

# Timber Harvesting

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REMEMBER:

Guidelines help with *how* to manage,  
not *whether* to manage.

These guidelines focus on *how* to protect the functions and values of forest resources during forest management activities. They do not provide advice on *whether* to manage or which management activities are needed.

Guidelines provide a *menu*, not a *mandate*.

Site-level resource management decisions are based on many different factors, including resource needs, landowner objectives, site capabilities, existing regulations, economics and the best information available at any given time. No one will apply all of the guidelines related to a particular activity. Instead, the landowner, resource manager or logger will consider many different factors in determining which combination of guidelines provides the best “fit” for a particular site at a particular time. The intent of having multiple guidelines is to provide decision-makers with as much flexibility—and as much choice—as possible in taking steps to effectively balance forest management needs and resource sustainability.

*General* guidelines and *activity-specific* guidelines  
are closely related.

Frequent references from activity-specific guidelines back to the general guidelines will make it easy for landowners, resource managers, loggers and others to consider all of the related guidelines—both general and specific—that apply to a particular management activity.

Guidelines are supplemented from time to time  
by “Additional Considerations.”

The guidelines are supplemented from time to time by “Additional Considerations,” which provide additional guidance to further promote the sustainability of forest resources.



## INTRODUCTION

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Timber harvesting involves planning harvest and reforestation; cutting trees and moving them to a landing; processing, sorting and loading; and transporting materials.

### The Benefits of Guidelines

**Benefits to cultural resources:** Timber harvesting guidelines can minimize the potential effects of harvesting activities, such as mixing of surface soils, rutting, compaction and erosion, which can damage certain kinds of cultural resources. Guidelines for construction of roads and landings, felling, skidding and slash management can help to protect cultural resources.

**Benefits to forest soils:** Timber harvesting guidelines are designed to help protect the physical, chemical and biological properties of forest soils by minimizing the effects of soil compaction and rutting, erosion and nutrient removal that can result from timber harvesting activities. Reducing these potential impacts can maintain root penetration, availability of water, water absorption by plants, availability of oxygen and other gases in the soil, and the degree to which water moves laterally and vertically through the soil. Guidelines can also minimize the need for expensive rehabilitation of highly impacted soils.

**Benefits to riparian areas:** Timber harvesting guidelines can minimize the alteration of vegetation within the riparian area. That vegetation is important for providing inputs of coarse woody debris and fine litter to water bodies; retaining nutrients, sediment and energy; bank and shoreline stabilization; maintenance of moderate water temperatures through shading; and wildlife habitat. Guidelines for retaining vegetation can also have a positive impact on aesthetics, wood products and recreation.

**Benefits to visual quality:** Timber harvesting guidelines can moderate the potential adverse visual quality impacts from timber harvesting activities and help reduce the impression of poor harvesting and utilization. Guidelines related to perceived harvest size, slash, landings and snags have the greatest potential to enhance visual quality.

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**Benefits to water quality and wetlands:** Timber harvesting guidelines provide protection to water quality and wetlands by minimizing potential nonpoint source pollution resulting from soil disturbance, disruption of vegetative cover, and timber harvesting activities in close proximity to streams, lakes and wetlands. Guidelines to help maintain vegetative cover can also help riparian areas moderate water temperatures. Guidelines that address equipment operations and maintenance can help protect water quality, and guidelines to minimize rutting in wetlands help maintain normal water flows.

**Benefits to wildlife habitat:** Timber harvesting guidelines reduce the potential for timber harvesting activities to disturb sensitive sites, rare species, water features and unique habitats. Guidelines related to timber harvesting, especially clearcutting, are aimed at maintaining structural components on a site (including live trees, snags, woody debris, shrubs and ground cover) that are needed by forest wildlife now and as the stand regenerates.

### Considerations

#### Protecting soil and water resources

- ❑ Appropriate reforestation goals should be considered before beginning harvest activity. The plan should include site preparation techniques, if needed, and species selection prior to harvest. It may include natural regeneration of existing species.
- ❑ Special soil conditions and topographic features make some areas of the state more sensitive than others to soil disturbance. Two primary examples of these localized sensitive areas are the blufflands of southeast Minnesota and the Nemadji River Basin south of Duluth.
- ❑ When working in areas with special soil conditions and topographic features that make them more sensitive to disturbance than others, the landowner, resource manager or operator needs to increase the intensity of planning compared to other forested regions of the state. Planning should address long-term development and maintenance needs.

- ❑ Soil impacts can be minimized by limiting the soil area impacted by infrastructure (roads, landings and primary skid trails), and by careful consideration of timing, equipment being used, and harvesting methods. Planning considerations include carefully determining appropriate operating seasons for any given soil, as well as using harvest layouts, strategies and equipment that minimize the surface area of a site that is trafficked.
- ❑ Appropriate timber harvesting strategies and practices can be employed to ensure that timber harvesting practices do not reduce the productive capacity of forest soils through removal of nutrients or disruptions of nutrient cycles. On most Minnesota forest soils, nutrient removal through harvest is not a concern. However, guidelines should be applied in specific situations and site conditions, with the goal of balancing the level of nutrients removed through timber harvest with natural nutrient inputs.
- ❑ Susceptibility to compaction and rutting on wetlands is dependent on several factors, including level of equipment trafficking, type of equipment used, soil type (mineral soil or peatland), soil water content at the time the silvicultural activity is conducted, and season of activity. In general for mineral soil wetlands, compaction and rutting increase as soil texture becomes finer and soil water content increases. In unfrozen peatland, deep rutting can bring muck to the surface and block normal water flow.
- ❑ Wetlands are highly productive sites for a variety of ecologic functions, as well as for the enhancement of water quality. All forest management operations in or adjacent to wetlands should be planned and conducted in a manner that protects these functions.
- ❑ Using appropriate forest management guidelines for harvesting activities will minimize the potential for sediment, chemical, nutrient and debris movement into streams, lakes, wetlands, seasonal ponds and ground water. Guidelines will also minimize thermal (heating) impacts on surface waters.
- ❑ Employing loggers who have been trained in guideline implementation can aid in proper and efficient application of site-level timber harvesting guidelines.

