

Chapter 7

Common operational situations



In this chapter you will find out how to:

- ✓ Use redirects (rub trees or stumps).
- ✓ Manage the boundary between winch-assist and hand falling.
- ✓ Anchor winch excavators on a narrow ridge.
- ✓ Use uphill winch-assisted systems.

Redirects (rub trees or stumps)

It is best to stay in lead by moving the anchor machine. Sometimes this is not possible, e.g. in broken country with side ridges. Most operators use redirects.

They are also commonly referred to as rub trees or stumps or 'side-washing' in North America. Redirects help maintain the felling machine directly up and down the face. Some manufacturer guidelines specifically allow for it but give restrictions.



A Redirect stumps and trees



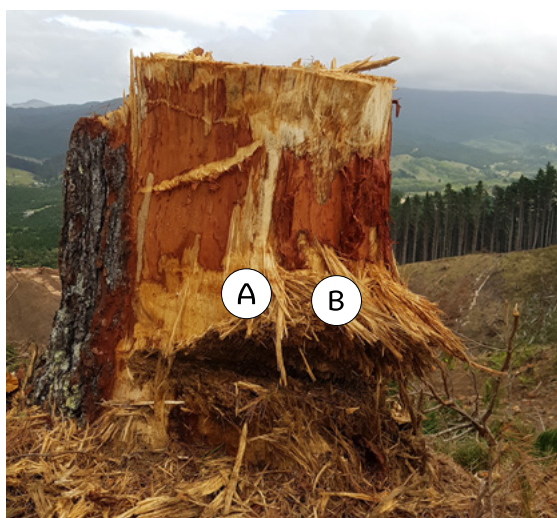
B High redirects are more likely to cause falling or leaning trees

Redirects help:

- Maintain a proper lead angle.
- Enable the steep slope harvesting machine (SSH) to cover more ground each machine anchor shift as multiple corridors are worked without moving the machine back to the anchor.
- Control where and how the SSH descends and ascends a slope, e.g. when there's broken ground.



Hazards created by redirects



- A Redirects can cause the rope to cut / bind
- B Redirects can create high temperatures from friction

Also, redirects can:

- Move or fail, causing a wire rope shock load, or steep slope harvesting machine instability.
- Binding can lead to rope tension being different above and below the stump, causing inaccurate tension readings.
- Increase hazard zones, e.g. rub trees.

How redirects change rope tension

Redirects add friction and result in the rope tension being different above and below the redirect. For example, if a winch applies a rope tension, the pulling power of the rope reduces after going around a redirect. The greater the redirect angle, the less tension goes to the SSH when being pulled uphill.

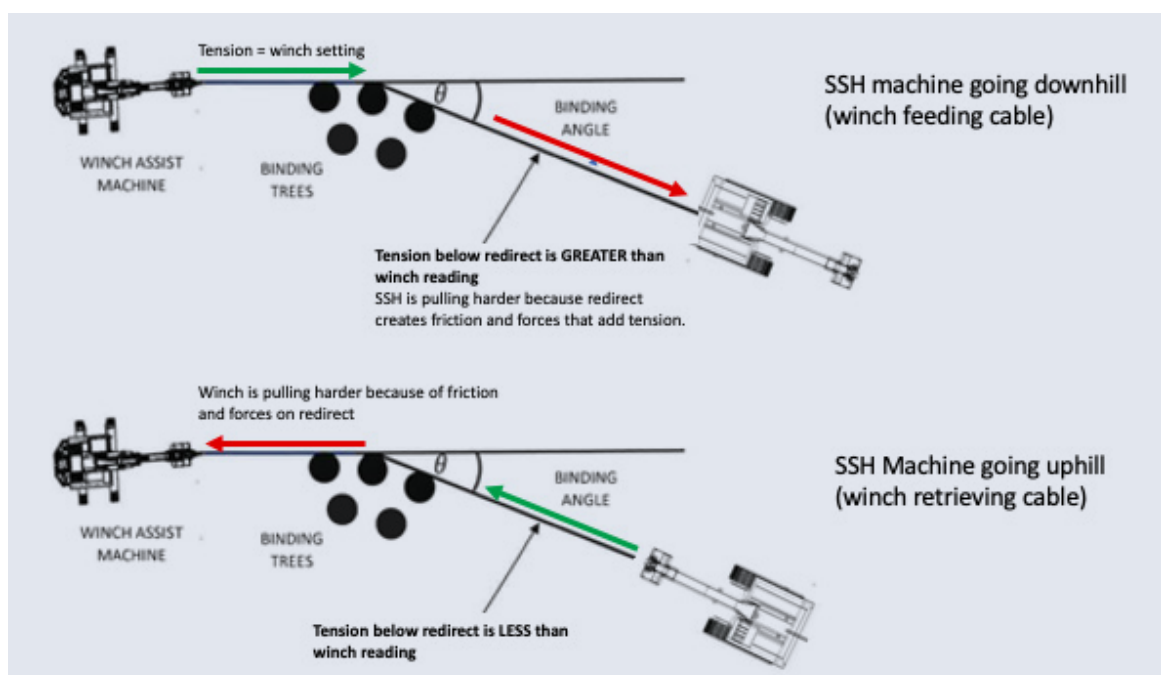
The stump's friction takes 25% of the rope's tension under load. However, if the SSH is moving downhill, the machine has to drag the rope around the stump that is

