

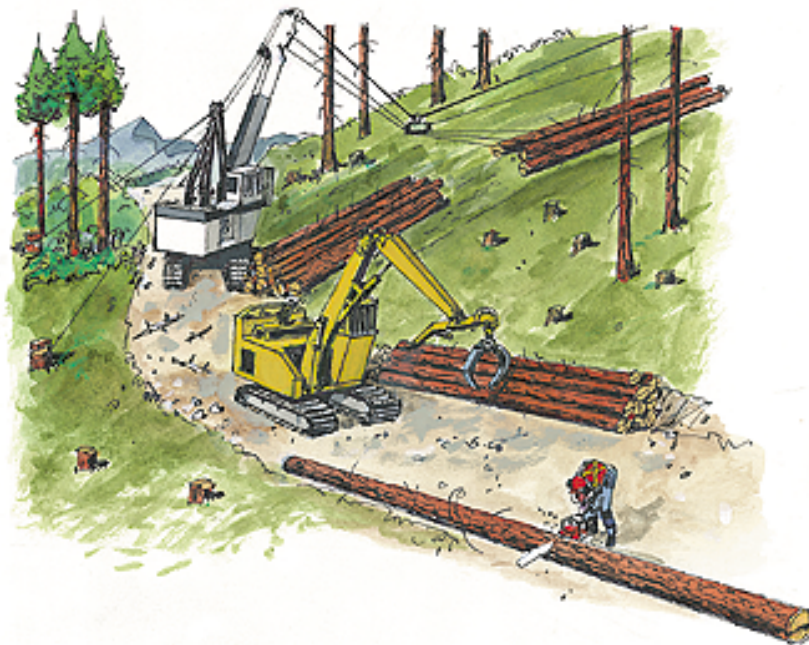
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## Designing Safe Cable-logging Methods

### Landings

In the design of landings for cable-logging operations, planners must:

- provide enough room for the safe landing, processing and loading of logs: where there is not enough room to process or load the logs, they must be skidded away from the yarder to a more suitable area;
- ensure appropriate dimensions so that at least two-thirds of the length of each log can be landed on a flat surface for safe chasing. Where this is not practical, some other safe means of landing logs (such as a brow log system) should be used;
- ensure that adequate guyline clearances for through traffic and loading equipment are available during harvesting;
- ensure that guylines in standing timber have a clear path for rig-up and yarding;
- ensure that adequate guyline anchor stumps are available, or that equipment, rock or soil anchors, or “deadman” anchors can be employed. Standing trees may not be used for guyline anchors if anyone would be endangered should the tree be pulled over.



*Loading and processing areas must be clear of log landing areas.*

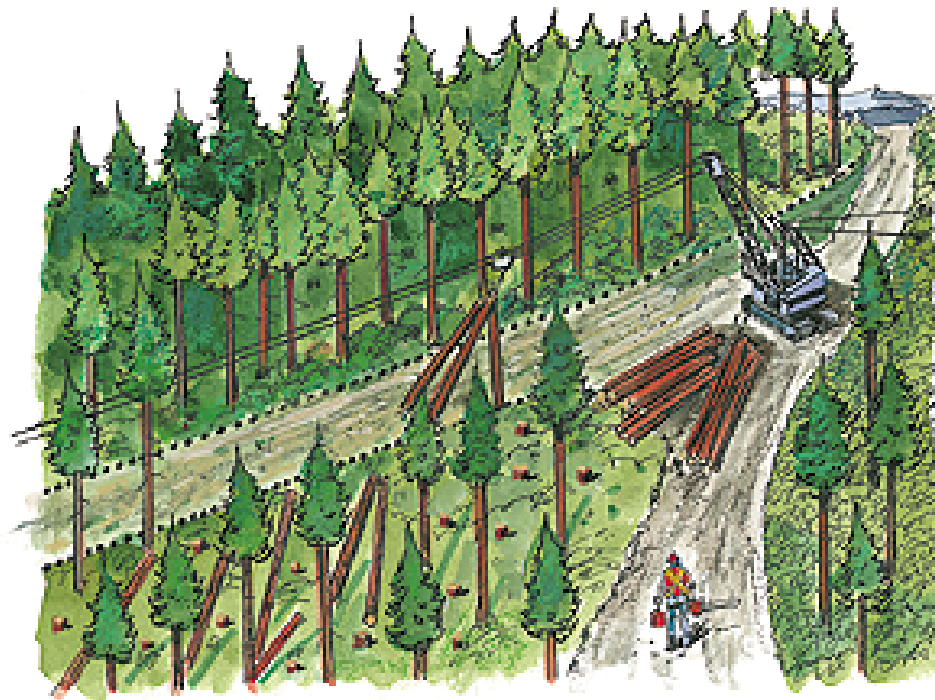
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## Yarding Corridors