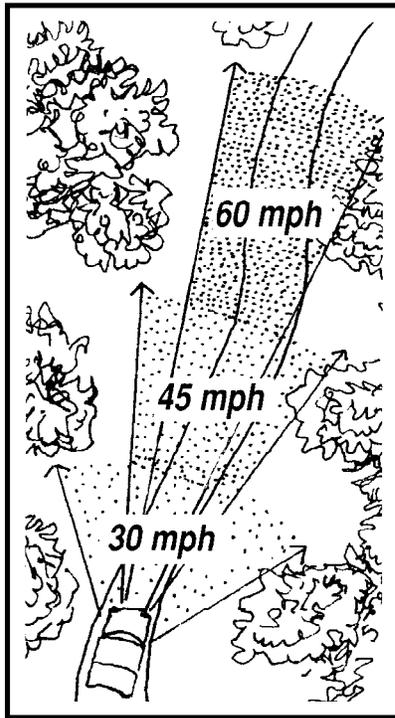


Figure TH-1: Travel speed affects apparent field of vision and observation time.

## Visual impacts

- Travel speed affects the apparent field of vision and the observation time, which impact the users' levels of concern. See Figure TH-1.
- Type of harvest (clearcut vs. partial cut, for example) affects user perception of apparent size.
- Stand condition and health should be considered along with visual impacts.
- Desired future condition of a particular stand should be considered along with visual impacts.
- Proximity to recreational use areas results in enhanced user concerns regarding apparent size of harvest.

## Managing slash

- Slash is unavoidable when timber harvesting.
- Slash treatment has a definite cost.
- Slash near streams, lakes and wetlands is subject to special regulation.
- Slash provides soil nutrients.

## Landings

- Size and number of landings are affected by species, products developed, size of sale and timber sale design.
- Topography can limit both placement and number of landings.
- Proximity of harvest to travel routes or use areas can affect placement of landings.
- Proposed future use of landing area (as a parking area along a recreational trail or as a wildlife opening, for example) can affect size and placement of landing.
- Landing treatment practices may result in additional cost, no change in cost, or a savings in cost.

## Snags

- Snags represent a potential safety hazard for logging operations.
- Snags can limit effective growth of future plantations by occupying space that could otherwise be used by healthy trees.
- Snags may increase the potential risk of lightning fires.
- Snags enhance the quality of wildlife habitats, providing nesting, denning, feeding and roosting sites, as well as escape areas.
- Snags may increase insect and disease problems for regeneration of a new stand.

## Design Outcomes To Maintain Soil Productivity

Timber harvesting should be designed and conducted to achieve the following beneficial outcomes regarding soil productivity:

- Soil in a condition that favors regeneration and growth of native vegetation and trees
- No more than 1-3% of the timber harvest area occupied by roads and landings (Small or irregularly shaped units may result in higher percentages.)
- No more than 10-15% of the timber harvest area occupied by primary skid trails, with access to the rest of the site (1-2 pass trails) occupying no more than an additional 20-30% of the area (Small or irregularly shaped units may result in higher percentages.)
- Minimal rutting in primary skid trails, roads and landings; and avoidance of rutting in the general harvest area
- Minimal change to the hydrologic condition of the site
- Minimal loss of nutrients on nutrient-sensitive site
- Nutrient removal from timber harvest resulting in no reduction to tree growth or change in vegetative composition of the site
- Bare soil areas stabilized from surface erosion, with soil erosion control measures properly applied and functional on skid trails, roads and landings



Have you identified  
your goals and objectives?

See *Identifying Goals and Objectives*  
in General Guidelines.

Have you conducted a site inventory?

See *Conducting a Site Inventory*  
in General Guidelines.

## PLANNING AND DESIGN

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IMPORTANT! Review General Guidelines:

- , Incorporating Sustainability into Forest Management Plans
- , Maintaining Filter Strips
- , Managing Riparian Areas

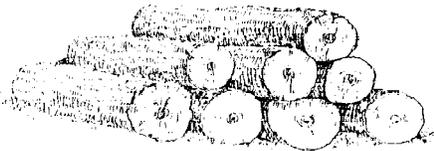


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**U** Consider water quality concerns as management objectives are established:

- Include provisions for water protection in the timber sale contract.
- Avoid building landings, skid trails and roads in wetlands.
- Where avoidance is not practical, the resource manager, logger, contractor or landowner should minimize impacts by limiting the extent of wetland activities.

**U** Consider soil or site conditions that may dictate specific timing, harvest methods or equipment to be used, or that may lead to weather-related or seasonal closure of the operation.



**U** When designing timber sales (including layout, size and shape):

- Consider and incorporate forest management goals, harvesting efficiencies and site impacts.
- Use natural features and avoid artificial patterns where possible. These natural features may correspond to changes in topography, soils, wetland interfaces and timber types.

**U** If practical and feasible, protect cultural resource areas:

- Exclude cultural resource areas from timber sale area.
- Keep roads, skid trails and landings away from cultural resource areas.
- If harvest will take place on or near a cultural resource, consider applying guidelines in *Timber Harvesting: Protecting Sensitive Areas* (page 20).

