NATURAL RESOURCES CONSERVATION SERVICE
MONTANA CONSERVATION PRACTICE SPECIFICATION

FOREST TRAILS AND LANDINGS (FEET AND ACRE)

CODE 655

DEFINITION: A temporary or infrequently used route, path or cleared area.

SCOPE: This practice applies on the following conditions:

When providing access to a forest stand for:

- Management (including fire suppression)
- Removal and collection of forest products.

FOREST TRAILS AND LANDINGS REQUIREMENTS:

- The size, gradient, number, and location of forest trails and landings will meet the intended purpose and the type of equipment used.
- Trails and landings shall be configured to minimize adverse site impacts.
- Timing and use of equipment will be commensurate with site and soil conditions.
- Slash and debris left on the site will not present a fire or pest hazard.
- Waterbars, rolling dips, and other drainage measures for trails shall be of the size, interval, and gradient for drainage and erosion control.
- Trails and landings shall be re-vegetated to control erosion.

OPERATION AND MAINTENANCE:

- Periodically inspect trails and landings and make any necessary repairs.
- Landings and trails no longer used can be removed and re-vegetated.
- Waterbars, rolling dips, and other drainage measures for trails shall be maintained and left in a stable, functioning condition.

GENERAL SPECIFICATIONS: Procedures, technical details, and other information listed below provide additional guidance for carrying out selected components of the named practice. This material is referenced from the conservation practice standard for the named practice and supplements the requirements and considerations listed therein.

PLANNING HARVEST TRAIL LOCATIONS:

- Confine the area covered by harvest trails and landings to less than 15 percent.
- Even one pass with ground equipment can cause soil compaction.
- Less area in harvest trails means less soil compaction/displacement and more area favorable for tree growth.

On gentle ground in small timber, the harvest trail spacing chart to the right yielded the percent of areas shown.

SPACING (8-FOOT WIDTH)	PERCENT OF AREA IN HARVEST TRAILS
Logger's Choice	20
100 feet	11
150 feet	7
250 feet	4

Systematically located harvest trails reduce skidding distances. Two common patterns are the branching (FIGURE 1.) and the parallel (FIGURE 2.) harvest trails.

GENTLE SLOPES

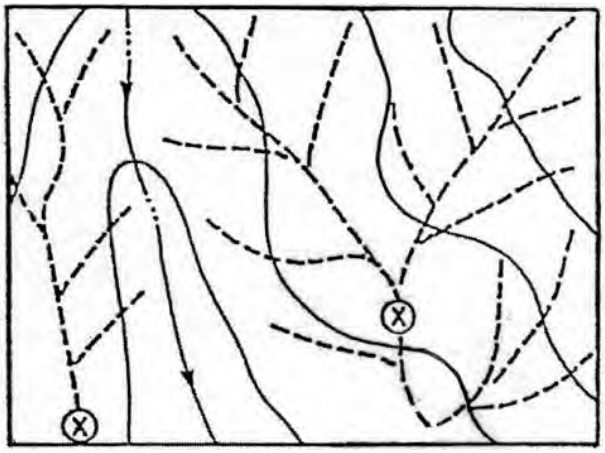


FIGURE 1 Branching pattern–not to scale.
X = Landing Locations

STEEPER SLOPES

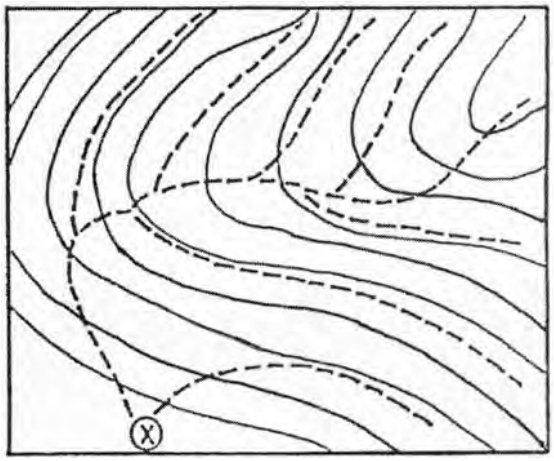


FIGURE 2 Parallel pattern–not to scale.
X = Landing Locations

LANDING LOCATIONS: Locate landings–area used for decking and loading logs onto trucks–as the first step in layout. Landings should be large enough to accommodate trucks, the loader, slash, and log decks. Landings should be a minimum 1/4-acre size. Locate landings where horizontal relief is straight or convex. Concave relief collects runoff and increases the potential for erosion and adverse site conditions.

The slope of the landing should be less than eight (8) percent.