- Planners should design well-engineered systems with correct corridor configuration (e.g., width, running line height, spacing) to:
  - ~ enable the lateral yarding of logs into the corridor and prevent the turn of logs from hanging up on trees as the turn is yarded into the landing
  - ~ avoid or minimize the danger that lines will strike and damage trees, creating hazards for the workers. Special consideration should be given to minimizing hazards created by skyline excursion during the lateral yarding of logs.
  - ~ permit the safe yarding of maximum log lengths and swinging of the log turn during yarding.

A well-designed yarding system may, in fact, utilize relatively narrow corridors.

- Planners should also:
  - ~ plan for sufficient deflection where full suspension yarding is desired
  - ~ ensure that deflection is adequate to avoid up-ending logs
  - ~ consider flaring corridors at the landing if necessary for the safe landing and handling of logs
  - ~ ensure suitable tailholds are available
  - ~ ensure rub trees are free of unsafe defects, with stable roots; dead trees must never be selected for rub trees.



*Mouth of corridor widened to prevent trees from being pulled over onto the machine or landing workers.*

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## Downhill Yarding

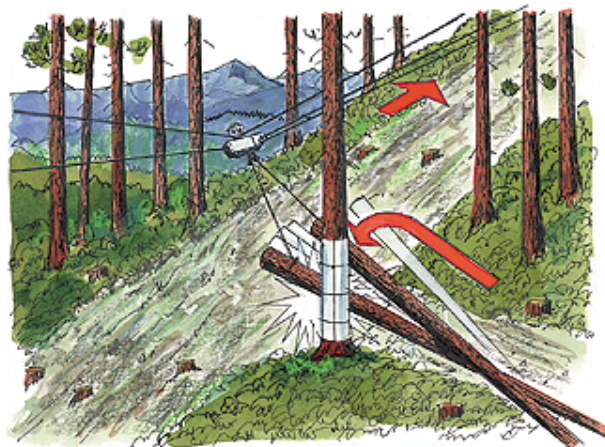
- For downhill yarding, plan for a yarding angle that will allow safe log landing and minimize the danger of runaway logs.
- Straight downhill yarding on steep slopes is prohibited because of runaway log hazard.

## Uphill Yarding

- For steep uphill yarding on runaway-prone ground, the safest corridor orientation is a system of parallel corridors laid out sufficiently bias to the contour lines. This allows workers to clear to the upslope side of the turn more easily, ensuring that runaway logs slide downslope, away from workers.
- Although corridors laid out perpendicular to the contours make it easier to control logs during both the lateral and corridor yarding sequences and reduce damage to residual trees, straight uphill yarding is extremely hazardous and should only be used where the following conditions exist:
  - ~ no other safe rig-up is possible
  - ~ a site-specific determination of runaway risk has been made on the basis of local topography, ground and weather conditions, and proposed season of harvest
  - ~ safe work procedures are followed to ensure that workers clear the turn and potential runaway areas before any yarding and/or loading activity is permitted. Workers must stay in this safe position until the rigging is spotted and any landing activity that has even the remotest possibility of dislodging material or logs ceases.

## Cross-Slope Yarding

- Where cross-slope yarding must occur, full-suspension logging may be necessary to prevent damage to retained trees on the down side of the yarding corridors. This will require the use of live or standing tower skyline systems.
- Planners should identify and flag all corridors and access routes.