### Progressive Timber Harvest Pattern

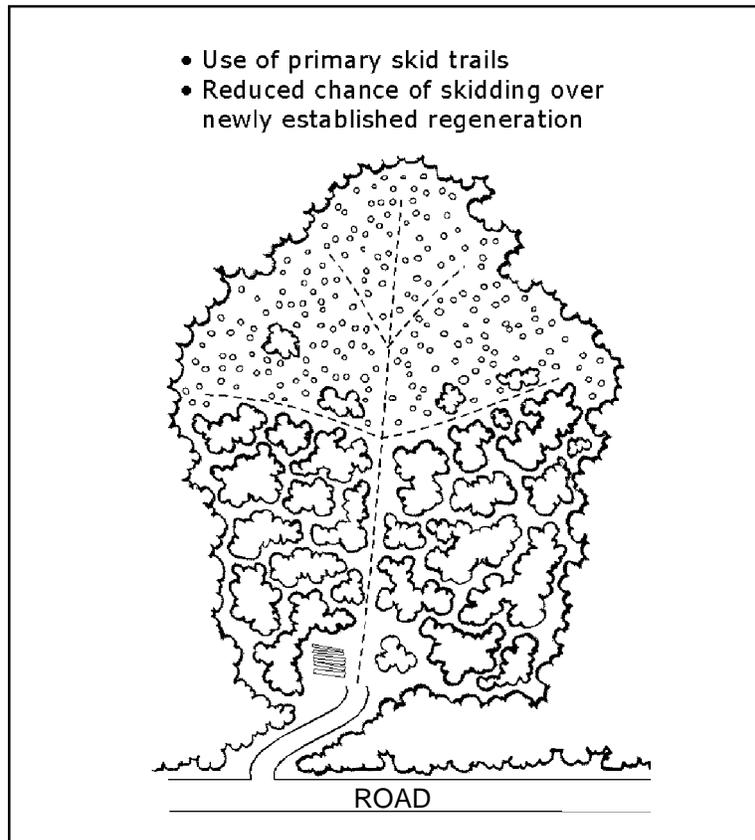


Figure TH-2

**U** Plan a progressive harvesting technique that avoids trafficking over pre-cut areas where possible. See Figure TH-2.

**U** Mimic natural disturbance by leaving some live trees, snags and reserve patches in clearcut harvest areas. Consider leaving fingers and fire shadow areas next to wetlands in fire-dependent forest types. See Figure TH-3, and see *General Guidelines: Retaining Live Trees*.

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**U** Create a variety of patch sizes within selection harvests.

**U** For aspen or hardwood cover types on well-drained sandy soils or on shallow soils (8 inches or less) over bedrock, consider one or more of the following guidelines:

- Convert or manage site for tree species that store fewer nutrients in the bole and bark of the tree, such as red pine or jack pine.
- Retain or redistribute slash on the site.
- Avoid full-tree harvesting or full-tree skidding that piles slash, or redistribute slash back onto the site.
- During non-frozen seasons, leave slash in small piles or drags along skid trails or in the skid trails themselves, rather than trafficking off of established trails, because the negative effects of soil trafficking outside of skid trails may outweigh the benefits of redistributing slash.
- Add nutrients to the site, such as municipal sludge, ash or commercial fertilizer. For sources of technical assistance before applying nutrients, see *Resource Directory*.
- Avoid shortened rotations.
- Consider extending harvest rotation age.



### Fingers and Fire Shadows

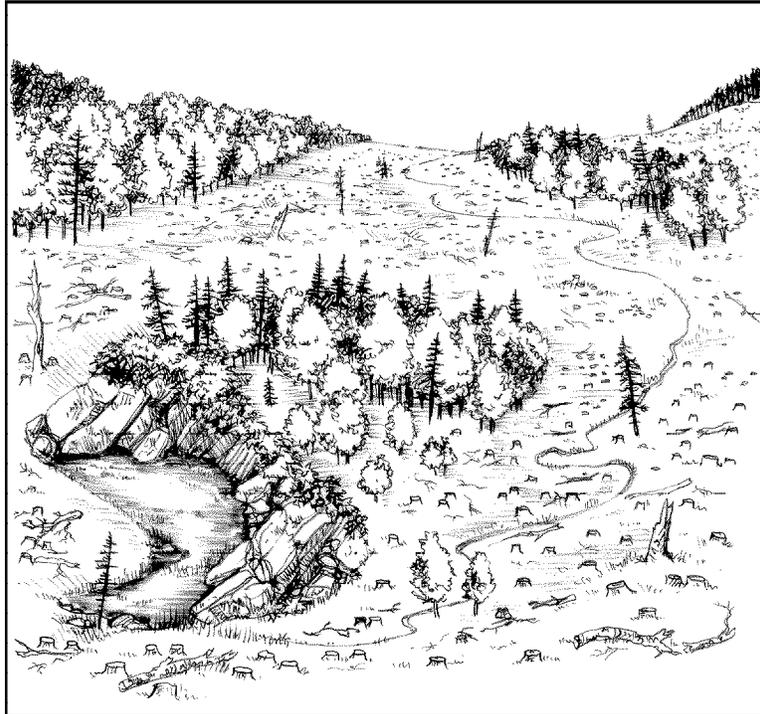


Figure TH-3

**U** For organic soils deeper than 24 inches, consider one or more of the following guidelines:

- Retain or redistribute slash on the site.
- Avoid full-tree harvesting or full-tree skidding that piles slash, or redistribute slash back onto the site.
- Add nutrients to the site, such as municipal sludge, ash or commercial fertilizer. For sources of technical assistance before applying nutrients, see *Resource Directory*.
- Avoid shortened rotations.
- Consider extending harvest rotation age.



### *Additional Considerations*

**K** Consider whether a legacy patch is needed. See *Part 2, Wildlife Habitat: Additional Consideration: Legacy Patches*, for information about legacy patches.

**K** Consider maintaining the diversity of mast sources on the site, as well as some level of current production of mast sources. For example, maintain landings as openings or avoid machinery operation in pockets of fruit-producing shrubs.



## Reducing Visual Impacts of Apparent Harvest Size

### *In areas classified as most sensitive: \**

**U** Limit apparent harvest size to 5 acres or less by:

- Leaving patches of trees to break up the harvest area.
- Using one or more of the techniques listed below.

### *In areas classified as moderately sensitive: \**

**U** Limit apparent harvest size to 5–10 acres by:

- Leaving patches of small unmerchantable species in the harvest area.
- Using one or more of the techniques listed below.

### *In areas classified as less sensitive: \**

**U** Follow standards and guidelines that best achieve integrated resource management objectives for the area.

### Techniques for limiting apparent harvest area size:

**U** Create narrow openings into harvest area to limit view from public roads, lakes and rivers, or recreation areas. See Figure TH-4.

