

Appendix 1 Soil Disturbance Classification

Soil Disturbance Described under the Forest Practices Code

Excavated or Bladed Trail ("R")

A constructed trail that has:

- a mineral soil cutbank height greater than 30 cm, and
- an excavated width greater than 1.5 meters.

Measure disturbance depending on whether fill slopes are considered unfavorable in the Silviculture Prescription:

- If fill slopes are unfavorable: include the width of the trail in horizontal distance from the top of the cut to the point where the sidecast fill is continuously 20 cm deep. Do not count accumulations of slash that are "clean woody debris" as part of the sidecast. Clean woody debris contains less than 30% mineral soil.
- If fill slopes are favorable: include the width in of the trail in horizontal distance from the top of the cut to the outside edge of the compacted running surface. If the running surface is not compacted (e.g. a winter trail), then measure the excavated width only.

Corduoroyed Trail ("Y")

A trail constructed using logs and woody debris placed side by side to form a surface greater than 2 meters in length capable of supporting equipment traffic.

This disturbance is counted on all sites.

Compacted Area ("A")

An area of soil greater than 100 m², having a minimum width of 5 m that:

- has been compacted by equipment travelling over the area, and
- has the same characteristics as Repeated Machine Traffic and/or Wheel/Track Ruts

This disturbance is counted on all sites.

Dispersed Trails: Wheel / Track Ruts ("T") on All Sites

The depth criteria for this category vary depending on the compaction hazard, as defined in the FPC hazard assessment guidebook¹. On High and Very High Compaction Hazard sites both depth criteria apply. No evidence of compaction is required to assess ruts.

Definition Criteria

Impressions or ruts in the soil that are at least 30 cm wide and 2 meters long with depth measured as follows:

- 1. On all sites: a minimum of 15 cm** at the deepest point in the perpendicular cross section, when measured from the top of the undisturbed forest floor to the top of the intact forest floor in the rut, or the mineral soil surface if forest floor is not present in the rut. The rut must be 15 cm deep over the entire length of 2 meters. Ignore any accumulations of slash, needles or other organic debris that accumulated in the rut or on the adjacent undisturbed forest floor during harvesting operations when making this assessment.
- 2. On sites with a High or Very High Compaction Hazard:** a minimum of 5 cm at the deepest point in the perpendicular cross section, when measured from the undisturbed mineral soil to the mineral soil surface in the rut. The rut must be 5 cm deep over the entire length of 2 meters.

Dispersed Trails: Repeated Machine Traffic ("E")

General Description

This category describes disturbance where there is evidence of repeated, heavy machine traffic, but where ruts are not visible.

This type of disturbance typically occurs where there has been heavy machine traffic on repeatedly used skid trails which are obvious linear features. "Repeated use" generally means 3 or more passes over the same location on the ground. This disturbance may also occur on heavy traffic areas in roadside landings and around piles constructed by windrowing or round piling slash.

On Moderate to Very High Compaction Hazard sites logged under moist conditions, compaction may occasionally result from fewer than 3 passes of heavy equipment. This disturbance rarely occurs on Moderate or Low Compaction Hazard soils logged under dry conditions, where random skidding operations have limited the use of trails to 1 or 2 passes.

Repeated Machine Traffic is counted on all sites.

Definition Criteria

- 1. The survey point shows evidence of compaction** (see "Assessing Compaction" below).

¹ Hazard Assessment Keys for Evaluating Site Sensitivity to Soil Degrading Processes Guidebook (June 1995).

2. In addition, there is either evidence of compaction in 100% of a 1 x 2 meter rectangle, or there must be a combination of the following attributes covering 100% of a 1 x 2 meter rectangle:

- exposed mineral soil
- forest floor, fine slash or woody debris crushed into the mineral soil
- forest floor crushed or scraped to 1/2 of its original depth, with evidence of repeated machine traffic
- evidence of large roots, vegetation or stumps which have been scraped by repeated machine traffic.
- bedrock, coarse fragments or large roots exposed by repeated machine traffic

These attributes are taken as an indication the compaction at the point also exists in the entire 1 x 2 meter rectangle. When present it is not necessary to dig in the circle.

If you do dig and find that the rectangle is not 100% compacted, then do not call the disturbance Repeated Machine Traffic.

3. Include as Repeated Machine Traffic, survey points which fall on rocks or stumps that are surrounded by disturbance that would be classified in this category.

