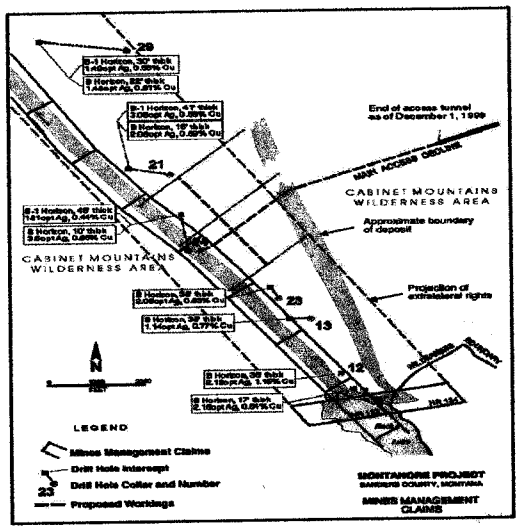
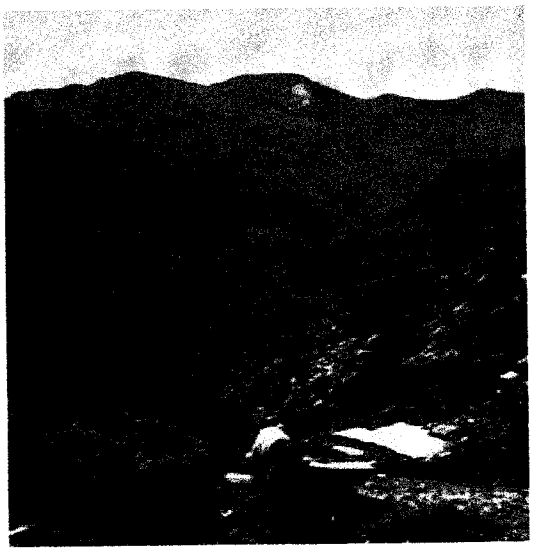
MONTANORE PROJECT

AMENDED APPLICATION

HARD ROCK OPERATING PERMIT

AMENDED PLAN OF OPERATIONS





Appendix E

Vegetation

December 2004

Mines Management, Inc.

VEGETATION

ADDENDUM

BASELINE VEGETATION STUDY

Montana Project

LINCOLN & SANDERS COUNTIES, MONTANA

prepared for

Noranda Minerals Corp.
65 N. Edison Way Suite 4 P.O. Box 7176 Reno, Nevada 89510

prepared by

Western Resource Development Corporation
711 Walnut St. P.O. Box 467 Boulder, Colorado 80306

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SECTION 1.0

INTRODUCTION

1.0 INTRODUCTION

1.1 Background

Following completion of the baseline vegetation study report in February, 1989, the project planning process identified developments for areas not studied during the 1988 field season. Specifically, the Bear Creek Road (U.S. Forest Service Road 278) was identified as the major transportation access to the project site; the Cherry Creek impoundment site was expanded both to the east and west, but reduced in its southern limit; two percolation sites were added; the Ramsey Creek mine/mill site was enlarged; the Libby Creek surface facilities site was moved down valley; and access corridors connecting the tailings impoundment, percolation sites, and the Ramsey and Libby Creek facilities were delineated.

1.2 Study Area Locations

The transportation access corridor extends from U.S. Highway 2 for about 10 miles southwest to the tailings impoundment. The corridor then proceeds from the south side of the tailings impoundment about one and one-half miles farther south to the two percolation sites. From the south end of percolation site no. 1, the corridor divides with one branch extending about two and one-quarter miles southwest up Ramsey Creek to the mine/mill site and another two miles southwest across a low ridge and then up Libby Creek to the surface facilities site. The width of the transportation corridor is 2000 feet. Figure 1 illustrates the location of the transportation corridor, tailings impoundment, percolation sites, and Ramsey and Libby Creek facilities.

The elevation of the transportation corridor is about 2,600 feet at U.S. Highway 2, and about 3,600 feet at the north entrance to the tailings impoundment. The terminus of the corridor in Ramsey and Libby Creek is at an elevation of 4,200 feet and 3,800 feet, respectively. The corridor crosses tributaries to Big Cherry Creek, Bear Creek, Poorman Creek, Ramsey Creek, and parallels Libby Creek. Little Cherry Creek is crossed within the tailings impoundment.

The 1818 acre tailings impoundment is in the Little Cherry Creek drainage. The portion of the tailings area studied in 1989 is about 1205 acres in size. The 181 acre addition to the west includes a section of Bear Creek and a gentle east sloping ridge at about 4,200 feet. The 432 acre addition to the east includes areas east and west of Libby Creek, areas along Little Cherry Creek, and the relatively flat ridges between these streams. The elevation of this region extends from about 3,100 feet to 3,500 feet.

Both percolation sites are located on a gentle east-sloping ridge between Poorman and Ramsey Creek. Site No. 1, the westernmost, is 218 acres in size, and ranges in elevation from 3,800 feet to 4,200 feet. Site No. 2, at about 3,600 feet, is 199 acres in size and has a gentler topography with steep slopes to the south along a short bisection by Ramsey Creek.

All but 124 acres of the 164 acre Ramsey Creek mine/mill site were studied in 1988. The 1989 study area includes steep north and south-facing slopes on both sides of the valley which is at about 4,200 feet in elevation and a small section of the valley bottom.

The 202 acre Libby Creek surface facilities site is located in the Libby Creek valley immediately down stream of the area studied in 1988. This site includes relatively gentle topography along Libby Creek at about 4,000 feet elevation and steep south- and north-facing slopes.

1.3 Study Objectives

The objective of this vegetation study was to collect qualitative and quantitative vegetation data on those areas of the project not studied in 1988. Each of the new areas was mapped with respect to existing and potential vegetation (habitat types) and ten quantitative data samples were collected in the area of the tailings impoundment, percolation sites, and Libby Creek surface facilities areas. Qualitative observations were collected along the transportation corridor and at the Ramsey Creek mine/mill site.

SECTION 2.0

METHODS

2.0 METHODS

The methods for delineating existing and potential vegetation (habitat types) and for collecting quantitative data are identical to those used during the 1988 field study. Section 2.0 of the baseline vegetation study (WRD 1989) documents these methods. As per the 1988 field study, plants were collected and identified and special attention devoted to looking for plant species of special concern.

This report presents a summary table for each of the ten quantitative field samples. Additionally, the individual sample data have been added to the respective existing vegetation and habitat type data to produce new project summary tables for cover; tree density, reproduction, height, dbh, basal area, volume, and age; shrub density; and herbaceous production. The new summary tables located in Section 3.7 following the other data tables contain quantitative data for all areas sampled in 1988 and 1989.

SECTION 3.0

RESULTS AND DISCUSSION

3.0 RESULTS AND DISCUSSION

3.1 Bear Creek and Other Access Roads

3.1.1 Existing Vegetation

The 10 mile long corridor along Bear Creek Road from U.S. Highway 2 to the tailings impoundment is characterized by a coniferous forest, clearcuts, small wetlands, and a single hay meadow. The section of road access corridor connecting the tailings impoundment, percolation sites, and Ramsey and Libby Creek sites is dominated by a coniferous forest with small patches of clearcuts, one wetlands, shrublands, and talus slopes. Figure 1 illustrates the existing vegetation types of the transportation corridor study area. Each type is discussed below from qualitative observations.

3.1.1.1 Coniferous Forest

The coniferous forest on the relatively flat terrain along Bear Creek Road from U.S. Highway 2 southwest for about three miles to the first small hill is dominated by Douglas-fir (*Pseudotsuga menziesii*). Ponderosa pine (*Pinus ponderosa*) is the most common associate, although Western larch (*Larix occidentalis*) and white pine (*Pinus monticola*) are occasionally present.

Understory shrub and herbaceous species presence and abundance is variable and generally sparse. Shrubs present include kinnikinnik (*Arctostaphylos uva-ursi*), white spirea (*Spiraea betulifolia*), baldhip rose (*Rosa gymnocarpa*), serviceberry (*Amelanchier alnifolia*), ocean spray (*Holodiscus discolor*), Canada buffaloberry (*Shepherdia canadensis*), Rocky Mountain maple (*Acer glabrum*), and Oregon grape (*Berberis repens*). Pinegrass (*Calamagrostis rubescens*) is the major herbaceous component. Other herbaceous species observed include yarrow (*Achillea millefolium*), penstemon (*Penstemon confertus*),heartleaf arnica (*Arnica cordifolia*), elk sedge (*Carex geyeri*), beargrass (*Xerophyllum tenax*), woodland strawberry (*Fragaria vesca*), and spreading dogbane (*Apocynum androsaemifolium*).

Areas further south along Bear Creek Road and along sections between the tailings impoundment, the percolation sites, and the Ramsey and Libby Creek sites, have a mixed coniferous forest dominated by varying compositions of the tree species present in the area. The presence and abundance of conifers in these stands is related to past fires, the length of time since last burning, competition between the forest tree species, and seed source and dispersal, etc. These forests are very similar to the coniferous forest type quantitatively sampled and described in Section 3.2.1.1 of the baseline study (WRD 1989). Western red cedar (*Thuja plicata*), grand fir (*Abies grandis*), and western hemlock (*Tsuga heterophylla*) are the dominant trees in this segment of the corridor. Other trees present include white

pine, lodgepole pine (*Pinus contorta*), western hemlock, Douglas-fir, subalpine fir (*Abies lasiocarpa*), and Engelmann spruce (*Picea engelmannii*). Major understory shrubs include Rocky Mountain maple, Pacific yew (*Taxus brevifolia*), Sitka alder (*Alnus sinuata*), huckleberry (*Vaccinium globulare*), twinflower (*Linnaea borealis*), and thimbleberry (*Rubus parviflorus*). Common herbaceous understory species include tiarella (*Tiarella trifoliata*), queencup beadlily (*Clintonia uniflora*), western goldthread (*Coptis occidentalis*), beargrass, lady fern (*Athyrium filix-femina*), oak fern (*Gymnocarpium dryopteris*), and bracken fern (*Pteridium aquilinum*).

3.1.1.2 Clearcut

Small clearcuts occur sporadically all along the corridor from U.S. Highway 2 to the Ramsey and Libby Creek sites. These clearcuts were generally logged 10-20 years ago and are currently being colonized by tree species from surrounding forests.

The vegetation of the clearcuts is very similar to the clearcuts described in Section 3.2.1.2 of the baseline study (WRD 1989). The most frequently occurring trees in the clearcuts are western larch , Douglas-fir, lodgepole pine, Engelmann spruce, and western red cedar. Other less abundant colonizers include grand fir, subalpine fir, white pine, and western hemlock. Not all clearcuts are characterized by several different tree species. The low elevation clearcut just west of the intersection of U.S. Highway 2 and Bear Road is being characterized almost entirely by lodgepole pine. Lodgepole pine dominated clearcuts were also sampled during the 1988 study.

Common shrubs in clearcuts include Sitka alder, pachystima (*Pachistima myrsinites*), white spirea, huckleberry, snowbush, dwarf bilberry (*Vaccinium myrtillus*), Scouler willow (*Salix scouleriana*), baldhip rose, Utah honeysuckle (*Lonicera utahensis*), western serviceberry, kinnikinnik, western twinflower, thimbleberry, and Oregon grape.

The major graminoid components to clearcuts are pinegrass, northwest sedge (*Carex concinnoides*), western fescue (*Festuca occidentalis*), purple reedgrass (*Calamagrostis purpurascens*), and annual hairgrass (*Deschampsia danthanoides*). Common forbs include Virginia strawberry (*Fragaria virginiana*), fireweed (*Epilobium angustifolium*), orange hawkweed (*Hieracium aurantiacum*), beargrass, and Canada goldenrod (*Solidago canadensis*).

3.1.1.3 Agricultural

One small hayfield about 25 acres in size occurs within the 2000 foot wide corridor separated from Bear Creek Road by a narrow band of conifer trees. This hayfield is dominated by timothy (*Phleum pratense*), Kentucky bluegrass (*Poa pratensis*), orchardgrass (*Dactylis glomerata*), white clover (*Trifolium*

repens), red clover (Trifolium pratense), all introduced cultivars. Common yarrow and oxeye daisy (Chrysanthemum leucanthemum), weedy species, have invaded the meadow in some areas.

3.1.1.4 Wetlands

Numerous small wetlands occur around small permanent ponds, seasonal ponds, and in habitats with moist soils (Figure 1). The wetlands type around small ponds have knot-sheath sedge (Carex retrorsa) and few-flowered spike rush (Eleocharis pauciflora) in the shallow water zone, surrounded by Douglas' spirea (Spiraea douglasii) in the moist soil zone. The fringe of the spirea zone may have a few willows (Salix spp.), black cottonwood (Populus trichocarpa), grand fir, lodgepole pine, or even aspen (Populus tremuloides), with an understory of baldhip rose, red-osier dogwood (Cornus stolonifera), and redtop (Agrostis alba). In seasonal ponds Douglas' spirea occurs throughout the spring water accumulation zone. Like permanent ponds, the outer portion of the spirea zone has mesic tree and shrub species and, in turn, is often surrounded by a bluejoint reedgrass (Calamagrostis canadensis).

A larger wetlands occurs just east of Bear Creek Road in a small drainage about one-quarter mile north of the tailings impoundment. It is dominated by inflated sedge (Carex vesicaria) with some northern mannagrass (Glyceria borealis), redtop, and bluejoint reedgrass and has beaked sedge (Carex rostrata) in the deep water habitats. Sitka alder, fireweed, largeleaf avens (Geum macrophyllum), Canada goldenrod, and Eaton's aster (Aster eatonii) all have invaded this herbaceous wetlands. The entire wetlands is surrounded by Douglas spirea and Sitka alder.

Another wetlands occurs a little further south on the edge of the transportation corridor, east of Bear Creek Road, and immediately north of the tailings impoundment. The easternmost part of this wetlands has shallow water with yellow water lily (Nuphar variegatum), surrounded by knot-sheath sedge with northern mannagrass, with a concentric zone of Douglas spirea extending outward from the sedge/grass zone. The western extension of this wetlands has a shallow water zone which dries in summer to expose bare soil. The surrounding vegetated zone includes few-flowered spikerush, beaked sedge, northern mannagrass, and inflated sedge, all surrounded by Douglas spirea.

About 1,000 feet south of the tailings impoundment is another small wetlands. This wetlands (W2) is described in Section 3.2.1.5 of the baseline study (WRD 1989).

3.1.1.5 Shrublands

The shrubland type of the transportation corridor is located only in the Ramsey Creek valley. These shrublands are similar to those described in Section 3.2.1.3 of the baseline study (WRD 1989). Major shrub species include thimbleberry,

huckleberry, pachystima, Rocky Mountain maple, Sitka alder, rusty menziesia (*Menziesia ferruginea*), Scouler willow, red raspberry (*Rubus idaeus*), common snowberry (*Symphoricarpos albus*), Douglas' spirea, Sitka mountain ash (*Sorbus sitchensis*), and black elderberry (*Sambucus racemos*). Common herbaceous species include bluejoint reedgrass, blue wildrye (*Elymus glaucus*), beargrass, green false hellebore (*Veratium viride*), Hooker fairybell (*Disporum hookeri*), starry Solomon's seal (*Smilacina stellata*), and cow parsnip (*Heracleum lanatum*).

3.1.2 Potential Vegetation

The potential vegetation along the transportation access corridor is characterized by seven habitat types. They include:

- Douglas-fir/pinegrass (320)
- Engelmann spruce/common horsetail (410)
- Grand fir/queencup beadlily (520)
- Western red cedar/lady fern (540)
- Western red cedar/devil's club (550)
- Western hemlock/oak fern (565)
- Western hemlock/queencup beadlily (570)

Figure 2 illustrates the location of these habitat types within the transportation access corridor and each is briefly discussed in the following sections.

3.1.2.1 Douglas-fir/Pinegrass

The Douglas-fir/pinegrass habitat type occurs along the Bear Creek Road from U.S. Highway 2 south for about three miles to the first small hills. These stands are dominated by Douglas-fir and have an understory characterized by pinegrass and kinnikinnik. The first two paragraphs under Section 3.1.1.1 of this report provide further qualitative details on stands in this habitat type.

3.1.2.2 Engelmann Spruce/Common Horsetail

The Engelmann spruce/common horsetail habitat type is the climax for the numerous small wetlands described in Section 3.1.1.4 of this report. With time, these wetlands, an early seral stage, will fill with sediments and become dominated by Engelmann spruce and have an understory cover of common horsetail.

3.1.2.3 Grand Fir/Queencup Beadlily

This habitat type occurs along the transportation corridor on a west-facing slope about two miles north of the tailings impoundment. Grand fir is present and successfully reproducing in this habitat type. Associated trees include

Douglas-fir, western red cedar, white pine, and western larch. Characteristic understory shrubs present include white spirea, baldhip rose, serviceberry, pachystima, huckleberry, creambrush ocean spray, western twinflower, Oregon grape, common pipsissewa (*Chimaphila umbellata*), and thimbleberry. Herbaceous components include queencup beadlily, Virginia strawberry, sidebells pyrola (*Pyrola secunda*), rattlesnake plantain (*Goodyera oblongfolia*), starry Solomon's seal, beargrass, bracken fern, and western goldthread.

3.1.2.4 Western Red Cedar/Lady Fern

This habitat type is present where the transportation corridor crosses or intersects streams. It is present along Big Cherry Creek, Poorman Creek, Big Cherry Creek, Bear Creek, and small tributaries to some of these streams. Section 3.2.2.1 of the baseline report (WRD 1989) describes this habitat type from ten quantitative samples. Major trees in this habitat type within the study area include western red cedar and western hemlock. Dominant shrubs include Rocky Mountain maple, Sitka alder, devil's club (*Oplopanax horridum*), and snowberry. Lady fern has the highest cover in this habitat type and tiarella, oak fern, starry Solomon's seal, heartleaf arnica, and queencup beadlily are common.

3.1.2.5 Western Red Cedar/Devil's Club and Western Hemlock/Oak Fern Complex

This habitat type complex occurs where the transportation corridor crosses Bear, Ramsey, and Libby Creeks. The entire stream corridors have been mapped as a complex of these two habitat types. However, each of these habitat types is usually present as a small stand in wet habitats of stream terraces and on floodplains. Sections 3.2.2.2 and 3.2.2.3 of the baseline report (WRD 1989) describe these habitat types from quantitative data.

The western red cedar/devil's club habitat type as sampled and described in 1988 is characterized by western hemlock, the climax codominant, and has grand fir and Engelmann spruce as seral components. Western red cedar, however, is reproducing in the sample plot and nearby. The shrub understory is dominated by devil's club, Pacific yew, Rocky Mountain maple, huckleberry, Sitka alder, and rusty menziesia. Major herbaceous species include oak fern, tiarella, queencup beadlily, and lady fern.

The western hemlock/oak fern habitat type as sampled and described in 1988 is dominated by western hemlock and has grand fir, Engelmann spruce, and white pine as seral components. Major understory shrubs include Pacific yew, huckleberry, and rusty menziesia. Oak fern, with a dense cover of moss, characterizes the herbaceous zone.

3.1.2.6 Western Hemlock/Queencup Beadlily

Western hemlock/queencup beadlily, the most common habitat type in the transportation corridors, is described from quantitative data in Section 3.2.2.4 of baseline study (WRD 1989). This, the most common habitat type in the region, is characterized by eight conifer trees. Respectively they include grand fir, western hemlock, western red cedar, Douglas-fir, western larch, Engelmann spruce, lodgepole pine, and white pine. Dominant shrubs include western twinflower, common pipsissewa, dwarf bilberry, white spirea, pachystima, Pacific yew, and Rocky Mountain maple. Major herbaceous species include beargrass, goldthread, heartleaf arnica, queencup beadlily, tiarella, starry Solomon's seal, and roundleaf violet (*Viola orbiculata*).

3.2 Tailings Impoundment

The majority (1205 acres) of the 1818 acre tailings impoundment was mapped and quantitatively described by the initial baseline work in 1988. However, changes in the shape of the permit area resulted in the inclusion of unstudied lands to the west (181 acres) and east (432 acres). About one third of the southern part, an area studied in 1988, has been excluded from development.

3.2.1 Existing Vegetation

The new study areas of the tailings impoundment are dominated by coniferous forest and clearcut vegetation types. Figure 3, a vegetation type map of the current tailings impoundment, illustrates the vegetation of the new study areas and contiguous areas studied in 1988.

3.2.1.1 Coniferous Forest

Section 3.2.1.1 of the baseline report (WRD 1989) describes the coniferous forest type based on 35 quantitative samples collected in 1988. These data indicate a complex mosaic of seral coniferous stands composed of up to ten tree species. The presence and dominance of forest trees in each stand is related to past fire history, the period of time since burning, elevation, aspect, soils, available moisture, etc. The coniferous forest of the new study area as measured through three quantitative samples collected in 1989 and summarized in Tables 1, 2 and 3 is similar to stands sampled in 1988. These three stands reflect the variability of the coniferous forest type described in the baseline study (WRD 1989). Each stand is briefly discussed below from the absolute cover data.

Table 1 reports the data for sample 64 collected in the northeast section of the tailings impoundment along Bear Creek. This stand is dominated by Engelmann spruce (40.0%), grand fir (22.0%), and white pine (16.0%) and has a small presence of

western hemlock (4.0%). The understory is characterized by snowberry (30.0%), oak fern (30.0%), horsetail (*Equisetum arvense*) (24.0%), western goldthread (14.0%), thimbleberry (12.0%), Columbia brome (*Bromus vulgaris*) (8.0%), queencup beadlily (8.0%), and trail plant (*Adenocaulon bicolor*) (4.0%). In addition to cover data, the table reports information on tree density, reproduction, height, dbh, basal area and volume, and shrub density.

Table 2 summarizes data for a coniferous forest type sample 67 on a high terrace along Libby Creek. This stand is dominated by western larch (32.0%) and Douglas-fir (32.0%) and also has Engelmann spruce (14.0%) and grand fir (4.0%). Major understory shrubs include baldhip rose (12.0%), thimbleberry (12.0%), Oregon grape (10.0%), serviceberry (6.0%), and snowberry (6.0%). The most abundant herbaceous understory species include western goldthread (28.0%), starry Solomon's seal (16.0%), queencup beadlily (12.0%), and wild sarsparilla (*Aralia nudicaulis*) (6.0%).

Table 3 provides data for sample 68 located on a northwest facing slope high above Libby Creek. This stand is dominated by grand fir (32.0%) and western red cedar (22.0%) and has Engelmann spruce (10.0%), western larch (8.0%), Douglas-fir (8.0%), lodgepole pine (6.0%), white pine (2.0%), and western hemlock (2.0%). Thimbleberry (28.0%), Sitka alder (22.0%), pachystima (20.0%), and western twinflower (12.0%) dominate the shrub understory. Heartleaf arnica (24.0%), trail plant (4.0%), queencup beadlily (4.0%), and western goldthread (2.0%) are the major forbs.

3.2.1.2 Clearcuts

The clearcuts (Figure 3) of the new tailings impoundment study areas to the east and west are similar to those described by the baseline report (WRD 1989) in Section 3.2.1.2. Major colonizing trees are western larch, Douglas-fir, lodgepole pine, Engelmann spruce, and western red cedar. Sitka alder, pachystima, white spirea, huckleberry, snowbush (*Ceanothus velutinus*) and dwarf bilberry are the major shrubs and pinegrass, northwest sedge, western fescue, Virginia strawberry, fireweed, orange hawkweed (*Hieracium aurantiacum*), and beargrass are common graminoids and forbs.

3.2.2 Potential Vegetation

Three habitat types are present in the new 613 study acres of the tailings impoundment. They include: Western red cedar/lady fern (540), Western hemlock/queencup beadlily (570), and Western hemlock/oak fern (565). Each of these habitat types was present in the old tailings study area and quantitatively sampled and described in 1988. Figure 2 illustrates the location of these habitat types and the following sections briefly discuss each.

3.2.2.1 Western Red Cedar/Lady Fern

This habitat type is present along Libby Creek, Little Cherry Creek, and small tributaries to these creeks. Section 3.2.2.1 of the baseline report describes this type from quantitative data from 10 samples.

3.2.2.2 Western Hemlock/Oak Fern

This habitat type occurs only along a section of Bear Creek. Table 1 summarizes the results of one quantitative sample taken in 1989. Paragraph 2 of Section 3.2.1.1 of this report discusses this forest stand. This early seral stand has a low cover (4.0%) and density (162 trees/acre) of western hemlock. However, western hemlock, a shade-tolerant tree, is reproducing (162 seedlings/acre) and in time, will assume a greater dominance. Oak fern (30.0%) is the most abundant herbaceous plant.

3.2.2.3 Western Hemlock/Queencup Beadlily

This habitat type is ubiquitous to the old and new tailings impoundment study areas. Section 3.2.2.4 of the baseline report (WRD 1989) describes this habitat type based upon 17 quantitative samples. Tables 2 and 3 provide data on two western hemlock/queencup beadlily samples along Libby Creek.

