Forest Engineering Developments in New Zealand

6th International Forest Engineering Conference

17 April 2018

FOREST GROWERS RESEARCH

Harvesting issues & development drivers

1. **Labour shortages are limiting industry growth**
2. **Safety is still an issue**
3. **Environmental ‘licence to operate’ is under threat**
4. **Rising harvesting costs and marginal profitability of some forests**
5. **Need to continue to mechanise forestry operations**

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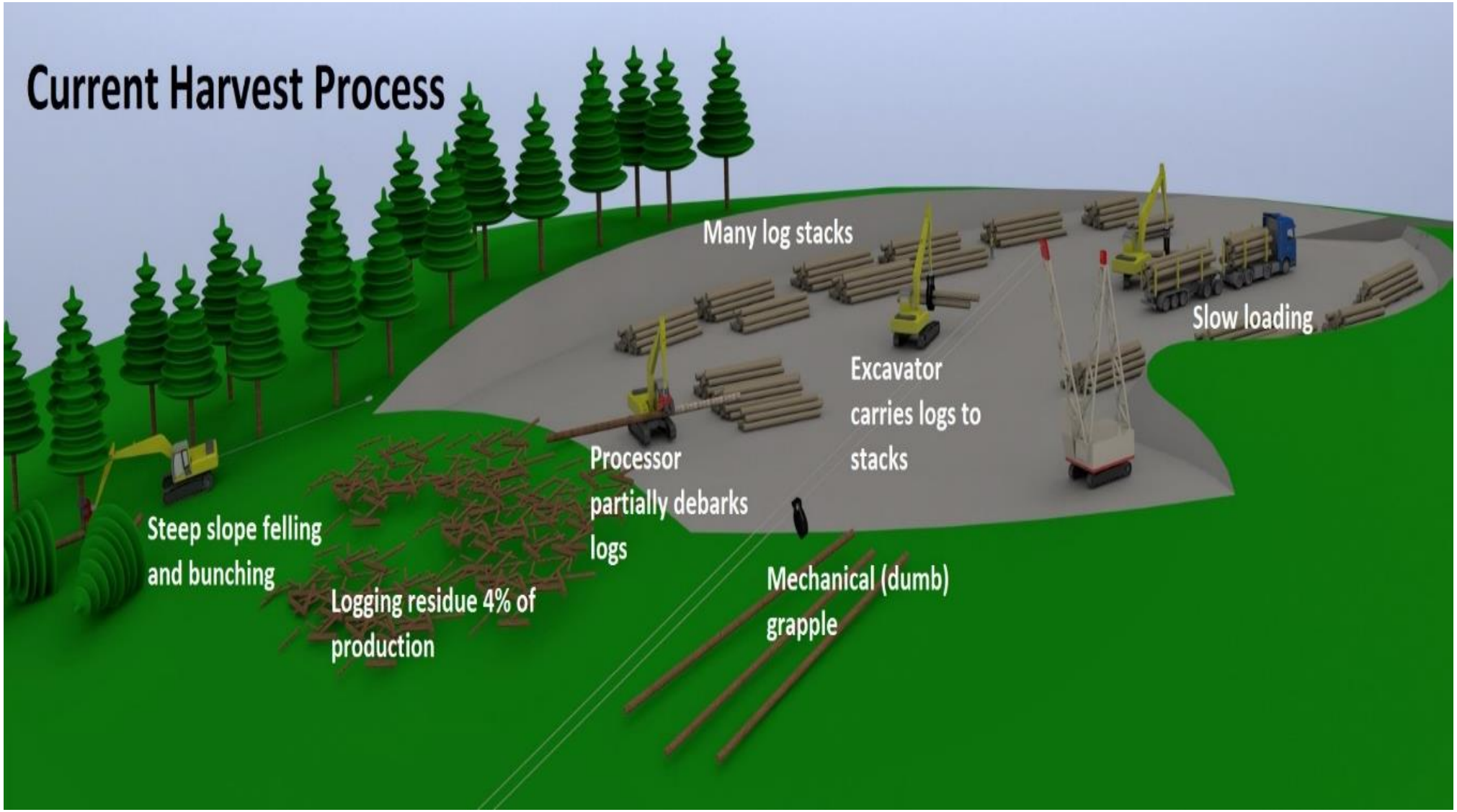
Current harvesting operations: A partially mechanised process



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Forest Engineering Developments

1. Winch-assisted felling
2. Teleoperated felling
3. Felling carriage
4. Grapple carriages
5. In-cab vision systems
6. Skyline shifting
7. Processing and loading
8. Robotics

