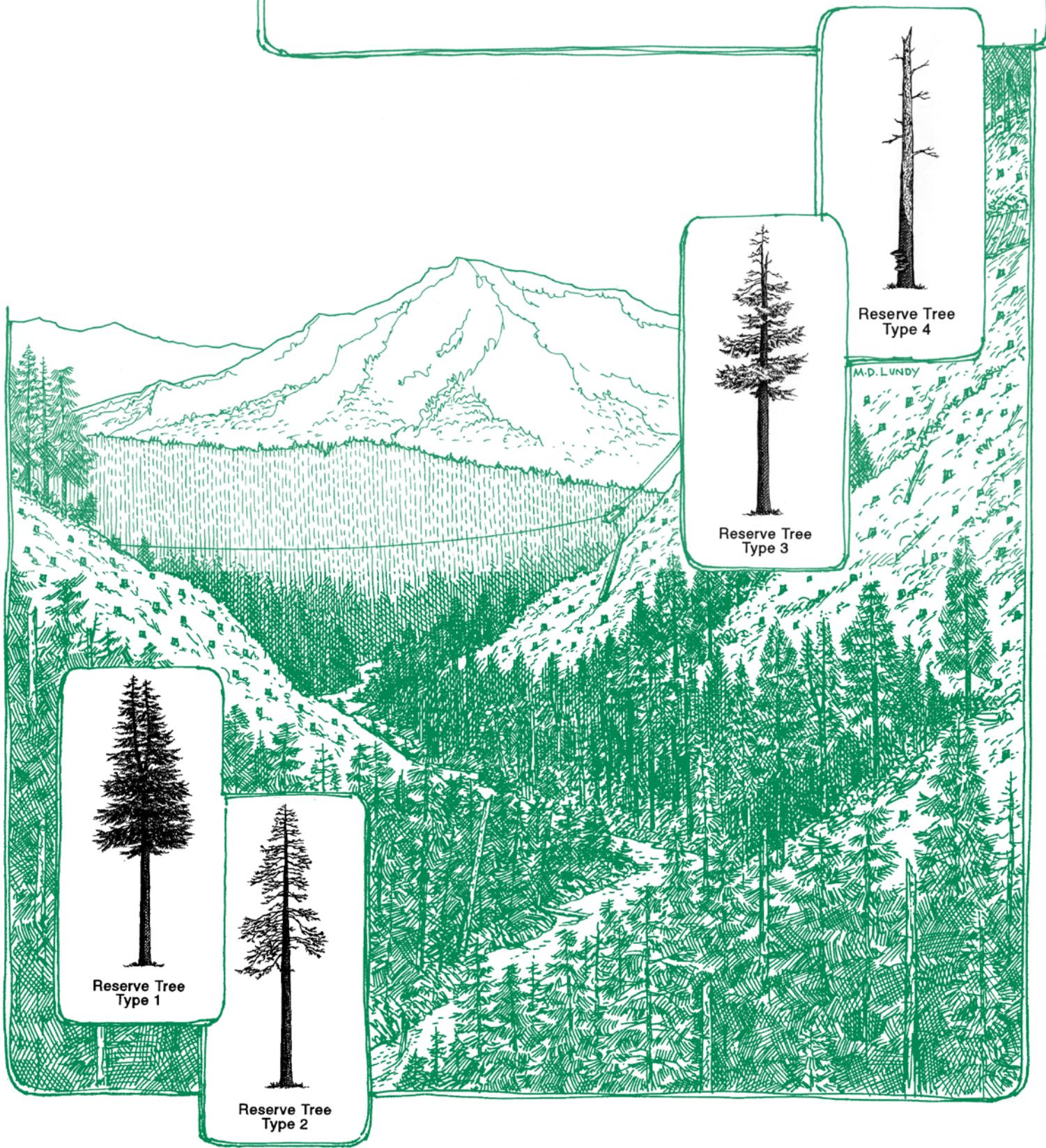


Guidelines for Selecting Reserve Trees



Reserve tree selection guidelines

Preface

This booklet is designed as a set of guidelines to help you make decisions about reserve tree retention.

These guidelines were written cooperatively by state and federal agencies and industry groups. Those involved in the development of these guidelines include:

- United States Forest Service
- Washington Department of Natural Resources
- Washington Department of Labor and Industries
- Washington Department of Fish and Wildlife
- Washington Forest Protection Association
- Washington Contract Loggers Association



WASHINGTON STATE DEPARTMENT OF
Natural Resources



Washington State Department of
Labor & Industries



Washington
Department of
**FISH and
WILDLIFE**



Reserve tree selection guidelines

	Page
I. Introduction	
Purpose of the guidelines.....	2
II. Planning	
Know the reserve tree objectives	3
Develop a viable site plan.....	5
Communicate to all workers	6
Follow the plan.....	7
Monitor continuously	7
Modify if necessary	7
III. Reserve tree types and hazard areas	8
IV. Operational guidelines	
Timber felling:	
Hand felling and mechanized	15
Ground-based logging systems:	
Tractor logging	17
Loader/shovel logging.....	17
Cable yarding	19
Helicopter logging.....	21
Roads, road construction and landings.....	22
V. Glossary	23

Reserve tree selection guidelines

Introduction

Purpose of the guidelines

Dead, dying and live defective trees are an important part of a healthy forest.

They provide habitat for birds, mammals, amphibians, reptiles, insects and a variety of plants.

These trees, as well as non-defective trees, now are being managed in forests as reserve trees.

Although reserving trees for wildlife can be challenging, with some forethought, they can be safely retained.

All potential reserve trees in the work area need to be evaluated to determine if a hazard exists.

These guidelines are intended for use in any forest practice activity where reserve trees are to be retained.

They are not policy. They provide a technical framework for achieving the objective of retaining reserve trees in concert with safe work practices and forest and wildlife management goals.

This should provide a basis for common understanding and cooperative efforts among loggers, foresters, biologists and safety specialists.

Elements of successful reserve tree planning are discussed.

Definitions and strategies for selecting reserve trees are presented that are compatible with modern forest practices and safety.

This should provide more options and flexibility for forest workers and lay the foundation for informed decisions about safe work practices and resource objectives.

Reserve tree selection guidelines

Planning

Safety planning is essential to ensure that workers are not exposed to the hazards of danger trees, and that the objectives for retaining reserve trees are achieved.

