Appendix 1: References

BC Forest Safety (2015) *Slope Logging Resource Package – Assessing Risks and Planning, Mechanical Harvesting on Steep Slopes*. Version 4

FPInnovations (2018) *Winch-Assist Harvester: Best Practice Manual*. Special Paper SP-533

FPInnovations, Amishev, Hunt and Boswell (2019) *Best Management Practices For Winch-Assist Equipment Version 2*

FPInnovations, Steep Slope Initiative. (2017) *'Wire Rope Integrity In Winch-Assisted Harvesting Operations – A Guide To Wire Rope Handling And Inspection For Machine Operators*

Hancock Forest Management (2017) *Interim Best Practice Guideline – Cable Assisted Steep Slope Harvesting*

Parker, FPInnovations (2017) *The Effect of Machine Position on Stability when Operating on Steep Slopes*. Tech report no. 60.

Pedofsky and Visser (2019) *Assessment of Winch-Assist Skidder In Gisborne, New Zealand*

Rayonier Matariki Forests (2020) *Safe System of Work Production Tree Felling (incl. Winch-Assisted)*. Version 2

Safetree (undated) *Steep slope risk assessment – Risk identification and assessment form*

Washington State Department of Labor & Industries, (2019) *Best Management and Operating Practices for Steep Slope Machine Logging*. Technical Report Number 98-02-2019

Worksafe NZ (2016) *Fact Sheet – Winch-Assisted Harvesting On Steep Slopes*

Visser, Rayonier Matariki report (2018) *Lead angle for Winch-Assist operations – a Review of Practices and Limits*

Visser, Raymond and Harrill (2014) 'Mechanised Steep Terrain Harvesting Options' *NZ Journal of Forestry, November 2014, Vol 59, No.3*

Visser (2019) *Steep Terrain and Winch-Assist Harvesting Workshop*

Appendix 2: Examples of steep slope risk assessments

A steep slope risk assessment document is a systematic system that both guides risk and mitigation of risk, as well as records that a formal risk assessment has been undertaken. Two examples are provided here. The second is a simplified version of the first.

Steep slope harvesting risk assessment[1]

This form is to be used in conjunction with the ACOP, the company safety plan, as well as the contractor's health and safety plan. It should be completed for a Harvest Setting when:

1. Any equipment is going to be operated on soils with low strength (e.g. very wet, or very loose) and on dominant slopes over 40% (22 deg), or
2. A crawler tractor, or a basic excavator base with grapple / felling/ processing head is going to be operated on dominant slopes over 40% (22 deg), or
3. Forestry equipment specifically designed for use on slopes (e.g. self-levellers; high and wide with custom grousers) is going to be operated on dominant slopes over 50% (27 deg).

The dominant slope for the harvest setting is ___ % / deg *(cross out unit that does not apply).*

Logging Contractor: _____ Date: _____

Forest / Compartment: _____ Harvest Area/ Landing: _____

1 DRAFT developed by R. Visser (SOF, UC) and Wayne Dempster (Rayonier) March 2017 based on consideration of (a) the BC FSC Steep Slope Logging Resource Package, (b) the SafeTree Steep Slope Risk Assessment form, and (c) NZ operating conditions.

Practices and Controls:

Compounding Steep Slope Risk Factors:			If YES – what practice to eliminate or minimise risk is required:
Unstable ground (e.g. fill slopes, slips, slumps) covering more than 25% of area.	YES	NO	
Ground roughness (e.g. boulders, rocky outcrops, depressions) covering more than 25% of area.	YES	NO	
Shallow soil over bedrock, or exposed areas of bedrock covering more than 25% of area.	YES	NO	
Wind-throw covering more than 25% of area.	YES	NO	
High stumps, and or deep slash that can interfere with machine operations.	YES	NO	
Large trees (i.e. > $3m^3$) that are difficult to handle on slope.	YES	NO	
List other risk factors:			

Mapping / Planning:

Where feasible, are the above steep slope risks identified on the map?	YES	NO	
Are all areas over 40% (22 deg), 50% (27 deg) identified on the harvest planning map?	YES	NO	
Are contiguous areas > $800m^2$ over 100% (450) identified as machine no-go areas?	YES	NO	

