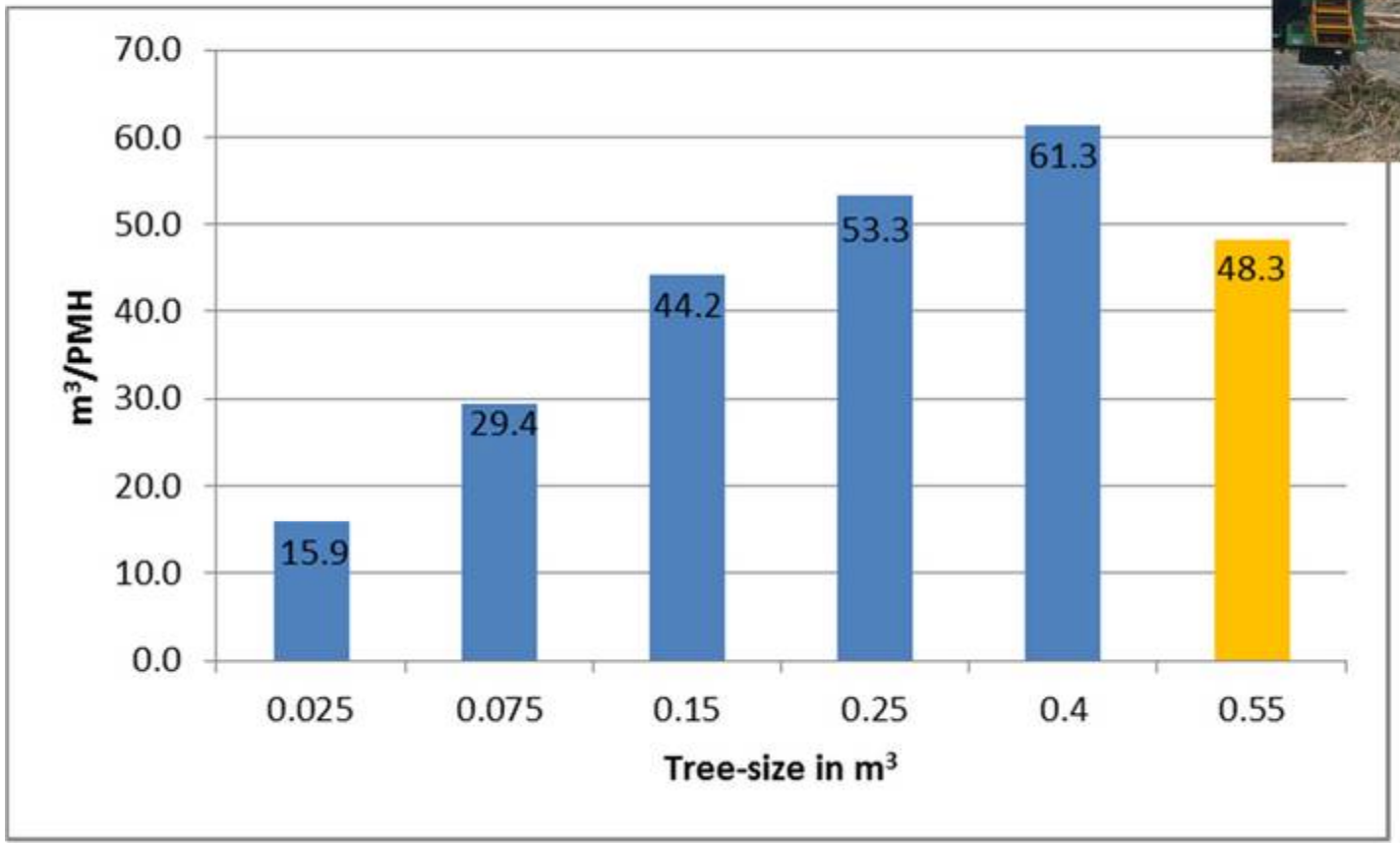
# CFDD&C productivity



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