**U** Utilize natural terrain. See Figure TH-5.

**U** Shape clearcuts to look more like natural openings where ownership patterns allow. See Figure TH-6.

**U** Adjust contiguous linear feet of harvest frontage along travel routes relative to travel speed.

**U** Consider multiple-stage cuts or other management methods such as shelterwood and selective harvesting. See Figure TH-7.

\*See Part 2, *Visual Quality: Visual Sensitivity Classifications* for information related to how classifications are determined and which Minnesota counties have developed visual sensitivity classification maps.



*Figure TH-4:* The impact of a highly visible harvest (upper left) is reduced by the use of narrow openings into the harvest area (lower right). A vegetative island further blocks the view into the harvest area.



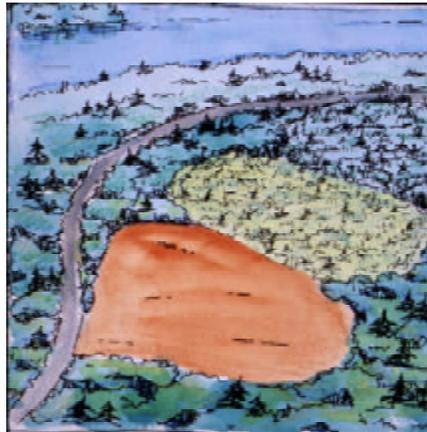
*Figure TH-5:* Using natural terrain to screen clearcuts from view can reduce the apparent size of a harvest area.



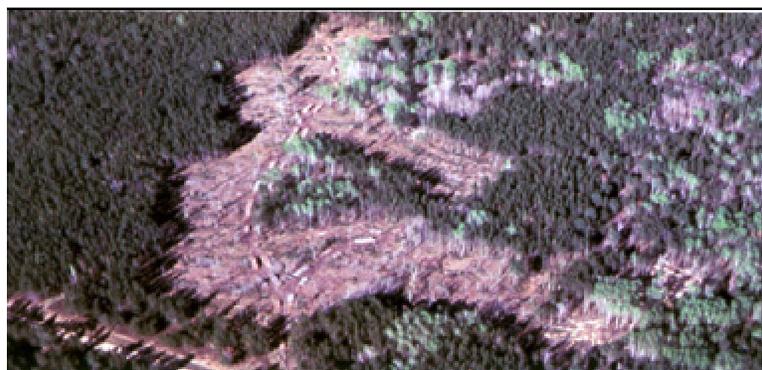
*Figure TH-6:* Shaping clearcuts to resemble natural openings (above) is more visually pleasing than geometric clearcut areas (below). The top opening also uses a vegetative island to reduce apparent size from the road.

*Figure TH-7:* Multiple-stage cutting (right) can reduce apparent harvest area size.

Vegetative islands (below) provide leave trees for wildlife habitat, serve as legacy patches, and help to reduce the apparent size of this clearcut from the main road (far right). This clearcut has also been shaped to resemble a natural opening. *Photo courtesy of Superior National Forest*



This aerial view of harvest activity in a clearcut area (below) reflects several visual quality management practices, including natural shaping, large vegetative islands and a narrow opening into the area that limits visual penetration from the road (lower left). *Photo courtesy of Chippewa National Forest*



## OPERATIONAL ACTIVITIES

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### IMPORTANT! Review General Guidelines:

- , Protecting Cultural Resources
- , Managing Equipment, Fuel and Lubricants
- , Protecting the Normal Flow of Streams and Wetlands
- , Protecting Wetland Inclusions and Seasonal Ponds
- , Retaining Leave Trees
- , Providing Coarse Woody Debris

### Other guidelines that apply:

For activities involving:	Refer to these guidelines:
Constructing and maintaining forest roads	Forest Road Construction and Maintenance

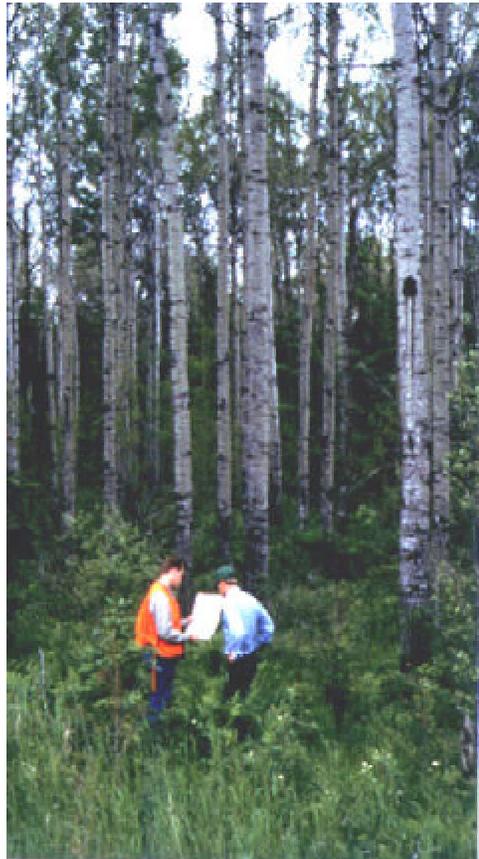
**U** Conduct on-site meetings with the logger, landowner and resource manager prior to moving equipment onto a site. Such meetings can help assure common understanding of landowner objectives, timber harvest specifications and site conditions.

### Protecting Sensitive Areas

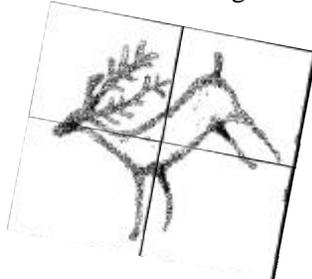
**U** Avoid sensitive areas discovered during the actual timber harvest that were not previously identified. Sensitive areas include areas with special soil conditions and topographic features that make them more sensitive to disturbance than others.