It must be an integral part of reserve tree retention plans.

The objective of the safety plan is to provide a safe working environment for the forest worker.

This is what you need to do to have an effective safety plan:

- Know the reserve tree objectives.
- Develop a viable site plan.
- Communicate it to all workers.
- Follow the plan.
- Monitor it continuously.
- Modify it if necessary.

Know the reserve tree objectives

Reserve tree objectives will determine the kinds, sizes, characteristics and locations of trees.

Knowing what the needs are, and why, will help in knowing what is useful and not useful when considering which cutting and logging techniques to use.

This helps to identify the options to work with when designing a safety plan.

Wildlife needs

A tree, when reserved for cavity-using wildlife, is either dead, dying or live defective.

It is extremely important, for both biological and safety reasons, to remember that this includes all trees from the live defective condition to fully dead.

Operating with this definition will expand the options for a workable plan.

Reserve tree selection guidelines

Planning

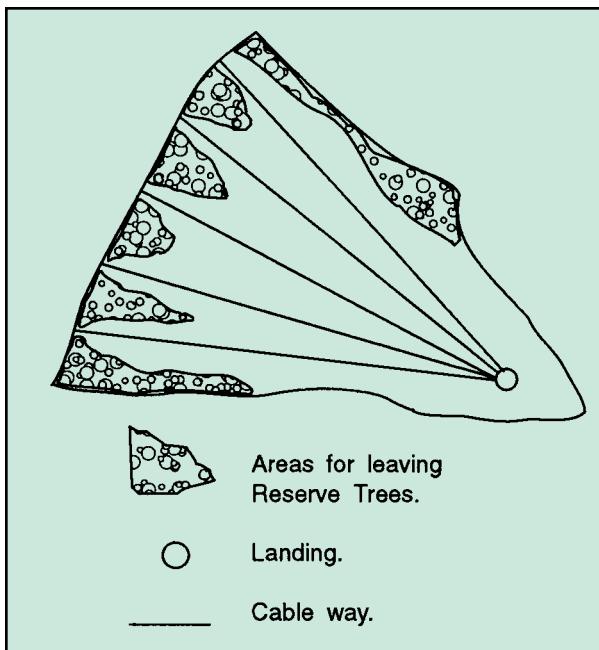
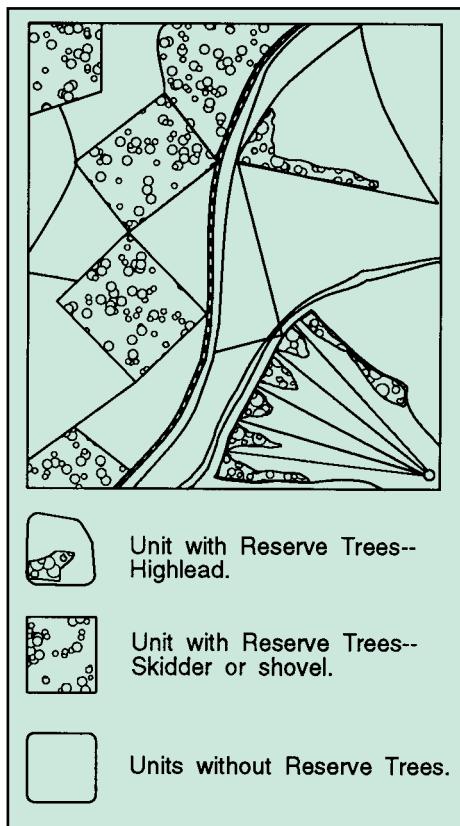


Fig. 1. — Distribution of clumps in a unit.

Fig. 2. — Distribution of units in a planning area.



Wildlife species that use cavities in trees are dependent on three major variables for survival:

- number and distribution of reserve trees
- height and diameter of reserve trees, and
- amount of decay in reserve trees.

A reserve tree objective for cavity-users would include these variables.

Long-range planning

Long-range planning on a large scale gives you more design options for safe ways to reserve trees for meeting wildlife needs.

The arrangement and distribution of reserve trees is key to meeting wildlife objectives in a manner compatible with safe work practices.

Uniform distribution of reserve trees on every acre is not necessary. Reserve trees can be clumped to accommodate operational needs. If adequate amounts of trees, clumps and units are well dispersed throughout the planning area, you may meet cavity-using wildlife needs (Figs. 1 and 2).

Long-range planning needs to allow for changes in reserve trees. For example, different tree species have different decay rates. Their classification will change through time.

There often is a time lag between unit layout and harvest. Long-range plans should provide criteria for tree selection and distribution that are flexible enough to account for ongoing tree decay processes and changes in the harvest plan.

Before forest practices begin, review the plan and adjust it to accommodate any changes in reserve tree classifications.

It also is important to consider how reserve trees will fit into plans for forest practices after harvest.

Reserve tree selection guidelines

Planning

This is especially important in uneven age management schemes where multiple entries are planned. When developing conceptual long-range plans and site-specific plans, consider whether a hazard would exist by the time future forest practice activities would take place.

Develop a viable site plan

Table 1

Site planning checklist

- Identify the reserve tree objectives.
- Evaluate work site conditions.
- Consider the specific abilities of equipment and processes to be used.
- Devise harvest practices which safely retain the amount, distribution, sizes and kinds of reserve trees desired.
- Map out the general plan.

A viable plan is one that prevents worker exposure to danger trees.

Many of the difficulties in retaining reserve trees during logging can be eliminated through careful site evaluation, considering the specific abilities of equipment and processes, planning and communication (Table 1).

Those involved in planning may include: landowner, purchaser, felling contractor, logging contractor, and safety, biology and forestry specialists.

Once specific reserve tree objectives are identified, assess the availability of reserve tree types, amounts and distribution in the unit.

Some will be danger trees if a hazard is present and there is potential for worker exposure. Identify and eliminate the hazards they present before exposing workers in all stages of the harvest operation.

Consider the logging system, topography, unit layout and any other pertinent factors and outline strategies to keep workers out of hazard areas of danger trees.

Each individual tree in the unit need not be assessed; rather, categorize the types of trees and general layout of the logging operation, and devise safety strategies for the variety of situations that may be encountered.

Reserve tree selection guidelines

Planning

An alternative to marking clumps or individual trees on the ground is to map their general locations.

For example, clumps between cable roads that contain desired types of reserve trees may be mapped once landings and tail holds are identified.