restricting its free movement. This means more tension is below the stump than above it at the winch anchor machine. This is because the winch can still spool off rope unrestricted. Don't use higher tension settings when moving downhill and using a redirect.

In the table below, if the winch is set at 20 tonnes and there is a 30-degree redirect, the actual tension on the cable below the setup could be 25 tonne so operating above the ropes safe working load.

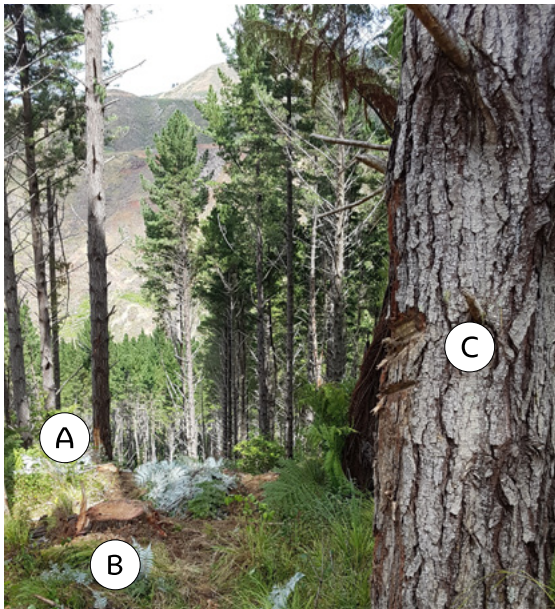
BINDING ANGLE (DEGREES θ)	TENSION (TONNES) When machine is tracking downhill				TENSION MONITOR READOUT
	5	10	15	20	
10	5.4	10.8	16.1	21.5	ACTUAL TENSION VALUES
20	5.8	11.6	17.4	23.1	
30	6.2	12.4	18.7	24.9	

The table gives indicative tensions only. Other factors can affect tension too.



Working in steep broken country that requires redirects

Working in steep broken country is challenging even for skilled operators. An example would be a steep face with lots of narrow gullies. The steepness makes the SSH machine have less traction, and the narrow gullies need redirects, so the machine is going up and down them, not sidling. Position the rope carefully to avoid unintentional redirects.



- A Use a redirect on the left side of the ridge if going right, otherwise there will not be enough room for the machine to pull up and over the ridge coming back up.
- B Re-cut stumps low on narrow ridges.
- C On ridges with flat sections, use redirect trees, otherwise the ropes will ride off the stumps. Two tree lengths apply for standing trees.



Stump failure increases the risk of rollover if redirecting across a steep side ridge.



Watch where your rope(s) run and what they run over. Wherever the rope runs that's where they will take you back up!