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Winch Assisted Felling

- **ClimbMAX Steep Slope Harvester**
  - **Single winch integrated into feller buncher track frame**
  - **Commercially available (ClimbMAX Equipment Ltd)**
  - **11 units sold (3 in NZ, 7 in Canada, 1 in U.S.)**

- **Falcon Hydraulic Winch Assist**
  - **Single winch excavator-based system with remote camera and multiple operating alarms**
  - **Commercially available (DC Equipment Ltd)**
  - **63 units sold (including exports)**

Winch Assisted Felling

- **Tractionline winch assist**
  - **Dual winch excavator system**
  - **Commercially available (EMS Ltd)**
  - **71 units sold (35 in NZ)**

- **Remote Operated Bulldozer (ROB)**
  - **Dual winch system with operating alarms**
  - **Commercially available (Rosewarne and May Ltd)**
  - **32 units sold to date (10 in NZ)**

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Winch Assisted Felling

- **Waka Engineering winch assist**
  - **Single winch excavator based system**
  - **Commercially available (Nathan Hill, Waka Welding Ltd, Waikouaiti)**
  - **6 units sold (all in NZ)**
- **Performance Mechanical winch assist**
  - **Dual winch system on bulldozer or excavator base**
  - **Commercially available (Performance Mechanical & Engineering Ltd, Taupo)**
  - **2 units sold to date (both in NZ)**

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Teleoperated Felling

- **Full teleoperation of John Deere 909 feller buncher**
  - **First teleoperation console built and tested**
  - **Full machine functionality**
  - **HD low latency cameras and LCD displays**
  - **Full size joysticks**
  - **Trailer side control system**
  - **Video interrupt warning system**
  - **Commercially available (Applied Teleoperation Ltd)**

Remote controlled felling carriage

- **Falcon Felling Carriage Prototype**
  - **Prototype developed by DC Equipment Ltd**
  - **Features two felling saws: a smaller front saw and a larger rear saw**
  - **Hydraulic operated arm to raise/lower felling head**
  - **Currently being trialed**
  - **Released at HarvestTECH 2017 in Rotorua – June 2017**
  - **Planned for commercial production and sale later in 2018**

Grapple Carriages

- **Falcon Claw Grapple Carriage**
  - Designed and built in NZ (now 3 models: 1250 / 1580 / 2150)
  - Kohler KD425-2 & KD625-2 air-cooled Diesel engine
  - Commercially available (DC Equipment Ltd
  - **40** units sold (34 in NZ)
- **Alpine Grapple carriage**
  - Designed and built by Alpine Logging Equipment (SA)
  - Non-motorised (hydraulic accumulator)
  - Modified and trialed in NZ
  - Commercially available (Logpro Ltd) - **13** sold to date in NZ

FFE FALCON FORESTRY EQUIPMENT

LOGPRO LIMITED

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Grapple Carriages

- **Hawkeye grapple carriage**
  - **Designed and built in NZ**
  - **Kohler 350 5.5kW Diesel engine**
  - **Remote control grapple open/close from cab**
  - **360 degree powered grapple rotation**
  - **Integrated digital camera and LED lighting**
  - **Commercially available (EMS Ltd)**
  - **20 units sold (including exports)**

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In-Cab Vision Systems

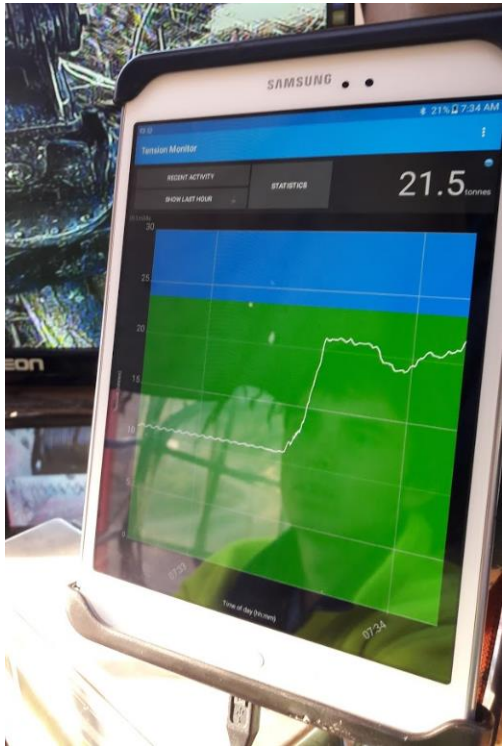
- **HarvestNav on-board navigation**
  - Harvest plan with GPS navigation and machine slope warnings
  - Commercially available (Margules Groome Ltd)
  - 18 implemented as free download ‘app’ plus 2 new version sold