Communicate to all workers

It is the responsibility of all woods workers to be informed of the hazards of working around danger trees.

They should be able to recognize a danger when it exists, and know how to deal with the situation. Specifically, all woods workers should:

- Review the safety plan with their supervisors before entering a new area, setting or new activity.
- Be able to recognize the four reserve tree types.
- Be able to avoid the hazard areas around Type 3 and Type 4 reserve trees.

Because timber fallers are usually the first workers to approach a danger tree or snag during the harvest activity, they are at greatest risk of having an accident.

Also, the trees they cut or retain determine the remaining opportunities for reserve tree retention in the harvest unit.

Including timber fallers in planning, or at least communicating the plan to them, is critical to achieving both safety and reserve tree objectives.

Reserve tree selection guidelines

Planning

Follow the plan

It is the responsibility of all workers to conduct their work according to the safety strategies in the plan.

Monitor continuously

Once the operation has begun, conditions may change.

It is the responsibility of both supervisor and workers to be alert to new or unanticipated hazards that may arise.

If a strategy is ineffective or becomes unworkable, it must be re-evaluated.

Modify if necessary

If new or revised strategies are needed, they should be developed before work proceeds further. Changes in the safety plan must be communicated to all workers on the site.

The following sections, Reserve Tree Types and Hazard Areas and Operational Guidelines, contain information which should be used in the development of the safety plan.

Reserve tree selection guidelines

Reserve tree types and hazard areas

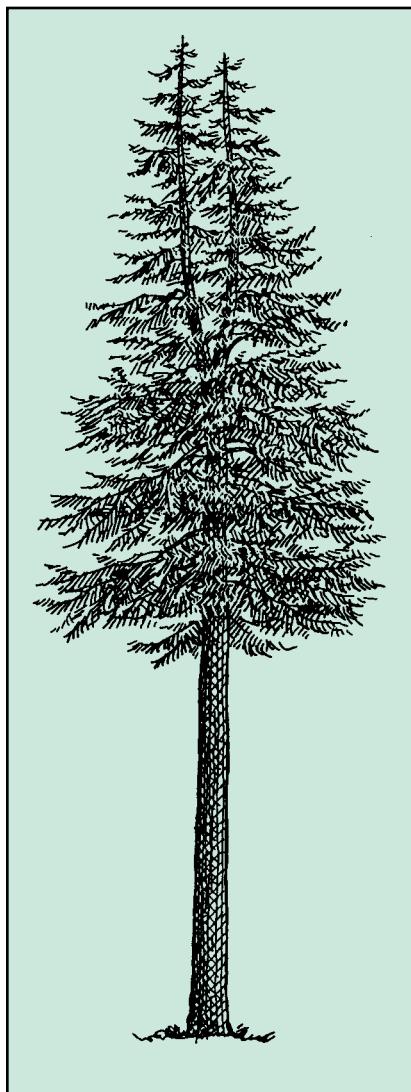


Fig. 3. — Reserve tree Type 1.

Reserve tree types — conifer only

Recognizing reserve tree types is the first step in identifying potential hazard areas. These definitions are based upon conditions that affect the tree's stability that are visible to an observer on the ground.

They are divided into four classifications, ranging from the safest to the most dangerous.

For example, Type 1 reserve trees have low-hazard and low-failure probability, while Type 4 reserve trees have extreme-hazard and extreme-failure probability. Non-defective, healthy green trees are not classified. All reserve trees fit one of these types.

Specific defects which could cause failure must be evaluated for each reserve tree.

When a reserve tree type is questionable, it should be assigned the next higher type.

Type 1 reserve trees are live trees that are defective or deformed with sound tops, trunks, and roots (Fig. 3).

They may have part of the top broken out or have evidence of other defects that include "cat face," animal chewing, old logging wound, weather injury, insect attack, or lightning strike.

Because these trees are stable, they pose the least hazard to workers.

Type 1 trees may be retained wherever healthy trees could be retained safely.

Reserve tree selection guidelines

Reserve tree types and hazard areas

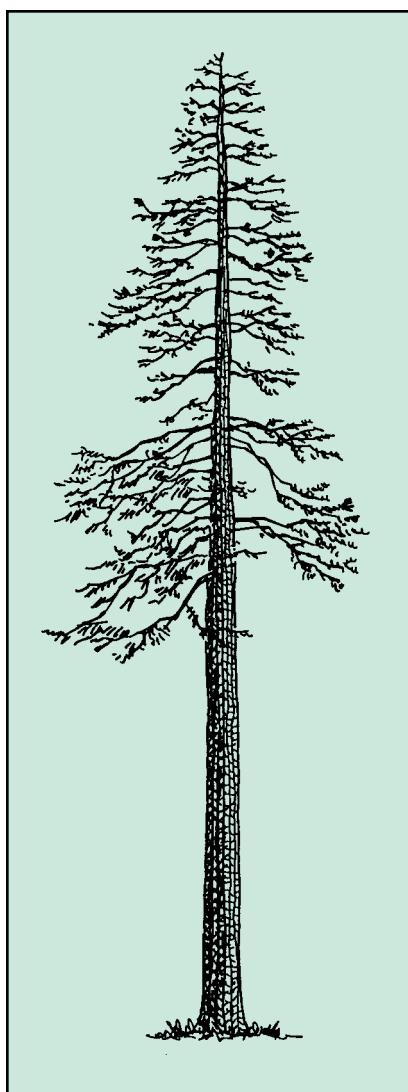


Fig. 4. — Reserve tree Type 2.

A **Type 2** reserve tree is a dead tree with sound top, trunk, and roots (Fig 4).

Identifying Type 2 reserve trees requires careful observation. Mortality may have been caused by canker, diseases, insects, fire, adverse weather or lightning. Needle and small twig retention is evidence of recent death, which may be an indicator of stability.

Fire-scorched trees may remain stable for many years if the trunk and root systems are not badly burned.

However, not all fire-scarred trees may be safe. Pre-existing defects may be charred and difficult to detect, rendering a tree that was dangerous before the fire even more dangerous afterward.

If the fire burned the root system, it may be damaged, changing it from a Type 2 to a Type 4 reserve tree. Similarly, trees infected with root rots have weakened root systems that automatically classify them as Type 4 reserve trees.

Because Type 2 reserve trees have stable tops, trunks, and roots, they may be retained wherever healthy, green trees could be retained safely.