Machines to Operate on Steep Slope:

Description	Will it be winch-assisted?		Features for working on steep slopes: (e.g. tilting cab; extended grouses; extended tracks; chains or belts on wheels; telescoping boom)
1:	YES	NO	
2:	YES	NO	

Operator Training, Competency, Fatigue and Communication

Operators that will be operating under this risk assessment are:

(1) _____ (2) _____ (3) _____

Do the operator(s) have the correct unit standards to operate on the dominant slope identified for this harvest area?	YES	NO
Have the operator(s) been deemed competent to operate on the dominant slope identified for this harvest area?	YES	NO

Fatigue – In addition to the fatigue management plan, what steps are taken to ensure the operator will remain focussed on the task?

Isolation – Communication system (i.e. RT?) _____; Check-in with (name) _____ at a frequency of __ min.

Assistance – What equipment is available to assist the machine on slope in case of a breakdown or emergency?

Weather – The suitability of operating on steep slopes should be reconsidered after rainfall events, high winds or other adverse weather conditions. Who is responsible?

Site – Any site specific requirements and notes:

Signatures

This form is accurate to the best of my knowledge: Date:

_____ _____

Person completing risk assessment: _____

Operator Name: _____

Operator Name: _____

Foreman / Contractors (counter-sign if operator is assessor) _____

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Steep slope risk assessment

Risk identification and assessment form.

Forest owner:		Logging contractor:		Date:
Forest:		Compartment:		
Mean tree height:		Tree species:		

Steep slope risk assessment and identification table

RISKS	LOW RISK	MEDIUM RISK	HIGH RISK	Comments
Slope and slope length (tracked machine)	☐ 22° to 27° and slope length <50 metres	☐ 22° to 27° and slope length >50 metres	☐ >27° and slope length >10 metres	
Slope and slope length (wheeled machine)	☐ 19° to 24° and slope length <50 metres	☐ 19° to 24° and slope length >50 metres	☐ >24° and slope length >10 metres	
Terrain stability/ classification	☐ No instability indicators and slopes <27°	☐ Instability indicators and slopes <27°	☐ Slopes >27°	
Ground roughness: boulders, outcrops, depressions	☐ <17° of steep slope area covered by roughness features	☐ <17° to 27° of steep slope area covered by roughness features	☐ >27° of steep slope area covered by roughness features	
Soils	☐ Well drained (e.g. gravel, coarse sand)	☐ Moderately drained (fine sand, silt indicators of sub-surface flows)	☐ Poorly drained or staurated (clay, silt) high water table	
Soil depth	☐ >30 cm to bedrock	☐ 15 to 30 cm to bedrock	☐ Thin soil (less than 15 cm) or bedrock exposures	
Pre-existing and post harvest debris	☐ Open understory, not windthrow	☐ Moderate windthrow, understory, stumps <30 cm	☐ Heavy windthrow, understory, stumps >30 cm	
Human factors: State of mind	C***onsider operator focus, alertness, understanding of plan and how to implement, confidence, stress level, physical and mental workplace distractions, well fed and well rested. AVOID complacency, fatique, rushing***			
Risk ranking	☐	☐	☐	
Operator competency	*Does the operator have adequate training and experience to complete this work? Has the operator demonstrated successful operations using this machine on sites with similar attributes and timber?*			
Risk ranking	☐	☐	☐	
Duration of exposure	*How long will the operator be working on a specific steep slope site? Also consider shift length, number of consecutive shift days, etc...*			
Risk ranking	☐	☐	☐	
Worker isolation – time for assistance to reach operator	☐ <15 minutes	☐ 15 to 30 minutes	☐ >30 minutes	
Weather conditions	☐ Calm day, change unlikely	☐ Chance of changeable weather	☐ Adverse rapidly changeable weather	

4 ticks in high risk or 5 ticks in medium risk, results in a ***"NO GO SITUATION"*** unless additional measures are taken.

Manager/Contractor/Foreman:.....**Signature:**.....


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