Sample 67 (Table 2) is an early seral western hemlock/queencup beadlily stand dominated by western larch and Douglas-fir. Western hemlock, however, is present and reproducing in low numbers and queencup beadlily has a relative cover of 5.7%.

Sample 68 (Table 3), further downstream on a high bank above Libby Creek, also an early seral stand, is dominated by western red cedar and grand fir. Western hemlock is present with a low cover (2.0%) and has a low reproduction rate. Queencup beadlily has a relative cover of 1.8%.

3.3 Percolation Sites

3.3.1 Existing Vegetation

The two percolation sites are characterized by coniferous forest and clearcut vegetation types (Figure 2). The majority of Site 1 is a clearcut and Site 2 includes one clearcut of about 90 acres and intersection portions of three other clearcuts. The majority of Site 2, however, is a coniferous forest.

3.3.1.1 Coniferous Forests

Samples 61, 63, and 69 were collected in 1989 in the coniferous forests of percolation sites. These three samples further characterize the coniferous forest of the area and are similar to stands sampled and described in Section 3.2.1.1 of the baseline study (WRD 1989).

Sample stand 61 (Table 4) is characterized by grand fir (54.0%), western red cedar (30.0%), and western hemlock (24.0%) stands with a small cover of white pine (8.0%). Western twinflower (4.0%) is the only shrub to provide cover. Major forbs include western goldthread (8.0%), queencup beadlily (2.0%), and beargrass (2.0%). Moss (4.0%) is the only cryptogam to provide cover.

Sample stand 63 (Table 5) along Ramsey Creek is dominated by western red cedar (52.0%) and Engelmann spruce (34.0%) and has a low cover of grand fir (8.0%) and the presence of western hemlock. Several shrubs such as Utah honeysuckle, devil's club, pachystima, and baldhip rose are present but do not provide cover. Oak fern (6.0%) is the major understory herbaceous component. Moss is abundant (28.0%) and queencup beadlily, sweet-scented bedstraw (*Galium triflorum*), and single delight (*Pyrola uniflora*) each has a cover of 2.0%.

Sample stand 69 (Table 6) at the southwest end of percolation site no. 1 is dominated by grand fir (30.0%) and western hemlock (28.0%), and has a fair presence of white pine (10.0%). Western twinflower (14.0%), common pipsissewa (10.0%), huckleberry (4.0%), baldhip rose (2.0%), and Utah honeysuckle (2.0%) are the dominant shrubs. Western goldthread (14.0%), beargrass (8.0%), and queencup beadlily (4.0%) are the major forbs.

3.3.1.2 Clearcuts

Two clearcuts were sampled in 1989. Sample 60 (Table 7) is located in percolation site no. 1 on a southeast facing slope. Ten tree species are colonizing the site. Respectively they include Douglas-fir (8.0%), grand fir (6.0%), white pine (4.0%), subalpine fir (2.0%), Engelmann spruce (2.0%), black cottonwood (2.0%), western larch (0.0%), lodgepole pine (0.0%), western red cedar (0.0%), and western larch (0.0%). Major shrubs include pachystima (16.0%), snowbrush ceanothus (10.0%), white spirea (4.0%), Sitka alder (4.0%), western twinflower (4.0%), Utah honeysuckle (2.0%), Scouler willow (2.0%), and Oregon grape (2.0%). Major herbaceous elements include northwest sedge (10.0%), fireweed (10.0%), beadlily (2.0%), western goldthread (2.0%), orange hawkweed, and beargrass (2.0%).

Sample 62 (Table 8), located in percolation site no. 2 is dominated by lodgepole pine (28.0%), but has grand fir (2.0%), white pine (2.0%), western larch (0.0%), black cottonwood (0.0%),

and Douglas-fir (0.0%). Major shrubs include white spirea (18.0%), kinnikinnik (16.0%), buffaloberry (10.0%), baldhip rose (2.0%), and dwarf bilberry (2.0%). Common herbaceous species include fireweed (14.0%), beargrass (8.0%), pinegrass (8.0%), orange hawkweed (4.0%), Canada goldenrod (4.0%), northwest sedge (2.0%), and narrow leaf cow wheat (*Melampyrum lineare*) (2.0%).

3.3.2 Potential Vegetation

Three habitat types, as illustrated by Figure 2, occur in the two percolation sites. All of Site 1 and all of Site 2 except the area along Ramsey Creek is a mountain hemlock/queencup beadlily (570) habitat type. The area along Ramsey Creek is a complex of western red cedar/devil's club (550) and western hemlock/oak fern (565).

3.3.2.1 Western Red Cedar/Devil's Club-Western Hemlock/Oak Fern Complex

Ramsey Creek has been mapped as a complex of the two habitat types as elements of both habitat types are present. These two habitat types sometimes occur as small isolated stands in moist sites surrounded by the western hemlock/queencup beadlily type which extends to the stream beds in drier incised areas. Sample 63, the one sample collected in this habitat type, is a western hemlock/oak fern habitat type. Western hemlock is present in the stand (Table 5) but was not encountered along the cover transect. However, western hemlock reproduction at 2752 trees/acre is quite vigorous and oak fern (6.0%) has the second highest understory herbaceous cover. Sections 3.2.2.2 and 3.2.2.3 of the baseline report provide additional data on these habitat types (WRD 1989).

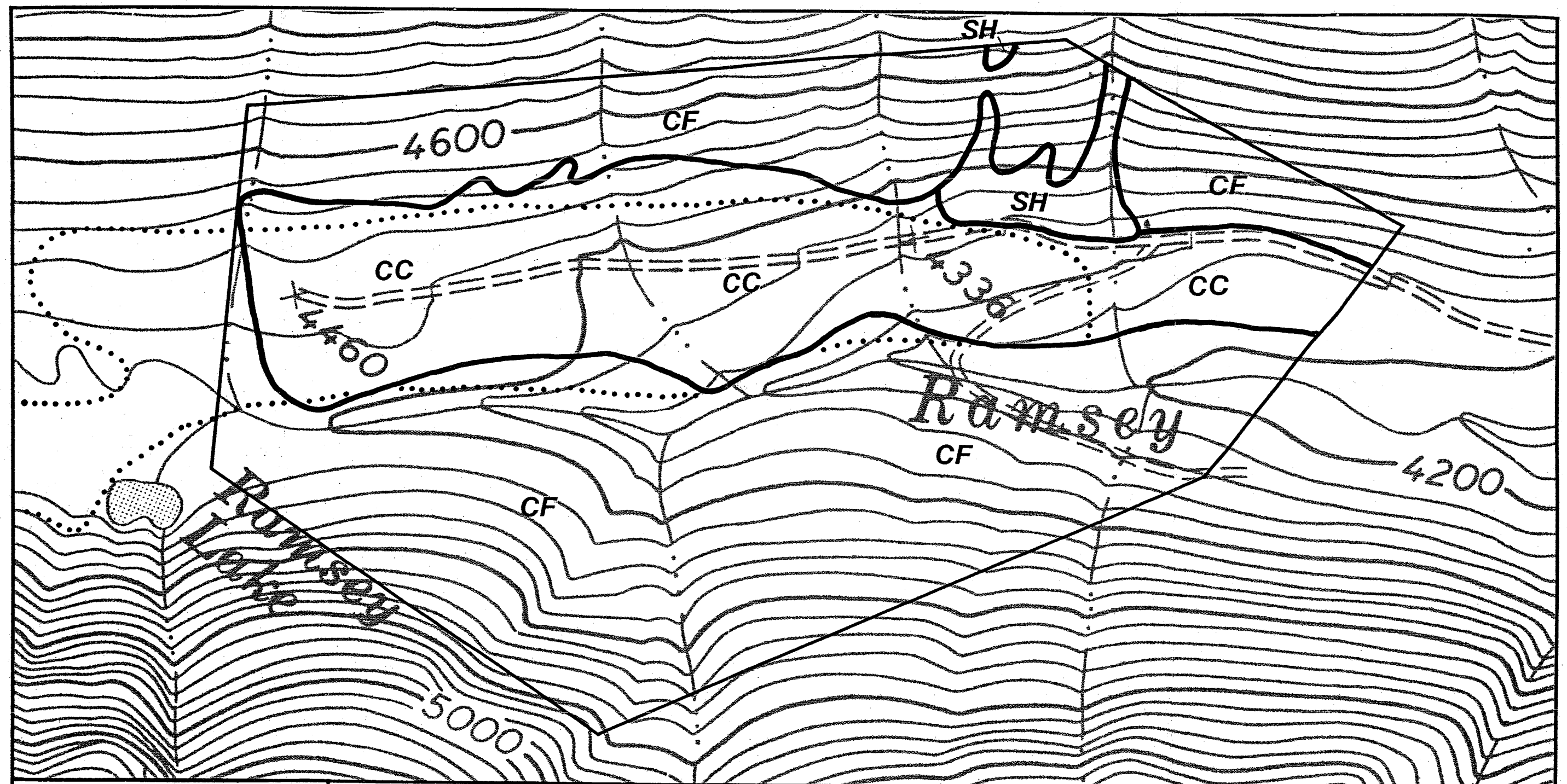
3.3.2.2 Western Hemlock/Queencup Beadlily

Samples 61 (Table 4) and 69 (Table 6) were collected in this habitat type. Each sample stand has a high cover (24% and 28.0%, respectively) of western hemlock, successful western hemlock reproduction, and a modest cover of queencup beadlily (2.0% and 4.0%, respectively). These western hemlock/queencup beadlily stands are similar to those sampled during the 1988 baseline study (WRD 1989) and described in Section 3.2.2.4.

3.4 Ramsey Creek Mine/Mill Site

3.4.1 Existing Vegetation

The expansion area (124 acres) of the Ramsey Creek mine/mill site has a coniferous forest vegetation type on the steep north-facing slope (Figure 5) and a coniferous forest with a small inclusion of a shrubland on the south-facing slope. The valley bottom is characterized by a clearcut.



NORANDA MINERALS CORP.

MONTANA PROJECT
Lincoln County, Montana

AUG. 1989 SCALE 1"=400'

prepared by
Western Resource Development Corp.

N

LEGEND

CC Clearcut
CF Coniferous Forest
SH Shrubland
•••• 1988 Study Area Boundary

FIGURE 5.
VEGETATION TYPE MAP - RAMSEY CREEK MINE/MILL SITE

3.4.1.1 Coniferous Forest

This coniferous forest, based on qualitative observations, is similar to the coniferous forest type for the areas as described in Section 3.2.1.1 of the baseline report (WRD 1989).

3.4.1.2 Shrubland

This small shrubland, located at the bottom of an avalanche chute, is similar to the shrubland type as described by the baseline report (WRD 1989) in Section 3.2.1.3.

3.4.2 Potential Vegetation

The 124 acre expanded study area for this site is primarily in the western hemlock/queencup beadlily (570) habitat type (Figure 6). However, small areas of western hemlock/oak fern (565) and western red cedar/devil's club (550) occur along the south side of Ramsey Creek and one small patch of subalpine fir/menziesia (670) is present at the highest elevation of the permit area on the north-facing slope.

3.4.2.1 Western Red Cedar/Devil's Club

This habitat type is described in Section 3.2.2.2 of the baseline study (WRD 1989) based on quantitative data.

3.4.2.2 Western Hemlock/Oak Fern

This habitat type is also described in the baseline study (WRD 1989) in Section 3.2.2.3 based on quantitative data.

3.4.2.3 Western Hemlock/Queencup Beadlily

This habitat type is likewise described in the baseline study (WRD 1989) in Section 3.2.2.4 based on quantitative data.

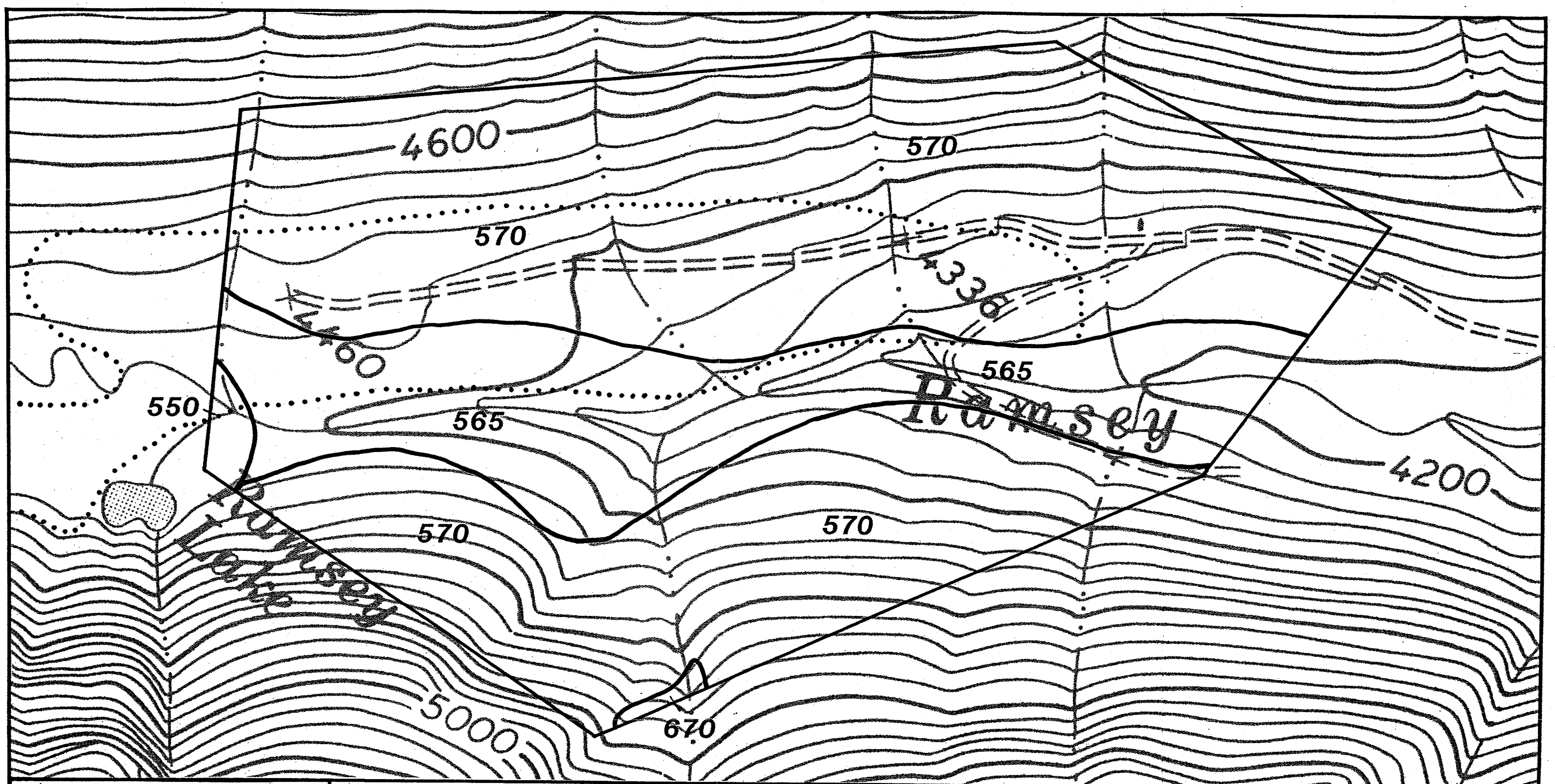
3.4.2.4 Subalpine Fir/Menziesia

This habitat type is described in Section 3.2.2.7 of the baseline report (WRD 1989) based on qualitative observations of the habitat type at the Ramsey Creek site near Ramsey Lake.

3.5 Libby Creek Surface Facilities Site

3.5.1 Existing Vegetation

The Libby Creek site is predominantly a coniferous forest with small inclusions of clearcuts, shrubland, and talus slopes (Figure 7).



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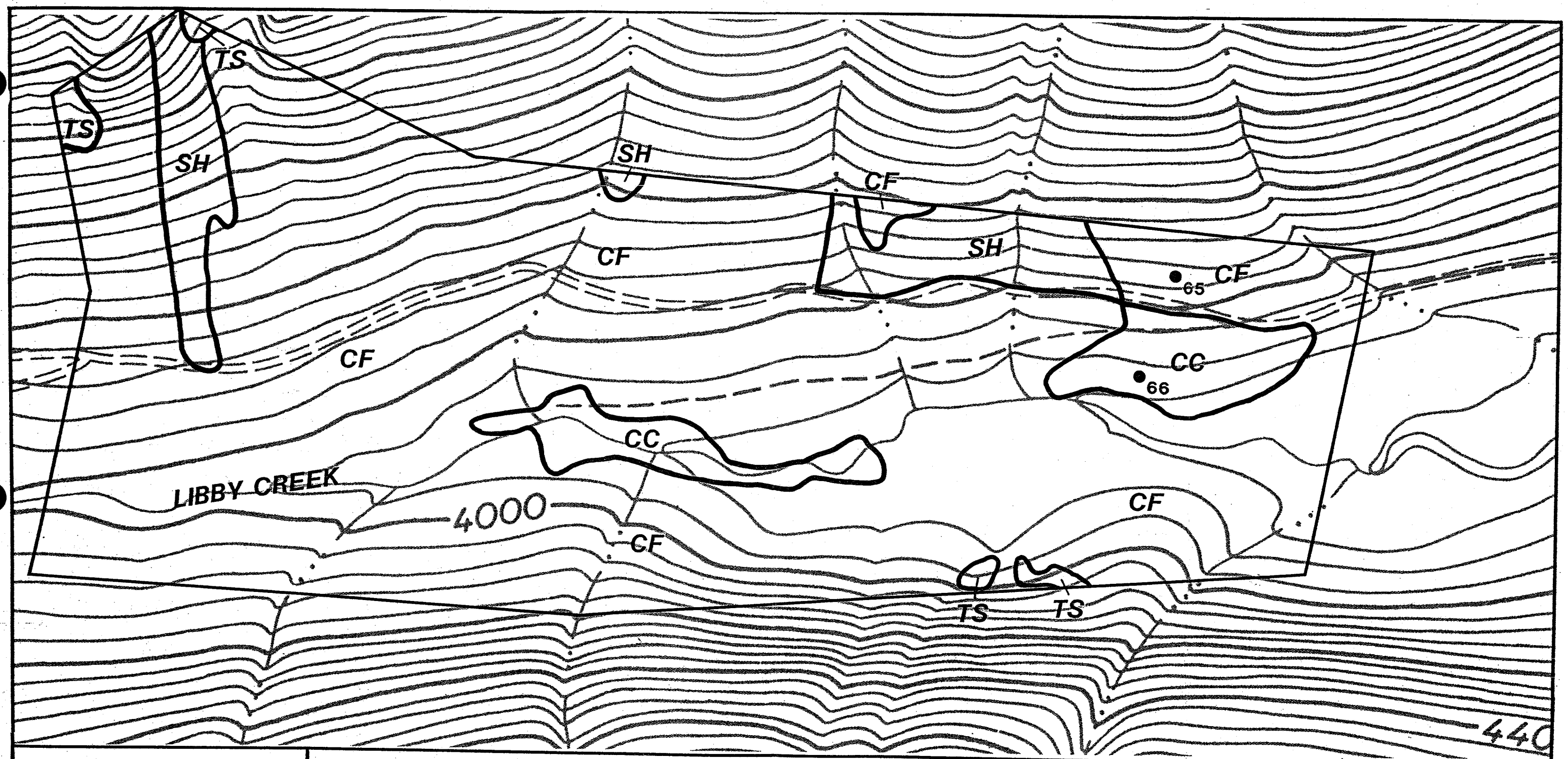
550 Western Red Cedar/Devil's Club
565 Western Hemlock/Oak Fern
570 Western Hemlock/Queencup Beadlily
670 Subalpine Fir/Menziesia
• • • 1988 Study Area Boundary

FIGURE 6.
HABITAT TYPE MAP - RAMSEY CREEK MINE/MILL SITE



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N

LEGEND

- CC Clearcut
- CF Coniferous Forest
- SH Shrubland
- TS Talus Slope
- ●65 Sample Site

FIGURE 7.
VEGETATION TYPE MAP - LIBBY CREEK SURFACE FACILITIES

3.5.1.1 Coniferous Forest

One quantitative sample, Number 65, (Table 9) was collected in the coniferous forest type on the south-facing slope during the 1989 field season. This forest stand is dominated by grand fir (94.0%) and has a small presence of western larch (6.0%). Pacific yew (22.0%) dominated the understory shrub zone. Less abundant shrubs include pachystima (2.0%) and huckleberry (2.0%). Major herbaceous components respectively include bracken fern (4.0%), moss (4.0%), roundleaf violet (4.0%), pinegrass (2.0%), queencup beadlily (2.0%), trail plant (2.0%), and side-bells pyrola (2.0%).

3.5.1.2 Clearcut

Sample 66 (Table 10) reports the quantitative data collected on the small clearcut paralleling Libby Creek. Engelmann spruce (8.0%), lodgepole pine (2.0%), subalpine fir (0.0%), and black cottonwood (0.0%) are the major colonizing trees. Snowberry (4.0%) and thimbleberry (4.0%) are the only shrubs providing cover. Major herbaceous components respectively include fireweed (30.0%), blue wildrye (26.0%), Canada goldenrod (22.0%), Columbia brome (12.0%), redtop (10.0%), bluejoint reed-grass (10.0%), and largeleaf avens (10.0%).

3.5.1.3 Shrubland

The small shrubland located in an avalanche chute on the south-facing slope is typical of the shrublands described in Section 3.2.1.3 of the baseline study (WRD 1989).

3.5.2 Potential Vegetation

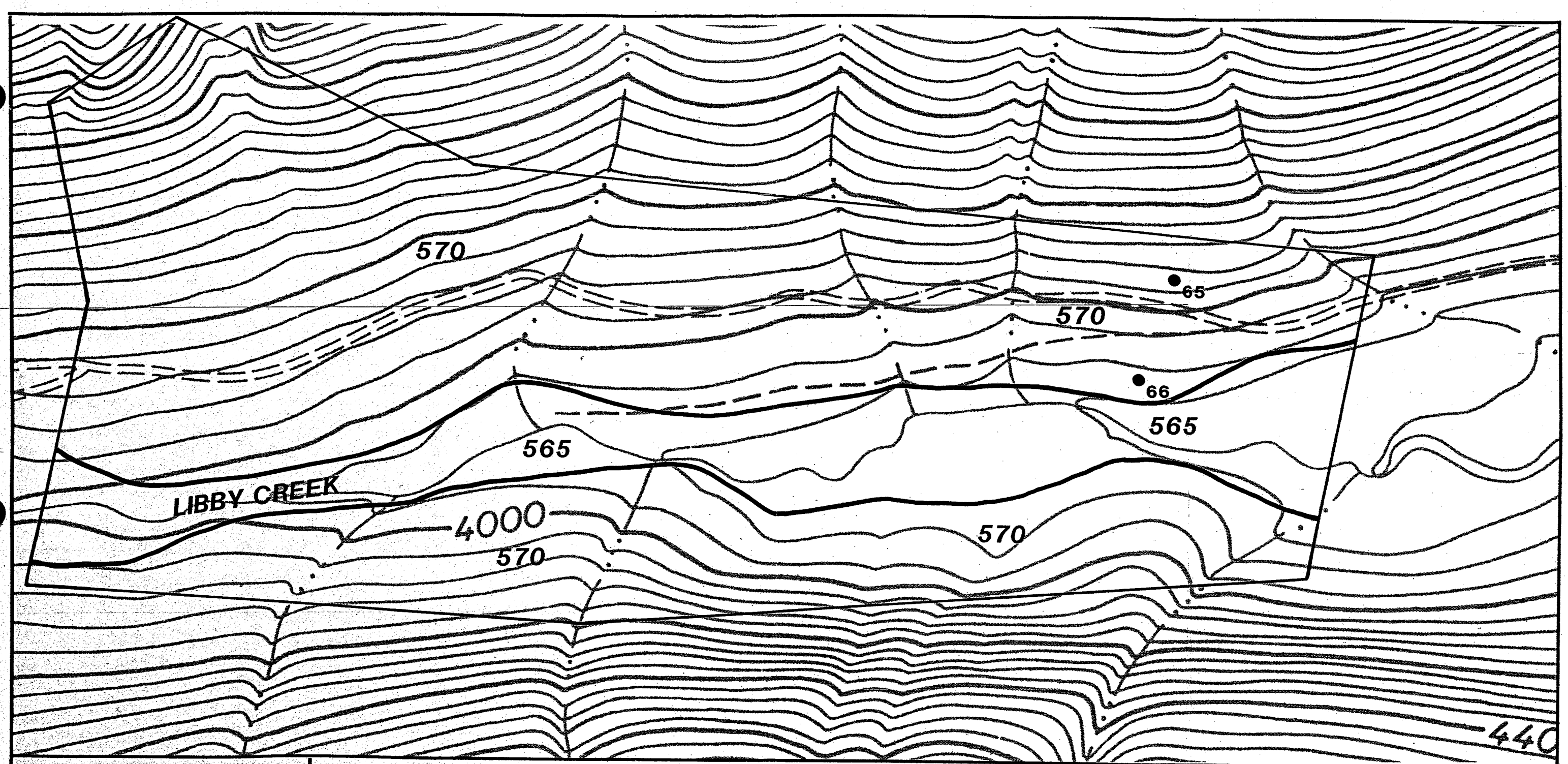
The vegetation of the Libby Creek site is all a western hemlock/queencup beadlily (570) habitat type except for the prevalence of a western hemlock/oak fern (565) type along the stream (Figure 8).