*Consider protective devices to increase durability of rub trees.*



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## Designing Safe Helicopter-logging Methods

### Layout and Project Management Considerations

In the layout and design of a helicopter-logging system, planners, in consultation with helicopter operations staff, must consider the following:

- *Aircraft selection:* The selected aircraft must be capable of safely handling the anticipated log weight with sufficient clearance to avoid brushing the lower timber edge. Flight windows must be felled, if necessary;
- *Hazard assessment procedure:* Danger tree hazard assessment must be carried out on all designated wildlife trees/patches, riparian reserves, leave-trees, and any other potentially hazardous trees adjacent to the work area which could endanger workers. A no-work zone of sufficient size and shape must be established around any wildlife tree designated for retention;
- *Rotor blade downwash hazard potential:* All snags/danger trees that could potentially reach or endanger workers if subject to rotor blade downwash must be identified and removed;
- *Safe flight paths:* Flight paths must be selected which minimize exposure and risk to workers and vehicular traffic;
- *Roadway and traffic control/coordination of radio frequencies:* Effective traffic control and radio use is necessary to ensure flight paths remain clear of crews and support aircraft, and that travelled roads can be closed if overhead flight paths are necessary. A secure, uninterrupted radio frequency must be used for logging purposes;
- *Adequate buffer:* A suitable topographic barrier must be present on steep ground to prevent runaway timber from reaching workers downslope (runaway trees have been known to “run” 300–500 m through standing timber);
- *Emergency safety plan:* An emergency safety plan must be in place for logging or silviculture crews stranded on the hillside due to unexpected fog and storm events; this should include clearly marked exit trails and/or overnight emergency provisions. Such a plan should also provide for the removal of injured workers. Felling and bucking operations should cease if fog or storm events make it impossible to remove workers who may become injured.



*Plan turns to avoid overhead hazards and brushing of leave-trees.*



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## Land-based Drop Zones

- Planners should:
  - ~ choose a level location/section of road for the landing drop zone
  - ~ design a drop zone large enough to facilitate the safe landing, chasing, decking and loading of logs, as well as an area for choker coiling
  - ~ ensure that flight paths will not cross active roads during logging (if that is not possible, planners should close affected roads, either with flagmen or gates)
  - ~ ensure the removal of trees and saplings adjacent to the landing which may be blown over or knocked into the landing.

## Helipads

- Where helipads have not yet been built, planners should ensure that workers receive training in safe “toe-in” hover exit procedures.
- Vertical descent locations should be avoided in choosing helipad sites.
- Planners should ensure that helipads are designed and constructed to safely support the intended helicopter, and establish a regular safety inspection procedure for the duration of the logging project and subsequent silvicultural work.
- Standard helipad design and construction methods exist for a variety of helicopter types. General guidelines in the *WCB Helicopter Operations Manual* should also be followed.
- Planners and logging supervisors should refer to the standards in the WCB handbook *Helicopter Operations in the Forest Industry* and:
  - ~ locate helipads no more than 20 minutes walking distance from work areas
  - ~ ensure that workers are not routinely delivered to work area by means of “toe-ins” (hover exits)
  - ~ number and mark helipad locations in the field (e.g., on cut stumps), and indicate locations on the cutblock maps
  - ~ ensure that the date of construction of the helipad and the materials used have been documented.



*Ensure helicopter pads are properly constructed, numbered, and marked on maps.*

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## Inspection of Remaining Stand

The hazard assessment for helicopter-logging operations using helicopters capable of lifts exceeding 2250 kg must be to a standard that is more rigorous than that required for cable or ground operations because of the extraordinary disturbance caused by high rotor wash winds. This requires that the following steps must be taken:

- All standing dead trees that can reach or endanger workers must be felled, subject to safe felling procedures, as per established standard industry practice. Rotor wash can cause snags to fall against their lean and can dislodge bark and limbs. Snags that are blown over or broken on the upper boundaries of a steep setting can slide or roll downhill.
- All standing green trees and saplings outside the block boundaries or adjacent to work areas that could endanger workers must be evaluated by a competent person who is familiar with the special hazards created by heli-logging, to ensure that:
  - ~ they are able to withstand helicopter rotor wash
  - ~ there are no overhead hazards.