Assessing Compaction

Any one of the 3 conditions listed below is considered to be compacted soil (compacted mineral soil, puddled mineral soil, compacted deposits of slash and organic debris).

1. **Mineral soil compaction is assessed relative to conditions in the adjacent undisturbed soil** (e.g. soil texture may change within the survey area). The specific criteria to use in assessing compaction will depend on the difference in moisture content in the undisturbed and disturbed soils. Any one of the following attributes defines a compacted condition:

- a) Coarse platy structure. The excavated soil breaks apart in consolidated plates that are typically 1 cm or greater in thickness. This structure is not evident in the adjacent undisturbed soil.
- b) Massive soil showing a loss of the normal structure evident in the undisturbed soil.
- c) A noticeable change in density. If the disturbed and undisturbed soils have the same moisture content, the changes in density may be recognized by any one of the following characteristics:
 - a difference in resistance to shovel penetration
 - a difference in resistance to crushing between the thumb and index finger, blocks of soil that are 2.5 cm thick

2. **Puddling** is characterized by the presence of any one of the following conditions:

- a) a loss of the normal structure evident in the undisturbed soil.
- b) the deposition of fine mineral particles on the soil surface
- c) organic material ground into the mineral soil

3. **Compacted deposits of forest floor, fine slash and woody debris** overlying the mineral soil that cannot be readily excavated with a shovel (e.g. deposits of compacted cribbed-in slash on winter skid trails that are deeper than 20 cm, and are not plantable)

Deep Gouge ("G")

Mineral soil gouged deeper than 30 cm, or to bedrock at the survey point.

Measure from the undisturbed mineral soil surface to the mineral soil surface evident at the time of the survey. In other words, do not count mineral soil deposits as gouged unless the top of the deposit is deeper than 30 cm. A "mineral soil deposit" must have at least 70% mineral soil, and not contain large air pockets created by buried slash.

This disturbance is counted on all sites.

Long Gouge ("L")

Mineral soil gouged deeper than 5 cm, or to bedrock at the survey point, and on over 100% of a 1.0 x 3.0 metre rectangle.

Measure to the depth of the mineral soil surface evident at the time of the survey using the same procedure described for Deep Gouges (i.e. do not count mineral soil deposits as gouged unless the top of the deposit is deeper than 5 cm).

This disturbance is counted on all sites.

Wide Gouge ("W")

Mineral soil gouged deeper than 5 cm, or to bedrock at the survey point, and on over 80% of a 1.8 x 1.8 metre square.

Note: 80% of a 1.8 x 1.8 m square is equivalent to 100% of areas that are 1.44 x 1.8 m, or 1.61 x 1.61 m.

Measure to the depth of the mineral soil surface evident at the time of the survey using the same procedure described for Deep Gouges (i.e. do not count mineral soil deposits as gouged unless the top of the deposit is deeper than 5 cm).

This disturbance is counted on all sites.

Very Wide Scalp ("V")

Forest floor removed at the survey point, and on over 80% of a 3.0 x 3.0 metre square.

Note: 80% of a 3.0 x 3.0 m square is equivalent to 100% of areas that are 2.40 x 3.0 m, or 2.68 x 2.68 m.

Forest floor is considered removed when there is:

- exposed mineral soil
- exposed mineral soil covered by fine woody slash, undecomposed needles or dislodged rotten wood
- exposed mineral soil covered by dislodged forest floor that is less than 50% of the adjacent undisturbed forest floor depth

Forest floor is **not removed** when it is:

- intact forest floor of any depth (see "intact forest floor" below)
- mixed forest floor and mineral soil (see "mixed forest floor" below)
- exposed mineral soil covered by dislodged forest floor that is $\geq 50\%$ of the adjacent undisturbed forest floor depth.

Intact forest floor typically shows the presence of roots growing into the mineral soil.

Mixed forest floor is a non-compact layer at least 5 cm thick at the surface with at least 50% incorporated forest floor.

Dislodged forest floor must be of similar character to the adjacent undisturbed forest floor to be acceptable.

This disturbance is counted on all sites.

Wide Scalp ("S")

Forest floor removed at the survey point, and on over 80% of a 1.8 x 1.8 metre square.

Note: 80% of a 1.8 x 1.8 m square is equivalent to 100% of areas that are 1.44 x 1.8 m, or 1.61 x 1.61 m.

Use the same definition of forest floor removal described for the Very Wide Scalp category.