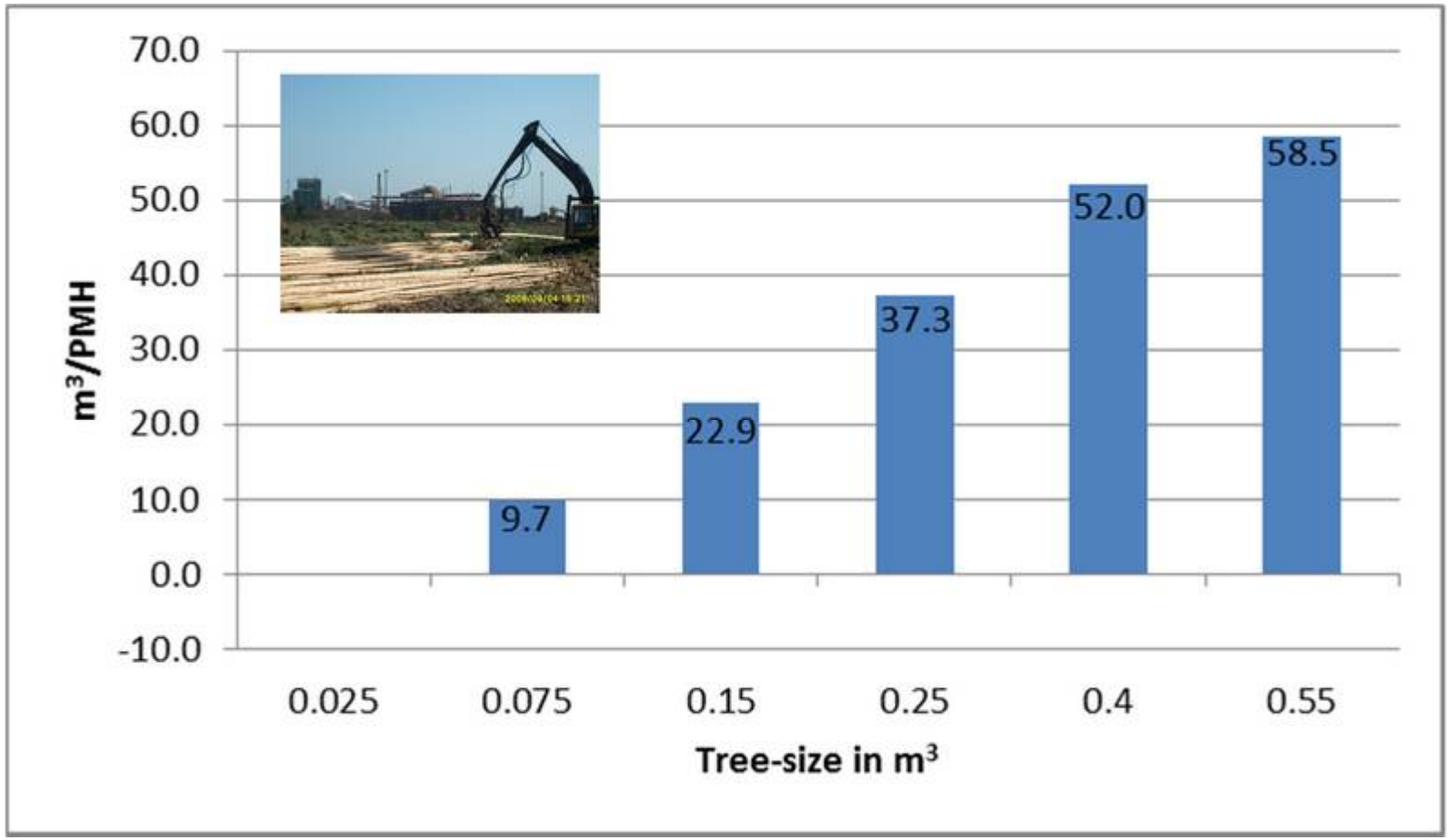
# Processing head (DHP)