- **CutoverCam hauler vision system**
  - Joystick control of pan, tilt and (optional) zoom
  - Light weight one piece construction [3.5kg]
  - Low latency video link with HD display
  - Commercially available (Applied Teleoperation Ltd)

In-Cab Vision Systems

- **Falcon Grapple Camera**
  - Can be fitted to any swing yarder grapple system
  - Clear vision day or night with range up to 900 metres
  - Commercially available (DC Equipment Ltd)
  - **78** installed and operating in swing yarders in NZ

- **Falcon tension monitoring ‘app’**
  - Prototype developed by University of Canterbury
  - Two prototype units installed and being trialled
  - Commercially available later in 2018 (DC Equipment Ltd)



Skyline shifting

- **Skyshifter Tail Hold Carriage**
  - **Lateral movement of skyline**
  - **Prototype built, tested and demonstrated in field**
  - **Available for production trial or lease (Awdon Technologies Ltd)**
- **Cab Assist Backline (CAB)**
  - **Low latency cameras and video link with warning system**
  - **High-definition LCD display**
  - **Commercially available (Applied Teleoperation Ltd)**

AWDON SKYSHIFTER

ATL
APPLIED TELEOPERATION LTD

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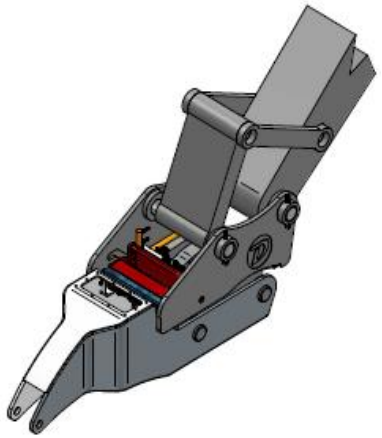
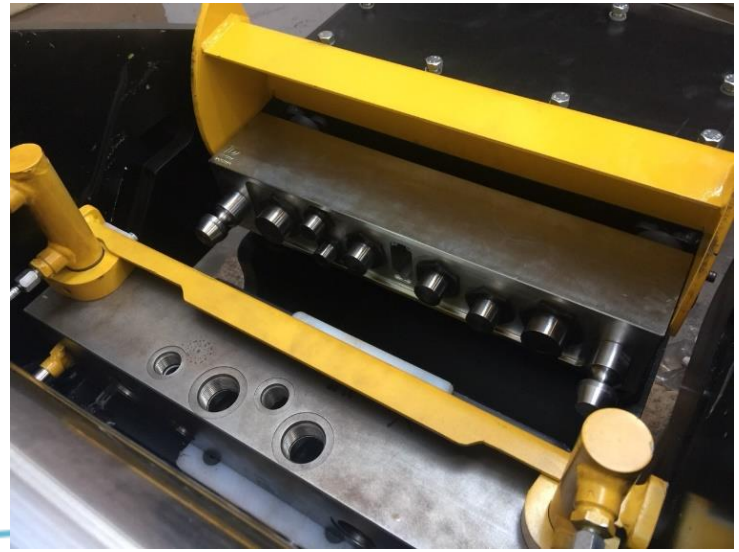
Processing and loading

- **Doherty automatic quick coupler**
  - **Rapid changeover from processor to log grapple**
  - **Single base machine to process logs and load trucks**
  - **First prototype designed and built**
  - **Ready for pressure testing in workshop**
  - **Installation to first adopter machine and field trials later in 2018**
  - **Marketed by Doherty Engineered Attachments Ltd and serviced by Total Hydraulic Solutions Ltd**