Locate landings to keep skid distances under 1,500 feet. Skid distances averaging 800 feet or less reduce logging costs, lessen resource damage, and improve aesthetics.

HARVEST TRAIL ALIGNMENT: Requirements for harvest trail alignment include:

1. Making trails as straight as possible for the longest practical distance, especially main trails, to minimize damage to residual trees.
2. Avoiding sharp curves especially at the bottom of steep downhill trail segments.
3. Removing all trees in harvest trails and cut stumps at the ground line.
4. On steeper slopes, parallel the contours and locating upslope trails on more gentle grades, preferably on ridges or convex slopes.
5. Using short trail branches to reach long corners of the unit.

HARVEST TRAIL GRADES:

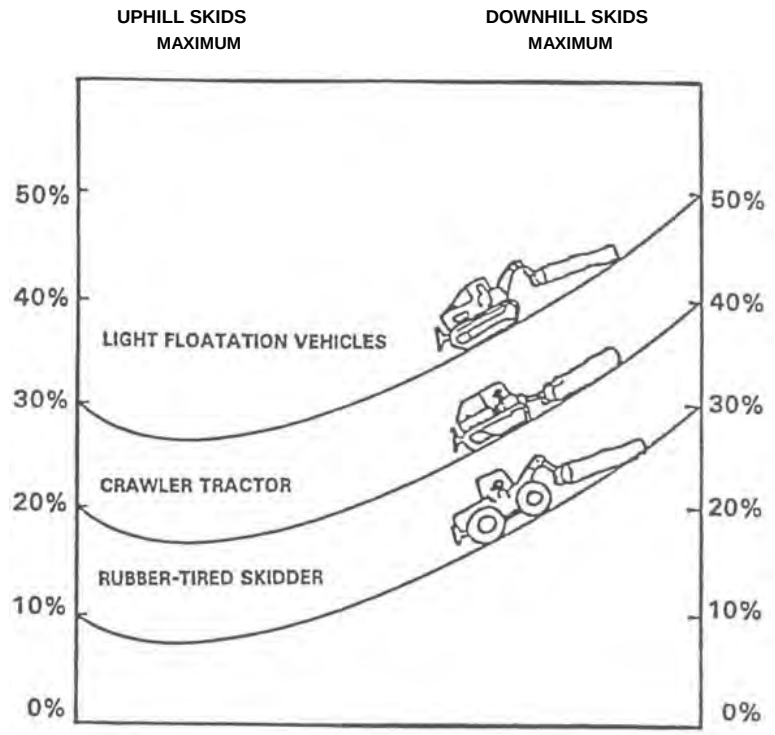
- Harvest trail grades affect skidding productivity.
- Skidding uphill is preferred for all ground-based systems.
- Recommended grades for harvest trails are less than 20 percent.
- The grades shown in FIGURE 3 are maximum grades.

Harvest trails are usually oriented up and down the slope to assure vehicle stability.

Harvest trails that cross slopes greater than 20 percent may require some excavating. This is necessary to avoid the load and vehicle side slipping downslope.

FIGURE 3. Left and right sides of the graph represent traction under the best conditions, but soil and weather conditions may reduce gradability.

From *Handbook for Ground Skidding and Road Building in the Kootenay Area of British Columbia*, Forest Engineering Research Institute of Canada (Vancouver, British Columbia, 1976).



EROSION CONTROL ON HARVEST TRAILS AND LANDINGS: On erodible harvest trails construct waterbars and reseed immediately after log skidding and site scarification. FIGURE 4 shows waterbar construction for harvest trails. See TABLE 2 for recommended waterbar spacings and TABLE 3 for species and seeding rates.

Harvest trails will need treatment only where ground litter has been removed to mineral soil. Drainage structures shall be placed to empty on stable material. Where this is not possible, suitable erosion control mattresses or get-away provisions will be constructed to minimize erosion damage and spread runoff onto stable material.

Species and varieties of grasses and forbs in TABLE 3 are recommended for six (6) different site adaptation zones. Each zone is briefly defined in terms of the expected climax forest overstory series and in some cases in combination with understory plants, groups, or plants.

Adapted plants and seeding rates are shown in TABLE 3. This table contains information on adapted species for *"critical"* areas and *"non-critical"* areas within different forest zones. Mixtures for erosion control are recommended for each zone. Consider plant species for wildlife or livestock use also. Refer to *Montana Interagency Plant Materials Handbook* for more information on seeding disturbed areas.

Critical areas here are defined as areas upon which the establishment of vegetation is difficult–such as road cuts, landings, harvest trails, and other areas of compacted or subsoil material.