Reserve tree selection guidelines

Reserve tree types and hazard areas

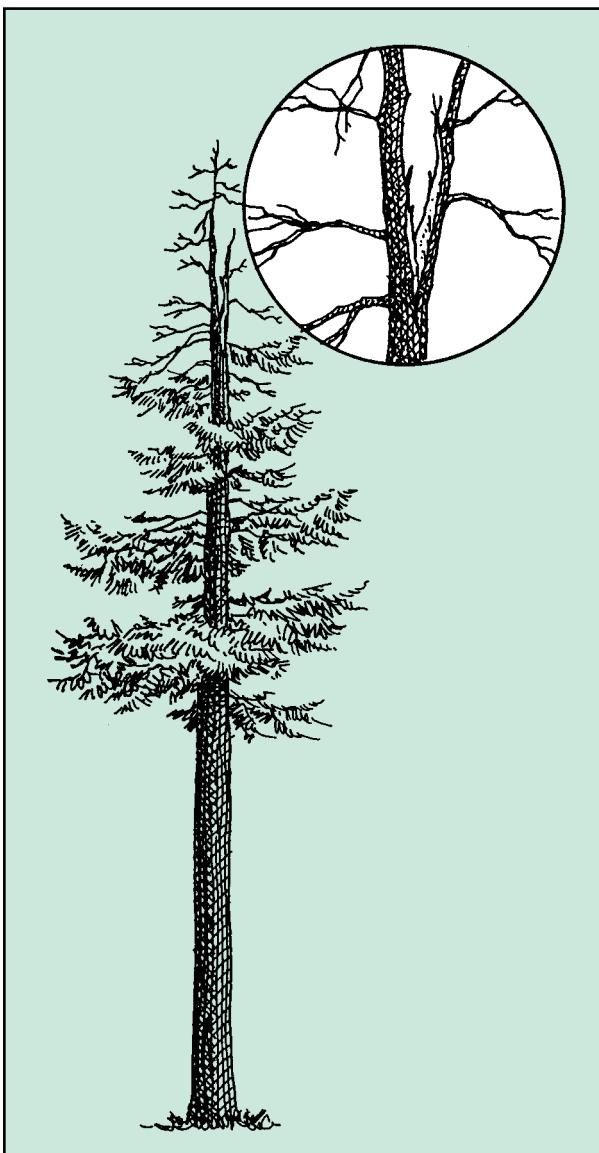


Fig. 5. — Reserve tree Type 3.

Type 3 trees are live or dead trees with unstable tops or upper portions (Fig. 5).

Although the roots and main portions of the trunk are sound, these reserve trees pose high hazard because of defect in live or dead wood higher up in the tree. Ground vibration from falling trees, wind, flying debris, heavy equipment or other industrial activity can dislodge slabs, chunks, limbs, or the entire upper portion of the tree.

Because these reserve trees do not collapse at the base, but somewhere above, testing the tree at breast height will not give an accurate indication of the tree's condition at a higher location where failures are likely to occur.

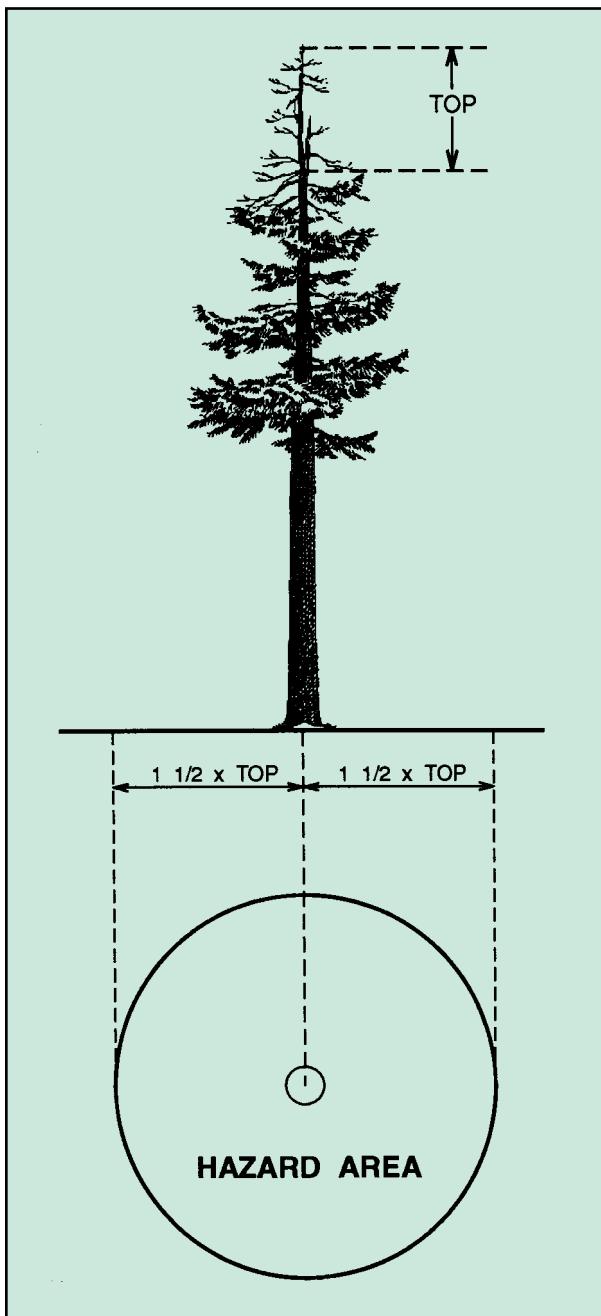
The area on the ground that could be reached by a dislodged top, slab or chunk is called the "hazard area" for a Type 3 reserve tree. Forest practices cannot take place within the hazard area.

In determining the hazard area, evaluate the following criteria:

- Slope of the ground.
- Amount and direction of lean — must be easily observable.
- Length of the top portion that would dislodge.

Reserve tree selection guidelines

Reserve tree types and hazard areas



Level or sloped ground ... no discernable lean (Fig. 6)

Step 1. Determine the length of the top or portion that would dislodge and add one half of its length.

Step 2. The hazard area forms a circle around the tree with a radius equal to $1\frac{1}{2}$ times the length of the dislodged portion.*

* *On steep ground, the hazard area may have to be extended to protect workers.*

Fig. 6. — Hazard area for a Type 3 reserve tree with no discernable lean.