3.5.2.1 Western Hemlock/Oak Fern

This habitat type is described in Section 3.2.2.3 of the baseline study (WRD 1989) from quantitative data. Sample Site 66 (Table 10), located in the clearcut along Libby Creek is a very early seral stage of this habitat type.

3.5.2.2 Western Hemlock/Queencup Beadlily

This habitat type is described in Section 3.2.2.4 of the baseline study (WRD 1989) from quantitative data. Sample Site 65 (Table 9) provides additional on-site data for the habitat type. This early seral stage of the habitat type is dominated by grand fir (94.0%). Western hemlock occurs near the sample stand and has a low, but successful reproduction. Queen-cup beadlily has a cover of 2.0%.



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N

LEGEND

565 Western Hemlock/Oak Fern

570 Western Hemlock/Queencup Beadlily

● Sample Site

FIGURE 8.
HABITAT TYPE MAP –
LIBBY CREEK SURFACE FACILITIES

3.6 Flora

3.6.1 Study Area Flora

The 1989 field inventory identified two perennial forbs not observed by the 1988 field survey. They include:

Scientific Name	Common Name	Family	Status
Aster conspicuous	Showy Aster	Asteraceae	N
Geranium viscossimum	Sticky Geranium	Geraniaceae	N

3.6.2 Plant Species of Special Concern

Woolgrass (Scirpus cyperinus), a U.S. Forest Service sensitive plant found in wetlands areas during the 1988 survey, was not observed in any of the wetlands habitats inventoried in 1989. Interestingly, populations of this plant identified in a wetlands (W1) in a part of the tailings impoundment no longer under consideration for development have expanded since last season. No other plants listed as special concern were observed.

3.6.3 Weedy Species

As per the 1988 study, the most abundant weedy species in the study area is spotted knapweed (Centaurea maculosa). This plant is ubiquitous along Bear Creek Road and other U.S. Forest Service roads of the study area. Many of the other weeds discussed in Section 3.4.4 of the baseline study (WRD 1989) are also present in the study area.

3.7 Data Tables

This section contains all the data tables. Tables 1-10 report the data for each of the stands sampled in 1989. During the 1989 sample period, seven new coniferous forest stands were sampled. This information has been added to the 35 stands sampled in 1988 to produce a summary for all areas sampled (Table 11). Table 12 summarizes the fourteen 1988 with the three 1989 clearcut samples. Likewise, data on two 1989 sample stands of the western hemlock/oak fern habitat type have been added to the four sample stands collected in 1988 to produce a new summary table (Table 13). Data on the five 1989 sample stands of western hemlock/queencup beadlily have been added to the 17 sample stands collected in 1988 to produce a new summary table (Table 14).

TABLE 1. CONIFEROUS FOREST COVER; TREE DENSITY, REPRODUCTION, HEIGHT, DBH, BASAL AREA AND VOLUME; SHRUB DENSITY; AND HERBACEOUS PRODUCTION DATA - TAILINGS IMPOUNDMENT, SAMPLE #64*

COVER

	1st Hit	All Hits	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS
TREES						
Abies grandis	14	22	14.0%	14.0%	22.0%	7.9%
Picea engelmannii	40	40	40.0%	40.0%	40.0%	14.4%
Pinus monticola	14	16	14.0%	14.0%	16.0%	5.8%
Tsuga heterophylla	4	4	4.0%	4.0%	4.0%	1.4%
Total % Trees	72	82	72.0%	72.0%	82.0%	29.5%
TALL SHRUBS						
Acer glabrum	P		P	0.0%	0.0%	0.0%
Total % Tall Shrubs	0	0	0.0%	0.0%	0.0%	0.0%
LOW SHRUBS						
Amelanchier alnifolia	P		P	0.0%	0.0%	0.0%
Cornus stolonifera	P		P	0.0%	0.0%	0.0%
Lonicera utahensis	P		P	0.0%	0.0%	0.0%
Ribes lacustre	P		P	0.0%	0.0%	0.0%
Rosa gymnocarpa		2	0.0%	0.0%	2.0%	0.7%
Spiraea betulifolia	P		P	0.0%	0.0%	0.0%
Symphoricarpos albus	6	30	6.0%	6.0%	30.0%	10.8%
Vaccinium globulare		2	0.0%	0.0%	2.0%	0.7%
Total % Low Shrubs	6	34	6.0%	6.0%	34.0%	12.2%
SUBSHRUBS						
Cornus canadensis	P		P	0.0%	0.0%	0.0%
Linnaea borealis	P		P	0.0%	0.0%	0.0%
Rubus parviflorus	2	12	2.0%	2.0%	12.0%	4.3%
Total % Subshrubs	2	12	2.0%	2.0%	12.0%	4.3%
PERENNIAL GRAMINOIDS						
Bromus vulgaris		8	0.0%	0.0%	8.0%	2.9%
Festuca subulata	P		P	0.0%	0.0%	0.0%
Total % Perennial Graminoids	0	8	0.0%	0.0%	8.0%	2.9%
PERENNIAL FORBS						
Aconitum columbianum	P		P	0.0%	0.0%	0.0%

*Western Hemlock/Oak Fern Habitat Type

TABLE 1. (CONTINUED)

	1st Hit	All Hits	COVER MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS
Actaea rubra	P		P	0.0%	0.0%	0.0%
Adenocaulon bicolor		4	0.0%	0.0%	4.0%	1.4%
Aralia nudicaulis		2	0.0%	0.0%	2.0%	0.7%
Arnica cordifolia	P		P	0.0%	0.0%	0.0%
Clintonia uniflora		8	0.0%	0.0%	8.0%	2.9%
Coptis occidentalis		14	0.0%	0.0%	14.0%	5.0%
Disporum hookeri	2	2	2.0%	2.0%	2.0%	0.7%
Galium triflorum	P		P	0.0%	0.0%	0.0%
Geum macrophyllum	P		P	0.0%	0.0%	0.0%
Heracleum lanatum	P		P	0.0%	0.0%	0.0%
Ligusticum verticellatum	P		P	0.0%	0.0%	0.0%
Pyrola asarifolia		4	0.0%	0.0%	4.0%	1.4%
Smilacina stellata	4	16	4.0%	4.0%	16.0%	5.8%
Thalictrum occidentale	P		P	0.0%	0.0%	0.0%
Tiarella trifoliata	2	16	2.0%	2.0%	16.0%	5.8%
Trillium ovatum		2	0.0%	0.0%	2.0%	0.7%
Veratrum viride	P		P	0.0%	0.0%	0.0%
Viola glabella	P		P	0.0%	0.0%	0.0%
Total % Perennial Forbs	8	68	8.0%	8.0%	68.0%	24.5%
CRYPTOGAMS						
Athyrium filix-femina		10	0.0%	0.0%	10.0%	3.6%
Equisetum arvense	6	24	6.0%	6.0%	24.0%	8.6%
Gymnocarpium dryopteris	4	30	4.0%	4.0%	30.0%	10.8%
Moss	2	10	2.0%	2.0%	10.0%	3.6%
Total % Cryptogams	12	74	12.0%	12.0%	74.0%	26.6%
TOTAL % VEGETATION	100	278	100.0%	100.0%	278.0%	100.0%
Soil						
Litter						
Rock						

P = SPECIES PRESENT, BUT
NOT ENCOUNTERED QUANTITATIVELY

TABLE 1. (CONTINUED)

TREE DENSITY

	MEAN NO. TREES/ 125 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY
TREES			
Abies grandis	7.0	226.6	36.8%
Picea engelmannii	4.0	129.5	21.1%
Pinus monticola	3.0	97.1	15.8%
Tsuga heterophylla	5.0	161.9	26.3%
Total Trees	19.0	615.1	100.0%
TREES (DEAD)			
Abies grandis	1.0	32.4	50.0%
Picea engelmannii	1.0	32.4	50.0%
Total Trees (Dead)	2.0	64.8	100.0%

TREE REPRODUCTION

	MEAN NO. SHRUBS/ 25 SQ METERS	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY
TREES			
Abies grandis	2.0	323.7	16.7%
Picea engelmannii	8.0	1295.0	66.7%
Thuja plicata	1.0	161.9	8.3%
Tsuga heterophylla	1.0	161.9	8.3%
Total Trees Reproduction	12.0	1942.5	100.0%

TABLE 1. (CONTINUED)

TREE HEIGHT (FEET)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	6	63	18.3
Picea engelmannii	14	105	68.3
Pinus monticola	20	110	59.3
Tsuga heterophylla	6	6	6.0
TREES (DEAD)			
Picea engelmannii	6	6	6.0

TREE DBH (INCHES)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	0.4	14.6	3.5
Picea engelmannii	3.5	23.6	15.2
Pinus monticola	5.9	32.7	15.5
Tsuga heterophylla	0.4	0.4	0.4
TREES (DEAD)			
Abies grandis	13.8	13.8	13.8

TREE BASAL AREA AND VOLUME

	THOUSAND BOARD FEET PER ACRE	BASAL AREA (SQ FEET) PER ACRE	QUADRATIC MEAN DIAMETER (INCHES)
Abies grandis	5.6	42.1	5.8
Abies lasiocarpa			
Larix occidentalis			
Picea engelmannii	39.6	205.7	17.1
Pinus contorta			
Pinus monticola	43.9	205.7	19.7
Populus trichocarpa			
Pseudotsuga menziesii			
Thuja plicata			
Tsuga heterophylla		0.1	0.4
Total Trees	89.1	453.6	

TABLE 1. (CONTINUED)

SHRUB DENSITY

	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY
LOW SHRUBS			
Amelanchier alnifolia	1.0	161.9	1.2%
Cornus stolonifera	1.0	161.9	1.2%
Ribes lacustre	2.0	323.8	2.5%
Rosa gymnocarpa	1.0	161.9	1.2%
Spiraea betulifolia	9.0	1456.9	11.0%
Symphoricarops albus	46.0	7446.3	56.1%
Vaccinium globulare	5.0	809.4	6.1%
Total Low Shrubs	65.0	10522.1	79.3%
SUBSHRUBS			
Rubus parviflorus	17.0	2751.9	20.7%
Total Subshrubs	17.0	2751.9	20.7%
TOTAL SHRUBS	82.0	13274.0	100.0%

HERBACEOUS PRODUCTION

SAMPLE NUMBER	64A	64B	64C	64D	GRAMS/ SQ M	LBS/ ACRE	REL. PROD.
Perennial Graminoids	5.6	0.5	0.1	1.1	1.8	16.2	3.6%
Annual Graminoids					0.0	0.0	0.0%
Perennial Forbs	74.9	33.4	29.8	58.4	49.1	437.4	96.4%
Annual & Biennial Forbs					0.0	0.0	0.0%
Total Production	80.5	33.9	29.9	59.5	50.9	453.6	100.0%

TABLE 2. CONIFEROUS FOREST COVER; TREE DENSITY, REPRODUCTION, HEIGHT, DBH, BASAL AREA AND VOLUME; SHRUB DENSITY; AND HERBACEOUS PRODUCTION DATA - TAILINGS IMPOUNDMENT, SAMPLE #67*

			COVER			
	1st Hit	All Hits	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS
TREES						
Abies grandis	4	4	4.0%	4.1%	4.0%	1.9%
Larix occidentalis	32	32	32.0%	33.3%	32.0%	15.1%
Picea engelmannii	14	14	14.0%	14.6%	14.0%	6.6%
Pseudotsuga menziesii	30	32	30.0%	31.3%	32.0%	15.1%
Tsuga heterophylla	P		P	0.0%	0.0%	0.0%
Total % Trees	80	82	80.0%	83.3%	82.0%	38.7%
LOW SHRUBS						
Amelanchier alnifolia		6	0.0%	0.0%	6.0%	2.8%
Pachistima myrsinites	P		P	0.0%	0.0%	0.0%
Rosa gymnocarpa	2	12	2.0%	2.1%	12.0%	5.7%
Spiraea betulifolia		2	0.0%	0.0%	2.0%	0.9%
Symphoricarpos albus	2	6	2.0%	2.1%	6.0%	2.8%
Total % Low Shrubs	4	26	4.0%	4.2%	26.0%	12.2%
SUBSHRUBS						
Berberis repens		10	0.0%	0.0%	10.0%	4.7%
Chimaphila umbellata		2	0.0%	0.0%	2.0%	0.9%
Cornus canadensis		2	0.0%	0.0%	2.0%	0.9%
Linnaea borealis	P		P	0.0%	0.0%	0.0%
Rubus parviflorus	4	12	4.0%	4.2%	12.0%	5.7%
Total % Subshrubs	4	26	4.0%	4.2%	26.0%	12.2%
PERENNIAL GRAMINOIDS						
Bromus vulgaris		2	0.0%	0.0%	2.0%	1.0%
Total % Perennial Graminoids	0	2	0.0%	0.0%	2.0%	1.0%
PERENNIAL FORBS						
Adenocaulon bicolor	P		P	0.0%	0.0%	0.0%
Aralia nudicaulis	2	6	2.0%	2.1%	6.0%	2.8%
Arnica cordifolia		2	0.0%	0.0%	2.0%	0.9%
Aster conspicuous	P		P	0.0%	0.0%	0.0%
Clintonia uniflora	2	12	2.0%	2.1%	12.0%	5.7%
Coptis occidentalis	4	28	4.0%	4.2%	28.0%	13.2%
Disporum hookeri	P		P	0.0%	0.0%	0.0%

*Western Hemlock/Queencup Beadlily Habitat Type

TABLE 2. (CONTINUED)

COVER

	1st Hit	All Hits	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS
Fragaria virginiana		4	0.0%	0.0%	4.0%	1.9%
Galium triflorum	P		P	0.0%	0.0%	0.0%
Osmorhiza chilensis	P		P	0.0%	0.0%	0.0%
Smilacina stellata		16	0.0%	0.0%	16.0%	7.6%
Thalictrum occidentale		8	0.0%	0.0%	8.0%	3.8%
Trillium ovatum	P		P	0.0%	0.0%	0.0%
Viola glabella	P		P	0.0%	0.0%	0.0%
Total % Perennial Forbs	8	76	8.0%	8.3%	76.0%	35.8%
TOTAL % VEGETATION	96	212	96.0%	100.0%	212.0%	100.0%
Soil			0.0%			
Litter	4	4	4.0%			
Rock			0.0%			

P = SPECIES PRESENT, BUT
NOT ENCOUNTERED QUANTITATIVELY

TABLE 2. (CONTINUED)

TREE DENSITY

	MEAN NO. TREES/ 125 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY
TREES			
Abies grandis	6.0	194.2	50.0%
Larix occidentalis	1.0	32.4	8.3%
Picea engelmannii	3.0	97.1	25.0%
Pseudotsuga menziesii	2.0	64.8	16.7%
Total Trees	12.0	388.5	100.0%
TREES (DEAD)			
Larix occidentalis	3.0	97.1	100.0%
Total Trees (Dead)	3.0	97.1	100.0%

TREE REPRODUCTION

	MEAN NO. SHRUBS/ 25 SQ METERS	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY
TREES			
Abies grandis	3.0	485.6	75.0%
Tsuga heterophylla	1.0	161.9	25.0%
Total Trees Reproduction	4.0	647.5	100.0%

TABLE 2. (CONTINUED)

TREE HEIGHT (FEET)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	6	36	12.5
Larix occidentalis	92	92	92.0
Picea engelmannii	6	49	30.7
Pseudotsuga menziesii	76	85	80.5

TREE DBH (INCHES)

	RANGE IN DBH (INCHES) MINIMUM	RANGE IN DBH (INCHES) MAXIMUM	MEAN DBH (INCHES)
TREES			
Abies grandis	0.4	5.5	1.5
Larix occidentalis	18.9	18.9	18.9
Picea engelmannii	0.8	8.7	5.0
Pseudotsuga menziesii	13.4	22.4	17.9
TREES (DEAD)			
Larix occidentalis	7.1	30.3	16.1

TREE BASAL AREA AND VOLUME

	THOUSAND BOARD FEET PER ACRE	BASAL AREA (SQ FEET) PER ACRE	QUADRATIC MEAN DIAMETER (INCHES)
Abies grandis		6.2	2.4
Abies lasiocarpa			
Larix occidentalis	9.6	63.1	18.9
Picea engelmannii		18.7	5.9
Pinus contorta			
Pinus monticola			
Populus trichocarpa			
Pseudotsuga menziesii	17.2	120.6	18.5
Thuja plicata			
Tsuga heterophylla			
Total Trees	26.8	208.6	

TABLE 2. (CONTINUED)

SHRUB DENSITY

	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY
LOW SHRUBS			
Amelanchier alnifolia	14.0	2266.3	12.7%
Rosa gymnocarpa	19.0	3075.7	17.3%
Spiraea betulifolia	15.0	2428.2	13.6%
Symphoricarops albus	9.0	1456.9	8.2%
Total Low Shrubs	57.0	9227.1	51.8%
SUBSHRUBS			
Berberis repens	39.0	6313.2	35.5%
Rubus parviflorus	14.0	2266.3	12.7%
Total Subshrubs	53.0	8579.5	48.2%
TOTAL SHRUBS	110.0	17806.6	100.0%

HERBACEOUS PRODUCTION

SAMPLE NUMBER	67A	67B	67C	67D	GRAMS/ SQ M	LBS/ ACRE	REL. PROD.
Perennial Graminoids	0.7			0.3	0.2	2.2	1.3%
Annual Graminoids					0.0	0.0	0.0%
Perennial Forbs	33.5	16.7	7.1	19	19.1	169.9	98.7%
Annual & Biennial Forbs					0.0	0.0	0.0%
Total Production	34.2	16.7	7.1	19.3	19.3	172.1	100.0%

TABLE 3. CONIFEROUS FOREST COVER; TREE DENSITY, REPRODUCTION, HEIGHT, DBH, BASAL AREA AND VOLUME; SHRUB DENSITY; AND HERBACEOUS PRODUCTION DATA - TAILINGS IMPOUNDMENT, SAMPLE #68*

COVER

	1st Hit	All Hits	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS
TREES						
Abies grandis	18	32	18.0%	18.7%	32.0%	14.2%
Larix occidentalis	4	8	4.0%	4.2%	8.0%	3.5%
Picea engelmannii	2	10	2.0%	2.1%	10.0%	4.4%
Pinus contorta	6	6	6.0%	6.3%	6.0%	2.7%
Pinus monticola		2	0.0%	0.0%	2.0%	0.9%
Pseudotsuga menziesii	4	8	4.0%	4.2%	8.0%	3.5%
Thuja plicata	18	22	18.0%	18.7%	22.0%	9.7%
Tsuga heterophylla		2	0.0%	0.0%	2.0%	0.9%
Total % Trees	52	90	52.0%	54.2%	90.0%	39.8%
TALL SHRUBS						
Acer glabrum		2	0.0%	0.0%	2.0%	0.9%
Alnus sinuata	22	22	22.0%	22.9%	22.0%	9.7%
Total % Tall Shrubs	22	24	22.0%	22.9%	24.0%	10.6%
LOW SHRUBS						
Amelanchier alnifolia		2	0.0%	0.0%	2.0%	0.9%
Lonicera ciliosa	P		P	0.0%	0.0%	0.0%
Lonicera utahensis	P		P	0.0%	0.0%	0.0%
Pachistima myrsinites	2	20	2.0%	2.1%	20.0%	8.8%
Rosa gymnocarpa		4	0.0%	0.0%	4.0%	1.8%
Sheperdia canadensis	P		P	0.0%	0.0%	0.0%
Spiraea betulifolia		4	0.0%	0.0%	4.0%	1.8%
Vaccinium myrtillus	P		P	0.0%	0.0%	0.0%
Total % Low Shrubs	2	30	2.0%	2.1%	30.0%	13.3%
SUBSHRUBS						
Arctostaphylos uva-ursi	P		P	0.0%	0.0%	0.0%
Berberis repens	P		P	0.0%	0.0%	0.0%
Cornus canadensis		2	0.0%	0.0%	2.0%	0.9%
Linnaea borealis	4	12	4.0%	4.2%	12.0%	5.3%
Rubus parviflorus	10	28	10.0%	10.4%	28.0%	12.4%
Total % Subshrubs	14	42	14.0%	14.6%	42.0%	18.6%

*Western Hemlock/Queencup Beadlily Habitat Type

TABLE 3. (CONTINUED)

COVER

	1st Hit	All Hits	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS
PERENNIAL FORBS						
Aralia nudicaulis		4	0.0%	0.0%	4.0%	1.8%
Arnica cordifolia	4	24	4.0%	4.1%	24.0%	10.6%
Aster conspicuous	P		P	0.0%	0.0%	0.0%
Clintonia uniflora		4	0.0%	0.0%	4.0%	1.8%
Coptis occidentalis		2	0.0%	0.0%	2.0%	0.8%
Hieracium albiflorum	P		P	0.0%	0.0%	0.0%
Pyrola asarifolia	P		P	0.0%	0.0%	0.0%
Smilacina stellata	P		P	0.0%	0.0%	0.0%
Thalictrum occidentale	P		P	0.0%	0.0%	0.0%
Viola orbiculata	P		P	0.0%	0.0%	0.0%
Total % Perennial Forbs	4	34	4.0%	4.1%	34.0%	15.0%
CRYPTOGAMS						
Moss	2	6	2.0%	2.1%	6.0%	2.7%
Total % Cryptogams	2	6	2.0%	2.1%	6.0%	2.7%
TOTAL % VEGETATION	96	226	96.0%	100.0%	226.0%	100.0%
Soil			0.0%			
Litter	4	4	4.0%			
Rock			0.0%			

P = SPECIES PRESENT, BUT
NOT ENCOUNTERED QUANTITATIVELY

TABLE 3. (CONTINUED)

TREE DENSITY

	MEAN NO. TREES/ 125 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY
TREES			
Abies grandis	24.0	777.0	28.9%
Larix occidentalis	5.0	161.9	6.0%
Picea engelmannii	7.0	226.6	8.4%
Pinus contorta	5.0	161.9	6.0%
Pinus monticola	1.0	32.4	1.2%
Pseudotsuga menziesii	8.0	259.0	9.7%
Thuja plicata	25.0	809.4	30.1%
Tsuga heterophylla	8.0	259.0	9.7%
Total Trees	83.0	2687.2	100.0%

TREE REPRODUCTION

	MEAN NO. SHRUBS/ 25 SQ METERS	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY
TREES			
Abies grandis	7.0	1133.1	43.7%
Picea engelmannii	2.0	323.8	12.5%
Thuja plicata	7.0	1133.1	43.8%
Tsuga heterophylla	Present		
Total Trees Reproduction	16.0	2590.0	100.0%

TABLE 3. (CONTINUED)

TREE HEIGHT (FEET)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	4	82	15.3
Larix occidentalis	9	40	22.8
Picea engelmannii	6	9	6.6
Pinus contorta	8	39	22.2
Pinus monticola	12	12	12.0
Pseudotsuga menziesii	6	12	7.6
Thuja plicata	6	86	11.0
Tsuga heterophylla	6	12	7.3

TREE DBH (INCHES)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	0.4	13.4	2.0
Larix occidentalis	0.4	3.9	1.8
Picea engelmannii	0.4	1.2	0.6
Pinus contorta	0.8	6.7	3.2
Pinus monticola	1.2	1.2	1.2
Pseudotsuga menziesii	0.4	1.2	0.6
Thuja plicata	0.4	23.2	1.6
Tsuga heterophylla	0.4	1.2	0.5

TREE BASAL AREA AND VOLUME

	THOUSAND BOARD FEET PER ACRE	BASAL AREA (SQ FEET) PER ACRE	QUADRATIC MEAN DIAMETER (INCHES)
Abies grandis	5.0	52.7	3.5
Abies lasiocarpa			
Larix occidentalis		4.1	2.2
Picea engelmannii		0.5	0.6
Pinus contorta		12.5	3.8
Pinus monticola		0.2	1.2
Populus trichocarpa			
Pseudotsuga menziesii		0.7	0.7
Thuja plicata	11.9	102.0	4.8
Tsuga heterophylla		0.5	0.6
Total Trees	16.9	173.2	

TABLE 3. (CONTINUED)

SHRUB DENSITY

	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY
LOW SHRUBS			
Amelanchier alnifolia	2.0	323.8	2.5%
Pachistima myrsinites	28.0	4532.5	34.6%
Rosa gymnocarpa	9.0	1456.9	11.1%
Spiraea betulifolia	1.0	161.9	1.2%
Total Low Shrubs	40.0	6475.1	49.4%
SUBSHRUBS			
Rubus parviflorus	41.0	6637.0	50.6%
Total Subshrubs	41.0	6637.0	50.6%
TOTAL SHRUBS	81.0	13112.1	100.0%

HERBACEOUS PRODUCTION

SAMPLE NUMBER	68A	68B	68C	68D	GRAMS/ SQ M	LBS/ ACRE	REL. PROD.
Perennial Graminoids		0.6			0.1	1.3	1.7%
Annual Graminoids					0.0	0.0	0.0%
Perennial Forbs	18.2	10.7	6.6	0	8.9	79.0	98.3%
Annual & Biennial Forbs					0.0	0.0	0.0%
Total Production	18.2	11.3	6.6	0	9.0	80.3	100.0%

TABLE 4. CONIFEROUS FOREST COVER; TREE DENSITY, REPRODUCTION, HEIGHT, DBH, BASAL AREA AND VOLUME; SHRUB DENSITY; AND HERBACEOUS PRODUCTION DATA - PERCOLATION SITE NO. 2, SAMPLE #61*

COVER

	1st Hit	All Hits	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS
TREES						
Abies grandis	38	54	38.0%	39.6%	54.0%	39.7%
Pinus monticola	8	8	8.0%	8.3%	8.0%	5.9%
Pseudotsuga menziesii	P		P	0.0%	0.0%	0.0%
Thuja plicata	24	30	24.0%	25.0%	30.0%	22.1%
Tsuga heterophylla	20	24	20.0%	20.8%	24.0%	17.6%
Total % Trees	90	116	90.0%	93.7%	116.0%	85.3%
LOW SHRUBS						
Lonicera utahensis	P		P	0.0%	0.0%	0.0%
Pachistima myrsinites	P		P	0.0%	0.0%	0.0%
Spiraea betulifolia	P		P	0.0%	0.0%	0.0%
Vaccinium globulare	P		P	0.0%	0.0%	0.0%
Vaccinium myrtillus	P		P	0.0%	0.0%	0.0%
Total % Low Shrubs	0	0	0.0%	0.0%	0.0%	0.0%
SUBSHRUBS						
Chimaphila umbellata	P		P	0.0%	0.0%	0.0%
Linnaea borealis	2	4	2.0%	2.1%	4.0%	2.9%
Total % Subshrubs	2	4	2.0%	2.1%	4.0%	2.9%
PERENNIAL FORBS						
Clintonia uniflora		2	0.0%	0.0%	2.0%	1.5%
Coptis occidentalis	2	8	2.0%	2.1%	8.0%	5.9%
Corallorhiza maculata	P		P	0.0%	0.0%	0.0%
Pyrola asarifolia	P		P	0.0%	0.0%	0.0%
Pyrola secunda	P		P	0.0%	0.0%	0.0%
Viola orbiculata	P		P	0.0%	0.0%	0.0%
Xerophyllum tenax	2	2	2.0%	2.1%	2.0%	1.5%
Total % Perennial Forbs	4	12	4.0%	4.2%	12.0%	8.9%
CRYPTOGAMS						
Moss		4	0.0%	0.0%	4.0%	2.9%
Total % Cryptogams	0	4	0.0%	0.0%	4.0%	2.9%

*Western Hemlock/Queencup Beadlily Habitat Type in sample stand, but not present along cover transect.