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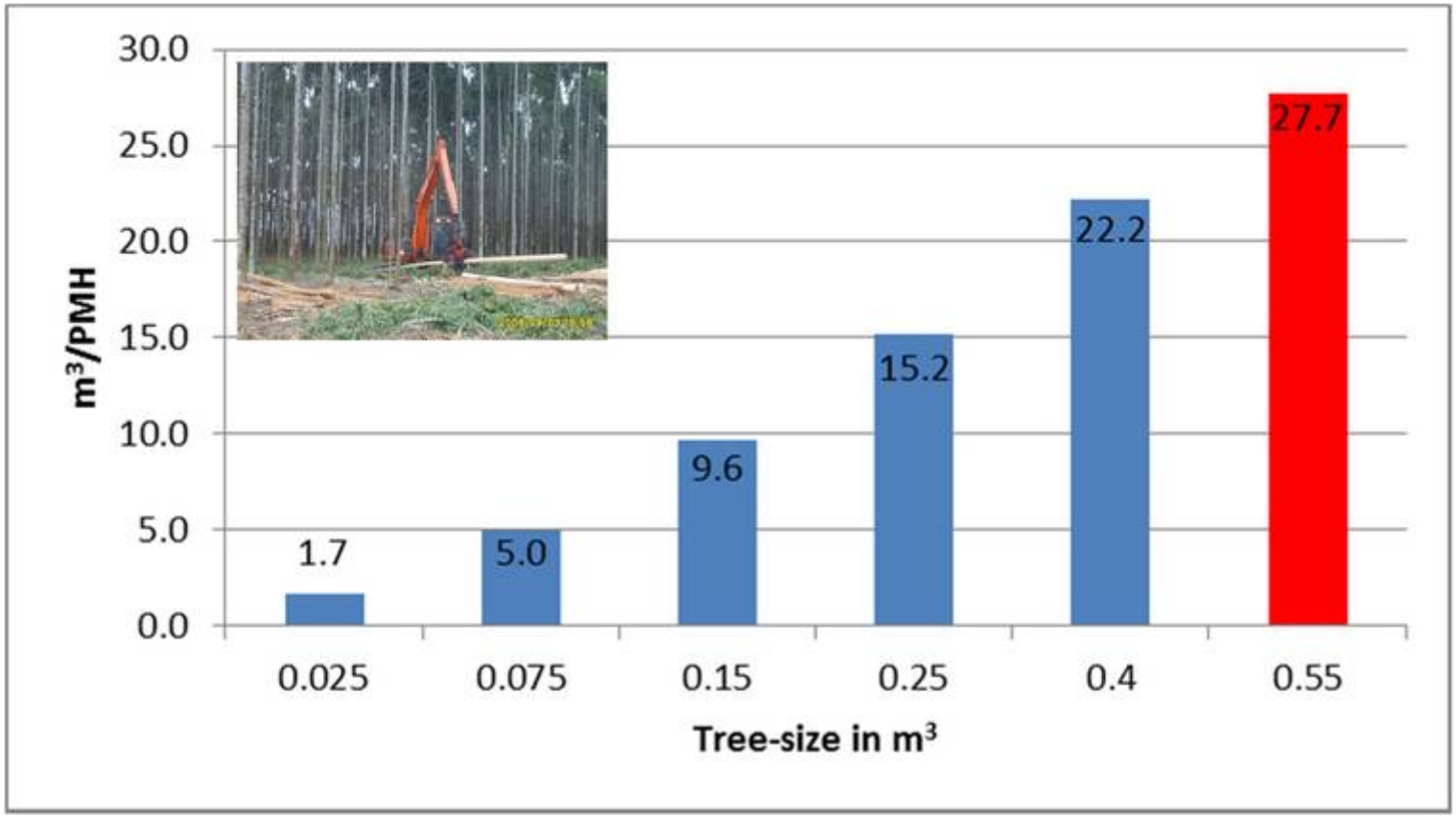
# Harvester productivity