Reserve tree selection guidelines

Reserve tree types and hazard areas

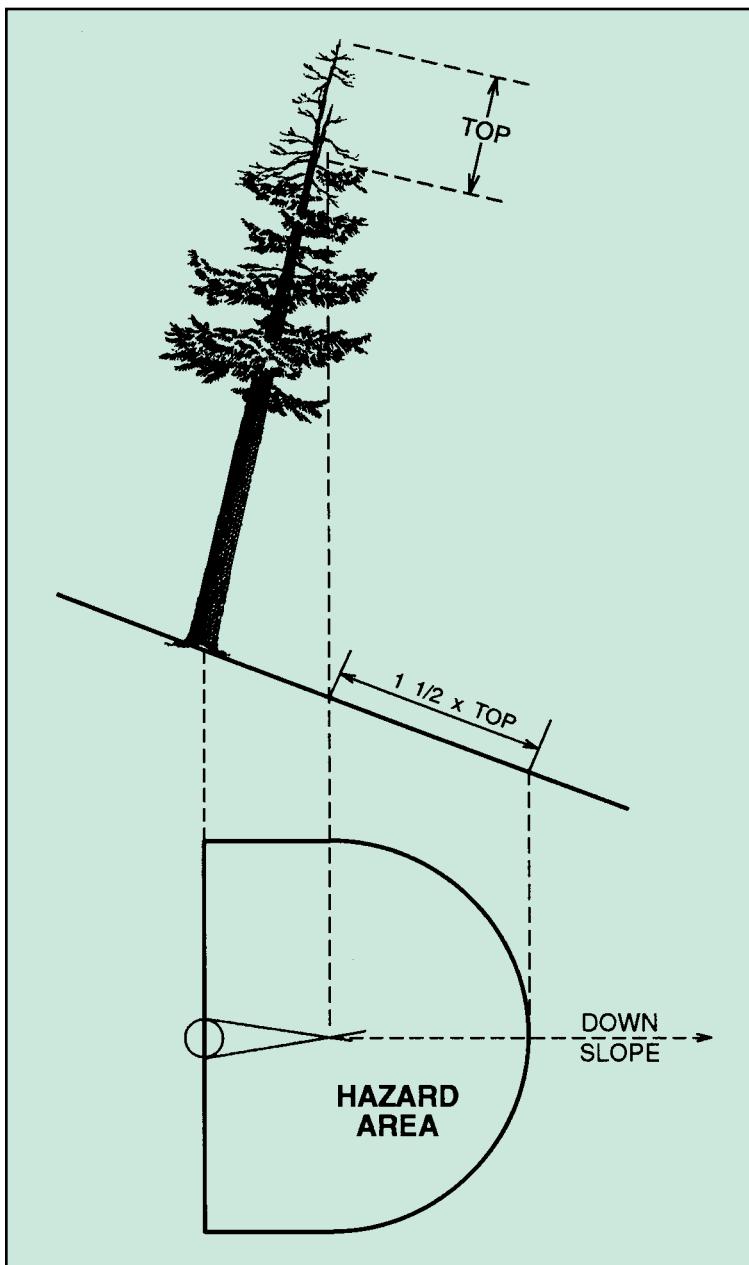


Fig. 7. — Hazard area for a Type 3 tree with a lean.

Level or sloped ground ... lean in any direction (Fig. 7)

Step 1. Determine the length of the top or portion that would dislodge and add one half of its length.

Step 2. Determine the amount of lean (horizontal distance from where the top or portion would dislodge relative to the base).

Step 3. The hazard area would be the distance determined by adding steps 1 and 2 and 90 degrees on each side of the lean beginning at the base.*

The area behind the lean is not a hazard area unless equipment, yarding activity or falling timber contacts the reserve tree. Striking a Type 3 reserve tree could force a backlash opposite the lean, creating an additional hazard during the time of impact.

* On steep ground, the hazard area may have to be extended to protect workers.

Reserve tree selection guidelines

Reserve tree types and hazard areas

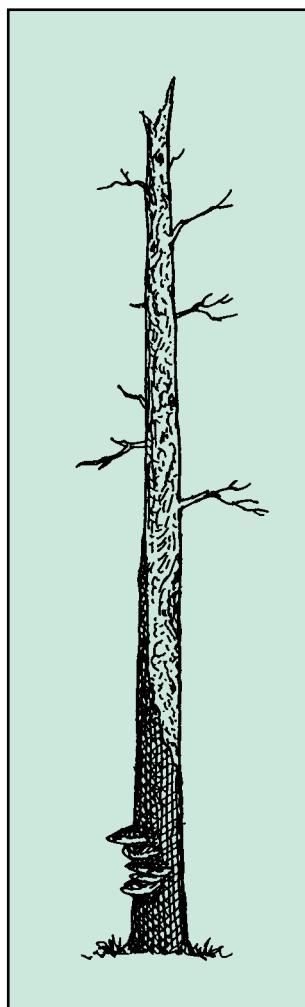


Fig. 8. — Reserve tree
Type 4.

Type 4 reserve trees are live or dead with unstable trunk or roots, with or without bark. This includes “soft” snags as well as live trees with unstable roots caused by root rot or fire. They are considered the most dangerous type (Fig. 8).

Unexpected collapse could occur from any portion of the roots or trunk. Testing the snag at breast height will not give an accurate indication of the tree’s condition higher up where failures can occur.

The hazard area for a Type 4 reserve tree is defined as the area on the ground that could be reached by any portion of the tree that may collapse.

Forest practices cannot take place within the hazard area.

In determining the hazard area, the following criteria must be evaluated:

- Slope of the ground.
- Direction of lean.
- Height of the tree.