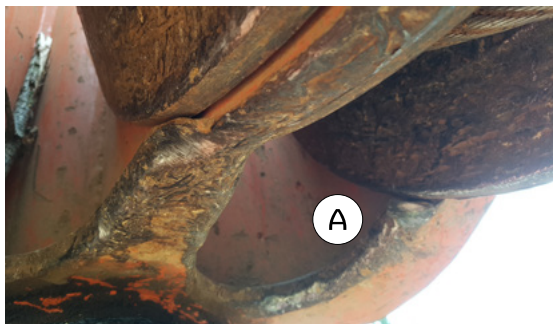
Moving up, then getting the rope over a redirect no longer needed

Coming back up the winch rope in steep and broken country creates additional challenges. Redirected ropes need lifting over stumps. In easy country, this is straightforward. The machine moves around them or lifts the rigging over them.

In steeper country, this can be much harder. Carefully plan where your redirects are placed. For example, use a redirect on the left side of the ridge if you're heading right. Otherwise, there is not enough room for the machine to pull up and over the ridge coming back up. If the stump is too close to the ridgetop, it becomes difficult to get up and around it safely.

On steep country rigging is usually lifted over stumps with the attachment. Weight needs taking off the winch rope. Be aware that redirect binding creates tension in the rigging. Spooling off rope can create significant hazards at the winch anchor like misfeeding and ropes riding off sheaves. Ropes get cut this way.

After spooling off a little slack, use the head to create slack at the rigging. Then lift over the redirect stump.



- A** Don't spool off too much. Slack can cause the wire not to feed correctly onto the fairlead sheave(s) as seen on two different machines. This can cut the rope.



Take care when shifting off redirects.

Binding from redirects significantly reduces anchor winches pulling power.



Ensure you can climb back on top of the ridge by using a redirect stump, and not left hanging off to the side. In difficult country, ensure you can get out of where you went down.

Redirecting using blocks

Blocks reduce:

- Friction and don't create the changes in tension like stumps or rub trees.
- Rope wear.
- Permanent rope damage like twisting which may affect rope life and spooling onto the drum.

Blocks can be challenging to manage, especially on twin rope winches where there is a need for double blocks. Also, multiple stump redirects are difficult, as is re-shifting winch ropes when moving back up the rope.

If the block is attached to a looped chain, then the SSH can carry it and put over a stump. It can then also be lifted back over the stump when the SSH returns uphill.

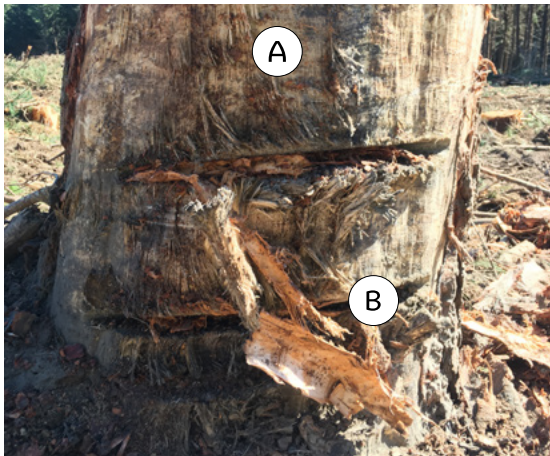


Use blocks rated for the expected load and forces, e.g. uphill winch-assist systems.

Ensure block redirects are correctly installed.



Use a block with an attached looped chain for redirects

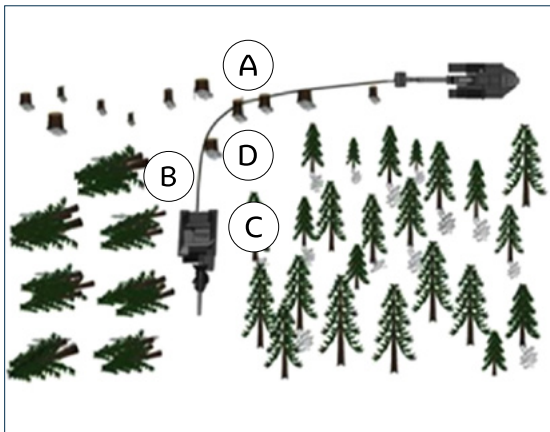


Guidance for redirecting

- A Use stumps that are large and strong so they won't move and create rope bending fatigue.
- B Position the rope low.