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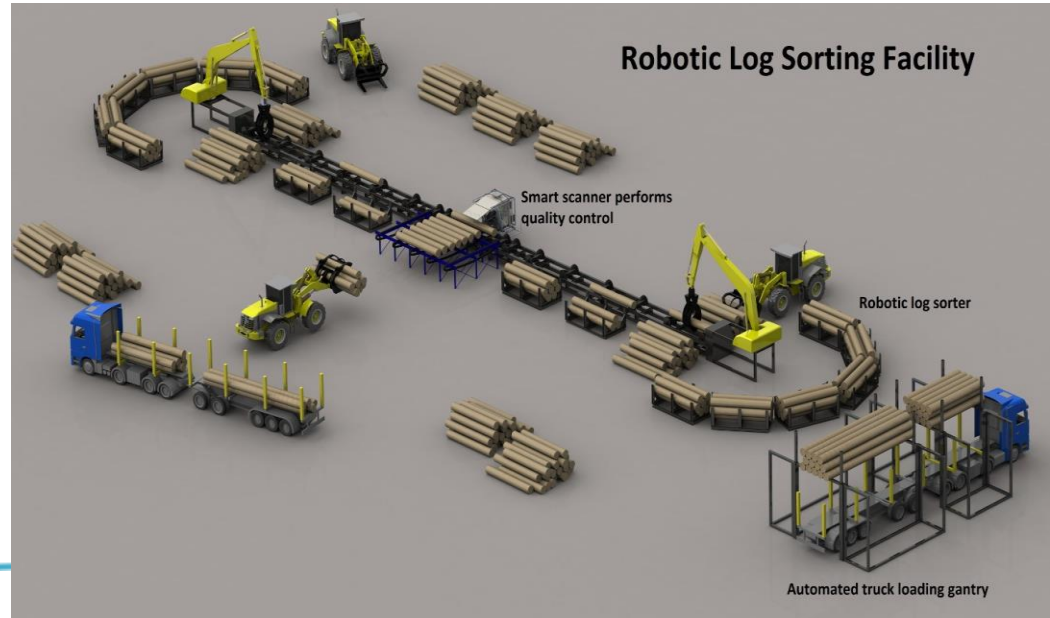
Robotics

- **Robotic Tree-to-tree machine (prototype)**
  - **Concept design by Scion**
  - **Prototype built by University of Canterbury Mechatronics programme**
  - **Field tested and demonstrated in Christchurch - Sept 2016**
  - **Needs more investment to develop further**
- **Robotic Log Sorting Facility (design)**
  - **Scan, sort and bulk load logs to HPMV trucks**
  - **Part of a new forestry automation programme**
  - **To be designed and built by Skookum Technology Ltd)**



Results of engineering developments to date

- **19 new products developed in last 5 years – 13 commercialised and 6 prototypes**
- **Suited to NZ forestry conditions**
- **Collaboration between forestry companies, contractors, Government and manufacturers has de-risked investment**
- **Growth of NZ forestry machinery manufacturers and technology developers**
- **Continues to catalyse innovations in harvesting**
- **Speeded up delivery of productivity and safety benefits**

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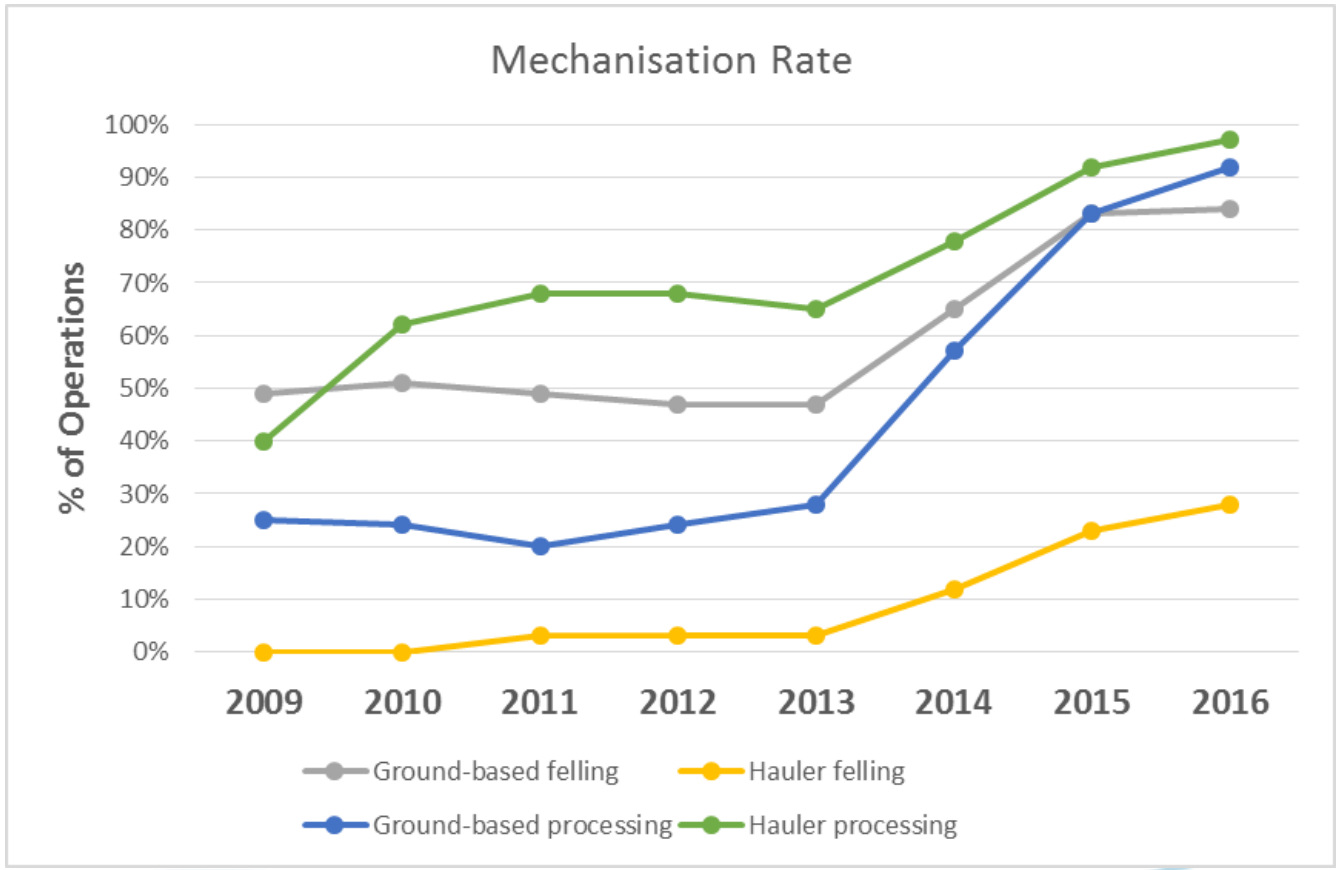
Sector-wide benefits: Mechanisation