*Falling supervisor assessing reserve tree.*

This evaluation must include a visual assessment (when possible) of:

- ~ broken, burned, rotten or damaged roots
  - ~ trees with shallow roots, rooted in areas of poor drainage, or rooted on rock
  - ~ widowmakers, dead limbs, broken hanging tops, dead tops, loose bark, witches' broom
  - ~ excessive lean
  - ~ stem condition (scarring, cat face, cracks and splits, schoolmarms, fungal fruiting bodies)
  - ~ signs of root rot or other disease
  - ~ windthrow, indicated by cracked or disturbed surrounding soil
  - ~ other indicators of decay or physical damage.
- Trees that, by location or as determined by this evaluation, are not able to withstand helicopter rotor wash or will present a hazard to the logging crew must be removed.
  - In partial cutting, all trees to be retained within the setting or block boundaries, as well as any suspect trees outside the block boundary, must be assessed as above, by persons who are familiar with the special hazards created by heli-logging and are certified wildlife/danger tree assessors. When possible, the assessors must apply the full wildlife/danger tree assessment to determine tree soundness and danger. However, the delineation of no-work zones is not permitted, and only trees determined to be sound and free from hazardous defect or excessive lean can be left standing during air operations. This procedure must provide verification of the evaluation of individual trees to be left standing.
  - After felling and before yarding, a competent person must inspect the block and adjacent timber to ensure the removal of hazards created by the felling process or other harvesting activities.
  - Heli-logging operators are responsible for ensuring that all the above requirements are met and that the crew will not be exposed to undue risk.





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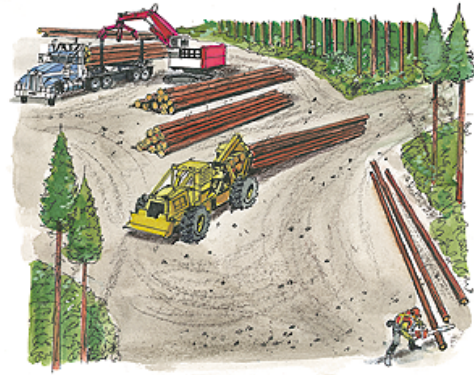
## Designing Safe Ground-based Logging Methods

### Layout and Equipment Considerations

- Trails should be oriented to provide for safe skidding of timber for both the current harvest operation and any future entries.
- The entire trail and landing network should be planned and laid out for complex harvest units prior to the initial entry. This will reduce the likelihood of hazards in subsequent entries.
- Harvesting patterns must be designed so that fallers can work a minimum of two tree-lengths from any other workers and avoid unnecessary brushing of other timber.
- During layout, planners should consider the specific types of equipment and equipment combinations to be used, taking into account:
  - ~ space requirements of each type of equipment
  - ~ safe maneuverability
  - ~ maximum physical and economic yarding/winchng distance
  - ~ maximum piece size (weight and length) for equipment type
  - ~ maximum reach of feller buncher/hoe to determine width of the crane zone and optimal trail spacing for mechanical/hoe-forwarding operations (the crane zone is the area on either side of the trail within which trees can be felled by the feller buncher/retrieved by the hoe-forwarder)
  - ~ where wider trail spacing is desired, trees beyond reach of the feller buncher may be felled manually toward and into the crane zone
  - ~ maximum winching distances to determine optimal trail spacing for cable skidding operations
  - ~ slope limitations for equipment, which should not exceed 30% for skidders, 40% for crawlers and feller bunchers, and 50% for light flotation forwarders (check manufacturer's specifications).
- Planners should also take stand structure and health into account when specifying equipment. Slope limitations for equipment may be affected by the presence of windfall, debris, loose rock, broken terrain and high stumps. Tree height must be considered where manual felling is employed between crane zones to increase trail spacing.

## Landings

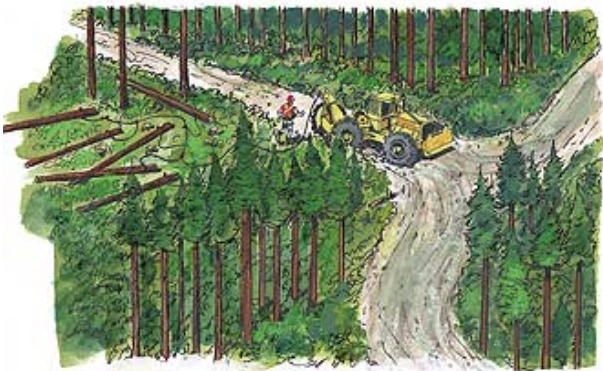
- Planners should establish landings large enough to:
  - ~ ensure the safe loading and chasing of the drag
  - ~ accommodate loader movement between the truck and log deck
  - ~ ensure safe tree processing and chain-filing/warm-up fire area
  - ~ accommodate crew and emergency vehicle parking, and fire equipment storage areas
  - ~ consider using self-loading logging trucks in tight operating situations; they can dramatically reduce landing size requirements because they can load at the roadside.
- Where landings must be small, the planners should consider:
  - ~ limiting the number of skidders
  - ~ using line or hydraulic grapple loaders or self-loading trucks that need less space and provide the flexibility of roadside decking and loading
  - ~ increasing the number of landings and rotating equipment and workers between the landings.



