

Chapter 4

Steep slope harvesting machines



In this chapter you will find out:

- ✓ What is a steep slope harvesting machine and their features.
- ✓ What affects traction, and how a cable improves it.
- ✓ Things that affect stability.
- ✓ Ways to help reduce machine rollover.

What are steep slope harvesting machines?

Steep slope harvesting (SSH) machines are purpose-built for working on steep slopes. In New Zealand, the most common winch-assisted SSH machine is the excavator-based feller-buncher that has replaced manual felling in many situations. However, SSH machines can be skidders, forwarders, excavators, and specialised tracked or wheeled harvesting machines. This leads to many makes and models. SSH can have a chassis built on tracks or wheels. The cab can often level. The power unit may be part of the cab /upper structure or on the chassis.

Felling and processing SSH machines are either wheeled harvesters or a tracked harvester/feller-director/feller-bunchers. They have either levelling or non-levelling bases. Levelling machines are more comfortable than non-levelling, especially when slewing during felling or shovelling.

Log or tree extraction SSH machines typically are levelling, or non-levelling tracked excavator forwarders, wheeled forwarders, clam bunk skidders, or four or 6-wheeled rubber-tyred grapple skidders.



Excavator base vs wheeled machines

In New Zealand, excavator-based machines are commonly used for felling and shoveling as they typically have more power, move larger trees, and have more traction in steeper terrain or poorer soils. However, their rigid base reduces the tracks contact on uneven terrain, such as when shallow rock is present.

In these situations, sudden loss of traction and stability can occur.

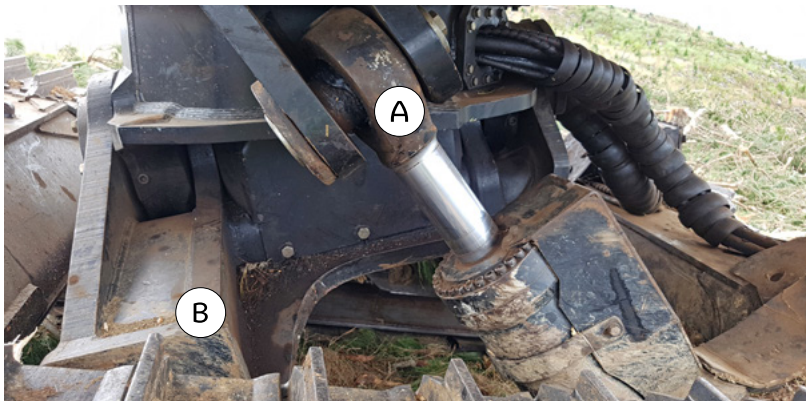
Wheels are better on undulating terrain. A major advantage is getting over obstacles like stumps that excavator-based machines struggle with. Wheeled machines tend to have significantly better vision than excavators because the boom is set high.



Levelling vs non-levelling cabs

A levelling cab is essential for winch-assisted operations on very steep slopes. A leveling cab redistributes the centre of gravity uphill to improve stability, especially on slopes over 33 degrees (65 percent). It has been shown that they reduce rollover risk.

Studies have also shown that productivity and operability is enhanced when using a levelling cab.