**U** Employ harvesting techniques that minimize the need to operate equipment on steep slopes (such as winching logs off steep slopes or cable yarding). Employ appropriate harvesting techniques and equipment when harvesting on steep slopes.

Conduct on-site meetings with the logger, landowner and resource manager prior to moving equipment onto a site. Such meetings can help assure common understanding of landowner objectives, timber harvesting regulations, contract specifications and site conditions. *Photo courtesy of Potlatch Corporation*



**U** If harvest will take place in the area of a cultural resource, employ measures to reduce soil disturbance, including (but not limited to) hand felling, cable skidding, limited-area feller buncher, low ground pressure (LGP) equipment, cut-to-length systems, and temporary protection such as slash, corduroy, tire mats or fill over geotextile.



## Landings

**U** Specify the number and location of landings as part of the harvesting agreement.

**U** Size landings to the minimum required for the acres to be harvested, the equipment likely to be used, and the products to be cut.

**U** Plan roads and landings to occupy no more than 1-3% of the timber harvest area. See Figure TH-8.

**U** Locate landings so that they are:

- On upland areas whenever practical
- On stable ground
- Outside of filter strips or the riparian management zone (RMZ), whichever is wider, where practical. (See *General Guidelines: Maintaining Filter Strips and General Guidelines: Managing Riparian Areas*.)
- Away from areas where a cultural resource is present

**U** Avoid landings in locations that will concentrate runoff from surrounding areas onto the landing.

**U** Avoid locating landings and yarding areas on open water wetlands.

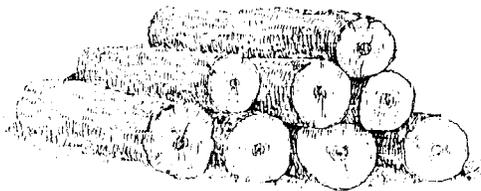
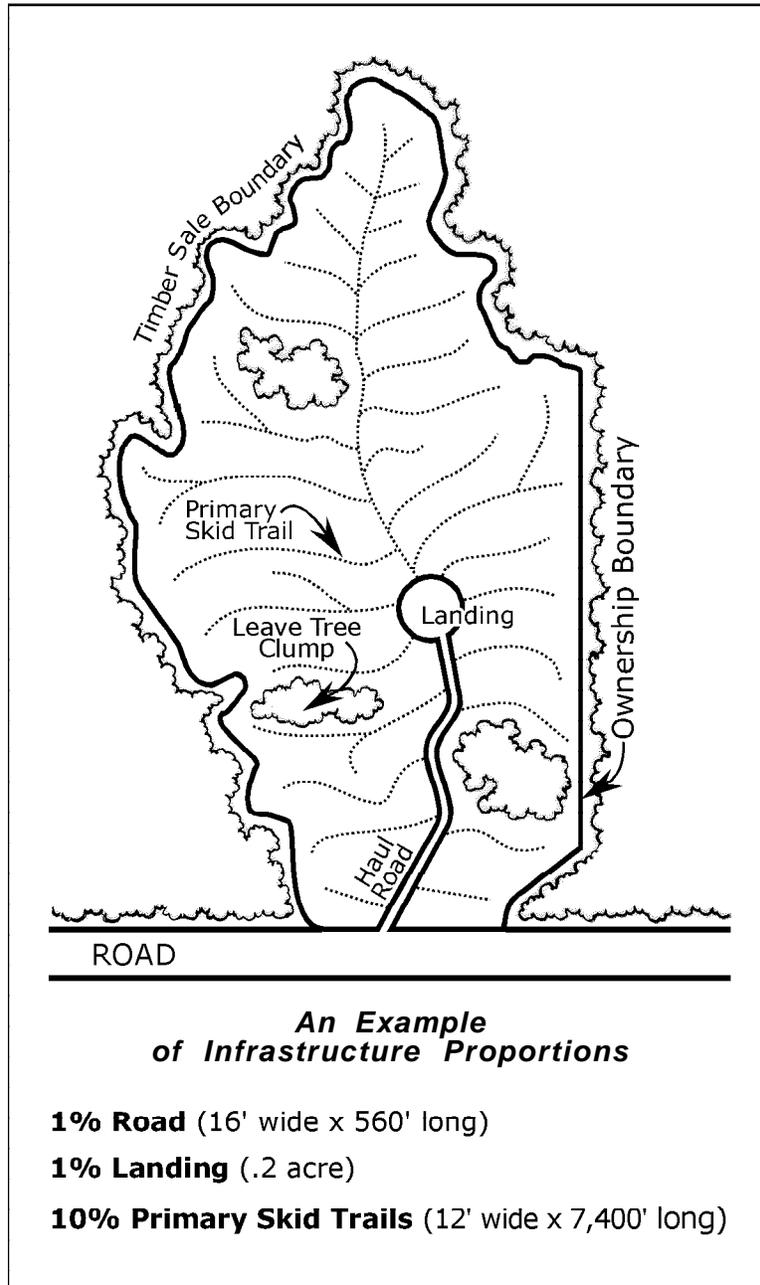


Figure TH-8

Sample 20-Acre Timber Sale



## Reducing Visual Impacts of Landings

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### *In areas classified as most sensitive: \**

**U** Avoid landings within view of travel routes or recreation areas. See Figure TH-9.

### *In areas classified as moderately sensitive: \**

**U** When possible, avoid landings within view of travel routes or recreation areas.

**U** If it is not possible to avoid landings within view of travel routes, screen landings from view as long as possible during logging.

### *In areas classified as most sensitive or moderately sensitive: \**

**U** Keep number of landings to a minimum.

**U** Remove all products promptly when development of visible landings is necessary.

**U** Dispose of grubbed stumps and trees so as not to be visible.

**U** Treat any slash at landings as soon as possible.

**U** Seed, plant and regenerate landings promptly.

**U** Remove all trash from landings upon completion of harvesting.

**U** Plan landings to access future sales.

*\*See Part 2, Visual Quality: Visual Sensitivity Classifications for information related to how classifications are determined and which Minnesota counties have developed visual sensitivity classification maps.*

*In areas classified as less sensitive: \**

- U** Avoid landings within a travel route right-of-way.
- U** Consider locating landings outside of maintained road right-of-way whenever possible.
- U** Remove all trash from landings upon completion of harvesting.
- U** Locate landings for best economy and reuse on subsequent sales.