TABLE 4. (CONTINUED)

COVER

	1st Hit	All Hits	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS
TOTAL % VEGETATION	96	136	96.0%	100.0%	136.0%	100.0%
Soil			0.0%			
Litter	4	4	4.0%			
Rock			0.0%			

P = SPECIES PRESENT

TABLE 4. (CONTINUED)

TREE DENSITY

	MEAN NO. TREES/ 125 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY
TREES			
Abies grandis	16.0	518.0	72.8%
Pinus monticola	1.0	32.4	4.5%
Pseudotsuga menziesii	1.0	32.4	4.5%
Thuja plicata	3.0	97.1	13.7%
Tsuga heterophylla	1.0	32.4	4.5%
Total Trees	22.0	712.3	100.0%
TREES (DEAD)			
Pinus contorta	1.0	32.4	100.0%
Total Trees (Dead)	1.0	32.4	100.0%

TREE REPRODUCTION

	MEAN NO. SHRUBS/ 25 SQ METERS	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY
TREES			
Abies grandis	3.0	485.6	13.0%
Thuja plicata	4.0	647.5	17.4%
Tsuga heterophylla	16.0	2590.0	69.6%
Total Trees Reproduction	23.0	3723.1	100.0%

TABLE 4. (CONTINUED)

TREE HEIGHT (FEET)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	6	65	18.1
Pinus monticola	94	94	94.0
Pseudotsuga menziesii	70	70	70.0
Thuja plicata	12	88	61.3
Tsuga heterophylla	83	83	83.0

TREE DBH (INCHES)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	0.8	7.9	2.8
Pinus monticola	28.0	28.0	28.0
Pseudotsuga menziesii	13.4	13.4	13.4
Thuja plicata	2.4	18.9	12.6
Tsuga heterophylla	21.7	21.7	21.7
TREES DEAD			
Pinus contorta	8.3	8.3	8.3

TREE BASAL AREA AND VOLUME

	THOUSAND BOARD FEET PER ACRE	BASAL AREA (SQ FEET) PER ACRE	QUADRATIC MEAN DIAMETER (INCHES)
Abies grandis		33.6	3.4
Abies lasiocarpa			
Larix occidentalis			
Picea engelmannii			
Pinus contorta			
Pinus monticola	27.0	138.0	28.0
Populus trichocarpa			
Pseudotsuga menziesii	3.3	31.6	13.4
Thuja plicata	14.8	112.3	14.6
Tsuga heterophylla	14.8	82.8	21.7
Total Trees	59.9	398.3	

TABLE 4. (CONTINUED)

SHRUB DENSITY

	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY
LOW SHRUBS			
Pachistima myrsinites	10.0	1618.8	35.7%
Spiraea betulifolia	1.0	161.9	3.6%
Vaccinium myrtillus	17.0	2751.9	60.7%
Total Low Shrubs	28.0	4532.6	100.0%
TOTAL SHRUBS	28.0	4532.6	100.0%

HERBACEOUS PRODUCTION

SAMPLE NUMBER	61A	61B	61C	61D	GRAMS/ SQ M	LBS/ ACRE	REL. PROD.
Perennial Graminoids					0.0	0.0	0.0%
Annual Graminoids					0.0	0.0	0.0%
Perennial Forbs	3	25.5	17.2	1.3	11.8	104.6	100.0%
Annual & Biennial Forbs					0.0	0.0	0.0%
Total Production	3	25.5	17.2	1.3	11.8	104.6	100.0%

TABLE 5. CONIFEROUS FOREST COVER; TREE DENSITY, REPRODUCTION, HEIGHT, DBH, BASAL AREA AND VOLUME; SHRUB DENSITY; AND HERBACEOUS PRODUCTION DATA - PERCOLATION SITE NO. 2, SAMPLE #63

COVER

	1st Hit	All Hits	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS
TREES						
Abies grandis	8	8	8.0%	9.1%	8.0%	5.7%
Picea engelmannii	34	34	34.0%	38.6%	34.0%	23.9%
Thuja plicata	34	52	34.0%	38.6%	52.0%	36.6%
Tsuga heterophylla	P		P	0.0%	0.0%	0.0%
Total % Trees	76	94	76.0%	86.3%	94.0%	66.2%
LOW SHRUBS						
Lonicera utahensis	P		P	0.0%	0.0%	0.0%
Oplopanax horridum	P		P	0.0%	0.0%	0.0%
Pachistima myrsinites	P		P	0.0%	0.0%	0.0%
Rosa gymnocarpa	P		P	0.0%	0.0%	0.0%
Total % Low Shrubs	0	0				
SUBSHRUBS						
Chimaphila umbellata	P		P	0.0%	0.0%	0.0%
Linnaea borealis	P		P	0.0%	0.0%	0.0%
Total % Subshrubs	0	0	0.0%	0.0%	0.0%	0.0%
PERENNIAL FORBS						
Arnica cordifolia	P		P	0.0%	0.0%	0.0%
Clintonia uniflora		2	0.0%	0.0%	2.0%	1.4%
Coptis occidentalis		8	0.0%	0.0%	8.0%	5.7%
Galium triflorum		2	0.0%	0.0%	2.0%	1.4%
Goodyera oblongfolia	P		P	0.0%	0.0%	0.0%
Hieracium albiflorum	P		P	0.0%	0.0%	0.0%
Pyrola asarifolia	P		P	0.0%	0.0%	0.0%
Pyrola uniflora	2	2	2.0%	2.3%	2.0%	1.4%
Smilacina stellata	P		P	0.0%	0.0%	0.0%
Tiarella trifoliata	P		P	0.0%	0.0%	0.0%
Trillium ovatum	P		P	0.0%	0.0%	0.0%
Total % Perennial Forbs	2	14	2.0%	2.3%	14.0%	9.9%

* Western Hemlock/Oak Fern Habitat Type

TABLE 5. (CONTINUED)

	1st Hit	All Hits	COVER MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS
CRYPTOGAMS						
Gymnocarpium dryopteris		6	0.0%	0.0%	6.0%	4.2%
Moss	10	28	10.0%	11.4%	28.0%	19.7%
Total % Cryptogams	10	34	10.0%	11.4%	34.0%	23.9%
TOTAL % VEGETATION	88	142	88.0%	100.0%	142.0%	100.0%
Soil			0.0%			
Litter	12	12	12.0%			
Rock			0.0%			

P = SPECIES PRESENT, BUT
NOT ENCOUNTERED QUANTITATIVELY

TABLE 5. (CONTINUED)

TREE DENSITY

	MEAN NO. TREES/ 125 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY
TREES			
Abies grandis	1.0	32.4	9.1%
Picea engelmannii	2.0	64.8	18.2%
Thuja plicata	8.0	259.0	72.7%
Total Trees	11.0	356.2	100.0%
TREES (DEAD)			
Thuja plicata	2.0	64.8	100.0%
Total Trees (Dead)	2.0	64.8	100.0%

TREE REPRODUCTION

	MEAN NO. SHRUBS/ 25 SQ METERS	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY
TREES			
Abies grandis	2.0	323.8	9.1%
Thuja plicata	3.0	485.6	13.6%
Tsuga heterophylla	17.0	2751.9	77.3%
Total Trees Reproduction	22.0	3561.3	100.0%

TREE HEIGHT (FEET)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	74	74	74.0
Picea engelmannii	75	76	75.5
Thuja plicata	7	31	20.6

TABLE 5. (CONTINUED)

TREE DBH (INCHES)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	7.5	7.5	7.5
Picea engelmannii	14.6	15.0	14.8
Thuja plicata	1.2	5.5	3.7
TREES (DEAD)			
Thuja plicata	2.8	3.1	3.0

TREE BASAL AREA AND VOLUME

	THOUSAND BOARD FEET PER ACRE	BASAL AREA (SQ FEET) PER ACRE	QUADRATIC MEAN DIAMETER (INCHES)
Abies grandis		9.9	7.5
Abies lasiocarpa			
Larix occidentalis			
Picea engelmannii	11.5	77.0	14.8
Pinus contorta			
Pinus monticola			
Populus trichocarpa			
Pseudotsuga menziesii			
Thuja plicata		22.2	4.0
Tsuga heterophylla			
Total Trees	11.5	109.1	

TABLE 5. (CONTINUED)

SHRUB DENSITY

	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY
LOW SHRUBS			
Pachistima myrsinites	5.0	809.4	100.0%
Total Low Shrubs	5.0	809.4	100.0%
TOTAL SHRUBS	5.0	809.4	100.0%

HERBACEOUS PRODUCTION

SAMPLE NUMBER	63A	63B	63C	63D	GRAMS/ SQ M	LBS/ ACRE	REL. PROD.
Perennial Graminoids					0.0	0.0	0.0%
Annual Graminoids					0.0	0.0	0.0%
Perennial Forbs	1.6	3.8	0.1	2.5	2.0	17.8	100.0%
Annual & Biennial Forbs					0.0	0.0	0.0%
Total Production	1.6	3.8	0.1	2.5	2.0	17.8	100.0%

TABLE 6. CONIFEROUS FOREST COVER; TREE DENSITY, REPRODUCTION, HEIGHT, DBH, BASAL AREA AND VOLUME; SHRUB DENSITY; AND HERBACEOUS PRODUCTION DATA - PERCOLATION SITE NO. 1, SAMPLE #69*

COVER

	1st Hit	All Hits	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS
TREES						
Abies grandis	30	30	30.0%	34.1%	30.0%	22.0%
Pinus monticola	10	10	10.0%	11.4%	10.0%	7.4%
Tsuga heterophylla	26	28	26.0%	29.5%	28.0%	20.6%
Total % Trees	66	68	66.0%	75.0%	68.0%	50.0%
LOW SHRUBS						
Amelanchier alnifolia	P		P	0.0%	0.0%	0.0%
Lonicera utahensis		2	0.0%	0.0%	2.0%	1.5%
Pachistima myrsinites	P		P	0.0%	0.0%	0.0%
Rosa gymnocarpa	2	2	2.0%	2.3%	2.0%	1.5%
Spiraea betulifolia	P		P	0.0%	0.0%	0.0%
Vaccinium globulare	2	4	2.0%	2.3%	4.0%	2.9%
Vaccinium myrtillus	P		P	0.0%	0.0%	0.0%
Total % Low Shrubs	4	8	4.0%	4.6%	8.0%	5.9%
SUBSHRUBS						
Chimaphila umbellata	4	10	4.0%	4.5%	10.0%	7.3%
Linnaea borealis	6	14	6.0%	6.8%	14.0%	10.3%
Total % Subshrubs	10	24	10.0%	11.3%	24.0%	17.6%
PERENNIAL FORBS						
Adencaulon bicolor	P		P	0.0%	0.0%	0.0%
Clintonia uniflora		4	0.0%	0.0%	4.0%	2.9%
Coptis occidentalis	4	14	4.0%	4.5%	14.0%	10.3%
Goodyera oblongfolia	P		P	0.0%	0.0%	0.0%
Pyrola secunda	P		P	0.0%	0.0%	0.0%
Smilacina stellata		8	0.0%	0.0%	8.0%	5.9%
Tiarella trifoliata	P		P	0.0%	0.0%	0.0%
Viola orbiculata	P		P	0.0%	0.0%	0.0%
Xerophyllum tenax	2	8	2.0%	2.3%	8.0%	5.9%
Total % Perennial Forbs	6	34	6.0%	6.8%	34.0%	25.0%

*Western Hemlock/Oak Fern Habitat Type in sample stand, but not present along cover transect.

TABLE 6. (CONTINUED)

COVER

	1st Hit	All Hits	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS
CRYPTOGAMS						
Moss	2	2	2.0%	2.3%	2.0%	1.5%
Total % Cryptogams	2	2	2.0%	2.3%	2.0%	1.5%
TOTAL % VEGETATION	88	136	88.0%	100.0%	136.0%	100.0%
Soil			0.0%			
Litter	12	12	12.0%			
Rock			0.0%			

P = SPECIES PRESENT

TABLE 6. (CONTINUED)

TREE DENSITY

	MEAN NO. TREES/ 125 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY
TREES			
Abies grandis	2.0	64.8	20.0%
Pinus monticola	5.0	161.9	50.0%
Tsuga heterophylla	3.0	97.1	30.0%
Total Trees	10.0	323.8	100.0%
TREES (DEAD)			
Pinus monticola	6.0	194.3	100.0%
Total Trees (Dead)	6.0	194.3	100.0%

TREE REPRODUCTION

	MEAN NO. SHRUBS/ 25 SQ METERS	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY
TREES			
Abies grandis	2.0	323.8	100.0%
Tsuga heterophylla	Present		
Total Trees Reproduction	2.0	323.8	100.0%

TABLE 6. (CONTINUED)

TREE HEIGHT (FEET)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	50	51	50.5
Pinus monticola	31	72	58.0
Tsuga heterophylla	6	41	19.7

TREE DBH (INCHES)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	7.9	10.2	9.1
Pinus monticola	3.9	17.3	12.1
Tsuga heterophylla	0.4	11.0	4.6
TREES (DEAD)			
Pinus monticola	2.4	16.9	6.8

TREE BASAL AREA AND VOLUME

	THOUSAND BOARD FEET PER ACRE	BASAL AREA (SQ FEET) PER ACRE	QUADRATIC MEAN DIAMETER (INCHES)
Abies grandis	1.1	29.5	9.1
Abies lasiocarpa			
Larix occidentalis			
Picea engelmannii			
Pinus contorta			
Pinus monticola	18.7	147.9	12.9
Populus trichocarpa			
Pseudotsuga menziesii			
Thuja plicata			
Tsuga heterophylla	0.7	22.5	6.5
Total Trees	20.6	199.9	

TABLE 6. (CONTINUED)

SHRUB DENSITY

	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY
LOW SHRUBS			
Amelanchier alnifolia	1.0	161.9	2.5%
Lonicera utahensis	2.0	323.7	5.0%
Pachistima myrsinites	1.0	161.9	2.5%
Rosa gymnocarpa	1.0	161.9	2.5%
Spiraea betulifolia	1.0	161.9	2.5%
Vaccinium globulare	32.0	5180.1	80.0%
Vaccinium myrtillus	2.0	323.7	5.0%
Total Low Shrubs	40.0	6475.1	100.0%
TOTAL SHRUBS	40.0	6475.1	100.0%

HERBACEOUS PRODUCTION

SAMPLE NUMBER	69A	69B	69C	69D	GRAMS/ SQ M	LBS/ ACRE	REL. PROD.
Perennial Graminoids	0.6				0.2	1.3	1.3%
Annual Graminoids					0.0	0.0	0.0%
Perennial Forbs	24.1	4.6	5.3	11.6	11.4	101.5	98.7%
Annual & Biennial Forbs					0.0	0.0	0.0%
Total Production	24.7	4.6	5.3	11.6	11.6	102.8	100.0%

TABLE 7. CLEARCUT COVER; TREE DENSITY, REPRODUCTION, HEIGHT, DBH; SHRUB DENSITY; AND HERBACEOUS PRODUCTION DATA - PERCOLATION SITE NO. 1, SAMPLE #60

COVER

	1st Hit	All Hits	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS
TREES						
Abies grandis	6	6	6.0%	6.7%	6.0%	4.7%
Abies lasiocarpa	2	2	2.0%	2.2%	2.0%	1.6%
Larix occidentalis	P		P	0.0%	0.0%	0.0%
Picea engelmannii	2	2	2.0%	2.2%	2.0%	1.6%
Pinus contorta	P		P	0.0%	0.0%	0.0%
Pinus monticola	2	4	2.0%	2.2%	4.0%	3.1%
Populus trichocarpa	2	2	2	2.2%	2.0%	1.6%
Pseudotsuga menziesii	8	8	8.0%	8.9%	8.0%	6.2%
Thuja plicata	P		P	0.0%	0.0%	0.0%
Tsuga heterophylla	P		P	0.0%	0.0%	0.0%
Total % Trees	22	24	22.0%	24.4%	24.0%	18.8%
TALL SHRUBS						
Alnus sinuata	4	4	4.0%	4.4%	4.0%	3.1%
Total % Tall Shrubs	4	4	4.0%	4.4%	4.0%	3.1%
LOW SHRUBS						
Ceanothus velutinus	10	10	10.0%	11.2%	10.0%	7.8%
Holodiscus discolor	P		P	0.0%	0.0%	0.0%
Lonicera utahensis	2	2	2.0%	2.2%	2.0%	1.5%
Pachistima myrsinites	8	16	8.0%	8.9%	16.0%	12.5%
Rosa gymnocarpa	P		P	0.0%	0.0%	0.0%
Rubus idaeus	P		P	0.0%	0.0%	0.0%
Salix scouleriana	2	2	2.0%	2.2%	2.0%	1.6%
Shepherdia canadensis	P		P	0.0%	0.0%	0.0%
Spiraea betulifolia	2	4	2.0%	2.2%	4.0%	3.1%
Vaccinium globulare	P		P	0.0%	0.0%	0.0%
Total % Low Shrubs	24	34	24.0%	26.7%	34.0%	26.5%
SUBSHRUBS						
Berberis repens	2	2	2.0%	2.2%	2.0%	1.6%
Linnaea borealis	2	4	2.0%	2.2%	4.0%	3.1%
Rubus parviflorus	P		P	0.0%	0.0%	0.0%
Total % Subshrubs	4	6	4.0%	4.4%	6.0%	4.7%

TABLE 7. (CONTINUED)

COVER

	1st Hit	All Hits	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS
PERENNIAL GRAMINOIDS						
Carex concinnoides	6	10	6.0%	6.7%	10.0%	7.8%
Festuca occidentalis	P		P	0.0%	0.0%	0.0%
Total % Perennial Graminoids	6	10	6.0%	6.7%	10.0%	7.8%
PERENNIAL FORBS						
Achillea millefolium	P		P	0.0%	0.0%	0.0%
Anaphalis margaritacea	P		P	0.0%	0.0%	0.0%
Castilleja miniata	P		P	0.0%	0.0%	0.0%
Clintonia uniflora		2	0.0%	0.0%	2.0%	1.6%
Coptis occidentalis		2	0.0%	0.0%	2.0%	1.6%
Epilobium angustifolium	10	10	10.0%	11.2%	10.0%	7.8%
Hieracium albiflorum	P		P	0.0%	0.0%	0.0%
Hieracium aurantiacum	2	2	2.0%	2.2%	2.0%	1.6%
Pyrola secunda	P		P	0.0%	0.0%	0.0%
Smilacina stellata	P		P	0.0%	0.0%	0.0%
Solidago canadensis	P		P	0.0%	0.0%	0.0%
Xerophyllum tenax	2	2	2.0%	2.2%	2.0%	1.6%
Total % Perennial Forbs	14	18	14.0%	15.6%	18.0%	14.1%
ANNUAL & BIENNIAL FORBS						
Melampyrum lineare	P		P	0.0%	0.0%	0.0%
Total % Annual & Biennial Forbs	0	0	0.0%	0.0%	0.0%	0.0%
CRYPTOGAMS						
Moss	16	32	16.0%	17.8%	32.0%	25.0%
Total % Cryptogams	16	32	16.0%	17.8%	32.0%	25.0%
TOTAL % VEGETATION	90	128	90.0%	100.0%	128.0%	100.0%
Soil	2	2	2.0%			
Litter	6	6	6.0%			
Rock	2	2	2.0%			

P = SPECIES PRESENT BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 7. (CONTINUED)

TREE DENSITY

	MEAN NO. TREES/ 125 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TREES				
Abies grandis	3.0	97.1	17.6%	
Picea engelmannii	1.0	32.4	5.9%	
Pinus monticola	6.0	194.3	35.3%	
Populus trichocarpa	2.0	64.7	11.8%	
Pseudotsuga menziesii	5.0	161.9	29.4%	
Total Trees	17.0	550.4	100.0%	

TREE REPRODUCTION

	MEAN NO. SHRUBS/ 25 SQ METERS	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
Abies grandis	2.0	323.8	18.1%	
Abies lasiocarpa	1.0	161.9	9.1%	
Picea engelmannii	1.0	161.9	9.1%	
Pinus contorta	1.0	161.9	9.1%	
Pinus monticola	3.0	485.6	27.3%	
Thuja plicata	3.0	485.6	27.3%	
Total Trees Reproduction	11.0	1780.7	99.9%	

TABLE 7. (CONTINUED)

TREE HEIGHT (FEET)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	5	7	6.0
Picea engelmannii	6	6	6.0
Pinus monticola	5	20	8.8
Populus trichocarpa	5	6	5.5
Pseudotsuga menziesii	7	15	11.6

TREE DBH (INCHES)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	0.4	0.8	0.7
Picea engelmannii	0.8	0.8	0.8
Pinus monticola	0.4	3.1	1.1
Populus trichocarpa	0.4	0.4	0.4
Pseudotsuga menziesii	1.2	2.4	1.9

TABLE 7. (CONTINUED)

SHRUB DENSITY

	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY
LOW SHRUBS			
Ceanothus velutinus	1.0	161.9	1.1%
Holodiscus discolor	1.0	161.9	1.1%
Pachistima myrsinites	33.0	5342.0	36.7%
Rosa gymnocarpa	5.0	809.4	5.6%
Spiraea betulifolia	32.0	5180.1	35.5%
Vaccinium globulare	2.0	323.7	2.2%
Total Low Shrubs	74.0	11979.0	82.2%
SUBSHRUBS			
Berberis repens	11.0	1780.6	12.2%
Rubus parviflorus	5.0	809.4	5.6%
Total Subshrubs	16.0	2590.0	17.8%
TOTAL SHRUBS	90.0	14569.0	100.0%

HERBACEOUS PRODUCTION

SAMPLE NUMBER	60A	60B	60C	60D	GRAMS/ SQ M	LBS/ ACRE	REL. PROD.
Perennial Graminoids	33.5	9.2	3.4	0.1	11.5	102.8	32.1%
Annual Graminoids					0.0	0.0	0.0%
Perennial Forbs	59.4	24.1	10.4	4	24.5	217.9	67.9%
Annual & Biennial Forbs					0.0	0.0	0.0%
Total Production	92.9	33.3	13.8	4.1	36.0	320.7	100.0%