- **Mechanised processing in over 90% ground-based and hauler**
- **Mechanised felling in over 80% ground-based and almost 30% hauler**



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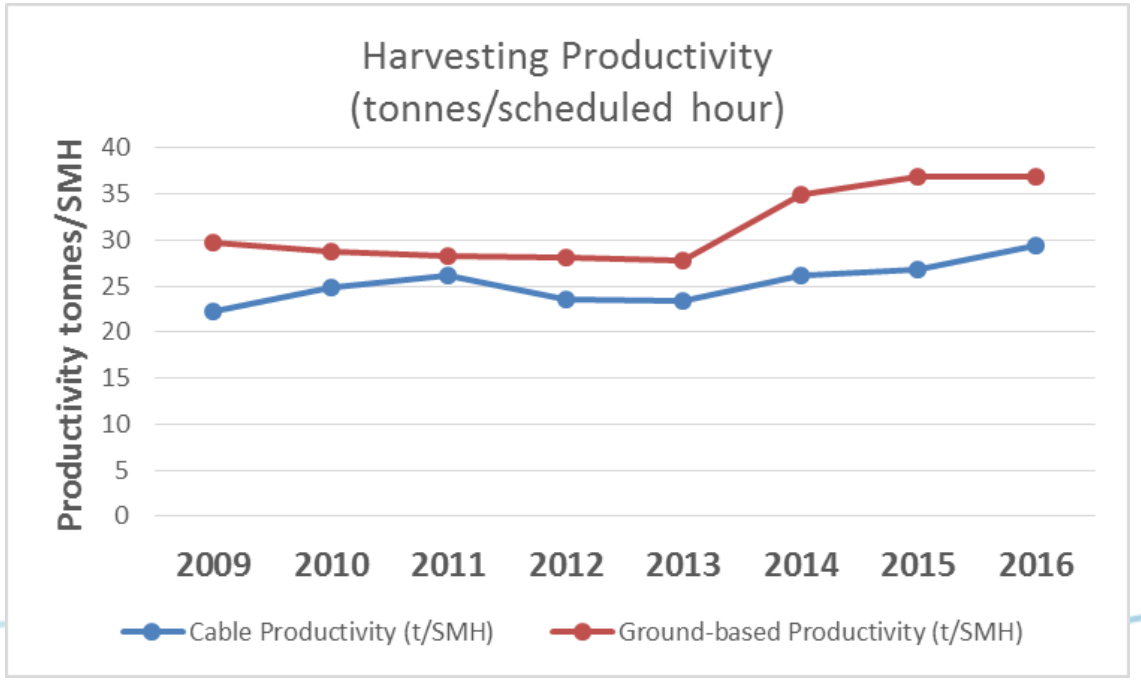
Sector-wide benefits: Productivity