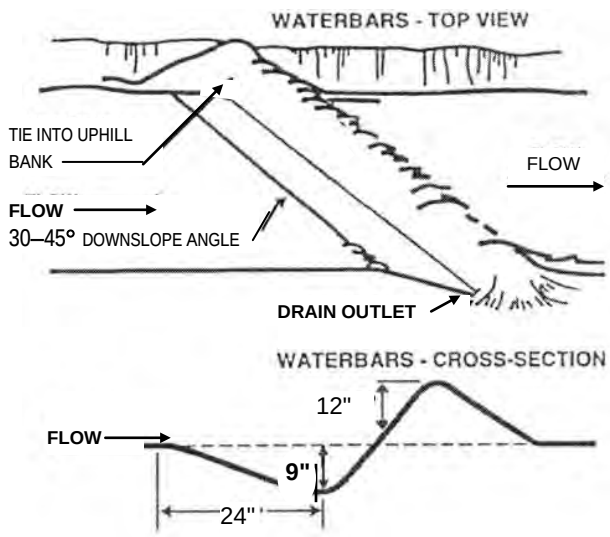
Seeding rates are as follows:

1. For *"non-critical"* areas--broadcast adapted seed at the rate of 40 pure live seeds per square foot (PLS).
2. For *"critical"* areas--double the rates specified above.

Seeded areas may be mulched with straw, wood chips, or other suitable material to reduce erosion and improve germination and growth. Refer to the Field Office Technical Guide (FOTG), Section IV, Practice Standards and Specifications, Mulching (Code 484) for more technical information and guidelines.

Dormant seedings in the fall do well. Seeding on the snow is acceptable, if snow is less than one (1) foot. Shrubs should be planted in the spring only.

FIGURE 4 **WATERBARS**



ADDITIONAL CRITERIA:

- Use harvest trails from previous logging operations if suitable.
- Avoid wet spots, springs, drainage ways, and rock outcrops.
- Minimize soil compaction by operating equipment under the proper soil moisture conditions. Certain soil textures have a higher risk for soil compaction. See TABLE 1.
- Restrict skidding machinery to harvest trail locations. Cable and winch trees back to the main trail or use mechanical harvesters to place the cut trees along the trails.
- The log ends should be suspended when skidding.

OTHER CONSIDERATIONS:

- Slash placed on the harvest trail will reduce compaction by tracked vehicles, but it may present traction problems for rubber-tired skidders.
- Skidding whole trees can reduce ground disturbance in harvest trails.
- Reduce the spread of noxious weeds:
  - Avoid skidding in areas containing noxious weeds
  - Equipment should be free of any weed seed.

TABLE 1. SOIL RATING CRITERIA FOR EQUIPMENT COMPACTION RISK (TOP 12" OF SOIL)*

FACTOR	ROCK FRAGMENTS >3"	LOW	MEDIUM	HIGH	IMPACT
	>60%	ALL	---	---	MINIMAL
TEXTURE CLASS	35-60%	cos, s, fs, vfs, lcos, ls lfs, lvfs, cosl, sl, fsl, l, scl, cl, sicl, sil, c, sc, sic	fsl, sil, sicl	---	SOME COMPACTION
	<35%	cos, s, fs, vfs, lcs, ls, lfs	lvfs, cosl, sl, l, scl, cl, c, sc, sic	fsl, sil, sicl	EASILY COMPACTED

CRITERIA NOTES:

Rock fragments resist compaction force by fragment-to-fragment friction and buffer the adjacent fine-earth fraction by distributing downward energy. Finer textures without coarse fragments are the least resistant to compaction. Duff layers greater than 4 inches thick act as protective blanket and absorb and distribute downward forces.

* NOTE: Reduce rating one level if duff layer is >4 inches thick.

TABLE 2. HARVEST TRAIL WATERBAR SPACING

Recommended spacing in feet for harvest trail waterbars in relation to rock fragments and slope of harvest trail.

	ROCK FRAGMENTS (TOP 12" OF SOIL)		
SLOPE	<35%	35-60%	>60%
<30%	100'	200'	AS NEEDED
>30%	50'	100'	

Reduce spacing if harvest trails are located in ravines where additional water is likely to accumulate.

Log waterbars are also effective.

Put waterbars where they will do the most good. TABLE 2 is a guide and spacing should be adjusted for actual conditions.

TABLE 3. SPECIES AND VARIETIES OF GRASSES AND FORBS FOR RE-VEGETATION OF DISTURBED AREAS

SITE ADAPTATION ZONES

ZONE 1 – Dry Douglas-fir, limber pine, and ponderosa pine habitat types; with a significant bunchgrass component in the understory.