TABLE 8. CLEARCUT COVER; TREE DENSITY, REPRODUCTION, HEIGHT, DBH; SHRUB DENSITY; AND HERBACEOUS PRODUCTION DATA - PERCOLATION SITE NO. 2, SAMPLE #62

COVER

	1st Hit	All Hits	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS
TREES						
Abies grandis	2	2	2.0%	2.1%	2.0%	1.2%
Larix occidentalis	P		P	0.0%	0.0%	0.0%
Pinus contorta	28	28	28.0%	29.8%	28.0%	17.5%
Pinus monticola	2	2	2.0%	2.1%	2.0%	1.2%
Populus trichocarpa	P		P	0.0%	0.0%	0.0%
Pseudotsuga menziesii	P		P	0.0%	0.0%	0.0%
Total % Trees	32	32	32.0%	34.0%	32.0%	19.9%
TALL SHRUBS						
Alnus sinuata	P		P	0.0%	0.0%	0.0%
Total % Tall Shrubs	0	0	0.0%	0.0%	0.0%	0.0%
LOW SHRUBS						
Ceanothus velutinus	P		P	0.0%	0.0%	0.0%
Cornus stolonifera	P		P	0.0%	0.0%	0.0%
Holodiscus discolor	P		P	0.0%	0.0%	0.0%
Lonicera utahensis	P		P	0.0%	0.0%	0.0%
Pachistima myrsinites	P		P	0.0%	0.0%	0.0%
Rosa gymnocarpa	2	2	2.0%	2.1%	2.0%	1.2%
Rubus idaeus	P		P	0.0%	0.0%	0.0%
Salix scouleriana	P		P	0.0%	0.0%	0.0%
Shepherdia canadensis	6	10	6.0%	6.4%	10.0%	6.3%
Spiraea betulifolia	2	18	2.0%	2.1%	18.0%	11.3%
Vaccinium myrtillus		2	0.0%	0.0%	2.0%	1.2%
Total % Low Shrubs	10	32	10.0%	10.6%	32.0%	20.0%
SUBSHRUBS						
Arctostaphylos uva-ursi	4	16	4.0%	4.3%	16.0%	10.0%
Total % Subshrubs	4	16	4.0%	4.3%	16.0%	10.0%
PERENNIAL GRAMINOIDS						
Calamagrostis rubescens	6	8	6.0%	6.4%	8.0%	5.0%
Carex concinnoides	2	2	2.0%	2.1%	2.0%	1.3%
Festuca occidentalis	P		P	0.0%	0.0%	0.0%
Phleum pratense	P		P	0.0%	0.0%	0.0%
Total % Perennial Graminoids	8	10	8.0%	8.5%	10.0%	6.3%

TABLE 8. (CONTINUED)

COVER

	1st Hit	All Hits	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS
PERENNIAL FORBS						
Anaphalis margaritacea	P		P	0.0%	0.0%	0.0%
Castilleja miniata	P		P	0.0%	0.0%	0.0%
Epilobium angustifolium	8	14	8.0%	8.5%	14.0%	8.8%
Fragaria virginiana	P		P	0.0%	0.0%	0.0%
Hieracium albiflorum	P		P	0.0%	0.0%	0.0%
Hieracium aurantiacum		4	0.0%	0.0%	4.0%	2.5%
Solidago canadensis	4	4	4.0%	4.3%	4.0%	2.5%
Xerophyllum tenax	6	8	6.0%	6.4%	8.0%	5.0%
Total % Perennial Forbs	18	30	18.0%	19.2%	30.0%	18.8%
ANNUAL & BIENNIAL FORBS						
Melampyrum lineare	2	2	2.0%	2.1%	2.0%	1.2%
Total % Annual & Biennial Forbs	2	2	2.0%	2.1%	2.0%	1.2%
CRYPTOGAMS						
Moss	2	12	2.0%	2.1%	12.0%	7.5%
Pteridium aquilinum	18	26	18.0%	19.2%	26.0%	16.3%
Total % Cryptogams	20	38	20.0%	21.3%	38.0%	23.8%
TOTAL % VEGETATION	94	160	94.0%	100.0%	160.0%	100.0%
Soil			0.0%			
Litter	6	6	6.0%			
Rock			0.0%			

P = SPECIES PRESENT, BUT
NOT ENCOUNTERED QUANTITATIVELY

TABLE 8. (CONTINUED)

TREE DENSITY

	MEAN NO. TREES/ 125 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY
TREES			
Larix occidentalis	1.0	32.4	2.6%
Pinus contorta	36.0	1165.5	94.8%
Pinus monticola	1.0	32.4	2.6%
Total Trees	38.0	1230.3	100.0%

TREE REPRODUCTION

	MEAN NO. SHRUBS/ 25 SQ METERS	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY
TREES			
Abies grandis	1.0	161.9	4.5%
Abies lasiocarpa	1.0	161.9	4.5%
Larix occidentalis	15.0	2428.1	68.2%
Pinus monticola	4.0	647.5	18.3%
Populus trichocarpa	1.0	161.9	4.5%
Total Trees Reproduction	22.0	3561.3	100.0%

TREE HEIGHT (FEET)

	MINIMUM	MAXIMUM	MEAN
TREES			
Larix occidentalis	7	7	7.0
Pinus contorta	6	21	14.7
Pinus monticola	18	18	18.0

TABLE 8. (CONTINUED)

TREE DBH (INCHES)

	MINIMUM	MAXIMUM	MEAN
TREES			
Larix occidentalis	0.4	0.4	0.4
Pinus contorta	0.8	2.8	1.7
Pinus monticola	2.4	2.4	2.4

SHRUB DENSITY

	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY
TALL SHRUBS			
Alnus sinuata	1.0	161.9	0.9%
Total Tall Shrubs	1.0	161.9	0.9%
LOW SHRUBS			
Cornus stolonifera	1.0	161.9	0.9%
Holodiscus discolor	1.0	161.9	0.9%
Pachistima myrsinites	1.0	161.9	0.9%
Rosa gymnocarpa	6.0	971.3	5.7%
Rubus idaeus	1.0	161.9	0.9%
Salix scouleriana	2.0	323.7	1.9%
Shepheria canadensis	8.0	1295.0	7.6%
Spiraea betulifolia	80.0	12950.2	75.5%
Vaccinium myrtillus	5.0	809.4	4.8%
Total Low Shrubs	105.0	16997.2	99.1%
TOTAL SHRUBS	106.0	17159.1	100.0%

TABLE 8. (CONTINUED)

HERBACEOUS PRODUCTION

SAMPLE NUMBER	62A	62B	62C	62D	GRAMS/ SQ M	LBS/ ACRE	REL. PROD.
Perennial Graminoids	33.5	2.5		15.2	12.8	114.0	30.0%
Annual Graminoids					0.0	0.0	0.0%
Perennial Forbs	50.2	12.8	2.7	53.8	29.9	266.0	70.0%
Annual & Biennial Forbs					0.0	0.0	0.0%
Total Production	83.7	15.3	2.7	69	42.7	380.0	100.0%

TABLE 9. CONIFEROUS FOREST COVER; TREE DENSITY, REPRODUCTION, HEIGHT, DBH, BASAL AREA AND VOLUME; SHRUB DENSITY; AND HERBACEOUS PRODUCTION DATA - LIBBY CREEK FACILITIES, SAMPLE #65*

			COVER			
	1st Hit	All Hits	MEAN % ABSOLUTE COVER 1ST HIT	MEAN % RELATIVE COVER 1ST HIT	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS
TREES						
Abies grandis	92	94	92.0%	92.0%	94.0%	66.3%
Larix occidentalis	6	6	6.0%	6.0%	6.0%	4.2%
Total % Trees	98	100	98.0%	98.0%	100.0%	70.5%
TALL SHRUBS						
Acer glabrum	P		P	0.0%	0.0%	0.0%
Taxus brevifolia		22	0.0%	0.0%	22.0%	15.5%
Total % Tall Shrubs	0	22	0.0%	0.0%	22.0%	15.5%
LOW SHRUBS						
Pachistima myrsinites		2	0.0%	0.0%	2.0%	1.4%
Rosa gymnocarpa	P		P	0.0%	0.0%	0.0%
Spiraea betulifolia	P		P	0.0%	0.0%	0.0%
Symphoricarpos albus	P		P	0.0%	0.0%	0.0%
Vaccinium globulare		2	0.0%	0.0%	2.0%	1.4%
Total % Low Shrubs	0	4	0.0%	0.0%	4.0%	2.8%
SUBSHRUBS						
Berberis repens	P		P	0.0%	0.0%	0.0%
Rubus parviflorus	P		P	0.0%	0.0%	0.0%
Total % Subshrubs	0	0	0.0%	0.0%	0.0%	0.0%
PERENNIAL GRAMINOIDS						
Bromus vulgaris	P		P	0.0%	0.0%	0.0%
Calamagrostis rubescens		2	0.0%	0.0%	2.0%	1.4%
Total % Perennial Graminoids	0	2	0.0%	0.0%	2.0%	1.4%
PERENNIAL FORBS						
Adenocaulon bicolor		2	0.0%	0.0%	2.0%	1.4%
Arnica cordifolia	P		P	0.0%	0.0%	0.0%
Clintonia uniflora		2	0.0%	0.0%	2.0%	1.4%
Disporum hookeri	P		P	0.0%	0.0%	0.0%
Galium triflorum	P		P	0.0%	0.0%	0.0%
Hieracium albiflorum	P		P	0.0%	0.0%	0.0%

*Western Hemlock/Queencup Beadlily Habitat Type

TABLE 9. (CONTINUED)

COVER

	1st Hit	All Hits	MEAN % ABSOLUTE COVER 1ST HIT	MEAN % RELATIVE COVER 1ST HIT	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS
Osmorhiza chilensis	P		P	0.0%	0.0%	0.0%
Pyrola secunda	2	2	2.0%	2.0%	2.0%	1.4%
Smilacina stellata	P		P	0.0%	0.0%	0.0%
Thalictrum occidentale	P		P	0.0%	0.0%	0.0%
Trillium ovatum	P		P	0.0%	0.0%	0.0%
Viola glabella	P		P	0.0%	0.0%	0.0%
Viola orbiculata		4	0.0%	0.0%	4.0%	2.8%
Total % Perennial Forbs	2	10	2.0%	2.0%	10.0%	7.0%
CRYPTOGAMS						
Moss		4	0.0%	0.0%	4.0%	2.8%
Pteridium aquilinum	P		P	0.0%	0.0%	0.0%
Total % Cryptogams	0	4	0.0%	0.0%	4.0%	2.8%
TOTAL % VEGETATION	100	142	100.0%	100.0%	142.0%	100.0%
Soil			0.0%			
Litter			0.0%			
Rock			0.0%			

P = SPECIES PRESENT, BUT
NOT ENCOUNTERED QUANTITATIVELY

TABLE 9. (CONTINUED)

TREE DENSITY

	MEAN NO. TREES/ 125 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY
TREES			
Abies grandis	6.0	194.2	66.7%
Larix occidentalis	2.0	64.8	22.2%
Tsuga heterophylla	1.0	32.4	11.1%
Total Trees	9.0	291.4	100.0%

TREE REPRODUCTION

	MEAN NO. SHRUBS/ 25 SQ METERS	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY
TREES			
Abies grandis	10.0	1618.8	100.0%
Tsuga heterophylla	Present		
Total Trees Reproduction	10.0	1618.8	100.0%

TREE HEIGHT (FEET)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	68	86	75.3
Larix occidentalis	100	110	105.0
Tsuga heterophylla	6	6	6.0

TABLE 9. (CONTINUED)

TREE DBH (INCHES)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	9.8	18.5	12.5
Larix occidentalis	19.7	26.4	23.0
Tsuga heterophylla	0.4	0.4	0.4

TREE BASAL AREA AND VOLUME

	THOUSAND BOARD FEET PER ACRE	BASAL AREA (SQ FEET) PER ACRE	QUADRATIC MEAN DIAMETER (INCHES)
Abies grandis	24.0	177.7	11.0
Abies lasiocarpa			
Larix occidentalis	35.1	191.3	23.3
Picea engelmannii			
Pinus contorta			
Pinus monticola			
Populus trichocarpa			
Pseudotsuga menziesii			
Thuja plicata			
Tsuga heterophylla		< 0.1	0.4
Total Trees	59.1	369.0	

TABLE 9. (CONTINUED)

SHRUB DENSITY

	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY
TALL SHRUBS			
Taxus brevifolia	2.0	323.8	6.7%
Total Tall Shrubs	2.0	323.8	6.7%
LOW SHRUBS			
Pachistima myrsinites	24.0	3885.1	80.0%
Rosa gymnocarpa	4.0	647.5	13.3%
Total Low Shrubs	28.0	4532.6	93.3%
TOTAL SHRUBS	30.0	4856.4	100.0%

HERBACEOUS PRODUCTION

SAMPLE NUMBER	65A	65B	65C	65D	GRAMS/ SQ M	LBS/ ACRE	REL. PROD.
Perennial Graminoids		0.1		2.1	0.5	4.9	9.1%
Annual Graminoids					0.0	0.0	0.0%
Perennial Forbs	6.6	1.6	1.3	12.4	5.5	48.7	90.9%
Annual & Biennial Forbs					0.0	0.0	0.0%
Total Production	6.6	1.7	1.3	14.5	6.0	53.6	100.0%

TABLE 10. CLEARCUT COVER; TREE DENSITY, REPRODUCTION, HEIGHT, DBH; SHRUB DENSITY; AND HERBACEOUS PRODUCTION DATA - LIBBY CREEK FACILITIES, SAMPLE #66

COVER

	1st Hit	All Hits	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS
TREES						
Abies lasiocarpa	P		P	0.0%	0.0%	0.0%
Picea engelmannii	4	8	4.0%	4.2%	8.0%	4.2%
Pinus contorta	2	2	2.0%	2.1%	2.0%	1.0%
Populus trichocarpa	P		P	0.0%	0.0%	0.0%
Total % Trees	6	10	6.0%	6.3%	10.0%	5.2%
TALL SHRUBS						
Alnus sinuata	P		P	0.0%	0.0%	0.0%
Total % Tall Shrubs	0	0	0.0%	0.0%	0.0%	0.0%
LOW SHRUBS						
Ribes lacustre	P		P	0.0%	0.0%	0.0%
Salix scouleriana	P		P	0.0%	0.0%	0.0%
Symphoricarpos albus	2	4	2.0%	2.1%	4.0%	2.1%
Total % Low Shrubs	2	4	2.0%	2.1%	4.0%	2.1%
SUBSHRUBS						
Rubus parviflorus		4	0.0%	0.0%	4.0%	2.1%
Total % Subshrubs	0	4	0.0%	0.0%	4.0%	2.1%
PERENNIAL GRAMINOIDS						
Agrostis alba	2	10	2.0%	2.1%	10.0%	5.2%
Bromus vulgaris	4	12	4.0%	4.2%	12.0%	6.3%
Calamagrostis canadensis		10	0.0%	0.0%	10.0%	5.2%
Carex concinnoides	2	2	2.0%	2.1%	2.0%	1.0%
Dactylis glomerata	P		P	0.0%	0.0%	0.0%
Elymus glaucus	12	26	12.0%	12.5%	26.0%	13.6%
Festuca subulata	2	2	2.0%	2.1%	2.0%	1.0%
Phleum pratense	2	2	2.0%	2.1%	2.0%	1.0%
Total % Perennial Graminoids	24	64	24.0%	25.0%	64.0%	33.3%
PERENNIAL FORBS						
Achillea millefolium		4	0.0%	0.0%	4.0%	2.1%
Anaphalis margaritacea		2	0.0%	0.0%	2.0%	1.0%

TABLE 10. (CONTINUED)

COVER

	1st Hit	All Hits	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS
Angelica arguta	P		P	0.0%	0.0%	0.0%
Campanula rotundifolia	P		P	0.0%	0.0%	0.0%
Castilleja miniata	2	2	2.0%	2.1%	2.0%	1.0%
Cirsium spp.	P		P	0.0%	0.0%	0.0%
Epilobium angustifolium	24	30	24.0%	25.0%	30.0%	15.7%
Fragaria vesca	P		P	0.0%	0.0%	0.0%
Geranium viscosisimum	P		P	0.0%	0.0%	0.0%
Geum macrophyllum	4	10	4.0%	4.1%	10.0%	5.2%
Heracleum lanatum	P		P	0.0%	0.0%	0.0%
Hieracium aurantiacum		2	0.0%	0.0%	2.0%	1.0%
Penstemon confertus	2	6	2.0%	2.1%	6.0%	3.2%
Pyrola asarifolia		2	0.0%	0.0%	2.0%	1.0%
Pyrola secunda	2	2	2.0%	2.1%	2.0%	1.0%
Smilacina stellata	4	6	4.0%	4.1%	6.0%	3.2%
Solidago canadensis	14	22	14.0%	14.6%	22.0%	11.5%
Thalictrum occidentale		2	0.0%	0.0%	2.0%	1.0%
Veratrum viride	2	2	2.0%	2.1%	2.0%	1.0%
Viola glabella		4	0.0%	0.0%	4.0%	2.1%
Total % Perennial Forbs	54	96	54.0%	56.2%	96.0%	50.0%
CRYPTOGAMS						
Equisetum arvense		2	0.0%	0.0%	2.0%	1.0%
Moss		2	0.0%	0.0%	2.0%	1.1%
Pteridium aquilinum	10	10	10.0%	10.4%	10.0%	5.2%
Total % Cryptogams	10	14	10.0%	10.4%	14.0%	7.3%
TOTAL % VEGETATION	96	192	96.0%	100.0%	192.0%	100.0%
Soil			0.0%			
Litter	4	4	4.0%			
Rock			0.0%			

P = SPECIES PRESENT, BUT
NOT ENCOUNTERED QUANTITATIVELY

TABLE 10. (CONTINUED)

TREE DENSITY

	MEAN NO. TREES/ 125 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY
TREES			
Abies lasiocarpa	1.0	32.4	10.0%
Picea engelmannii	7.0	226.6	70.0%
Pinus contorta	2.0	64.8	20.0%
Total Trees	10.0	323.8	100.0%

TREE REPRODUCTION

	MEAN NO. SHRUBS/ 25 SQ METERS	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY
TREES			
Picea engelmannii	10.0	1618.8	90.9%
Populus trichocarpa	1.0	161.9	9.1%
Tsuga heterophylla	Present		
Total Trees Reproduction	11.0	1780.7	100.0%

TREE HEIGHT (FEET)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies lasiocarpa	23	23	23.0
Picea engelmannii	6	7	6.1
Pinus contorta	21	23	22.0

TABLE 10. (CONTINUED)

TREE DBH (INCHES)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies lasiocarpa	3.1	3.1	3.1
Picea engelmannii	0.4	0.8	0.4
Pinus contorta	4.7	5.1	4.9

SHRUB DENSITY

	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY
TALL SHRUBS			
Taxus brevifolia	1.0	161.9	6.2%
Total Tall Shrubs	1.0	161.9	6.2%
LOW SHRUBS			
Spiraea betulifolia	6.0	971.3	37.5%
Symphoricarops albus	7.0	1133.1	43.8%
Total Low Shrubs	13.0	2104.4	81.3%
SUBSHRUBS			
Rubus parviflorus	2.0	323.7	12.5%
Total Subshrubs	2.0	323.7	12.5%
TOTAL SHRUBS	16.0	2590.0	100.0%

TABLE 10. (CONTINUED)

HERBACEOUS PRODUCTION

SAMPLE NUMBER	66A	66B	66C	66D	GRAMS/ SQ M	LBS/ ACRE	REL. PROD.
Perennial Graminoids	9.6	13.8	88.5	57.9	42.4	377.9	26.2%
Annual Graminoids					0.0	0.0	0.0%
Perennial Forbs	105.8	80.4	199.1	94.2	119.9	1067.3	73.8%
Annual & Biennial Forbs					0.0	0.0	0.0%
Total Production	115.4	94.2	287.6	152.1	162.3	1445.2	100.0%

TABLE 11. CONIFEROUS FOREST COVER; TREE DENSITY, REPRODUCTION, HEIGHT, DBH, BASAL AREA AND VOLUME; SHRUB DENSITY; AND HERBACEOUS PRODUCTION DATA - ALL SAMPLES 1988-1989

COVER

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
TREES					
Abies grandis	18.3%	19.2%	21.6%	12.9%	83.3%
Abies lasiocarpa	3.0%	3.1%	2.9%	1.8%	9.5%
Larix occidentalis	4.8%	5.1%	4.9%	2.9%	45.2%
Picea engelmannii	8.0%	8.4%	9.1%	5.4%	64.3%
Pinus contorta	2.0%	2.2%	2.1%	1.3%	19.0%
Pinus monticola	2.1%	2.3%	2.3%	1.4%	40.5%
Populus trichocarpa	1.7%	1.7%	1.7%	1.0%	2.4%
Pseudotsuga menziesii	4.8%	5.1%	5.6%	3.3%	45.2%
Thuja plicata	10.0%	10.4%	13.9%	8.3%	57.1%
Tsuga heterophylla	19.4%	20.4%	23.0%	13.8%	88.1%
Total % Trees	74.1%	77.9%	87.1%	52.1%	
TREES - DEAD					
Abies grandis	< 0.1	< 0.1	< 0.1	< 0.1	2.4%
Pinus contorta	1.1%	1.2%	1.1%	0.7%	4.8%
Total % Trees - Dead	1.2%	1.3%	1.2%	0.7%	
TALL SHRUBS					
Acer glabrum	2.9%	3.1%	4.2%	2.5%	38.1%
Alnus sinuata	1.9%	2.0%	2.1%	1.3%	16.7%
Sorbus scopulina	P	0.0%	0.0%	0.0%	7.1%
Sorbus sitchensis	< 0.1	< 0.1	< 0.1	< 0.1	9.5%
Taxus brevifolia	1.1%	1.2%	2.5%	1.5%	35.7%
Total % Tall Shrubs	6.0%	6.3%	8.9%	5.3%	
LOW SHRUBS					
Amelanchier alnifolia	0.0%	0.0%	0.3%	0.2%	28.6%
Cornus stolonifera	< 0.1	< 0.1	0.3%	0.2%	9.5%
Holodiscus discolor	0.0%	0.0%	< 0.1	< 0.1	2.4%
Lonicera ciliosa	P	0.0%	0.0%	0.0%	4.8%
Lonicera involucrata	P	0.0%	< 0.1	< 0.1	4.8%
Lonicera utahensis	0.0%	0.0%	0.2%	0.1%	50.0%
Menziesia ferruginea	0.2%	0.2%	0.2%	0.1%	21.4%
Oplopanax horridum	1.1%	1.2%	2.7%	1.6%	28.6%
Pachistima myrsinites	< 0.1	< 0.1	1.0%	0.6%	64.3%

TABLE 11. (CONTINUED)

	COVER				
	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Rhamnus alnifolia	0.0%	0.0%	0.1%	0.1%	4.8%
Ribes lacustre	0.0%	0.0%	0.1%	0.1%	28.6%
Ribes viscosissimum	P	0.0%	0.0%	0.0%	2.4%
Rosa gymnocarpa	0.1%	0.2%	0.7%	0.4%	50.0%
Rosa nutkana	P	0.0%	0.0%	0.0%	4.8%
Rubus idaeus	P	0.0%	0.0%	0.0%	4.8%
Salix scouleriana	< 0.1	< 0.1	< 0.1	< 0.1	4.8%
Sambucus racemosa	< 0.1	< 0.1	0.3%	0.2%	11.9%
Sheperdia canadensis	P	0.0%	< 0.1	< 0.1	9.5%
Spiraea betulifolia	< 0.1	< 0.1	0.5%	0.3%	47.6%
Symphoricarpos albus	0.3%	0.4%	1.5%	0.9%	21.4%
Vaccinium cespitosum	P	0.0%	0.0%	0.0%	2.4%
Vaccinium globulare	0.4%	0.4%	1.6%	0.9%	64.3%
Vaccinium myrtillus	0.0%	0.0%	0.4%	0.3%	26.2%
					0.0%
Total % Low Shrubs	2.4%	2.5%	10.2%	6.1%	0.0%
SUBSHRUBS					
Arctostaphylos uva-ursi	P	0.0%	0.0%	0.0%	4.8%
Berberis repens	0.0%	0.0%	0.2%	0.1%	21.4%
Chimaphila umbellata	0.3%	0.4%	1.1%	0.7%	42.9%
Cornus canadensis	0.0%	0.0%	0.2%	0.1%	19.0%
Linnaea borealis	0.6%	0.6%	3.0%	1.8%	54.8%
Penstemon ellipticus	P	0.0%	0.0%	0.0%	2.4%
Rubus parviflorus	0.6%	0.6%	2.4%	1.5%	40.5%
Rubus pedatus	0.0%	0.0%	0.2%	0.1%	2.4%
Total % Subshrubs	1.5%	1.6%	7.1%	4.3%	
PERENNIAL GRAMINOIDS					
Bromus vulgaris	0.0%	0.0%	0.3%	0.2%	35.7%
Calamagrostis canadensis	0.0%	0.0%	< 0.1	< 0.1	9.5%
Calamagrostis inexpansa	P	0.0%	0.0%	0.0%	2.4%
Calamagrostis rubescens	0.1%	0.1%	0.3%	0.2%	21.4%
Carex concinnoides	P	0.0%	< 0.1	< 0.1	4.8%
Carex deweyana	P	0.0%	0.0%	0.0%	4.8%
Carex rossii	P	0.0%	0.0%	0.0%	4.8%
Carex stipata	0.0%	0.0%	0.1%	< 0.1	2.4%
Deschampsia elongata	< 0.1	< 0.1	< 0.1	< 0.1	2.4%
Elymus glaucus	< 0.1	< 0.1	0.1%	< 0.1	7.1%