This disturbance is counted when there is:

- High or Very High Mass Wasting Hazard
- High or Very High Forest Floor Displacement Hazard
- Very High Soil Displacement Hazard
- Very High Compaction Hazard
- Very High Surface Erosion Hazard

Continuous Scalp ("C")

Mineral soil exposed at the survey point, and continuously exposed for a length of 5 meters.

This disturbance is counted when there is:

- High or Very High Mass Wasting Hazard
- High or Very High Surface Erosion Hazard
- Very High Soil Displacement Hazard

What's New in the Forest Practices Code

Table 4 Summary of Changes in Soil Disturbance Classification under the Forest Practices Code

Corresponding Categories		Description of Differences under the FPC
1994 Silviculture Regulation	Forest Practices Code	
Skidroad ("R")	Excavated/ Bladed/Trail ("R")	<ol style="list-style-type: none"> 1. The cutbank height must be at least 30 cm. 2. The excavated width must be at least 1.5 meters. 3. Include the fill slope to where it is continuously 20 cm deep if it is an "unfavorable growing medium" as defined on the Silviculture Prescription, otherwise include only the compacted running surface.
Extensive Uniform Compaction ("E")	Repeated Machine Traffic ("E")	<ol style="list-style-type: none"> 1. The dimensions assessed have changed: compaction or visual indicators must be evident over 100% of a 1 x 2 meter rectangle. Previously the area assessed was 75% of a 2-meter diameter circle. 2. Under the FPC this category is now assessed on all sites. Previously it was not assessed on Low Compaction Hazards. <p>Note: field procedures for assessing Extensive Uniform Compaction have also been amended from the 1994 field season (see Appendix 1).</p>
Wheel/Track Ruts ("T")	same	<ol style="list-style-type: none"> 1. No evidence of compaction is required. 2. The depth criteria are changed (length and width criteria are the same): <ul style="list-style-type: none"> • On all sites: a minimum of 15 cm deep, measured from the top of the forest floor; • On sites with a High or Very High Compaction Hazard: a minimum of 5 cm, measured from the top of the undisturbed mineral soil
Wide Gouge ("W")	same	<p>The depth criteria is now gouged deeper than 5 cm, instead of greater than or equal to 5 cm.</p> <p>Mineral soil deposits in gouges are also treated differently. The new procedure is to measure from the undisturbed mineral soil surface to the mineral soil surface evident at the time of the survey. In other words, do not count mineral soil deposits as gouged unless the top of the deposit is deeper than 5 cm. A "mineral soil deposit" must have at least 70% mineral soil, and not contain large air pockets created by buried slash.</p>

Soil Disturbance Guidelines

Table 3 Forest Practices Code Allowable Soil Disturbance and Forest Floor Displacement

Leading Soil Disturbance Hazard	Soil sensitivity rating	Categories Counted in Allowable Soil Disturbance ^{1,2}	Allowable Soil Disturbance (% NAR) ²		Allowable Forest Floor Displacement (% NAR)
			Coast & Interior	Coast & Interior	Coast & Interior
Mass wasting	VH	Always + S + C	5		5
Surface soil erosion	VH	Always + S + C	5		15
Soil displacement	VH	Always + S + C	5		15
Mass wasting	H	Always + S + C	5		25
Soil compaction	VH	Always + S	5		25
			Coast	Interior	Coast & Interior
Surface soil erosion	H	Always + C	5	10	25
Mass wasting	M, L	Always	5	10	30
Surface soil erosion	M, L	Always	5	10	30
Soil displacement	H, M, L	Always	5	10	30
Soil compaction	H, M, L	Always	5	10	30
Forest floor displacement	VH, H	Always + S	5	10	30
Forest floor displacement	M, L	Always	5	10	30

¹ "Always" includes soil disturbance that is always counted, namely: excavated/bladed trails, compacted areas, corduroyed trail, repeated machine traffic, ruts, deep gouges, long gouges, wide gouges, and very wide scalps (see Appendix 1 for definitions).

"S": Wide Scalps, "C": Continuous Scalps (see Appendix 1 for definitions).

² Combine the categories measured for different hazard ratings if that will result in more categories being counted, or a lower allowable disturbance limit. For example, on a site with a Very High Compaction Hazard, and a High Surface Erosion Hazard the categories counted would be "Always + S + C", and the counted disturbance limit would be 5%.