ZONE 2 – Mesic Douglas-fir, moist ponderosa pine habitat types.

ZONE 3 – Moist Douglas-fir with blue huckleberry in the understory. Grand fir, western red cedar, western hemlock habitat types occurring on well-drained soils.

ZONE 4 – Subalpine fir, mountain hemlock, and Engelmann spruce habitat types on well-drained soils.

ZONE 5 – High, cold environments–timberline habitat types.

ZONE 6 – Wet sites–imperfectly to poorly-drained soils–commonly in the Engelmann spruce, subalpine fir, western red cedar, or western hemlock climax forest overstory.

RECOMMENDED VARIETIES:	SITE ADAPTATION ZONE						SEEDING RATE
	1	2	3	4	5	6	#PLS/AC @ 40 SEEDS/FT^2*
HERBACEOUS:							
Bannack or Critana thickspike wheatgrass	C 1/	C	--	--	--	--	12.0
Ephriam or Fairway crested wheatgrass	N 2/	--	--	--	--	--	8.0
Manska or Luna pubescent wheatgrass	N	N	--	--	--	--	16.0
Hycrest crested wheatgrass	C	--	--	--	--	--	8.0
Rush, Reliant or Oahe intermediate wheatgrass	N	N	--	--	--	--	16.0
Amur or Greener intermediate wheatgrass	--	--	N	--	--	--	16.0
Pryor slender wheatgrass	C	--	--	--	--	--	12.0
Vavilov Siberian wheatgrass	C	--	--	--	--	--	10.0
Sodar streambank wheatgrass	N	N	--	--	--	--	10.0
Tegmar dwarf pubescent wheatgrass	N	N	--	--	--	--	16.0
Rosana western wheatgrass	--	N	--	--	--	--	16.0
Whitmar beardless wheatgrass	--	C	C	--	--	--	12.0
Goldar or Secar beardless wheatgrass	C	--	--	--	--	--	12.0
Durar hard fescue	--	C	C	C	--	--	4.0
Cover sheep fescue	C	C	--	--	--	--	4.0
Kenmont tall fescue	--	C	C	C	--	C	8.0
Pennlawn chewings red fescue	--	--	N	--	--	--	4.0
Redondo Arizona fescue	--	N	N	N	--	--	3.8
Nevada bluegrass	--	N	N	--	--	--	1.6
Sherman big bluegrass	C	N	N	--	--	--	2.0
Foot Hills or Reubens Canada bluegrass	--	--	C	N	--	--	1.0
Alpine bluegrass	--	--	--	--	C	--	1.6
Manchar smooth brome	--	N	N	--	--	--	10.0
Regar meadow brome	--	N	N	--	--	--	16.0
Bromar mountain brome	--	--	N	N	--	--	22.0
Garrison creeping foxtail	--	N	C	N	--	C	4.0
Meadow foxtail	--	--	N	N	N	N	2.4

1/ C = CRITICAL (ESTABLISHMENT OF VEGETATION IS DIFFICULT) AND NON-CRITICAL

2/ N = NON-CRITICAL (ESTABLISHMENT OF VEGETATION IS RELATIVELY EASY)

TABLE 3. SPECIES AND VARIETIES OF GRASSES AND FORBS FOR RE-VEGETATION OF DISTURBED AREAS--CONTINUED

RECOMMENDED VARIETIES:	SITE ADAPTATION ZONE						SEEDING RATE
	1	2	3	4	5	6	#PLS/AC @ 40 SEEDS/FT^2*
HERBACEOUS:							
Latar orchardgrass	--	C	C	C	N	--	3.8
Climax timothy	--	C	N	C	C	C	1.4
Alpine timothy	--	--	--	C	C	--	1.4
White dutch clover	--	--	N	N	--	--	2.2
Alsike clover	--	--	--	N	N	C	2.4
Tretana birdsfoot trefoil	--	--	N	N	N	C	4.2
Tufted hairgrass	--	--	--	--	C	C	0.7

1/ C = CRITICAL (ESTABLISHMENT OF VEGETATION IS DIFFICULT) AND NON-CRITICAL

2/ N = NON-CRITICAL (ESTABLISHMENT OF VEGETATION IS RELATIVELY EASY)

* NOTE: This is the rate for non-critical areas broadcasted.
For critical areas, double the rates specified.

REFERENCES:

Seeding Rate Statistics for Native and Introduced Species, August 1996, USDI–National Park Service and USDA–Natural Resources Conservation Service.

USDA–NRCS Technical Guides for Pasture and Hay Planting and Range Seeding.