*Figure TH-9:* In visually sensitive areas, a recommended practice is to avoid placing landings within view of travel routes or recreational areas. The landing and slash piles above are in full view of travelers and recreational users along the adjacent travel route and waterway. The landing and slash piles below are hidden from the travel route and waterway as a result of the dogleg access road.



## Skidding and Skid Trails

**U** Locate, design, construct and maintain skid trails to minimize damage to cultural resources or to the residual stand; minimize rutting; maintain surface and subsurface water flows in wetlands; and reduce erosion and sedimentation.

**U** Lay out skid trails to minimize the number of skid trails and site disturbance while also achieving necessary operating efficiency.

- If practical and feasible, keep skid trails away from cultural resource areas.
- Avoid locating skid trails in filter strips and riparian management zones (RMZs). See *General Guidelines: Maintaining Filter Strips* and *General Guidelines: Managing Riparian Areas*.
- Avoid operation of equipment on slopes steeper than 50%.
- Limit primary and secondary skid trails to no more than 10-15% of the timber harvest area. For the rest of the site, limit access to no more than 20-30% of the area using trails for no more than 1-2 passes with heavy equipment. (Small or irregularly shaped units may result in higher percentages of area occupied by infrastructure.)
- Skid low on a slope or across a slope to minimize erosion.
- Minimize long, straight skid trails that channel water. If long stretches cannot be avoided by careful siting, provide adequate drainage to avoid concentration of surface water flow. Divert water by proper shaping of the trail surface and by using broad-based dips, lead-off ditches or water bars. See *Forest Road Construction and Maintenance: Drainage*.

**U** Use full-tree skidding rather than tree-length skidding in the vicinity of a cultural resource, if practical and feasible.

**U** Concentrate equipment traffic on primary and secondary skid trails. Maximize the area NOT impacted by traffic by concentrating equipment movements to common trails. Skidders should always use skid trail routes, rather than the shortest distance, to travel to and from landings.

**U** Prepare skid trails for anticipated traffic needs, to avoid unnecessary maintenance or relocation of trails. Techniques can include packing of snow or ground cover to ensure freezing, or the use of appropriate wetland road construction methods to provide a stable trail surface.

**U** Maintain skid trails in good repair so that additional skid trails are not required.

**U** Reuse skid trails for thinning operations as trails for future thinnings and final harvest.

**U** If skid trails do not hold up (resulting in excessive rutting or requiring the need to create new skid trails), curtail operations until soils dry out.

### Other guidelines that apply:

For activities involving: Refer to these guidelines:

Skid trails

Forest Road Construction  
and Maintenance



## Minimizing Rutting

**U** Minimize rutting in primary skid trails, roads and landings; and avoid rutting in the general harvest area.

**U** If rutting occurs in the general harvest area (outside of primary skid trails), use alternative operating techniques, such as the following:

- Shifting harvest operations to a stable portion of the harvest area
- Using low ground pressure (LGP) equipment
- Using slash on skid trails as a driving surface
- Reducing loads carried by logging equipment
- Packing the snow or ground cover with LGP equipment to enhance freezing and permit off-trail operation of equipment

**U** If alternative operating techniques fail to eliminate rutting, stop harvesting operations.

## Managing Slash

**U** Favor practices that allow for dispersed slash on the site, rather than piling slash, where dispersed slash does not conflict with management objectives or reforestation. When piling slash, piles should be kept away from cultural resources.

**U** If moving slash on-site is desirable, use equipment that minimizes soil disturbance.

**U** Keep logging residue out of all streams, lakes and open water wetlands, except in cases where residue placement is specifically prescribed for fish or wildlife habitat. Make reasonable effort to keep logging residue out of all wetland inclusions, seasonal ponds and non-open water wetlands.

## Reducing Visual Impacts of Slash

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### *In areas classified as most sensitive: \**

- U** Encourage full utilization of all species in the harvest area.
- U** Avoid slash piles or windrows visible from travel routes and recreation areas.
- U** Eliminate or minimize slash within the first 50 feet from travel routes or recreation areas.
- U** Limit slash not screened from view beyond 50 feet from travel routes or recreation areas to a maximum height of 2 feet.

### *In areas classified as moderately sensitive: \**

- U** Encourage maximum utilization of all felled trees in the harvest area.
- U** Minimize visual exposure to slash piles and windrows.
- U** Limit slash not screened from view to a maximum height of 2 feet.

### *In areas classified as less sensitive: \**

- U** Avoid obtrusive piles in the foreground of visible areas.
- U** Use appropriate slash disposal to meet silvicultural goals.
- U** Limit slash not screened from view to a reasonable height to avoid a negative visual effect.

\*See Part 2, *Visual Quality: Visual Sensitivity Classifications* for information related to how classifications are determined and which Minnesota counties have developed visual sensitivity classification maps.



Visible slash is unsightly, as demonstrated in this blowdown site. In visually sensitive areas, eliminate or minimize slash within the first 50 feet from travel routes or recreation areas. *Photo courtesy of Superior National Forest*

## Water Quality and Wetlands

**U** Minimize the crossing of intermittent or perennial streams and open water wetlands. On both upland and lowland sites, install bridges, culverts, snow or ice bridges, fords or other means, if necessary, to prevent repeated soil and streambank disturbance where no practical alternative exists to crossing a stream. **IMPORTANT:** Such activity may require a permit from the DNR. See *Appendix H: Work Activities That Do Not Require a DNR Protected Waters Permit*.