Reserve tree selection guidelines

Reserve tree types and hazard areas

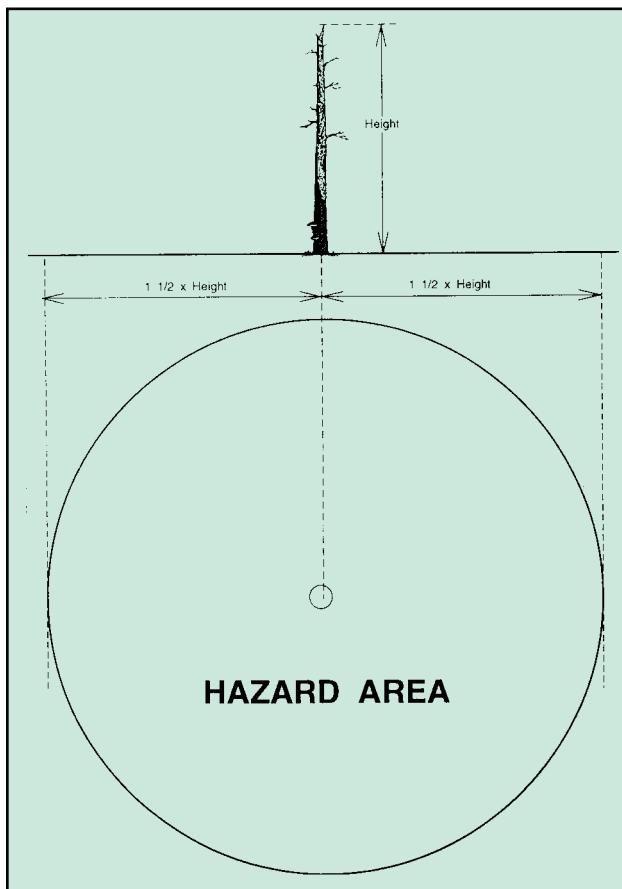


Fig. 9. — Hazard area for a reserve tree Type 4 with no discernable lean.

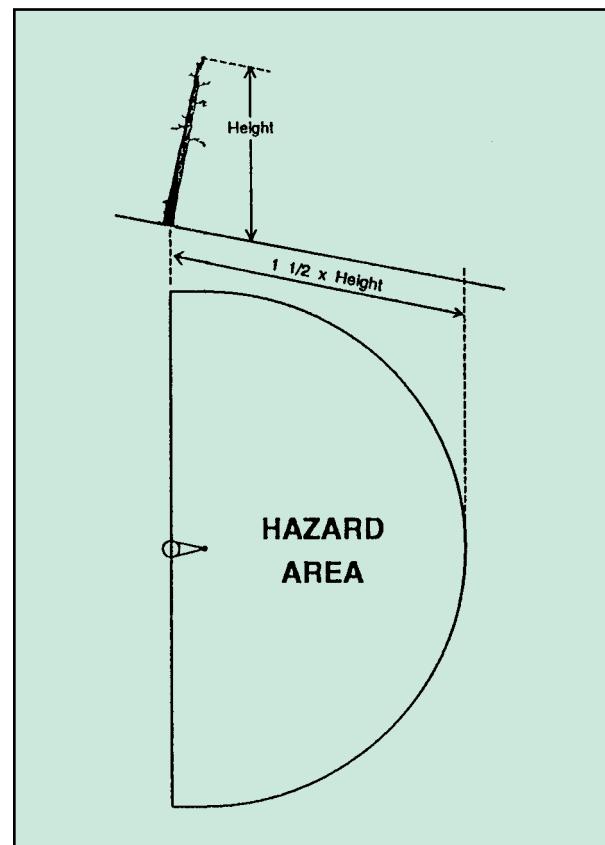
Level or sloped ground, no discernable lean (Fig. 9)

The hazard area would form a circle around the tree with a radius of 1 1/2 times the height.*

Level or sloped ground, lean in any direction (Fig. 10)

The hazard area would be 90 degrees on each side of the lean and within 1 1/2 times the height of the tree beginning at the base.*

The area behind the lean is not a hazard area unless equipment, yarding activity or falling timber contacts the reserve tree. Striking a Type 4 reserve tree could force a backlash opposite the lean, creating an additional hazard during the time of impact.



**On steep ground the hazard area downhill of the tree may have to be extended to protect workers.*

Fig. 10. — Hazard area for a Type 4 tree with lean.

Reserve tree selection guidelines

Operational guidelines

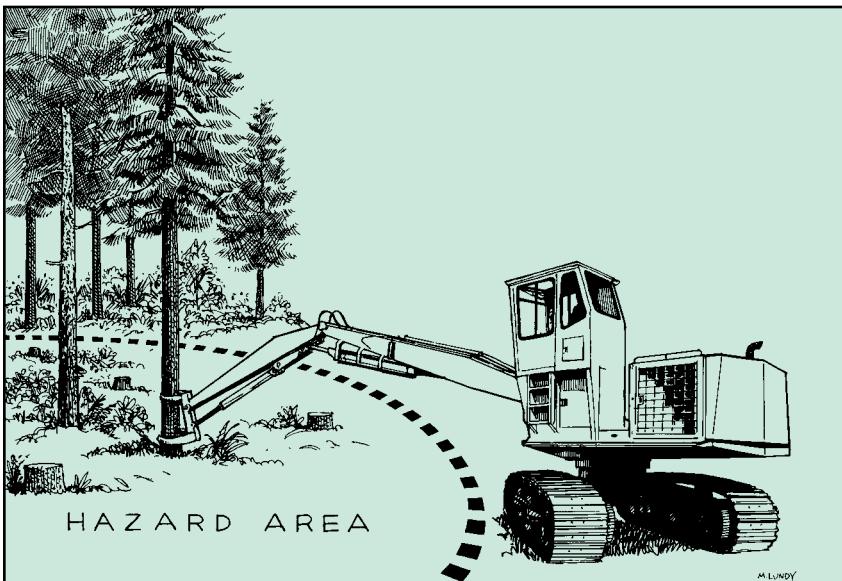


Fig. 11. — Felling trees from outside the hazard area.

Timber felling: hand felling and mechanized

Some strategies for retaining reserve trees:

- Mechanized felling equipment allows the operator to reach into the hazard area and fell timber while keeping the cab outside the hazard area (Fig. 11).



Fig. 12. — Reserve tree clumps compatible with logging systems.

- Select individual trees or clumps that will allow fallers to safely fell the timber and be compatible with the yarding system (Fig. 12 — see strategies listed under logging systems).

Reserve tree selection guidelines

Operational guidelines



Fig. 13. — A Type 4 reserve tree is isolated in a clump of safe trees.

- Leaving safe trees within the hazard area of a Type 3 or 4 reserve tree (clumping) is an effective way to isolate workers from exposure to the hazard (Fig. 13).
- If trees fall into the hazard area of a Type 3 or 4 reserve tree, leave them unbuckled so they can be choked or grappled without having workers or the cab of machinery entering the hazard area (Fig. 14).