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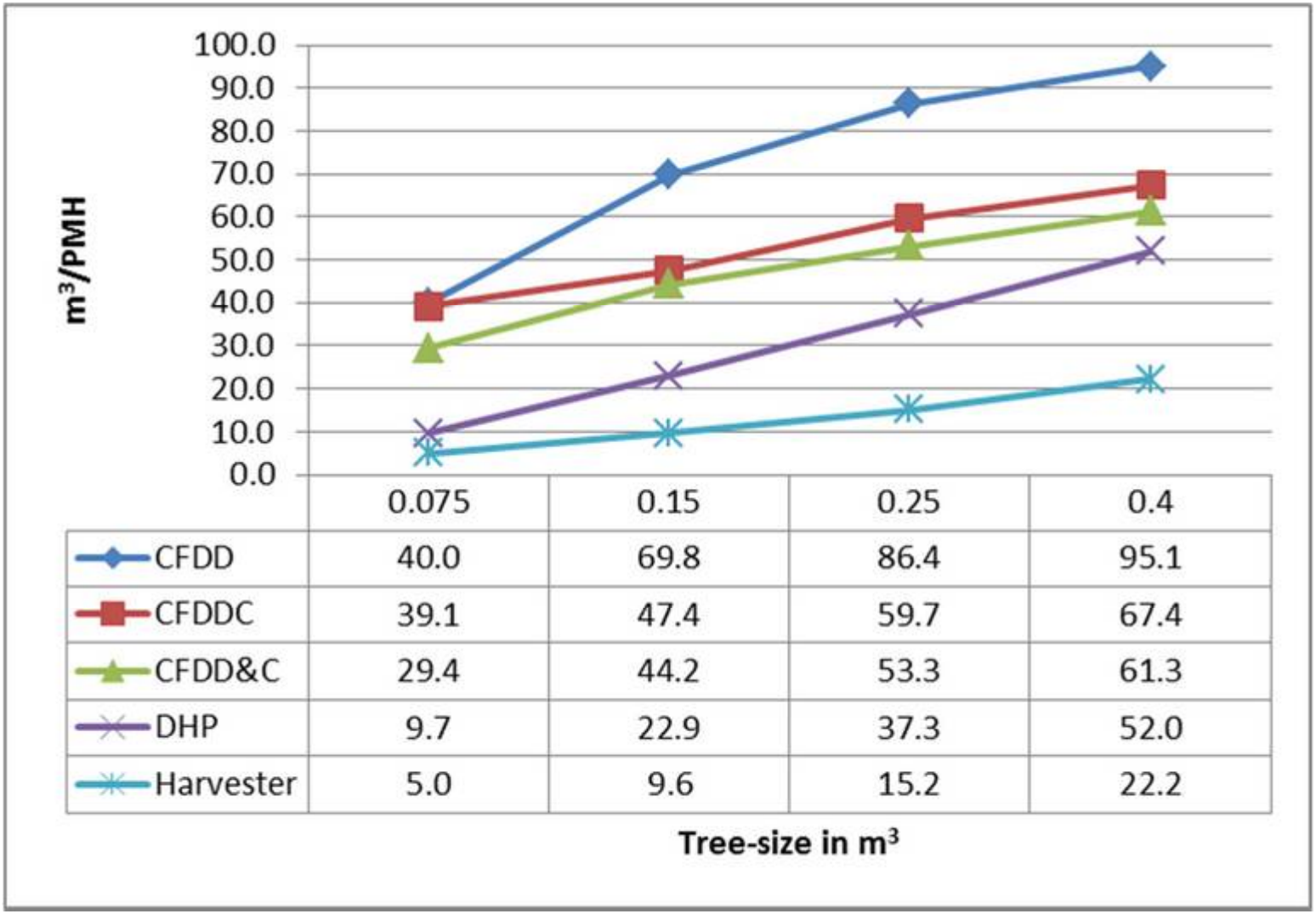
# Machine productivity comparisons




| | 0.075 | 0.15 | 0.25 | 0.4 |
|---|---|---|---|---|
| CFDD | 40.0 | 69.8 | 86.4 | 95.1 |
| CFDDC | 39.1 | 47.4 | 59.7 | 67.4 |
| CFDD&C | 29.4 | 44.2 | 53.3 | 61.3 |
| DHP | 9.7 | 22.9 | 37.3 | 52.0 |
| Harvester | 5.0 | 9.6 | 15.2 | 22.2 |