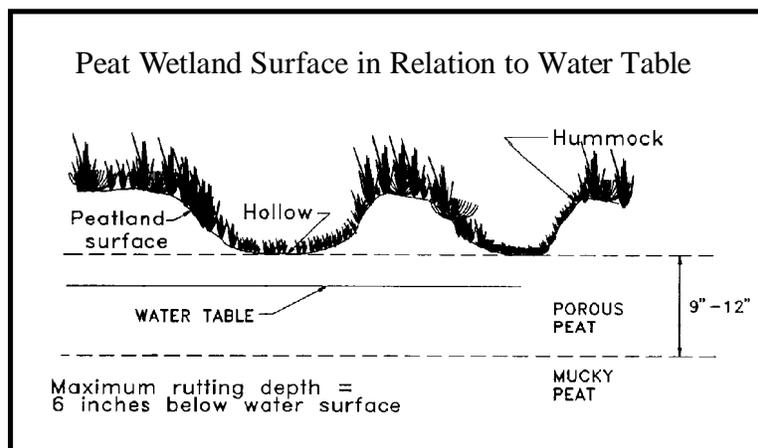
**U** Approach water crossings at or near right angles to the stream direction, and use measures to minimize streambank disturbances.

**U** Incorporate water diversion devices where needed during timber harvest activity (including water bars, tops and branches, ditch blocks and lead-offs). Divert surface flow before it enters landings or a water body. Incorporate water diversion devices during construction rather than as a remedial activity. See *Forest Road Construction and Maintenance: Drainage*.

**U** To prevent repeated rutting deeper than 6 inches on wetlands, shift harvest operations to a stable portion of the harvest area or alter operating techniques. Alternative operating techniques include:

- Employing low ground pressure (LGP) equipment
- Using slash on skid trails as a driving surface
- Minimizing the amount of off-trail equipment operation to reduce the area disturbed by heavy equipment
- Waiting for colder weather to freeze down the site, or enhancing freezing of site by packing snow and ground vegetation with LGP equipment.

**U** If repeated rutting deeper than 6 inches cannot be avoided with existing or alternative techniques, cease wetland timber harvesting operations. See Figure TH-10.



*Figure TH-10:* The water table (solid line) is near the bottom of the hollows (upper dotted line). Operations should stop when ruts reach 6 inches below the water table or 6 inches below the bottom of the hollows, whichever is lower. Peat is usually still porous 9 inches below the hollows, and ruts will heal in 2 to 3 years. Deep ruts (more than 12 inches below the hollows) will bring up well-decomposed, mucky peat and may take more than 20 years to heal.

## Maintaining and Perpetuating Oak

**U** Use appropriate management methods (including clearcut, shelterwood and group selection) to perpetuate oak types or oaks within other cover types, while retaining some trees on-site for continued mast production during stand regeneration. If no oaks can be left on a site, ensure that acorn-producing stands occur nearby for wildlife use during regeneration of the cut stand.

**U** Manage oak stands and other hard mast-producing trees on extended rotations, growing trees to large diameter to maximize mast production. Maintain oak in well-stocked stands by retaining vigorous trees with dominant crowns, as large crowned trees produce more mast. As older stands become less productive, their regeneration is one approach to long-term mast production.

### *Additional Consideration*

**K** Consider retaining oak inclusions when harvesting non-oak cover types.





Snags provide habitat for wildlife. *Photo courtesy of Potlatch Corporation*

## Snags (standing dead trees)

**U** Leave all snags possible standing in harvest areas.

**U** Exceptions to leaving all snags may be made for reasons related to visual quality. When leaving snags in areas classified as most sensitive or moderately sensitive:

- Avoid leaving snags in the foreground.
- Hide scattered snags with vegetative islands, or locate snags around the edge of an opening to allow for camouflage by background trees of similar color and texture.

## Leave Trees (live trees)

Leave trees are live trees retained on a site for resource benefits.

Two general options are recommended for retaining leave trees:

- Retaining leave trees in clumps, strips or islands
- Retaining scattered individual leave trees



This harvest area demonstrates implementation of several guidelines, including retaining leave trees and snags, dispersing slash throughout the site, and keeping slash low to the ground. These practices protect the soil, enhance wildlife habitat and reduce negative visual impacts. *Photo courtesy of Minnesota DNR*

Both options accomplish the management goals of retaining leave trees. Plans for retaining leave trees may utilize one of these options or, when appropriate, they may use the two options in combination.

**U** OPTION 1: Retain leave trees in clumps, strips or islands occupying a minimum of 5% of each clearcut harvest unit, using the following considerations and guidelines to aid in planning and design:

- With the exclusion of even-age management within riparian management zones (RMZs), trees left to protect cultural resources, visual quality, wetland inclusions, seasonal ponds, mast or other resources may be counted toward the 5% minimum recommendation. This consideration reflects the concept of overlapping guidelines where, in some instances, applying a guideline to benefit one resource may simultaneously fulfill guidelines focused on another resource.
- For even-age management, leave tree clumps, strips or islands should be positioned adjacent to the riparian management zone.

- Benefits of clumping leave trees include:
  - Potential to meet multiple management objectives simultaneously
  - Visual quality
  - Equipment maneuverability
  - Longevity and durability of leave trees
  - Potential for greater biodiversity within clumps
  - Easier application in larger harvest units
  - Breakup of harvest area and reduction in apparent harvest size
  - Better regeneration of intolerants on the rest of the site
  - Potential to provide nesting sites for some interior forest species when clumps exceed 2 acres
  - Increased animal feeding efficiency and protection from predators
- Clumps, islands or strips should:
  - Be distributed throughout a harvest unit
  - Be adjacent to the RMZ for even-age management
  - Vary in size, with a minimum of 1/4 acre per clump
  - Center around or coincide with such features as:
    - \* Wetland inclusions and seasonal ponds (see *General Guidelines: Protecting Wetland Inclusions and Seasonal Ponds*)
    - \* One or more large (> 18 inches DBH) active den trees or cavity trees
    - \* Mast trees
    - \* Preferred tree species (such as large white pine)
    - \* Raptor nests or rookeries
    - \* Sensitive communities or sites
- Minimal harvesting within clumps is acceptable as long as the integrity of the clump or key leave trees is not disturbed, and as long as the clump is not doubling as a legacy patch.