- **33% increase in ground-based productivity since 2013**

  (36.8 tonnes/hour in 2017 vs. 27.7 tonnes/hour in 2013 – FGR Benchmarking)

- **25% increase in cable harvesting productivity since 2013**

  (29.4 tonnes/hour in 2017 vs. 23.4 tonnes/hour in 2013 – FGR Benchmarking)



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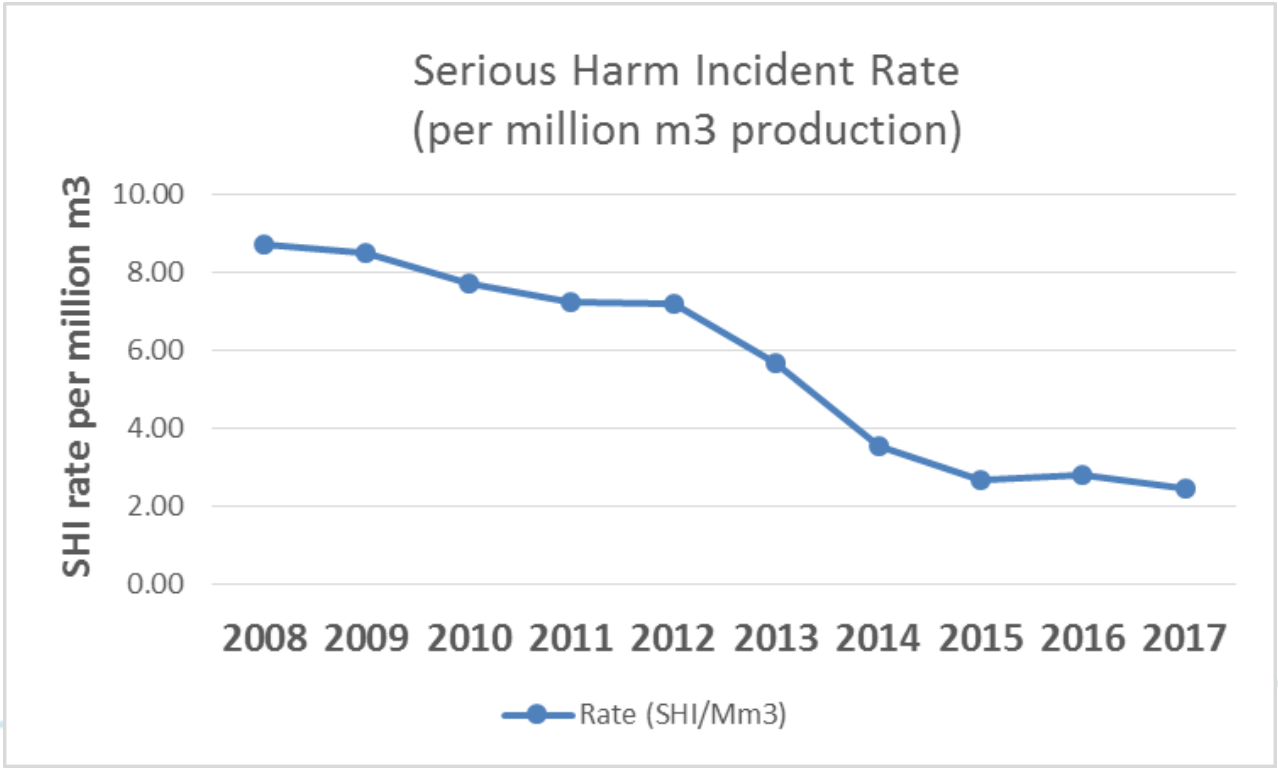
Sector-wide benefits: Safety

- **60% reduction in serious harm injuries from 2012 to 2017**

  (75 SHI incidents in 2017 vs. 194 SHI incidents in 2012 – WorkSafe NZ)

- **Over 200 workers removed from manual felling and breaking out**



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Sector-wide Commercial Outcomes

- Over 180 new winch-assist felling units sold
  - Including over 90 machine exports to North and South America
- Over 70 new grapple carriages sold
  - Alpine, Falcon and Hawkeye grapple carriages
- Over 100 new camera systems sold
- 20 HarvestNav navigation systems in use
- Over $110 million sales of new harvesting machinery and equipment since 2012

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