*Ensure adequate room at the landing, or alternately schedule activities to ensure safe operations.*

## Skidding/Forwarding Trails

- Planners should design the skid trail system so that:
  - ~ it efficiently accesses all areas of the cutblock and does not place equipment in compromised winching, skidding, forwarding or loading situations
  - ~ it takes maximum advantage of topographic features such as natural benches, stable/well-drained soils, moderate gradients, and natural deflection to facilitate skidding and minimize soil disturbance.



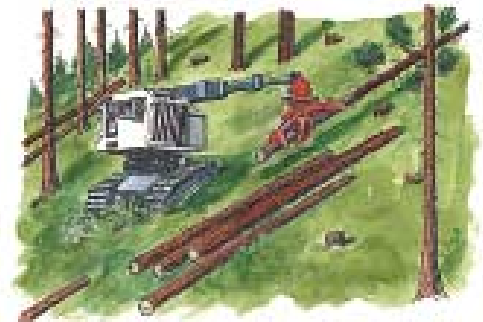
*Utilize favourable grades and natural topographic features in locating skid trails to efficiently access the cutblock, facilitate skidding, and minimize soil disturbance.*

- Avoid designing tight turns and right-angled corners by orienting skid trails to give angled access into the landing or roadside, or by creating wider trail-landing or trail-roadside junctions. This is necessary to manage the hazard of trees made unstable by equipment striking trees when turning or by the logs sweeping into the landing.
- Intersections of more than two trails should also be avoided.

- Where terrain is uneven or partial-cut requirements call for tight turns, planners should consider using short/medium log lengths or gentle curves to minimize the sweep of the turn.
- Where trails follow contours, widths between the trails may need to be increased.
- The maximum grade of the skid trail must conform to the safe operating range of the skidding equipment under the worst weather conditions anticipated.
- Planners should establish safe trail widths that take into account equipment requirements, and reduce the potential for root damage and/or brushing/rubbing standing timber.
- Trails on steep side slopes will require greater width on corners because the turn may swing downhill. Planners should consider designing an in-sloped running surface for trails on steep side slopes.
- Planners should ensure that the bearing strength of the running surface can support machine traffic where bladed trails are required, in accordance with the Forest Practices Code *Soil Conservation Guidebook*.
- Planners should avoid locating trails in seepage areas unless appropriate environmental protection, drainage structures and/or protective measures are utilized.

## Mechanical Felling

- Planners are responsible for specifying the required size and capacity of the mechanical feller.
- Mechanical felling should not be considered on slopes over 40% unless adequate written procedures are implemented to ensure machine stability.
- Areas where mechanical felling is prohibited should be identified on a map, and the boundaries marked in the field. A copy of the map should be kept in the cab of the machine.



*Do not exceed safe operating limits for equipment.*

## Skidding/Forwarding

- Planners should:
  - ~ ensure that equipment is matched to the site
  - ~ ensure skidding and forwarding is conducted in a safe and controlled manner to prevent "roll-over" events
  - ~ select stable rub trees free of defects and firm enough to prevent skidding damage to the residual stand. Standing dead trees or danger trees should not be selected as rub trees
  - ~ ensure skidding and forwarding are conducted in a manner which minimizes damage to leave-trees.



*Consider protecting rub trees to reduce bark damage.*

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## Designing Safe Horse-Logging Methods

As with other methods of logging, most accidents in horse logging occur during felling and bucking operations. Planners, in consultation with the teamster/faller, should:

- lay out the work area in such a way that both the faller and teamster can maintain a safety check on one another;
- avoid logging on side slopes where there is the risk that logs may roll down the hill onto the teamster and horses (e.g., slopes generally in excess of 10%);
- design armoured turns to reduce damage to standing trees (horses can't be backed up to move the load if in a bite);
- lay out the work area to accommodate the felling, bucking and skidding of appropriate log lengths, and meet leave-tree selection criteria.



*Avoid exposure to the risk of pivots and swinging logs.*