Notes:

What's New in the Forest Practices Code (cont'd)

Table 4 Summary of Changes in Soil Disturbance Classification under the Forest Practices Code (continued)

New Categories in the FPC		Notes
Deep Gouge ("G")	new	The depth criteria is now gouged deeper than 30 cm, instead of greater than or equal to 30 cm. Measure mineral soil deposits in the gouge as described under "Wide Gouges" on the preceding page.
Long Gouge ("L")	new	The depth criteria is now gouged deeper than 5 cm, instead of greater than or equal to 5 cm. Measure mineral soil deposits in the gouge as described under "Wide Gouges" on the preceding page.
Very Wide Scalp ("V")	new	Dimensions are the same. A scalp is where there is forest floor removal. The definition of "forest floor removal" has changed slightly. Forest floor is considered removed when there is: <ul style="list-style-type: none"> • exposed mineral soil • exposed mineral soil covered by fine woody slash, undecomposed needles or dislodged rotten wood • exposed mineral soil covered by dislodged forest floor that is less than 50% of the adjacent undisturbed forest floor depth Refer to Section 2 or Appendix 1 for a complete definition.
Wide Scalp ("S")	new	Dimensions are the same. See the new definition of "forest floor removal" described for Very Wide Scalps. Refer to Section 2 or Appendix 1 for a complete definition.
Continuous Scalp ("C")	new	See Section 2 or Appendix 1 for a complete definition.
Corduroyed Trail ("Y")	new	See Section 2 or Appendix 1 for a complete definition..
Compacted Area ("A")	new	See Section 2 or Appendix 1 for a complete definition.

Reconnaissance Survey - Field Layout

Transect Location

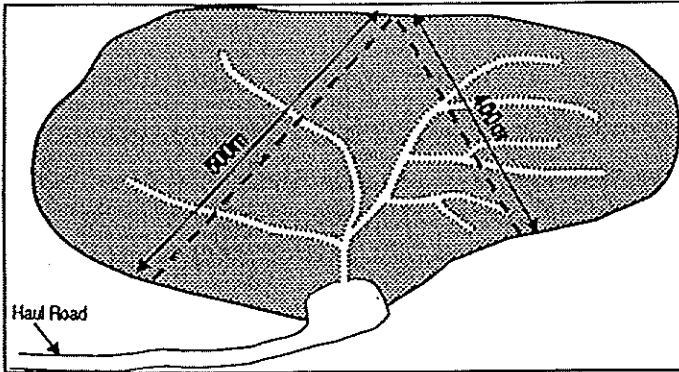
Transect layout is flexible, and can be adapted to the size and shape of the area and disturbance distribution. The configuration of transects can be any of the following:

Transect Layout	Application
2 long transects that are not parallel	most common method: suitable for most SU's
Sawtooth pattern	narrow (< 200 m) areas
Triangle pattern	use only where soil disturbance is randomly oriented
A single diagonal line	monitoring operations in progress
A series of parallel lines	suitable in all SU's where more detailed assessments are required

Notes:

Reconnaissance Survey - Pacing Method

Planning the Survey



Survey points are assessed at equal spacing along the transect.

Calculate your point spacing as follows.

1. Use a target of at least 300 - 400 survey points. Use more points or transects if you require more accurate results.

$$\text{e.g. } \frac{900 \text{ m transect}}{300 \text{ points}} = 3.0 \text{ meters}$$