Tree-size in m³

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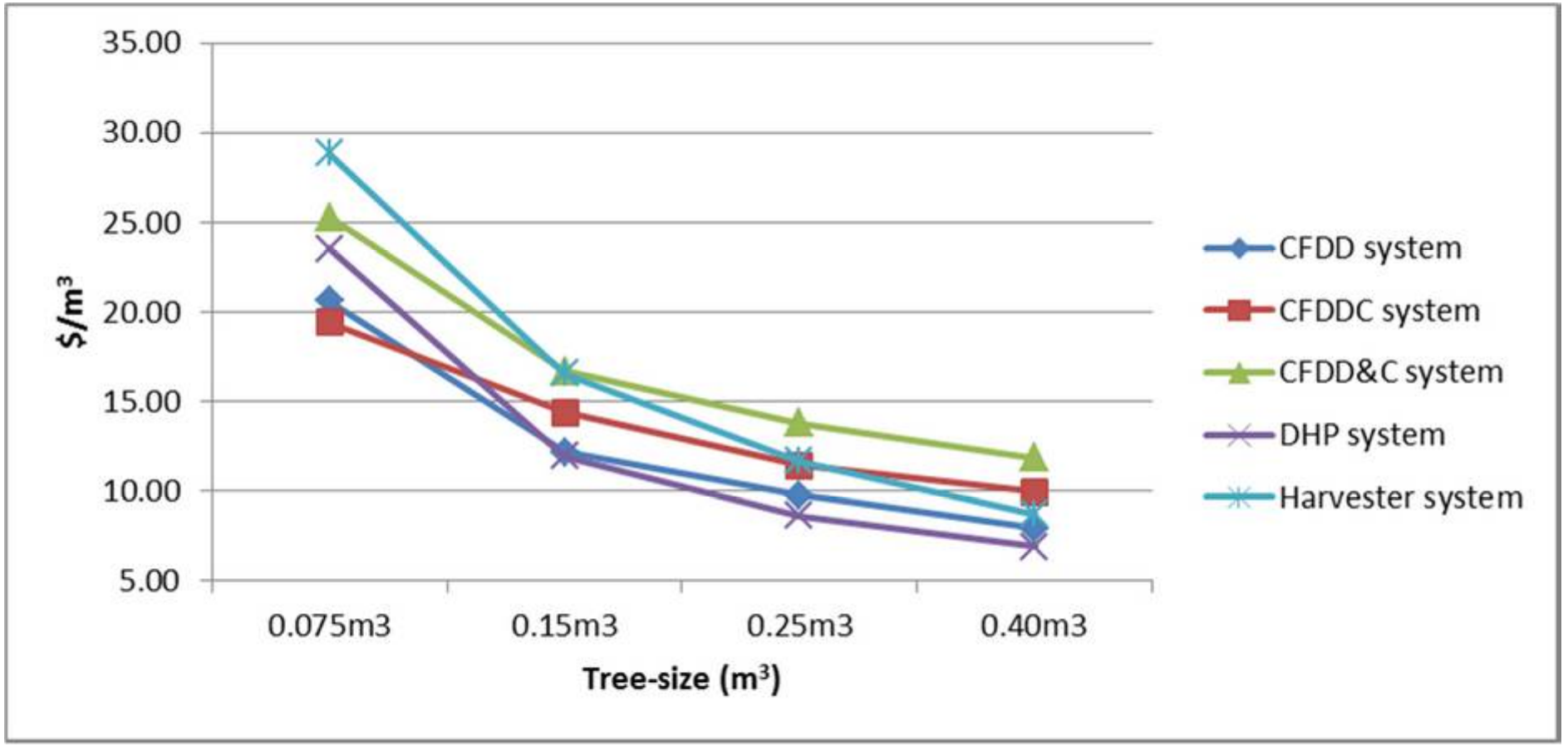
# System cost comparisons



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# Cost summary

- 0.075 $m^3$:
  - CFDDC and CFDD
- 0.15 $m^3$:
  - CFDD and DHP
- 0.25 $m^3$:
  - DHP and CFDD
- 0.40 $m^3$:
  - DHP and CFDD

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# Factors to consider

- Effect of form and strippability
- Developments in certain technologies
- Hot systems vs cold systems
- Landing space
- Annual volumes

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- Chile:
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- Zululand:
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  - Tigercat and AfrEquip
  - Mr Revel Falker



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THANK YOU
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