Also:

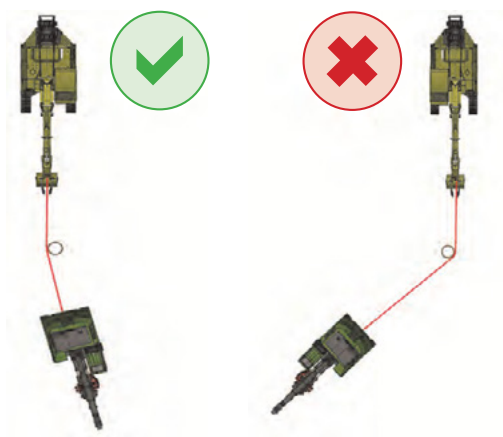
- Avoid redirects during high fire hazard.
- Consider using blocks with redirect trees.
- Check a redirect stump frequently, to confirm its stability.



- A Use multiple stumps or stems. A single stump failure could result in shock-loading. Even though multiple redirects will cause rope wear and reduce anchor winch power, it is safer than a single stump.
- B Position the winch rope to avoid unintentional redirects.
- C Avoid using trees. They can be more unstable than stumps.
- D Keep the redirect angle as wide as possible.



Minimise using standing trees for redirects.



Avoid angles over 45 degrees. Stumps can pull out or cut through.

Managing the boundary between mechanised and hand felling

In steeper and more challenging broken country, mechanised felling may not be safe or possible. This could include inaccessible anchor locations or areas below bluffs, rock or terrain that mechanised machines cannot go on, or slopes exceeding 45 degrees. This is considered the absolute upper limit for any winch-assist operation. The felling plan needs to identify hand felling areas. It isn't always clear, especially if the boundaries aren't obvious ones.

Ideally, the hand fallers fell before the winch-assisted operation starts in the setting. However, often it isn't until the winch-assisted machine is on the slope that the operator can work out the hand felling boundary, leaving the hand felling until later. Otherwise, if hand felling occurred first, the winch-assist operator may not harvest all the remaining trees.

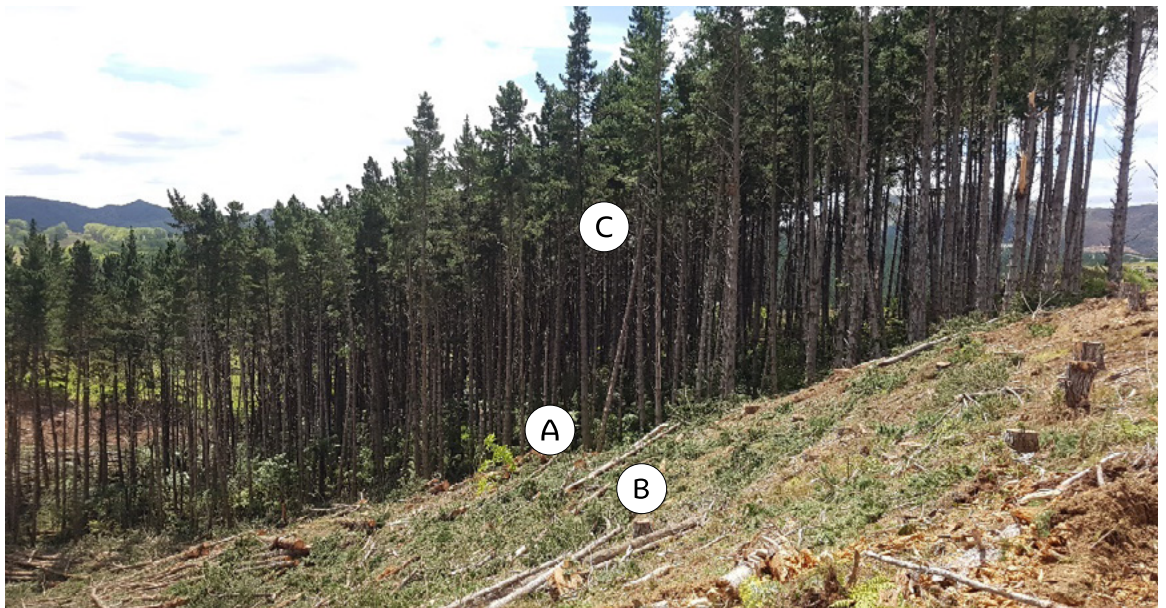
Guidance for managing the boundary where hand felling follows mechanised