2. Calibrate the point spacing to your pace:

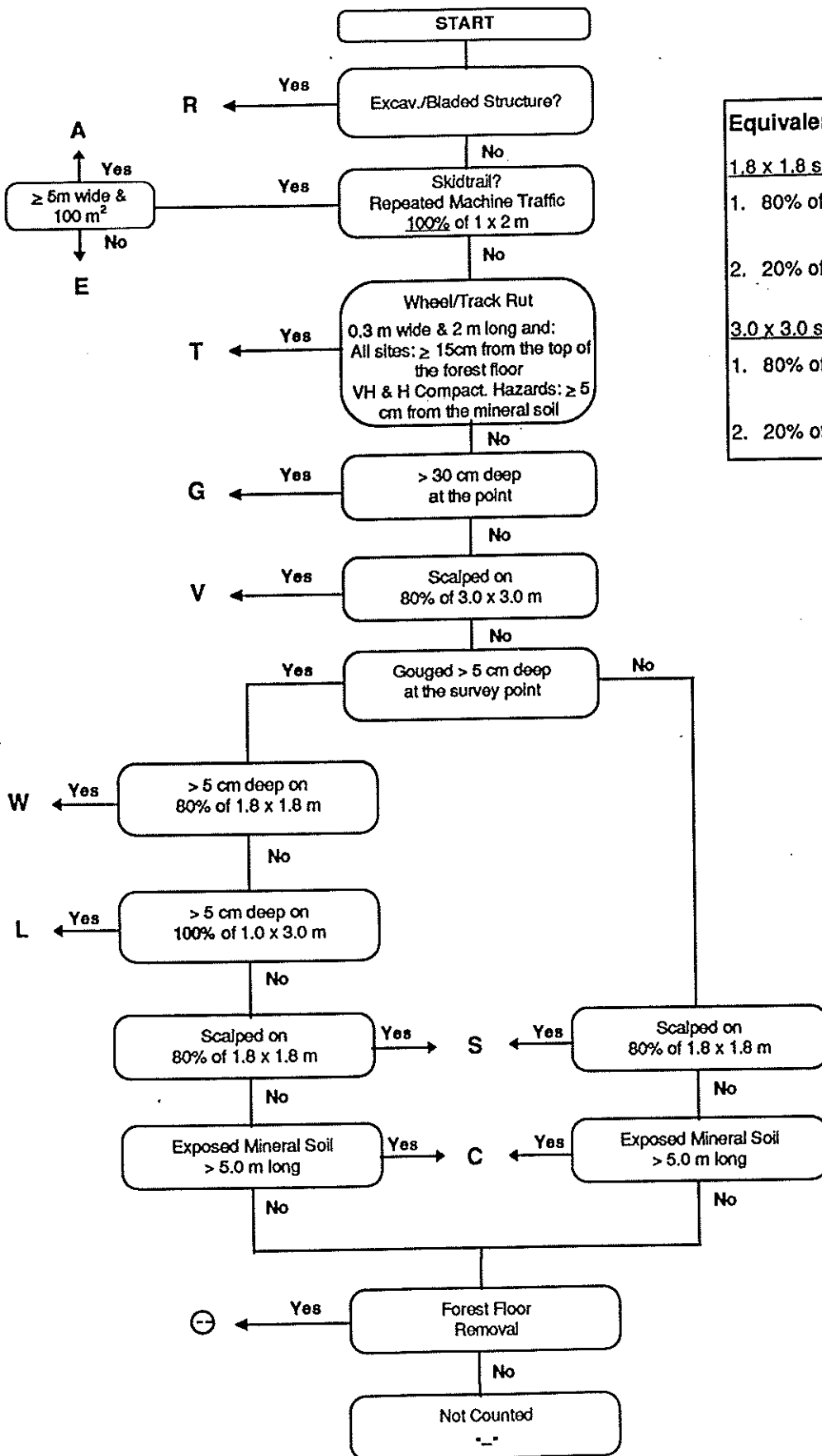
$$3.0 \text{ m} \times 1.23 \text{ paces / m} = 3.69 \longrightarrow 3 \text{ paces between points}$$

KEY: Always round down. If you round up, you will obtain fewer than your target number of sample points.

3. Record field data as shown on the example.

Notes:

Appendix 3 Soil Disturbance Classification Flow Chart



Equivalent Dimensions:

1.8 x 1.8 squares

1. 80% of 1.8 x 1.8 m = 100% of 1.61 x 1.61 m
= 100% of 1.44 x 1.8 m
2. 20% of 1.8 x 1.8 m = 0.8 x 0.8 m

3.0 x 3.0 squares

1. 80% of 3.0 x 3.0 m = 100% of 2.68 x 2.68 m
= 100% of 2.40 x 3.0 m
2. 20% of 3.0 x 3.0 m = 1.34 x 1.34 m

Summary of Soil Disturbance Categories

Disturbance Surveyed After Harvesting

Code	Category
R	Skid Roads
E	Extensive Uniform Compaction (Unbladed Skid Trails)
W	Wide Gouges (Skid Trails)
T	Wheel / Track Ruts

Disturbance Surveyed After MSP

Code	Category
G	Deep Gouges
W	Wide Gouges
L	Long Gouges
V	Very Wide Scalps

S	Wide Scalps
C	Continuous Scalps

O Other Scalps and Gouges

Always Counted

Sometimes counted

Counted in Total Displacement

Not Counted or Not Surveyed

- Not Counted (Undisturbed, etc.)
- X Not Surveyed