TABLE 11. (CONTINUED)

COVER

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Habenaria obtusata	P	0.0%	0.0%	0.0%	2.4%
Heracleum lanatum	P	0.0%	0.0%	0.0%	2.4%
Hieracium albiflorum	P	0.0%	0.0%	0.0%	28.6%
Hieracium cynoglossoides	P	0.0%	0.0%	0.0%	2.4%
Ligusticum verticillatum	P	0.0%	0.0%	0.0%	7.1%
Listera convallarioides	P	0.0%	0.0%	0.0%	11.9%
Mitella breweri	0.0%	0.0%	< 0.1	< 0.1	4.8%
Osmorhiza chilensis	0.0%	0.0%	0.1%	0.1%	40.5%
Pedicularis bracteosa	P	0.0%	0.0%	0.0%	2.4%
Polemonium pulcherrimum	P	0.0%	0.0%	0.0%	2.4%
Pyrola asarifolia	0.1%	0.1%	0.2%	0.1%	42.9%
Pyrola chlorantha	0.0%	0.0%	< 0.1	< 0.1	9.5%
Pyrola minor	P	0.0%	0.0%	0.0%	2.4%
Pyrola secunda	< 0.1	< 0.1	0.3%	0.2%	47.6%
Pyrola uniflora	< 0.1	< 0.1	0.1%	< 0.1	11.9%
Saxifraga ferruginea	P	0.0%	< 0.1	< 0.1	2.4%
Senecio triangularis	0.1%	0.1%	0.3%	0.2%	9.5%
Smilacina stellata	0.2%	0.3%	3.2%	1.9%	71.4%
Streptopus amplexifolius	< 0.1	< 0.1	0.3%	0.2%	19.0%
Thalictrum occidentale	0.1%	0.1%	0.6%	0.4%	42.9%
Tiarella trifoliata	0.5%	0.6%	4.3%	2.6%	64.3%
Trillium ovatum	0.0%	0.0%	0.1%	< 0.1	50.0%
Urtica dioica	P	0.0%	0.0%	0.0%	4.8%
Veratrum viride	< 0.1	< 0.1	0.1%	< 0.1	16.7%
Veronica americana	0.0%	0.0%	< 0.1	< 0.1	4.8%
Viola glabella	0.0%	0.0%	0.7%	0.4%	57.1%
Viola orbiculata	0.2%	0.2%	0.6%	0.3%	61.9%
Xerophyllum tenax	0.9%	1.0%	2.8%	1.7%	38.1%
Total % Perennial Forbs	4.4%	4.5%	28.0%	16.7%	
ANNUAL & BIENNIAL FORBS					
Melampyrum lineare	0.1%	0.1%	0.1%	< 0.1	7.1%
Verbascum thapsus	P	0.0%	0.0%	0.0%	4.8%
Total % Annual & Biennial Forbs	0.1%	0.1%	0.1%	< 0.1	
CRYPTOGAMS					
Athyrium filix-femina	2.6%	2.8%	7.0%	4.2%	47.6%
Dryopteris filix-mas	< 0.1	< 0.1	< 0.1	< 0.1	4.8%

TABLE 11. (CONTINUED)

COVER

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Equisetum arvense	0.1%	0.2%	1.1%	0.7%	14.3%
Equisetum hyemale	P	0.0%	0.0%	0.0%	2.4%
Gymnocarpium dryopteris	0.6%	0.7%	5.6%	3.4%	42.9%
Lycopodium annotinum	P	0.0%	0.0%	0.0%	2.4%
Moss	1.2%	1.3%	7.1%	4.2%	81.0%
Polystichum andersonii	P	0.0%	0.0%	0.0%	2.4%
Polystichum lonchitis	P	0.0%	0.0%	0.0%	2.4%
Pteridium aquilinum	0.5%	0.5%	1.5%	0.9%	33.3%
Thelypteris phegopteris	P	0.0%	0.0%	0.0%	2.4%
Total % Cryptogams	5.1%	5.4%	22.4%	13.4%	
TOTAL % VEGETATION	95.2%	100.0%	167.1%	100.0%	
Soil					
Litter	4.8%				
Rock					

P = SPECIES PRESENT BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 11. (CONTINUED)

TREE DENSITY

	MEAN NO. TREES/ 125 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TREES				
Abies grandis	5.3	172.7	26.1%	
Abies lasiocarpa	0.5	16.2	2.5%	
Larix occidentalis	1.1	35.4	5.4%	
Picea engelmannii	1.6	50.9	7.7%	
Pinus contorta	1.5	47.8	7.2%	
Pinus monticola	1.2	38.5	5.8%	
Populus trichocarpa	0.0	1.5	0.2%	
Pseudotsuga menziesii	1.2	40.1	6.1%	
Thuja plicata	4.0	128.0	19.4%	
Tsuga heterophylla	4.0	129.5	19.6%	
Total Trees	20.4	660.6	100.0%	17.3
TREES (DEAD)				
Abies grandis	0.3	10.8	12.3%	
Abies lasiocarpa	0.1	2.3	2.6%	
Larix occidentalis	0.2	7.7	8.8%	
Picea engelmannii	0.3	9.3	10.5%	
Pinus contorta	1.1	34.7	39.5%	
Pinus monticola	0.5	17.7	20.2%	
Tsuga heterophylla	0.1	3.9	4.4%	
Thuja plicata	< 0.1	1.5	1.7%	
Total Trees (Dead)	2.7	87.9	100.0%	4.6

TREE REPRODUCTION

	MEAN SHRUBS/25 SQ M	MEAN SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TREES (< 1.3m dbh)				
Abies grandis	2.5	404.7	16.5%	
Picea engelmannii	0.2	38.5	1.6%	
Pseudotsuga menziesii	0.1	11.6	0.5%	
Thuja plicata	1.4	231.2	9.4%	
Tsuga heterophylla	10.9	1761.4	72.0%	
Total Tree Reproduction	15.1	2447.4	100.0%	26.8

TABLE 11. (CONTINUED)

TREE HEIGHT (FEET)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	3	96	29.5
Abies lasiocarpa	5	94	38.7
Larix occidentalis	9	128	74.2
Picea engelmannii	5	105	43.2
Pinus contorta	8	81	46.6
Pinus monticola	6	114	31.9
Pseudotsuga menziesii	6	109	45.7
Thuja plicata	5	101	24.1
Tsuga heterophylla	1	108	31.5
Total Trees			34.8
TREES (DEAD)			
Abies grandis	38	38	38.0
Larix occidentalis	96	96	96.0
Picea engelmannii	13	42	24.4
Pinus contorta	16	16	16.0
Pinus moniticola	12	99	55.5
Total Dead Trees			43.5

TABLE 11. (CONTINUED)

TREE DBH (INCHES)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	0.4	25.2	4.8
Abies lasiocarpa	0.4	28.3	8.4
Larix occidentalis	0.4	26.8	10.1
Picea engelmannii	0.4	30.3	8.0
Pinus contorta	0.8	16.1	5.6
Pinus monticola	0.4	32.7	5.0
Populus trichocarpa	33.1	35.0	34.1
Pseudotsuga menziesii	0.4	31.1	7.9
Thuja plicata	0.4	26.8	4.3
Tsuga heterophylla	0.4	46.5	4.9
Total Trees			5.7
TREES (DEAD)			
Abies grandis	1.6	13.8	5.1
Abies lasiocarpa	3.5	10.2	6.0
Larix occidentalis	1.6	12.2	15.3
Picea engelmannii	1.2	11.0	3.6
Pinus contorta	1.6	9.8	5.8
Pinus monticola	0.4	26.4	4.8
Pseudotsuga menziesii	7.9	7.9	7.9
Thuja plicata	2.8	3.1	3.0
Tsuga heterophylla	2.0	6.7	3.7
Total Dead Trees			5.7

TREE BASAL AREA AND VOLUME

	THOUSAND BOARD FEET PER ACRE	BASAL AREA (SQ FEET) PER ACRE	QUADRATIC MEAN DIAMETER (INCHES)
Abies grandis	4.0	39.5	6.5
Abies lasiocarpa	1.1	11.6	11.5
Larix occidentalis	3.9	27.4	11.6
Picea engelmannii	2.7	31.5	10.8
Pinus contorta	0.2	22.5	8.2
Pinus monticola	2.7	16.3	5.2
Populus trichocarpa	*	9.8	34.1
Pseudotsuga menziesii	3.7	26.7	11.6
Thuja plicata	1.5	35.1	7.3
Tsuga heterophylla	5.1	49.4	8.7
Total Trees	24.9	269.8	

* Tree height data not available

TABLE 11. (CONTINUED)

SHRUB DENSITY

	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TALL SHRUBS				
Acer glabrum	1.3	208.1	3.0%	
Alnus sinuata	0.2	34.7	0.5%	
Sorbus scopulina	0.1	19.3	0.3%	
Taxus brevifolia	0.5	73.2	1.0%	
Total Tall Shrubs	2.1	335.3	4.8%	
LOW SHRUBS				
Amelanchier alnifolia	1.2	196.6	2.8%	
Cornus stolonifera	0.1	15.4	0.2%	
Holodiscus discolor	0.1	11.6	0.2%	
Lonicera utahensis	0.7	119.5	1.7%	
Menziesia ferruginea	0.2	34.7	0.5%	
Oplopanax horridum	2.1	339.2	4.9%	
Pachistima myrsinites	7.6	1233.4	17.7%	
Rhamnus alnifolia	0.1	23.1	0.3%	
Ribes lacustre	0.3	42.4	0.6%	
Ribes viscosissiumum	< 0.1	3.8	< 0.1	
Rosa gymnocarpa	4.0	647.5	9.3%	
Rosa nutkana	0.2	27.0	0.4%	
Rubus idaeus	< 0.1	3.8	< 0.1	
Salix scouleriana	0.1	15.4	0.2%	
Sambucus racemosa	0.1	19.3	0.3%	
Shepheria canadensis	0.1	15.4	0.2%	
Spiraea betulifolia	3.3	531.9	7.6%	
Symphoricarops albus	3.0	477.9	6.9%	
Vaccinium globulare	9.6	1553.3	22.3%	
Vaccinium myrtillus	3.0	485.6	7.0%	
Vaccinium scoparium	< 0.1	3.8	< 0.1	
Total Low Shrubs	35.8	5800.6	83.3%	
SUBSHRUBS				
Berberis repens	1.9	308.3	4.4%	
Rubus parviflorus	3.2	520.3	7.5%	
Total Subshrubs	5.1	828.6	11.9%	
TOTAL SHRUBS	43.0	6964.6	100.0%	36.0

TABLE 11. (CONTINUED)

HERBACEOUS PRODUCTION

	GRAMS SQ M (MEAN)	LBS/ ACRE	REL. PROD.	STD DEV
Perennial Graminoids	0.6	5.0	3.5%	
Annual Graminoids	0.0	0.0	0.0%	
Perennial Forbs	15.6	139.2	96.5%	
Annual & Biennial Forbs	0.0	0.0	0.0%	
Total Production	16.2	144.3	100.0%	23.4

TABLE 12. CLEARCUT COVER; TREE DENSITY, REPRODUCTION, HEIGHT, DBH; SHRUB DENSITY; AND HERBACEOUS PRODUCTION DATA - ALL SAMPLES 1988-1989

COVER

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
TREES					
Abies grandis	1.4%	1.8%	1.4%	1.3%	70.6%
Abies lasiocarpa	0.2%	0.3%	0.5%	0.4%	35.3%
Larix occidentalis	3.8%	4.7%	3.9%	3.6%	94.1%
Picea engelmannii	2.5%	3.1%	3.1%	2.9%	76.5%
Pinus contorta	4.2%	5.3%	4.4%	4.0%	76.5%
Pinus monticola	1.0%	1.2%	1.1%	1.0%	76.5%
Populus tremuloides	P	0.0%	0.0%	0.0%	23.5%
Populus trichocarpa	0.9%	1.2%	0.9%	0.9%	64.7%
Pseudotsuga menziesii	3.1%	3.8%	3.1%	2.9%	64.7%
Thuja plicata	3.3%	4.1%	5.3%	4.9%	29.4%
Tsuga heterophylla	0.2%	0.3%	0.4%	0.3%	35.3%
Total % Trees	20.6%	25.8%	24.1%	22.2%	
TALL SHRUBS					
Alnus sinuata	3.3%	4.1%	3.8%	3.5%	70.6%
Sorbus scopulina	P	0.0%	0.0%	0.0%	5.9%
Sorbus sitchensis	P	0.0%	0.0%	0.0%	5.9%
Total % Tall Shrubs	3.3%	4.1%	3.8%	3.5%	
LOW SHRUBS					
Amelanchier alnifolia	0.5%	0.6%	0.7%	0.7%	52.9%
Ceanothus velutinus	2.4%	2.9%	2.4%	2.2%	17.6%
Cornus stolonifera	P	0.0%	0.0%	0.0%	11.8%
Holodiscus discolor	P	0.0%	0.0%	0.0%	17.6%
Lonicera ciliosa	0.2%	0.3%	0.4%	0.3%	29.4%
Lonicera utahensis	0.2%	0.3%	0.4%	0.3%	58.8%
Pachistima myrsinites	3.1%	3.8%	4.4%	4.0%	76.5%
Ribes lacustre	P	0.0%	0.0%	0.0%	17.6%
Ribes spp.	P	0.0%	0.0%	0.0%	5.9%
Rosa gymnocarpa	0.5%	0.6%	0.4%	0.4%	47.1%
Rubus idaeus	P	0.0%	0.0%	0.0%	29.4%
Salix brachycarpa	P	0.0%	0.0%	0.0%	5.9%
Salix lutea	P	0.0%	0.0%	0.0%	5.9%
Salix scouleriana	0.6%	0.7%	0.7%	0.7%	47.1%
Salix wolfii	P	0.0%	0.0%	0.0%	5.9%
Sambucus racemosa	0.1%	0.1%	0.1%	0.1%	5.9%
Sheperdia canadensis	0.5%	0.6%	0.7%	0.7%	35.3%

TABLE 12. (CONTINUED)

	COVER				
	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Spiraea betulifolia	1.8%	2.2%	3.4%	3.1%	88.2%
Spiraea douglasii	0.1%	0.2%	0.1%	0.1%	17.6%
Symphoricarpos albus	0.1%	0.2%	0.2%	0.2%	29.4%
Vaccinium globulare	1.4%	1.8%	1.9%	1.7%	23.5%
Vaccinium myrtillus	0.9%	1.2%	1.5%	1.4%	35.3%
Vaccinium scoparium	P	0.0%	0.0%	0.0%	5.9%
Total % Low Shrubs	12.4%	15.5%	17.3%	15.9%	
SUBSHRUBS					
Arctostaphylos uva-ursi	1.8%	2.2%	3.5%	3.3%	52.9%
Berberis repens	0.6%	0.7%	0.6%	0.5%	47.1%
Chimaphila umbellata	P	0.0%	0.0%	0.0%	11.8%
Cornus canadensis	0.2%	0.3%	0.6%	0.5%	23.5%
Linnaea borealis	0.9%	1.2%	1.2%	1.1%	47.1%
Rubus parviflorus	0.5%	0.6%	0.7%	0.7%	52.9%
Total % Subshrubs	4.0%	5.0%	6.6%	6.1%	
PERENNIAL GRAMINOIDS					
Agropyron repens	P	0.0%	0.0%	0.0%	5.9%
Agrostis alba	0.7%	0.9%	1.2%	1.1%	29.4%
Agrostis exarata	0.1%	0.2%	0.1%	0.1%	23.5%
Bromus anomalous	0.1%	0.1%	0.1%	0.1%	11.8%
Bromus vulgaris	0.5%	0.6%	1.0%	0.9%	17.6%
Calamagrostis canadensis	0.0%	0.0%	0.6%	0.5%	5.9%
Calamagrostis purpurascens	1.2%	1.5%	1.2%	1.1%	11.8%
Calamagrostis rubescens	6.0%	7.5%	7.4%	6.8%	64.7%
Carex concinnoides	2.1%	2.7%	3.2%	3.0%	76.5%
Carex geyeri	P	0.0%	0.0%	0.0%	17.6%
Carex mertensii	P	0.0%	0.0%	0.0%	5.9%
Carex microptera	P	0.0%	0.0%	0.0%	11.8%
Carex rossii	0.4%	0.4%	0.5%	0.4%	5.9%
Dactylis glomerata	0.1%	0.2%	0.1%	0.1%	17.6%
Elymus glaucus	0.7%	0.9%	1.5%	1.4%	17.6%
Festuca occidentalis	1.1%	1.3%	1.3%	1.2%	64.7%
Festuca subulata	0.1%	0.1%	0.1%	0.1%	11.8%
Luzula glabrata	P	0.0%	0.0%	0.0%	5.9%
Melica subulata	0.1%	0.1%	0.1%	0.1%	11.8%
Phleum pratense	0.2%	0.3%	0.2%	0.2%	23.5%

TABLE 12. (CONTINUED)

COVER

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Poa palustrus	P	0.0%	0.0%	0.0%	5.9%
Poa pratensis	P	0.0%	0.0%	0.0%	5.9%
Stipa occidentalis	0.1%	0.2%	0.1%	0.1%	11.8%
Trisetum canescens	0.1%	0.1%	0.1%	0.1%	5.9%
Total % Perennial Graminoids	13.6%	17.1%	18.8%	17.3%	
ANNUAL GRAMINOIDS					
Deschampsia danthoniodes	0.1%	0.1%	0.1%	0.1%	7.1%
Total % Annual Graminoids	0.1%	0.1%	0.1%	0.1%	
PERENNIAL FORBS					
Achillea millefolium	0.4%	0.4%	0.8%	0.8%	52.9%
Agoseris glauca	P	0.0%	0.0%	0.0%	17.6%
Anaphalis margaritacea	0.5%	0.6%	1.3%	1.2%	94.1%
Angelica arguta	P	0.0%	0.0%	0.0%	5.9%
Antennaria microphylla	P	0.0%	0.0%	0.0%	11.8%
Aralia nudicaulis	P	0.0%	0.0%	0.0%	5.9%
Arnica amplexicaulis	P	0.0%	0.0%	0.0%	5.9%
Arnica cordifolia	0.1%	0.2%	0.5%	0.4%	17.6%
Arnica latifolia	0.1%	0.2%	0.2%	0.2%	23.5%
Aster chilensis	P	0.0%	0.0%	0.0%	17.6%
Aster eatonii	P	0.0%	0.0%	0.0%	5.9%
Aster laevis	P	0.0%	0.0%	0.0%	5.9%
Campanula rotundifolia	P	0.0%	0.0%	0.0%	17.6%
Castilleja miniata	0.1%	0.2%	0.1%	0.1%	35.3%
Cerastium arvense	P	0.0%	0.0%	0.0%	11.8%
Cirsium spp.	P	0.0%	0.0%	0.0%	5.9%
Cirsium arvense	0.1%	0.1%	0.1%	0.1%	23.5%
Cirsium flodmanii	P	0.0%	0.1%	0.1%	5.9%
Cirsium vulgare	0.1%	0.1%	0.1%	0.1%	11.8%
Clintonia uniflora	P	0.0%	0.1%	0.1%	47.1%
Coptis occidentalis	0.2%	0.3%	0.6%	0.6%	64.7%
Epilobium angustifolium	5.1%	6.3%	6.0%	5.6%	88.2%
Erigeron peregrinus	P	0.0%	0.0%	0.0%	5.9%
Fragaria vesca	P	0.0%	0.0%	0.0%	5.9%
Fragaria virginiana	3.5%	4.4%	4.4%	4.0%	64.7%
Galium triflorum	P	0.0%	0.0%	0.0%	23.5%
Gentiana amarella	P	0.0%	0.0%	0.0%	17.6%

TABLE 12. (CONTINUED)

COVER

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Geranium viscosisimum	P	0.0%	0.0%	0.0%	5.9%
Geum macrophyllum	0.2%	0.3%	0.6%	0.5%	17.6%
Goodyera oblongfolia	P	0.0%	0.0%	0.0%	5.9%
Heracleum lanatum	P	0.0%	0.0%	0.0%	5.9%
Hieracium albiflorum	0.2%	0.3%	0.4%	0.3%	76.5%
Hieracium aurantiacum	1.8%	2.2%	3.1%	2.8%	58.8%
Osmorhiza chilensis	P	0.0%	0.0%	0.0%	11.8%
Pedicularis racemosa	P	0.0%	0.0%	0.0%	5.9%
Penstemon confertus	0.1%	0.2%	0.4%	0.3%	17.6%
Penstemon eriantherus	P	0.0%	0.0%	0.0%	5.9%
Penstemon spp.	P	0.0%	0.0%	0.0%	5.9%
Polemonium pulcherrimum	P	0.0%	0.0%	0.0%	17.6%
Prunella vulgaris	P	0.0%	0.0%	0.0%	11.8%
Pyrola asarifolia	P	0.0%	0.1%	0.1%	17.6%
Pyrola chlorantha	P	0.0%	0.0%	0.0%	5.9%
Pyrola secunda	0.1%	0.2%	0.1%	0.1%	17.6%
Ranunculus spp.	P	0.0%	0.0%	0.0%	5.9%
Smilacina stellata	0.6%	0.7%	1.3%	1.2%	52.9%
Solidago canadensis	2.2%	2.8%	2.7%	2.5%	82.4%
Solidago multiradiata	P	0.0%	0.0%	0.0%	5.9%
Taraxacum officinale	P	0.0%	0.0%	0.0%	23.5%
Thalictrum occidentale	0.1%	0.2%	0.4%	0.4%	17.6%
Tiarella trifoliata	P	0.0%	0.1%	0.1%	11.8%
Tragopogon dubius	P	0.0%	0.0%	0.0%	17.6%
Trillium ovatum	P	0.0%	0.0%	0.0%	5.9%
Trifolium pratense	0.1%	0.1%	0.1%	0.1%	5.9%
Trifolium repens	1.1%	1.3%	1.2%	1.1%	29.4%
Veratrum viride	0.1%	0.1%	0.1%	0.1%	5.9%
Viola glabella	0.0%	0.0%	0.2%	0.2%	5.9%
Viola orbiculata	0.0%	0.0%	0.2%	0.2%	17.6%
Xerophyllum tenax	2.1%	2.7%	2.5%	2.3%	52.9%
Total % Perennial Forbs	19.0%	24.0%	27.8%	25.6%	
ANNUAL & BIENNIAL FORBS					
Apocynum androsaefolium	P	0.0%	0.0%	0.0%	5.9%
Epilobium paniculatum	0.8%	1.0%	0.9%	0.9%	23.5%
Gentiana amarella	P	0.0%	0.0%	0.0%	5.9%
Melampyrum lineare	0.4%	0.5%	0.4%	0.3%	29.4%
Trifolium agrarium	0.0%	0.0%	0.1%	0.1%	17.6%

TABLE 12. (CONTINUED)

COVER

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Verbascum thapsus	0.2%	0.3%	0.2%	0.2%	5.9%
Total % Annual & Biennial Forbs	1.4%	1.8%	1.6%	1.5%	
CRYPTOGAMS	0.0%				
Equisetum arvense	0.1%	0.2%	0.3%	0.2%	17.6%
Gymnocarpium dryopteris	P	0.0%	0.0%	0.0%	5.9%
Lichen	0.1%	0.1%	0.1%	0.1%	5.9%
Moss	3.1%	3.8%	5.5%	5.1%	70.6%
Pteridium aquilinum	2.0%	2.5%	2.6%	2.4%	35.3%
Total % Cryptogams	5.3%	6.6%	8.5%	7.8%	
TOTAL % VEGETATION	79.7%	100.0%	108.6%	100.0%	
Soil	1.8%				
Litter	17.9%				
Rock	0.6%				

P = SPECIES PRESENT, BUT
NOT ENCOUNTERED QUANTITATIVELY

TABLE 12. (CONTINUED)