Managing the boundary between mechanical and hand felling is essential.

- Communicate the harvest plan with the hand fallers and involve them in the planning processes.
- Map out the area to be hand felled.
- Have the hand fallers work first if possible.
- Minimise 'unnatural hazards' if the hand fallers come in last. These are hazards that have been made by the winch-assisted machine that would otherwise not be there.



Always make boundaries as safe as possible for the hand fallers.



A Keep hand fallers escape routes open on the boundary

B Fall away from the boundary. No branches or tops in the hand falling area

C Leave a clean boundary canopy, with minimal broken branches. These are hard to see because they are still green

Also:

- Redirect (rub) trees must be felled by the winch-assist machine.
- Remove risks identified by hand fallers.
- Eliminate other hazards that could be between standing and felled trees.
- Inform the hand fallers of boundary hazards.



Have the hand fallers work first if possible. Even when you think you can get all the wood, fell as if you might not.

Anchoring excavators on narrow tracks or ridges

Narrow ridges are common in many parts of New Zealand and can cause difficulty when setting up winch-assisted machines. There is not enough space for the winch-anchor machine to be in line with the steep slope harvester (SSH) requiring an alternative anchoring method.

A solution is to sit the excavator perpendicular (90 degrees) to the lead angle and use the bucket to redirect the load from the SSH. Unlike the standard winch-anchor machine anchoring where the anchoring is through machine, boom and bucket, most of the rope's force goes on the bucket:

- The strength of the soil that the bucket is dug into holds the SSH machine's forces

- Digging the bucket deeper and using solid ground creates more holding force
- Locating the bucket further back from the edge improves holding force and the rope will cut through the ground.

Increasing sideways forces could generate forces large enough for failure on the bucket/bloom/sheave unless manufacturers have modified their equipment design to accommodate such large angles.

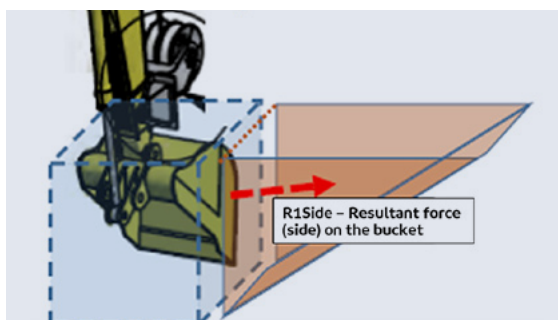
It may also be challenging for the SSH machine to access on or off the ridge. A solution is to sit the winch-anchor machine far enough back or use redirects.



A Excavator is back far enough to allow the felling machine to be on the rope as it moves over the edge



B Ensures the bucket is in strong natural soil or in hard ground on a track



The orange wedge of soil holds the force from the steep slope harvesting machine!



The soil around the bucket is susceptible to loosening over time. Use solid ground and not uncompacted fill.

Uphill winch-assisted systems

Depending on the location, a common situation is where a mobile machine cannot access the top of the winch-assisted harvesting slope or cut an access track.

This occurs for many reasons including crossing into a different property, no physical way of access, environmental reasons, or a different age class of trees.

Winch on the steep slope harvesting machine

Steep slope harvesting (SSH) machines with winch mounts, like the Climamax can use suitable stump(s) or tree anchor(s). This is a system advantage.