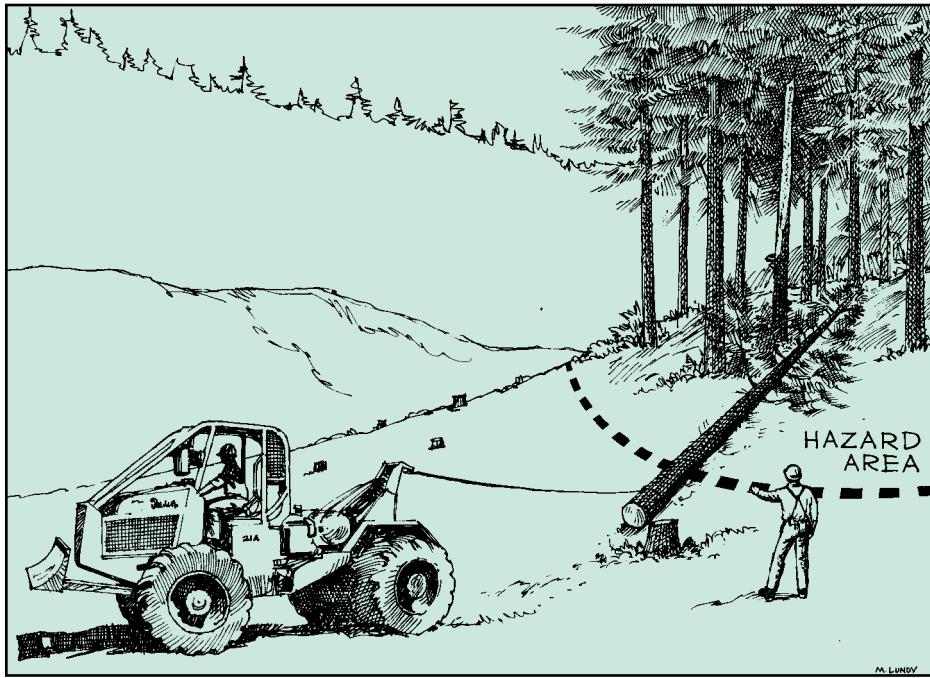


Fig. 14. — Reaching trees from outside the hazard area.

Reserve tree selection guidelines

Operational guidelines

Ground-based logging systems: **Tractor logging** **Loader/shovel logging**



Fig. 15. — “Leaners” away from work area.

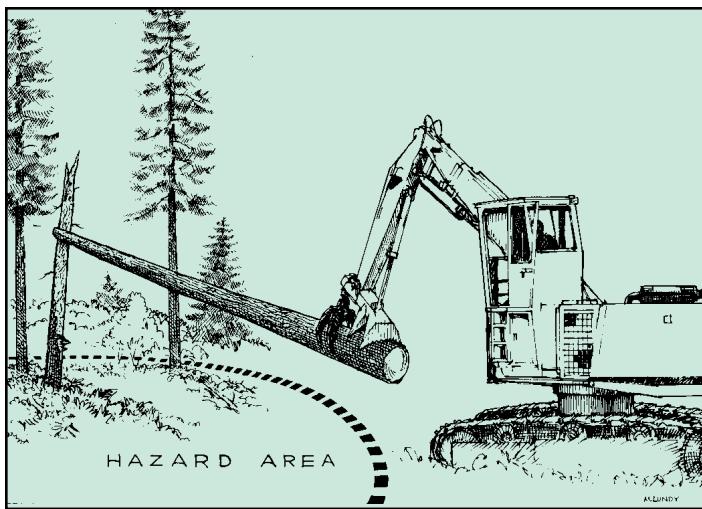


Fig. 16. — Reducing snag to a safe height.

Ground-based equipment has the ability to maneuver around obstacles such as stumps, trees and snags. Groups of trees, or single trees, can be located nearly anywhere on the unit since ground-based equipment can approach them from various directions. However, the location of reserve trees must not pose a danger to workers.

Trees classed as Type 1 or 2 may be retained individually or in clumps wherever healthy green trees could be retained within the unit. If Type 3 or 4 reserve trees are selected for retention, work (including landings and skid trails) cannot take place within their hazard area.

Strategies for locating Type 3 or 4 trees:

- Hazard areas along the edge of the unit are easiest to avoid. Potential danger trees should lean away from the work area (Fig. 15).
- While loader/shovel logging, you may encounter a potentially dangerous reserve tree that can be reduced to a safe height by using a grappled log to push the unstable portion down. The cab must be outside the hazard area. Once a snag is reduced to a safe height, trees that were located in the hazard area could be harvested (Fig. 16).

Reserve tree selection guidelines

Operational guidelines



Fig. 17. — Distribution of reserve trees.

- Single trees and clumps may be dispersed inside the unit as long as work doesn't take place within any hazard area. Locate landings and skid trails outside hazard areas. Leaving safe trees within the hazard area (clumping) is an effective way to isolate work from the hazard (Fig. 17).

Reserve tree selection guidelines

Operational guidelines

Cable Yarding



Fig. 18. — Individual reserve trees and clumps distributed in a lateral skidding unit.

The type of yarding system and topography will determine where reserve trees may be safely retained. For example, there are more opportunities for retaining reserve trees in midsetting using a system with lateral skidding capability than with highlead.

Trees classed as type 1 or 2 may be retained individually or in clumps wherever healthy green trees can be retained within the unit. If Type 3 or 4 reserve trees are selected, landings, yarder lines and workers cannot be within the hazard area.

Strategies for retaining reserve trees:

- Individual Type 1 or 2 reserve trees can be located within the unit. Their distribution must be compatible with the type of yarding system (Fig. 18). Lateral skidding systems are the most flexible because of their ability to reach a great distance from the skid road and yard logs around obstacles. Highlead is the least flexible.
- Leaving safe trees within the hazard area of a Type 3 or 4 reserve tree (clumping) is an effective way to isolate workers from exposure to the hazard (Fig. 13).
- Locate clumps or individual trees between skid roads on fan type or parallel settings. The size and shape of a clump is determined by the distance between skid roads, yarding system and hazard area (Fig. 12).

Reserve tree selection guidelines

Operational guidelines



Fig. 19. — Clumps in mid-setting.