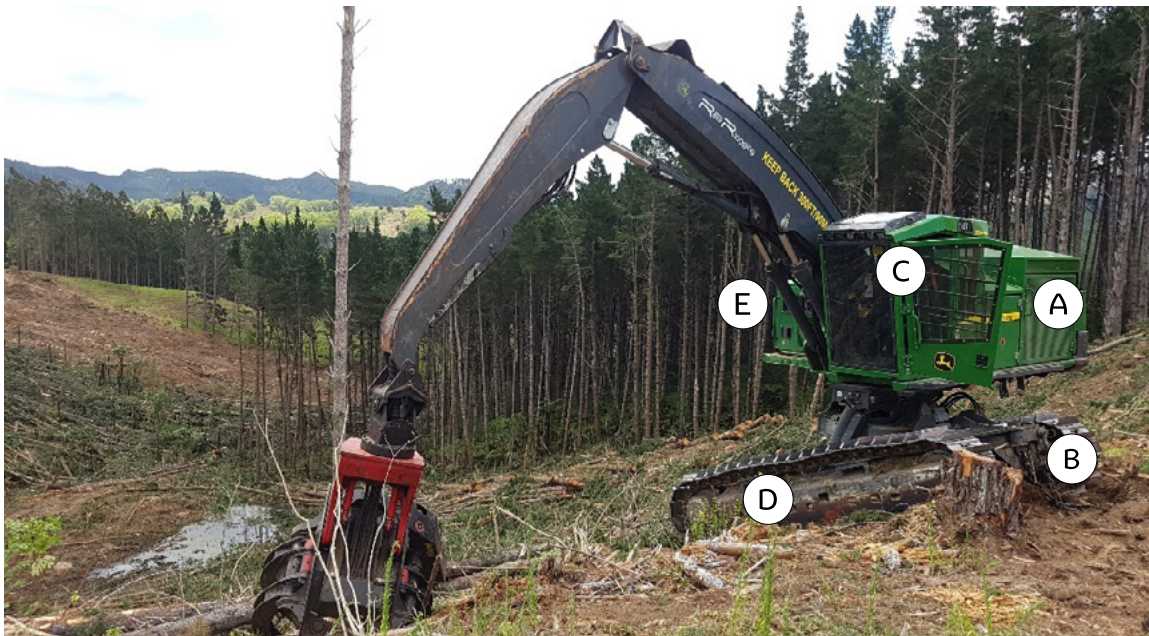


Hydraulic rams A and a pivot B levels the cab.

Machine features to safely and effectively work on steep slopes

Steep slope harvesting machines are purpose built for their work environment.

General operation



A Engine designed to work on the maximum slope limit

B Cable attachment points engineered for the expected loads

C Minimum 2 (preferably 3) emergency exits with two accessible from the outside

D Adequate traction and slew power for steep slopes

E Fluid systems designed to operate on steep slopes

Also:

- Emergency back-up system to ensure stability should the winch, wire rope, or anchor fail.
- Designed and tested to operate continuously for steep winch-assist.

Cabin



A Fully integrated/automatic fire suppression system

B Minimum four-point seat belt harness (lap 75mm + shoulder 50mm)

C Comms system

D Fire extinguisher

Also:

- Noise levels less than of 85 dBA otherwise hearing protection.
- Aircon (15-25^{oc}).
- A place to secure all water and food containers.
- No loose or dangerous material inthe cab.

Upper structure – external



A Compliant forestry cab with ROPS, FOPS, and OPS

B 19mm polycarbonate or equivalent front window

Also:

- Over-riding and functional braking system in the event of loss of machine power.
- Guarding that protects the steep slope harvesting machine's mechanical operation.
- Company safety/emergency stickers.

Undercarriage



Extended (>50mm) single grouser track shoes for tracked machines and chains or bands for rubber tyred machines.

Machine attachment points

A low frame-mounted attachment point is usually best. Do not sling around the lower structure.

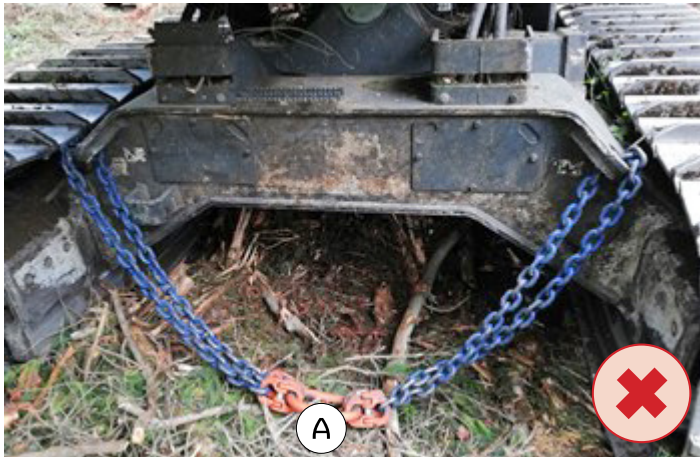
Sharp edges can damage the rope or chain and the machine structure could also be damaged.



Cable attachment points engineered for the expected loads.



A certified heavy duty towing hitch.



A Risk of extreme side loading of chain link

Electronic systems

The following are recommended:

- A winch monitor, with audible alarms, showing the hydraulic temperature or over-temperature light, cable tension and overloads, remaining available rope length, and when the minimum number of cable wraps is reached, rope length in use and spooling errors.
- Hour meter that tallies the number of hours the winch and cable operated to monitor cable use and life.



Remote control systems that incorporate safety redundancies.



Prevent accidental operation of the Steep Slope Harvesting machine when the winch is in manual mode.



Inclinometers can have digital readouts or mechanical.



Camera display of obstructed view areas for the operator including winch.



Take care of aerial and electronics, they can be damaged.