- Drag strawline directly from the SSH to the stump.
- Pull up the winch line.
- Securely anchor and back up anchor, if needed.
- Attach a stump movement monitor.

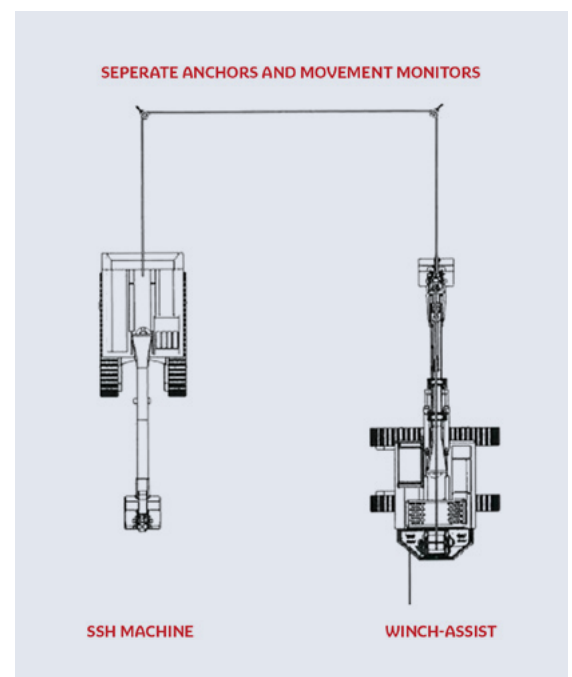
Winch anchor machines (WAM)

A solution for WAM machines is for the winch rope to be fed through blocks at the top of the winch-assist harvest area back to the SSH machine.

The system integrity depends on the:

- Quality of the stump or tree anchors. Each anchor may need to have backups, e.g. 2 or more stumps
- Using correct rigging, e.g. the right size and type of blocks, shackles, and strops

Forces on the anchor and rigging are significantly increased. If a single anchor was used, and the tension on the SSH machine was 18 tonnes, then the force at the stump, block, strops, and shackles would be double at 36 tonnes.





Anchor or anchor rigging failure may result in SSH machine destabilisation or rollover.

Work area exclusion zones

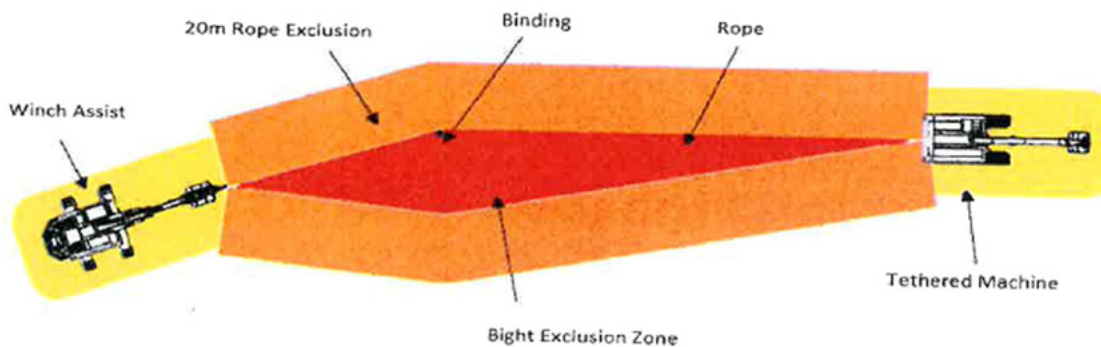
Operational work exclusion zones differ depending on the harvest site. These should be determined as part of the site safety plan. The following are indicative work area exclusion zones.

Minimum 6m

- Behind and to the side of a stump or deadman anchor.
- Around the winch anchor machine.
- Around the SSH machine (depending on the operation).

Minimum 20m

- Either side of the winch rope if operating without redirects.
- Beyond the extent of the bight if using redirects (see diagram).



Serious hazards exist from winch-assisted harvesting rigging and system.