TREE DENSITY

	MEAN NO. TREES/ 125 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TREES				
Abies grandis	1.1	34.3	3.9%	
Abies lasiocarpa	0.3	9.5	1.1%	
Betula occidentalis	< 0.1	1.9	0.2%	
Larix occidentalis	4.1	131.4	15.0%	
Picea engelmannii	4.0	129.5	14.8%	
Pinus contorta	5.3	171.4	19.5%	
Pinus monticola	1.8	59.0	6.7%	
Pinus ponderosa	< 0.1	1.9	0.2%	
Populus trichocarpa	1.8	59.0	6.7%	
Pseudotsuga menziesii	2.3	74.3	8.5%	
Thuja plicata	6.3	203.8	23.2%	
Tsuga heterophylla	< 0.1	1.9	0.2%	
Total Trees	27.1	877.9	100.0%	27.3
TREES - DEAD				
Pinus contorta	0.5	15.2	57.2%	
Pinus monticola	< 0.1	1.9	7.1%	
Thuja plicata	0.3	9.5	35.7%	
Total Trees - Dead	0.8	26.6	100.0%	3.1

TREE REPRODUCTION

	MEAN NO. TREES/ 25 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
Abies grandis	1.1	180.9	8.0%	
Abies lasiocarpa	0.1	19.0	0.8%	
Larix occidentalis	2.0	323.8	14.3%	
Picea engelmannii	3.9	638.0	28.3%	
Pinus contorta	0.7	114.3	5.1%	
Pinus monticola	1.9	304.7	13.5%	
Pinus ponderosa	0.1	9.5	0.4%	
Populus tremuloides	0.1	9.5	0.4%	
Populus trichocarpa	1.8	285.7	12.7%	
Pseudotsuga menziesii	0.2	28.6	1.3%	
Thuja plicata	1.2	190.4	8.4%	
Tsuga heterophylla	0.9	152.4	6.8%	
Total Tree Reproduction	14.0	2266.3	100.0%	12.4

TABLE 12. (CONTINUED)

TREE HEIGHT (FEET)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	1	10	6.3
Abies lasiocarpa	7	23	12.4
Betula occidentalis	12	12	12.0
Larix occidentalis	6	70	18.8
Picea engelmannii	4	17	6.9
Pinus contorta	6	70	15.5
Pinus monticola	4	20	8.4
Pinus ponderosa	7	7	7.0
Populus trichocarpa	5	24	9.2
Pseudotsuga menziesii	5	39	14.6
Thuja plicata	5	41	12.8
Tsuga heterophylla	6	6	6.0
Total Trees			12.7

TREE DBH (INCHES)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	0.4	1.2	0.7
Abies lasiocarpa	1.2	3.1	2.1
Betula occidentalis	0.8	0.8	0.8
Larix occidentalis	0.4	10.2	2.1
Picea engelmannii	0.4	3.9	0.8
Pinus contorta	0.8	7.5	1.9
Pinus monticola	0.4	2.8	1.0
Pinus ponderosa	1.2	1.2	1.2
Populus trichocarpa	0.4	2.8	0.8
Pseudotsuga menziesii	0.4	3.9	1.9
Thuja plicata	0.4	5.1	1.6
Tsuga heterophylla	0.4	0.4	0.4
Total Trees			1.5
TREES (DEAD)			
Pinus contorta	3.9	9.4	7.0
Pinus monticola	0.4	0.4	0.4
Thuja plicata	0.8	2.4	1.4
Total Trees (Dead)			4.6

TABLE 12. (CONTINUED)

SHRUB DENSITY

	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TALL SHRUBS				
Acer glabrum	0.1	28.6	0.2%	
Alnus sinuata	2.0	323.7	2.2%	
Total Tall Shrubs	2.1	352.3	2.4%	
LOW SHRUBS				
Amelanchier alnifolia	1.4	219.0	1.5%	
Ceanothus velutinus	2.0	323.8	2.2%	
Cornus stolonifera	0.1	9.5	0.1%	
Holodiscus discolor	0.1	19.0	0.1%	
Lonicera utahensis	2.6	428.5	2.9%	
Pachistima myrsinites	14.2	2304.4	15.7%	
Ribes lacustre	0.4	66.7	0.5%	
Rosa gymnocarpa	7.2	1171.2	8.0%	
Rubus idaeus	0.5	76.2	0.5%	
Salix lutea	0.1	9.5	0.1%	
Salix scouleriana	0.6	104.7	0.7%	
Salix spp.	0.1	9.5	0.1%	
Shepherdia canadensis	0.5	76.2	0.5%	
Spiraea betulifolia	23.9	3866.0	26.3%	
Spiraea douglasii	0.1	9.5	0.1%	
Spiraea pyramidata	0.9	152.4	1.0%	
Symphoricarpos albus	1.3	209.5	1.4%	
Vaccinium globulare	8.7	1409.3	9.5%	
Vaccinium myrtillus	15.4	2494.8	17.0%	
Vaccinium scoparium	0.1	19.1	0.1%	
Total Low Shrubs	80.2	12978.8	88.3%	
SUBSHRUBS				
Berberis repens	4.8	771.3	5.2%	
Rubus parviflorus	3.7	599.9	4.1%	
Total Subshrubs	8.5	1371.2	9.3%	
TOTAL SHRUBS	90.8	14702.3	100.0%	56.1

TABLE 12. (CONTINUED)

HERBACEOUS PRODUCTION

	GRAMS/ SQ M	LBS/ ACRE	REL. PROD.	STD. DEV.
Perennial Graminoids	15.8	140.3	33.6%	
Annual Graminoids	< 0.1	0.1	< 0.1	
Perennial Forbs	30.8	274.6	65.8%	
Annual & Biennial Forbs	0.3	2.4	0.6%	
Total Production	46.9	417.4	100.0%	47.8

TABLE 13. WESTERN HEMLOCK/OAK FERN COVER; TREE DENSITY, REPRODUCTION, HEIGHT, DBH, BASAL AREA AND VOLUME; SHRUB DENSITY; AND HERBACEOUS PRODUCTION DATA - ALL SAMPLES 1988-1989

COVER

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
TREES					
Abies grandis	7.3%	7.7%	9.0%	5.0%	66.7%
Abies lasiocarpa	2.3%	2.5%	2.3%	1.3%	16.7%
Picea engelmannii	14.7%	15.4%	16.0%	9.0%	66.7%
Pinus monticola	2.3%	2.5%	2.7%	1.5%	33.3%
Thuja plicata	5.7%	5.9%	8.7%	4.9%	33.3%
Tsuga heterophylla	49.7%	52.3%	50.0%	28.1%	83.3%
Total % Trees	82.0%	86.3%	88.7%	49.8%	
TALL SHRUBS					
Acer glabrum	0.0%	0.0%	1.7%	1.0%	33.3%
Taxus brevifolia	1.7%	1.7%	2.3%	1.3%	50.0%
Total % Tall Shrubs	1.7%	1.7%	4.0%	2.3%	
LOW SHRUBS					
Amelanchier alnifolia	P	0.0%	0.0%	0.0%	16.7%
Cornus stolonifera	P	0.0%	0.0%	0.0%	16.7%
Lonicera utahensis	P	0.0%	0.0%	0.0%	33.3%
Menziesia ferruginea	0.3%	0.3%	0.3%	0.2%	16.7%
Oplopanax horridum	0.0%	0.0%	1.3%	0.7%	50.0%
Pachistima myrsinites	P	0.0%	0.0%	0.0%	16.7%
Ribes lacustre	P	0.0%	0.0%	0.0%	33.3%
Ribes viscosissimum	P	0.0%	0.0%	0.0%	16.7%
Rosa gymnocarpa	0.0%	0.0%	0.3%	0.2%	33.3%
Spiraea betulifolia	P	0.0%	0.0%	0.0%	16.7%
Symphoricarpos albus	1.0%	1.0%	5.7%	3.2%	33.3%
Vaccinium globulare	0.0%	0.0%	1.7%	0.9%	83.3%
Total % Low Shrubs	1.3%	1.3%	9.3%	5.2%	
SUBSHRUBS					
Chimaphila umbellata	P	0.0%	0.0%	0.0%	16.7%
Cornus canadensis	P	0.0%	0.0%	0.0%	16.7%
Linnaea borealis	P	0.0%	0.0%	0.0%	33.3%
Rubus parviflorus	1.0%	1.1%	3.0%	1.7%	33.3%
Rubus pedatus	0.0%	0.0%	1.3%	0.7%	16.7%

TABLE 13. (CONTINUED)

COVER

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Total % Subshrubs	1.0%	1.1%	4.3%	2.4%	
PERENNIAL GRAMINOIDS					
Bromus vulgaris	0.0%	0.0%	1.3%	0.7%	16.7%
Calamagrostis canadensis	P	0.0%	0.0%	0.0%	16.7%
Elymus glaucus	0.3%	0.4%	0.7%	0.4%	16.7%
Festuca subulata	P	0.0%	0.0%	0.0%	16.7%
Luzula parviflora	0.0%	0.0%	0.3%	0.2%	16.7%
Total % Perennial Graminoids	0.3%	0.4%	2.3%	1.3%	
PERENNIAL FORBS					
Aconitum columbianum	P	0.0%	0.0%	0.0%	16.7%
Actaea rubra	P	0.0%	0.0%	0.0%	16.7%
Adenocaulon bicolor	0.0%	0.0%	0.7%	0.4%	16.7%
Aralia nudicaulis	0.0%	0.0%	0.3%	0.2%	16.7%
Arnica cordifolia	P	0.0%	0.0%	0.0%	66.7%
Clintonia uniflora	0.0%	0.0%	3.0%	1.7%	100.0%
Coptis occidentalis	0.0%	0.0%	3.7%	2.0%	33.3%
Disporum hookeri	0.3%	0.3%	0.7%	0.4%	50.0%
Galium boreale	0.3%	0.4%	0.3%	0.2%	16.7%
Galium triflorum	0.0%	0.0%	0.3%	0.2%	33.3%
Geum macrophyllum	P	0.0%	0.0%	0.0%	16.7%
Goodyera oblongfolia	P	0.0%	0.0%	0.0%	16.7%
Heracleum lanatum	P	0.0%	0.0%	0.0%	16.7%
Hieracium albiflorum	P	0.0%	0.0%	0.0%	16.7%
Ligusticum verticillatum	P	0.0%	0.0%	0.0%	16.7%
Mitella breweri	0.0%	0.0%	0.3%	0.2%	16.7%
Pyrola asarifolia	0.0%	0.0%	0.7%	0.4%	33.3%
Pyrola secunda	0.0%	0.0%	0.7%	0.4%	50.0%
Pyrola uniflora	0.3%	0.4%	0.3%	0.2%	33.3%
Smilacina stellata	0.7%	0.7%	2.7%	1.5%	66.7%
Streptopus amplexifolius	P	0.0%	0.0%	0.0%	16.7%
Thalictrum occidentale	P	0.0%	0.0%	0.0%	33.3%
Tiarella trifoliata	0.7%	0.7%	6.7%	3.7%	83.3%
Trillium ovatum	0.0%	0.0%	0.3%	0.2%	50.0%
Veratrum viride	P	0.0%	0.0%	0.0%	16.7%
Viola glabella	0.0%	0.0%	0.3%	0.2%	33.3%
Viola orbiculata	P	0.0%	0.0%	0.0%	16.7%

TABLE 13. (CONTINUED)

COVER

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Total % Perennial Forbs	2.3%	2.5%	21.0%	11.8%	
CRYPTOGAMS					
Athyrium filix-femina	0.0%	0.0%	2.3%	1.3%	50.0%
Equisetum arvense	1.0%	1.1%	4.0%	2.3%	16.7%
Gymnocarpium dryopteris	2.7%	2.8%	21.3%	12.0%	100.0%
Moss	2.7%	2.8%	20.7%	11.6%	100.0%
Total % Cryptogams	6.4%	6.7%	48.3%	27.2%	
TOTAL % VEGETATION	95.0%	100.0%	179.0%	100.0%	
Soil	0.0%				
Litter	5.0%				
Rock	0.0%				

P = SPECIES PRESENT BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 13. (CONTINUED)

TREE DENSITY

	MEAN NO. TREES/ 125 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TREES				
Abies grandis	1.7	54.0	10.3%	
Abies lasiocarpa	0.5	16.2	3.1%	
Picea engelmannii	2.0	64.7	12.4%	
Pinus monticola	0.5	16.2	3.1%	
Thuja plicata	1.3	43.2	8.2%	
Tsuga heterophylla	10.2	329.1	62.9%	
Total Trees	16.2	523.4	100.0%	6.9
TREES (DEAD)				
Abies grandis	0.2	5.4	16.7%	
Picea engelmannii	0.5	16.2	50.0%	
Thuja plicata	0.3	10.8	33.3%	
Total Trees (Dead)	1.0	32.4	100.0%	1.0

TREE REPRODUCTION

	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
Abies grandis	0.7	107.9	4.5%	
Picea engelmannii	1.3	215.9	9.1%	
Thuja plicata	0.7	107.9	4.5%	
Tsuga heterophylla	12.0	1942.5	81.9%	
Total Tree Reproduction	14.7	2374.2	100.0%	14.9

TABLE 13. (CONTINUED)

TREE HEIGHT (FEET)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	6	90	32.4
Abies lasiocarpa	32	76	54.0
Picea engelmannii	14	105	47.3
Pinus monticola	20	110	59.3
Thuja plicata	7	31	20.6
Tsuga heterophylla	5	100	24.2
Total Trees			29.6
TREES (DEAD)			
Picea engelmannii	13	42	20.3
Total Dead Trees			20.3

TREE DBH (INCHES)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	0.4	21.3	5.7
Abies lasiocarpa	2.8	12.2	7.7
Pinus monticola	5.9	32.7	7.4
Picea engelmannii	1.6	23.6	15.0
Tsuga heterophylla	0.4	25.2	3.7
Thuja plicata	1.2	5.5	4.5
Total Trees			5.6
TREES (DEAD)			
Abies grandis	13.8	13.8	13.8
Picea engelmannii	1.2	6.7	3.9
Thuja plicata	2.8	3.1	3.0
Total Dead Trees			5.5

TABLE 13. (CONTINUED)

TREE BASAL AREA AND VOLUME

	THOUSAND BOARD FEET PER ACRE	BASAL AREA (SQ FEET) PER ACRE	QUADRATIC MEAN DIAMETER (INCHES)
Abies grandis	5.5	22.3	3.7
Abies lasiocarpa	0.6	6.6	8.7
Picea engelmannii	8.5	49.4	11.8
Pinus monticola	7.3	34.3	19.7
Thuja plicata		3.7	4.0
Tsuga heterophylla	58.3	124.7	10.4
Total Trees	80.2	241.0	

SHRUB DENSITY

	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TALL SHRUBS				
Taxus brevifolia	0.1	27.0	0.5%	
Total Tall Shrubs	0.1	27.0	0.5%	
LOW SHRUBS				
Amelanchier alnifolia	0.2	27.0	0.5%	
Cornus stolonifera	0.2	27.0	0.5%	
Menziesia ferruginea	0.2	27.0	0.5%	
Oplopanax horridum	3.3	539.6	10.2%	
Pachistima myrsinites	0.8	134.9	2.5%	
Ribes lacustre	1.0	161.9	3.0%	
Ribes viscosissimum	0.2	27.0	0.5%	
Rosa gymnocarpa	0.2	27.0	0.5%	
Sambucus racemosa	0.5	80.9	1.5%	
Spiraea betulifolia	1.5	242.8	4.6%	
Symphoricarpos albus	7.6	1241.0	23.4%	
Vaccinium globulare	13.0	2104.4	39.6%	
Total Low Shrubs	28.7	4640.5	87.3%	
SUBSHRUBS				
Rubus parviflorus	4.0	647.5	12.2%	
Total Subshrubs	4.0	647.5	12.2%	
TOTAL SHRUBS	32.8	5315.0	100.0%	28.0

TABLE 13. (CONTINUED)

HERBACEOUS PRODUCTION

	GRAMS/ SQ M	LBS/ ACRE	REL. PROD.	STD DEV
Perennial Graminoids	2.0	0.1	4.1%	
Annual Graminoids	0.0	0.0	0.0%	
Perennial Forbs	46.6	3.3	95.9%	
Annual & Biennial Forbs	0.0	0.0	0.0%	
Total Production	48.6	3.5	100.0%	19.7

TABLE 14. WESTERN HEMLOCK/QUEENCUP BEADLILY COVER; TREE DENSITY, REPRODUCTION, HEIGHT, DBH, BASAL AREA AND VOLUME; SHRUB DENSITY; AND HERBACEOUS PRODUCTION DATA - ALL SAMPLES 1988-1989

COVER

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
TREES					
Abies grandis	30.0%	31.9%	34.7%	22.7%	90.9%
Larix occidentalis	8.4%	8.9%	8.6%	5.6%	77.3%
Picea engelmannii	4.2%	4.5%	5.1%	3.3%	40.9%
Pinus contorta	3.4%	3.7%	3.6%	2.3%	31.8%
Pinus monticola	3.4%	3.6%	3.6%	2.4%	59.1%
Pseudotsuga menziesii	8.6%	9.2%	9.9%	6.5%	72.7%
Thuja plicata	8.9%	9.5%	14.7%	9.6%	77.3%
Tsuga heterophylla	13.2%	14.0%	17.5%	11.5%	86.4%
Total % Trees	80.1%	85.3%	97.7%	63.9%	
TREES - DEAD					
Abies grandis	0.1%	0.1%	0.1%	0.1%	4.5%
Pinus contorta	2.2%	2.3%	2.2%	1.4%	9.1%
Total % Trees - Dead	2.3%	2.4%	2.3%	1.5%	
TALL SHRUBS					
Acer glabrum	0.2%	0.3%	1.1%	0.7%	31.8%
Alnus sinuata	1.0%	1.0%	1.0%	0.6%	4.5%
Sorbus sitchensis	0.1%	0.1%	0.1%	0.1%	4.5%
Taxus brevifolia	0.1%	0.1%	1.6%	1.1%	22.7%
Total % Tall Shrubs	1.4%	1.5%	3.8%	2.5%	
LOW SHRUBS					
Amelanchier alnifolia	0.0%	0.0%	0.4%	0.3%	45.5%
Cornus stolonifera	0.0%	0.0%	0.0%	0.0%	4.5%
Holodiscus discolor	0.0%	0.0%	0.1%	0.1%	4.5%
Lonicera ciliosa	0.0%	0.0%	0.0%	0.0%	9.1%
Lonicera utahensis	0.0%	0.0%	0.3%	0.2%	68.2%
Menziesia ferruginea	0.0%	0.0%	0.0%	0.0%	9.1%
Oplopanax horridum	0.0%	0.0%	0.2%	0.1%	4.5%
Pachistima myrsinites	0.1%	0.1%	1.7%	1.1%	90.9%
Ribes lacustre	0.0%	0.0%	0.0%	0.0%	4.5%
Rosa gymnocarpa	0.3%	0.3%	1.3%	0.8%	68.2%
Salix scouleriana	0.1%	0.1%	0.1%	0.1%	9.1%
Sheperdia canadensis	0.0%	0.0%	0.1%	0.1%	13.6%
Spiraea betulifolia	0.1%	0.1%	1.0%	0.6%	72.7%

TABLE 14. (CONTINUED)

COVER

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Symphoricarpos albus	0.1%	0.1%	0.3%	0.2%	13.6%
Vaccinium globulare	0.2%	0.3%	0.5%	0.4%	59.1%
Vaccinium myrtillus	0.0%	0.0%	0.8%	0.5%	45.5%
Total % Low Shrubs	0.9%	1.0%	6.8%	4.5%	
SUBSHRUBS					
Arctostaphylos uva-ursi	0.0%	0.0%	0.0%	0.0%	9.1%
Berberis repens	0.0%	0.0%	0.4%	0.3%	40.9%
Chimaphila umbellata	0.6%	0.7%	2.1%	1.4%	68.2%
Cornus canadensis	0.0%	0.0%	0.4%	0.2%	22.7%
Linnaea borealis	1.2%	1.2%	5.7%	3.8%	81.8%
Rubus parviflorus	0.8%	0.9%	2.4%	1.5%	27.3%
Total % Subshrubs	2.6%	2.8%	11.0%	7.2%	
PERENNIAL GRAMINOIDS					
Bromus vulgaris	0.0%	0.0%	0.3%	0.2%	22.7%
Calamagrostis rubescens	0.2%	0.2%	0.6%	0.4%	40.9%
Carex concinnoides	0.0%	0.0%	0.1%	< 0.1	9.1%
Carex rossii	0.0%	0.0%	0.0%	0.0%	9.1%
Festuca occidentalis	0.0%	0.0%	0.0%	0.0%	9.1%
Muhlenbergia asperifolia	0.0%	0.0%	0.1%	< 0.1	4.5%
Total % Perennial Graminoids	0.2%	0.2%	1.1%	0.7%	
PERENNIAL FORBS					
Actaea rubra	0.0%	0.0%	0.2%	0.1%	9.1%
Adenocaulon bicolor	0.0%	0.0%	0.3%	0.2%	40.9%
Angelica arguta	0.0%	0.0%	0.0%	0.0%	4.5%
Aralia nudicaulis	0.1%	0.1%	0.4%	0.3%	13.6%
Arnica cordifolia	0.8%	0.9%	3.9%	2.6%	45.5%
Aster conspicuous	0.0%	0.0%	0.0%	0.0%	9.1%
Cirsium flodmanii	0.0%	0.0%	0.0%	0.0%	4.5%
Clematis columbiana	0.1%	0.1%	0.2%	0.1%	4.5%
Clintonia uniflora	0.5%	0.5%	2.9%	1.9%	95.5%
Coptis occidentalis	1.1%	1.1%	6.4%	4.2%	72.7%
Corallorhiza maculata	0.0%	0.0%	0.0%	0.0%	9.1%
Disporum hookeri	0.0%	0.0%	0.0%	0.0%	27.3%
Fragaria virginiana	0.1%	0.1%	0.3%	0.2%	13.6%

TABLE 14. (CONTINUED)

COVER

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Galium triflorum	0.0%	0.0%	0.0%	0.0%	27.3%
Goodyera oblongfolia	0.0%	0.0%	0.0%	0.0%	63.6%
Hieracium albiflorum	0.0%	0.0%	0.0%	0.0%	50.0%
Listera convallarioides	0.0%	0.0%	0.0%	0.0%	18.2%
Osmorhiza chilensis	0.0%	0.0%	0.0%	0.0%	31.8%
Pedicularis bracteosa	0.0%	0.0%	0.0%	0.0%	4.5%
Pyrola asarifolia	0.2%	0.2%	0.2%	0.1%	59.1%
Pyrola chlorantha	0.0%	0.0%	0.0%	0.0%	13.6%
Pyrola minor	0.0%	0.0%	0.0%	0.0%	4.5%
Pyrola secunda	0.1%	0.1%	0.2%	0.1%	59.1%
Smilacina stellata	0.1%	0.1%	2.2%	1.4%	59.1%
Thalictrum occidentale	0.0%	0.0%	0.5%	0.4%	40.9%
Tiarella trifoliata	0.1%	0.1%	1.4%	0.9%	45.5%
Trillium ovatum	0.0%	0.0%	0.1%	0.1%	40.9%
Veratrum viride	0.0%	0.0%	0.0%	0.0%	4.5%
Viola glabella	0.0%	0.0%	0.2%	0.1%	50.0%
Viola orbiculata	0.3%	0.4%	0.9%	0.6%	90.9%
Xerophyllum tenax	1.7%	1.8%	5.2%	3.4%	59.1%
Total % Perennial Forbs	5.2%	5.5%	25.5%	16.7%	
ANNUAL & BIENNIAL FORBS					
Melampyrum lineare	0.2%	0.2%	0.2%	0.1%	13.6%
Verbascum thapsus	0.0%	0.0%	0.0%	0.0%	4.5%
Total % Annual & Biennial Forbs	0.2%	0.2%	0.2%	0.1%	
CRYPTOGAMS					
Athyrium filix-femina	0.0%	0.0%	0.1%	0.1%	18.2%
Gymnocarpium dryopteris	0.0%	0.0%	0.0%	0.0%	9.1%
Moss	0.6%	0.7%	3.3%	2.1%	63.6%
Pteridium aquilinum	0.4%	0.4%	1.1%	0.7%	40.9%
Total % Cryptogams	1.0%	1.1%	4.5%	2.9%	
TOTAL % VEGETATION	93.9%	100.0%	152.9%	100.0%	
Soil	0.0%				
Litter	6.0%				
Rock	0.1%				

P = SPECIES PRESENT BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 14. (CONTINUED)

TREE DENSITY

	MEAN NO. TREES/ 125 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TREES				
Abies grandis	8.7	282.5	32.1%	
Larix occidentalis	2.0	66.2	7.5%	
Picea engelmannii	1.3	39.7	4.5%	
Pinus contorta	2.4	78.0	8.9%	
Pinus monticola	2.0	64.7	7.4%	
Pseudotsuga menziesii	2.3	75.1	8.5%	
Thuja plicata	5.2	167.8	19.1%	
Tsuga heterophylla	3.3	106.0	12.0%	
Total Trees	27.2	880.0	100.0%	7.7
TREES (DEAD)				
Abies grandis	0.6	19.2	12.7%	
Larix occidentalis	0.5	14.7	9.8%	
Picea engelmannii	0.3	10.3	6.9%	
Pinus contorta	2.0	66.2	44.1%	
Pinus monticola	1.0	33.8	22.5%	
Pseudotsuga menziesii	< 0.1	1.5	1.0%	
Tsuga heterophylla	0.1	4.4	3.0%	
Total Trees (Dead)	4.6	150.1	100.0%	5.8