**U** OPTION 2: As an alternative or supplement to clumps, employ scattered individual leave trees, especially if they are larger, windfirm specimens of preferred species. Scattered leave trees may be easier to apply to small or narrow harvest units than clumps. Use the following guidelines for scattering individual leave trees:

- On most clearcut sites where this method is employed, leave 6-12 trees standing per acre, selecting trees preferentially. For preferred characteristics, see *General Guidelines: Retaining Leave Trees*.
- On certain clearcut sites, there may be no leave trees or as many as 15 or more leave trees per acre, depending on local conditions or landowner objectives, but the majority (80%) of these sites and their overall harvest acres should retain an average of 6-12 per acre. See Table TH-1.
- On non-clearcut sites (including selection or partial-cut), be sure that the remaining stand includes a minimum of 6 cavity trees, potential cavity trees and/or snags per acre.
- Distribute leave trees throughout the harvested site as much as possible.



Cavity trees enhance the quality of wildlife habitat. *Photo courtesy of Itasca County Land Department*

Suggested Numbers of Leave Trees for Clearcut Harvests Using Scattered, Individual Leave Trees  
(Clumped leave trees are preferred in most cases)

Management or Sale Area Size	Approx. number of leave trees per acre	Approx. spacing (in feet) if evenly distributed	Forest Type
	0	—	OPEN/BRUSH
	3	120'	LOWLAND DECIDUOUS
	6	85'	LOWLAND CONIFER
	9	70'	UPLAND CONIFER
	12	60'	UPLAND DECIDUOUS
15+	54'	UPLAND MIXED UPLAND WETLAND INCLUSIONS	

**Note:** Numbers of vertebrate species using cavity trees varies among habitats. The number of leave trees should reflect the variation among habitats and among site conditions.

Table TH-1

During initial harvest entries of seed tree or shelterwood cuts, select ultimate leave trees using the following guidelines:

- Leave a variety of sizes and species of trees, along with the intended seed/shelter trees, to be retained during the final harvest.
- Plan for and protect integrity of reserve tree clumps in initial harvest entries.
- Prevent damage to leave trees in initial and followup harvest entries.

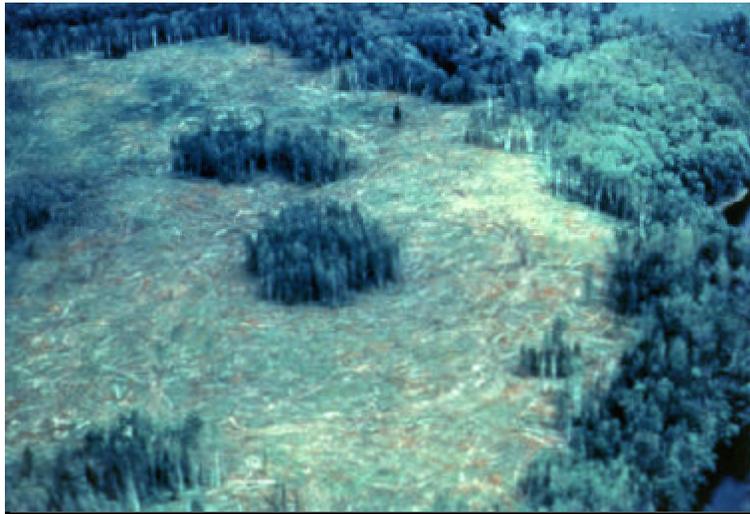
**U** Exceptions to the above leave tree and snag guidelines may be made for a number of reasons, including:

- Operator safety (of loggers, aerial spray applicators and others)
- Public safety (hazard trees near rights-of-way, recreation sites or airport vicinities)
- Specific forest management applications (such as genetic considerations for seed reproduction systems)
- Visual quality
- Alignment of skid trails
- Surrounding landscape concerns (sites adjacent to sharp-tailed grouse management units, for example)
- Forest insects and diseases (such as dwarf mistletoe on black spruce, gypsy moth and pine bark beetles)

**U** Protect conifer regeneration (less than 4 inches DBH) when harvesting mixed deciduous coniferous stands. See *Leave Trees* (page 33) and *General Guidelines: Retaining Leave Trees* for guidelines on retention of mature conifer trees. Clumps of conifers are preferable to scattered trees.

**U** Retain mast trees with bear claw marks on trunk, which indicate a preferred food source.



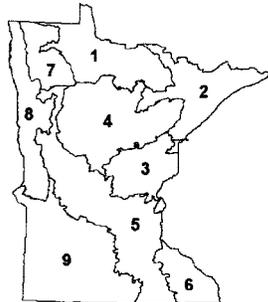


Retaining conifer clumps in a clearcut is preferable to leaving scattered trees.

### *Additional Considerations*

**K** Consider providing wildlife security cover and access to food when designing timber sales in Ecoregions 5 and 6. If the width of a harvest area exceeds 300-400 feet, and/or the size exceeds 40 acres, consider retaining travel lanes where topography does not already provide such cover. Travel lanes should be large enough to economically manage as a stand.

**K** Consider retaining more than the recommended number of leave trees in harvest sites of greater than 100 acres. This practice would better mimic natural disturbances, such as fire and windstorm.



## Post-Operational Activities

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**IMPORTANT!** Review General Guidelines:

, Post-Operational Activities and Followup Visits

**U** Evaluate the harvest operation and plan future adaptations at post-harvest conferences with the logger and landowner.

**U** Plan for removal of equipment and cut material from wetland areas at the end of the winter season prior to thawing.

**U** Avoid removing soil from the general harvest area to rehabilitate roads, landings and skid trails. Use already disturbed soil, if needed, rather than disturbing additional soil.

**U** Rehabilitate landings and skid trails when necessary to mitigate soil compaction and reduce erosion.

### *Additional Consideration*

**K** Consider scarifying the soil in the vicinity of conifer seed trees to enhance regeneration of these species.