- Clumps may be left in midsetting if there is sufficient deflection and the equipment has the ability to suspend logs over the clump or yard from around the clump (Fig. 19). Note, yarding lines must not be located within the hazard area of a Type 3 or 4 reserve tree.
- Other locations include:
 - Along the edge of the unit (Fig. 12).
 - On yarding breaks between settings (Fig. 12).
 - On rock outcrops, cliffs or blind leads where harvesting is uneconomical (Fig. 12).

Reserve tree selection guidelines

Operational guidelines

Helicopter logging

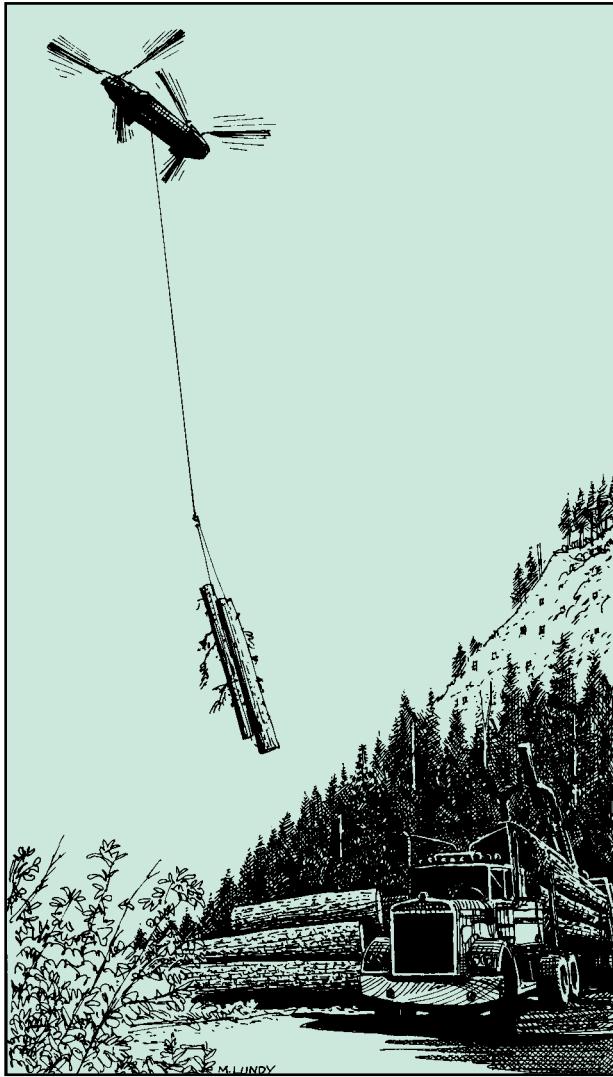


Fig. 20. — Helicopter logging.

Helicopter logging allows flexibility to leave reserve trees nearly anywhere in the unit because it can access logs from various directions (Fig. 20).

However, it creates special problems with rotor downwash, such as flying limbs and chunks.

Logs swinging against standing trees during log pick up may also dislodge portions of reserve trees. The hazard area may need to be enlarged to address this increased hazard.

Strategies for retaining reserve trees:

Type 1 or 2 reserve trees can be left singularly or in clumps within the unit.

Leaving safe trees within the hazard area of a Type 3 or 4 reserve trees (clumping) is an effective way to isolate workers from exposure to the hazard (Fig. 13).

Hazard areas along the edge of the unit are easiest to avoid.

Reserve tree selection guidelines

Operational guidelines



Fig. 21. — Reserve trees near roads.

Roads, road construction and landings

Snags along roads and landings can create dangerous working conditions. Ground vibration from heavy equipment could cause unexpected collapse; snags could be bumped during road building or loading activities.

Consider long-range planning objectives when selecting reserve trees along a road. For example, a Type 2 reserve tree which leans toward a road may not be dangerous when selected, but will eventually become dangerous as it decays. It would then need to be removed.

Strategies for retaining reserve trees:

- Leave Type 3 or 4 reserve trees along roads or near landings if their hazard area does not extend into a work area, yarder lines or roadway (Fig. 21).
- On steep ground, the downhill side of corners can be a good place to leave trees or clumps.
- Type 1 or 2 reserve trees can be left along roads and near landings. Note: trees located on a cutbank with a weakened root system would be classed as a Type 4.

Reserve tree selection guidelines

Glossary

Danger tree: Any tree of any height, dead or alive, that poses a hazard to workers because of rot, root, stem or limb damage, lean, or any other observable condition created by natural process or man-made activity.

Exposure (to danger trees): A potentially unsafe condition that exists whenever a worker is within the hazard area around a danger tree during forest practices.

Forest practices: Any activity conducted on or directly pertaining to forest land and relating to growing, harvesting, or processing timber, including but not limited to road construction, harvesting, precommercial thinning, reforestation, fertilization, and brush control. “Forest practice” does not include preparatory work such as tree marking, surveying and road location.

Hazard area: The area on the ground around a tree that could be reached by any dislodged portion of that tree.

Mechanized felling: Falling of standing timber by a self-propelled, mobile-wheeled or tracked machine equipped with a shear or other powered cutting device.

Reserve tree: Trees which are reserved from cutting, for a variety of purposes, such as wildlife, seed source, research, genetics and structural diversity.

Shovel/loader logging: The operation of gathering logs on a setting with log loading equipment, as opposed to gathering logs by cable yarding, ground skidding or other traditional methods. Shovel logging does not include “feller-buncher” type operations.

Reserve tree selection guidelines

Glossary

Snag: A dead standing tree or portion thereof.

Type 1 reserve tree: A live tree that is defective or deformed with sound roots, trunk and top.

Type 2 reserve tree: A dead tree with sound roots, trunk and top.

Type 3 reserve tree: A live or dead tree with sound roots and trunk, but with an unstable top.

Type 4 reserve tree: A tree with roots or trunk no longer sound.

Wildlife reserve tree: Any live defective, dead, damaged or dying tree which provides or has the potential to provide habitat for those wildlife species which use these trees to meet a crucial life need.

Work area: Any area that a worker may occupy while performing daily tasks.

DNR: Washington Department of Natural Resources.

L&I: Washington Department of Labor and Industries.

USFS: United States Forest Service.

Upon request, foreign language support and formats for persons with disabilities are available. Call 1-800-547-8367. TDD users, call 360-902-5797. L&I is an equal opportunity employer.

PUBLICATION F417-092-000 [08-2005]