TREE REPRODUCTION

	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
Abies grandis	4.1	662.2	24.1%	
Picea engelmannii	0.1	14.7	0.5%	
Pseudotsuga menziesii	0.1	14.7	0.5%	
Thuja plicata	2.3	375.3	13.7%	
Tsuga heterophylla	10.4	1685.0	61.2%	
Total Tree Reproduction	17.0	2751.9	100.0%	5.0

TABLE 14. (CONTINUED)

TREE HEIGHT (FEET)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	14	82	29.5
Larix occidentalis	9	113	73.5
Picea engelmannii	6	88	36.7
Pinus contorta	8	70	46.0
Pinus monticola	8	114	30.3
Pseudotsuga menziesii	6	100	44.5
Thuja plicata	6	88	18.6
Tsuga heterophylla	6	83	30.6
Total Trees			33.9
TREES (DEAD)			
Abies grandis	38	38	38.0
Larix occidentalis	96	96	96.0
Picea engelmannii	21	40	30.5
Pinus contorta	16	16	16.0
Pinus monticola	12	99	55.5
Total Dead Trees			52.3

TREE DBH (INCHES)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	0.4	22.4	4.6
Larix occidentalis	0.4	26.8	9.9
Picea engelmannii	0.4	15.0	5.4
Pinus contorta	0.8	16.1	5.5
Pinus monticola	0.4	28.0	4.9
Pseudotsuga menziesii	0.4	29.1	7.5
Thuja plicata	0.4	23.2	3.0
Tsuga heterophylla	0.4	26.8	4.7
Total Trees			5.1
TREES (DEAD)			
Abies grandis	1.6	13.8	4.5
Larix occidentalis	1.6	30.3	9.2
Picea engelmannii	1.2	11.0	3.4
Pinus contorta	1.6	9.8	7.5
Pinus monticola	0.4	26.4	4.8
Pseudotsuga menziesii	7.9	7.9	7.9
Tsuga heterophylla	2.8	3.5	3.3
Total Dead Trees			6.1

TABLE 14. (CONTINUED)

TREE BASAL AREA AND VOLUME

	THOUSAND BOARD FEET PER ACRE	BASAL AREA (SQ FEET) PER ACRE	QUADRATIC MEAN DIAMETER (INCHES)
Abies grandis	5.0	58.1	6.1
Larix occidentalis	6.9	48.8	11.8
Picea engelmannii	1.1	11.3	7.2
Pinus contorta	0.3	15.4	6.0
Pinus monticola	3.1	21.5	7.6
Pseudotsuga menziesii	5.6	43.2	10.3
Thuja plicata	2.8	28.0	5.5
Tsuga heterophylla	3.1	27.7	7.0
Total Trees	27.9	254.0	

TABLE 14. (CONTINUED)

SHRUB DENSITY

	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TALL SHRUBS				
Acer glabrum	1.5	235.5	2.9%	
Taxus brevifolia	0.3	51.5	0.7%	
Total Tall Shrubs	1.8	287.0	3.6%	
LOW SHRUBS				
Amelanchier alnifolia	2.2	360.5	4.5%	
Holodiscus discolor	0.1	22.1	0.3%	
Lonicera utahensis	1.0	154.5	1.9%	
Oplopanax horridum	0.1	14.7	0.2%	
Pachistima myrsinites	12.1	1957.3	24.3%	
Rosa gymnocarpa	7.5	1214.1	15.1%	
Rosa nutkana	0.1	14.7	0.2%	
Salix scouleriana	0.1	22.1	0.2%	
Shepheria canadensis	0.2	29.5	0.3%	
Spiraea betulifolia	5.9	949.2	11.8%	
Symphoricarops albus	0.5	88.3	1.1%	
Vaccinium globulare	6.8	1103.7	13.7%	
Vaccinium myrtillus	4.5	721.1	9.0%	
Total Low Shrubs	41.1	6651.7	82.6%	
SUBSHRUBS				
Berberis repens	3.6	588.7	7.3%	
Rubus parviflorus	3.2	522.4	6.5%	
Total Subshrubs	6.8	1111.1	13.8%	
TOTAL SHRUBS	49.7	8049.8	100.0%	6.2

TABLE 14. (CONTINUED)

HERBACEOUS PRODUCTION

	GRAMS/ SQ M	LBS/ ACRE	REL. PROD.	STD DEV
Perennial Graminoids	0.3	254.6	2.7%	
Annual Graminoids	0.0	0.0	0.0%	
Perennial Forbs	11.6	9073.3	97.3%	
Annual & Biennial Forbs	0.0	0.0	0.0%	
Total Production	11.9	9328.0	100.0%	20.3

SECTION 4.0

LITERATURE CITED

4.0 LITERATURE CITED

Western Resource Development. 1989. Baseline vegetation study, Montana Project, Lincoln and Sanders Counties, Montana.

BASELINE VEGETATION STUDY

Montana Project

LINCOLN & SANDERS COUNTIES, MONTANA

prepared for

Noranda Minerals Corp.
65 N. Edison Way Suite 4 P.O. Box 7176 Reno, Nevada 89501

prepared by

Western Resource Development Corporation
711 Walnut St. P.O. Box 467 Boulder, Colorado 80306

February 1989

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SUMMARY

INTRODUCTION

A baseline vegetation inventory was conducted by Western Resource Development (WRD) during the 1988 growing season for the Montana Project. Quantitative data was collected on vegetation of the plant site, tailings area, and evaluation adit study area alternatives and qualitative observations were collected on the alternative transmission line study area.

Prior to initiation of studies, a detailed Plan of Study was developed based upon the Montana Metal Mines Reclamation Act (MMMRA), Environmental Policy Act (NEPA), and guidelines to these acts. The Plan of Study was presented to personnel at the U.S. Forest Service, Kootenai National Forest, and Montana Department of State Lands and modified to reflect their concerns.

METHODS

The vegetation of the plant sites, tailings area, and exploration adits was mapped per existing and potential vegetation type (forest habitat type). Existing vegetation types were segregated according to vegetation structure and species dominance. The forest habitat type mapping was based upon a refinement of the U.S. Forest Service, Kootenai National Forest Habitat Type Map according to systems of Pfister et al. (1977) and Cooper et al. (1987). Quantitative sample sites were selectively located in representative existing vegetation and forest habitat types. Vegetation cover; tree density; reproduction, diameter, basal area, volume and age; shrub density; and herbaceous production were quantified. Existing vegetation types and forest habitats are described based upon the quantitative data and published literature.

Vegetation in the transmission line study areas was mapped according to existing vegetation type and forest habitat type and described according to published literature and qualitative observations. The small, isolated wetlands area has been mapped and qualitatively described.

All quantitative sampling for cover, density, height, diameter, age, and production occurred at the same sample sites. All sampling was within a 5 m by 25 m rectangular shaped quadrat. A point-intercept method was used for cover

sampling and quadrat methods for density and herbaceous production.

RESULTS AND DISCUSSION

Existing Vegetation - Intensive Study Area

The 2,296 acre intensive study area which includes plant site alternatives in Ramsey and Libby Creek, tailings alternatives along Little Cherry Creek, and evaluation adit alternatives in the Rock Creek drainage is characterized by four major vegetation types, one minor vegetation type, disturbances, talus slopes, and open water. Vegetation types and their acreage are as follows: coniferous forest (1141), clearcuts (1035), shrubland (81), subalpine (15), and wetlands (7). Each of these types is briefly described below from quantitative data collected in 1988.

Coniferous Forest. Coniferous forests with a total of ten tree species are common to about 50% of the intensive study area. Past fires and a logging history have created numerous different aged seral stands to the climax forest habitat types. Timbering and avalanches to a lesser degree have reduced the extent of coniferous forests.

Major trees in the coniferous forest type include western hemlock (*Tsuga heterophylla*), grand fir (*Abies grandis*), western red cedar (*Thuja plicata*), and Engelmann spruce (*Picea engelmannii*). Western hemlock has the highest cover, but grand fir the highest density. Western hemlock, however, accounts for about three-fourths of the tree reproduction. Less abundant trees include Douglas-fir (*Pseudotsuga menziesii*), western larch (*Larix occidentalis*), subalpine fir, (*Abies lasiocarpa*), lodgepole pine (*Pinus contorta*), and black cottonwood (*Populus trichocarpa*).

Common shrubs in the understory include Rocky Mountain maple (*Acer glabrum*), Pacific yew (*Taxus brevifolia*, Sitka alder (*Alnus sinuata*), devil's club (*Oplopanax horridum*), huckleberry (*Vaccinium globulare*), pachistima (*Pachistima myrsinites*), and white spirea (*Spirea betulifolia*).

Nineteen graminoids are present, but provide little cover. The most common graminoids include reed mannagrass (*Glyceria grandis*), pinegrass (*Calamagrostis canadensis*), and northwest sedge (*Carex concinnoides*).

Tiarella (*Tiarella trifoliata*), queencup beadlily (*Clintonia uniflora*), heartleaf arnica (*Arnica cordifolia*), western goldthread (*Coptis occidentalis*), beargrass (*Xerophyllum tenax*), stream violet (*Viola glabella*), and roundleaf violet (*Viola orbiculata*) are respectively the most abundant of the 52 forbs present. Cryptogams are more common than forbs. Lady fern (*Athyrium filix-femina*), oak fern (*Gymnocarpium dryopteris*), and bracken fern (*Pteridium aquilinum*) are respectively the most abundant cryptogams.

Clearcuts. Based on results of tree core analysis, most of the clearcuts were logged 10-20 years ago. These clarcuts are located primarily in the tailings study area. Considering cover and density, western larch , western red cedar, Douglas-fir, lodgepole pine, and Engelmann spruce are the most abundant of the 11 trees present. Engelmann spruce, black cottonwood, and western white pine (*Pinus monticola*) have the highest reproduction rates respectively.

Shrub cover and density is high in the clearcuts. The most abundant shrubs include white spirea, pachistima, Sitka alder, huckleberry, snowberry (*Symphoricarpos alba*), dwarf bilberry (*Vaccinium myrtillus*), and baldcup rose (*Rosa gymnocarpa*).

Herbaceous cover of graminoids and forbs is high and includes 23 perennial graminoids and 51 perennial forbs. Pinegrass, northwest sedge, western fescue (*Festuca occidentalis*) and purple reedgrass (*Calamagrostis purpurascens*) are the domininant graminoids. Major forbs respectively include Virginia strawberry (*Fragaria virginiana*), fireweed (*Epilobium angustifolium*), orange hawkweed (*Hieracium aurantiacum*), beargrass, Canada goldenrod (*Solidago canadensis*), and white clover (*Trifolium repens*).

Shrublands. Shrublands, located in the avalanche chutes in Libby, Ramsey, and Rock Creek, are dominated by a complex assoication of 26 shrubs. Major species of the cover and density are thimbleberry (*Rubus parviflorus*), pachistima, red raspberry (*Rubus idaeus*), white spirea, Rocky Mountain maple, Sitka alder, and rusty menziesia (*Menziesia ferruginea*). Major trees colonizing the shrublands include subalpine fir, aspen (*Populus tremuloides*), and grand fir.

Herbaceous understory cover is dominated by perennial forbs, but includes numerous perennial graminoids. Beargrass is the major perennial forb, while bluejoint reedgrass is the most abundant perennial graminoid. Other common forbs

include green false hellebore (*Veratrum viride*), hooker fairybell (*Disporum hookeri*), starry Solomon's seal (*Smilacina stellata*), cow parsnip (*Heracleum lanatum*), bedstraw (*Galium triflorum*), and western meadowrue (*Thalictrum occidentale*). Less abundant perennial graminoids include blue wildrye (*Elymus glaucus*), columbia brome (*Bromus vulgaris*), and bearded fescue (*Festuca subulata*).

Subalpine. This shrubby community, located at about 5,000 foot elevation in the Rock Creek drainage, is charaterized by an open tree canopy with a dense cover of low shrubs and perennial forbs. Douglas fir and subalpine fir are the major tree species. Also present are mountain hemlock (*Tsuga mertensiana*), grand fir. and white pine. Douglas-fir provides three-fourths of the reproduction. Dominant shrubs include pachistima, dwarf bilberry, Utah honeysuckle (*Lonicera utahensis*), and western serviceberry.

Beargrass is the most abundant plant in the community. Less abundant forbs include common yarrow (*Achillea millefolium*), fireweed, and Lyall's penstemon (*Penstemon lyallii*). Major graminoids, respectively, include elk sedge (*Carex geyeri*), sedges (*Carex* spp.), redtop (*Agrostis alba*), pinegrass, and blue wildrye.

Wetlands. Numerous small wetlands generally less than one-half acre in size occur on the tailings alternatives in poorly drained depressions. The center or wettest area of these wetlands is dominated by beaked sedge (*Carex rostrata*), knot-sheath sedge (*Carex retrorsa*), water sedge (*Carex aquatilus*), winged sedge (*Carex microptera*), inflated sedge (*Carex vesicaria*), northern mannagrass (*Glyceria borealis*), dulichium (*Dulichium arundinaceum*) and spikerush (*Eleocharis pauciflora*). Dense stands of Douglas spirea with some Sitka alder, alder buckthorn (*Rhamnus alnifolia*), and an occasional invading lodgepole pine, Engelmann spruce, or white pine surround the wet sedge wetlands center.

A portion of forested wetlands type, classified as the Engelmann spruce/common horsetail (410) habitat type occurs in the project area along Ramsey Creek. This wetlands is dominated by Engelmann spruce with scattered western white pine, subalpine fir, grand fir, and lodgepole pine. Understory species include common horsetail (*Equisetum arvense*), bluejoint reedgrass, arrowleaf groundsel (*Senecio triangularis*), and sphagnum moss (*Sphagnum angustifolium* and *S. squarrosum*).

Existing Vegetation - Transmission Line Corridor

The transmission line corridors include areas of native vegetation, agricultural lands, industrial sites, residential areas, talus slopes, water, and disturbances. The native communities are in various stages of ecological succession as a past history of logging, fire, agricultural, or other disturbances has arrested or re-initiated the progress toward the climax. Major native communities mapped include coniferous forest, clearcut, riparian, shrubland, and wetlands. These communities are similar to those described for the intensive study area.

Potential Vegetation (Forest Habitat Type) - Intensive Study Area and Transmission Line Alternatives

Twelve forest habitat types in seven climax series occur in the intensive study area and along the transmission line alternatives. Table 1 identifies these habitat types by climax series.

Western hemlock/queencup beadlily is ubiquitous to the tailings areas and also occurs at each of the plant sites, the exploration adit area, and is common along the upper elevations of both transmission line alternatives. This habitat type is composed of young seral stands dominated respectively by grand fir, western hemlock, western red cedar, Douglas-fir, western larch, Engelmann spruce, lodgepole pine, and white pine.

Western hemlock/oak fern occurs at the upper Libby plant site along Libby Creek and is associated with the Engelmann spruce/common horsetail habitat type which is also present in Ramsey Creek. Western hemlock, the climax tree, dominates the study area sample stands. Major seral trees present include grand fir, Engelmann spruce, and white pine.

Other habitat types of drainages include the western red cedar/lady fern which occurs on the moist draw at the tailings sites and the western red cedar/devil's club which is present along Ramsey Creek. The western red cedar/lady fern habitat type is dominated by western red cedar and western hemlock, the climax codominants. Engelmann spruce and black cottonwood are common in the habitat type. The western red cedar/devil's club habitat type is characterized by grand fir and Engelmann spruce, seral components of the climax, and western hemlock, the climax codominant. Western red cedar is not present.

TABLE 1. FOREST SERIES AND HABITAT TYPES

Western Hemlock Series

western hemlock/queencup beadlily (570)
western hemlock/oak fern (565)

Western Red Cedar Series

western red cedar/devil's club (550)
western red cedar/lady fern (540)

Mountain Hemlock Series

mountain hemlock/queencup beadlily (685)
mountain hemlock/beargrass (710)

Subalpine Fir Series

subalpine fir/queencup beadlily (620)
subalpine fir/menziesia (670)

Grand Fir Series

grand fir/queencup beadlily (520)

Engelmann Spruce Series

Engelmann spruce/common horsetail (410)

Douglas-fir Series

Douglas-fir/common snowberry (310)
Douglas-fir/pinegrass (320)

Mountain hemlock/queencup beadlily and mountain hemlock/beargrass are high elevation habitat types found only in the Rock Creek exploration adit study area. These two habitat types are represented in the study area as seral brush fields. Although the mountain hemlock/beargrass habitat type is characterized by a sparse density of mountain hemlock and Douglas-fir amid a dense cover of shrubs.

The two habitat types of the subalpine fir series (subalpine fir/queencup beadlily and subalpine fir/mentziesia) characterize the upper elevation slopes of Libby and Ramsey Creeks. The subalpine fir/queencup beadlily habitat type is characterized by a dense cover of grand fir and a sparse representation of six seral tree species. The subalpine fir/menziesia habitat type occurs only as a seral brush field on steep, north-facing slopes in the Ramsey Creek.

The grand fir/queencup beadlily habitat type is present only along intermediate elevations of the Miller Creek transmission line alternative.

The Engelmann spruce/common horsetail habitat type is present in the transmission line alternatives along sections of Libby and Miller creeks and the Fisher River. Due to the historical disturbance along these streams the vegetation includes many diverse seral communities.

Lower elevation habitat types of dry sites include Douglas-fir/common snowberry and Douglas-fir/pinegrass. These habitat types occur along the town of Libby to plant sites alternative transmission line and were not quantitatively sampled.

Threatened and Endangered Species

The U.S. Fish and Wildlife Service has not listed any federally classified threatened or endangered plant species for Montana pursuant to the Endangered Species Act. A small population of woolgrass *Scirpus cyperinus*, a plant listed by the Kootenai National Forest as a "sensitive species" was found at the tailing study area in a wetlands and in an adjacent ditch along the Forest Service Road. A larger population was found in a wetlands habitat outside the intensive study area along Libby Creek.

SECTION 1.0

INTRODUCTION

1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

This baseline study was initiated by U.S. Borax as part of the licensing requirements for the development and mining of a silver/copper deposit located underneath the Cabinet Mountain Wilderness Area in the Kootenai National Forest, Sanders and Lincoln counties, Montana (Figure 1). Whereas the State of Montana, Department of State Lands, and the Kootenai National Forest have primary responsibility for permitting these activities, the two agencies and U.S. Borax developed a Plan of Study that defined the nature and extent of the baseline work. This work was initiated in the spring of 1988 and has been conducted in accordance with the terms of the Plan of Study.

A number of alternative sites were identified for portals, processing plant, tailings disposal, and ancillary facilities. The area encompassing and adjacent to these sites then became the focus of the baseline work.

In September, 1988, Noranda Minerals Corp. and Montana Reserves formed a venture and purchased the silver/copper deposit from U.S. Borax and continued with project development under the "Montana Project" name. Noranda Minerals Corp. (Noranda) was designated the project manager.

Noranda continued to build from the data and information that had been generated by U.S. Borax, and after reviewing the many alternative sites, developed the proposed mining program detailed in the Application for a Hard Rock Operating Permit from the Montana Department of State Lands. The application also serves as a proposed Plan of Operation to the Kootenai National Forest. Basically, the application describes a 20,000 ton per day operation accessed from two (twin) portals in Ramsey Creek, a mill site located adjacent to the Ramsey portals, a portal in Libby Creek, two portals in the Rock Creek drainage for ventilation and emergency access, and a tailing impoundment in the Little Cherry Creek drainage. Access to the Ramsey Creek mine site would be over the existing Bear Creek Road. A new transmission line from Pleasant Valley to the mine site would provide electrical energy for the operation. The total labor force is expected to number approximately 400 people. These positions would be filled by hiring locally as much as possible.

1.2 DEVELOPMENT OF PLAN OF STUDY

During the 1988 growing season a baseline vegetation study was conducted for the area of the development

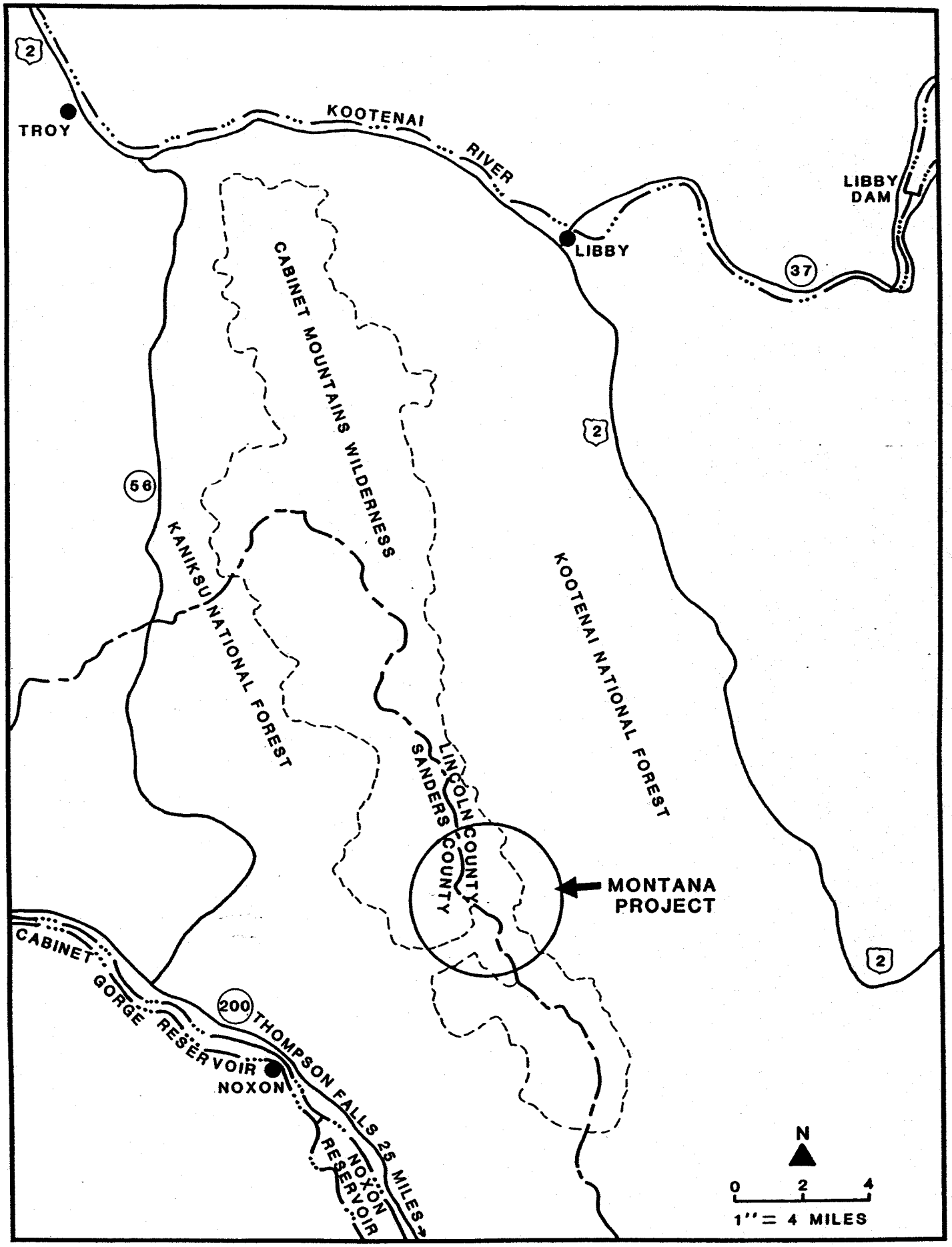

FIGURE 1. PROJECT LOCATION

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LINCOLN & SANDERS COUNTIES, MONTANA

alternatives. All aspects of the baseline vegetation study were coordinated with regulatory agencies. Prior to initiation of the studies, a detailed Plan of Study was developed based upon the Montana Metal Mines Reclamation Act (MMMRA), Montana Environmental Policy Act (MEPA), the National Environmental Policy Act (NEPA), and guidelines to these acts. The objective of the vegetation inventory was to identify, map, and quantitatively and qualitatively describe the vegetation resources of the Montana Project study area. This description is to be used for an alternative analysis, for predicting potential impacts, and for development of reclamation plans. The Plan of Study was presented to personnel at the U.S. Forest Service, Kootenai National Forest, and Montana Department of State Lands and modified to reflect their concerns. A copy of the vegetation Plan of Study as approved by these regulatory agencies is contained in Section 5.0.

SECTION 2.0

METHODS

2.0 METHODS

2.1 EXPERIMENTAL DESIGN

The vegetation of the alternative plant sites, tailings areas, exploration adits, and transmission line corridors was mapped per existing and potential vegetation types. Vegetation cover; tree density, reproduction, height, diameter, basal area volume and age; shrub density; and herbaceous production were quantified for existing and potential vegetation types at plant sites, tailings areas, and exploration adits. Existing and potential vegetation types along the transmission lines were identified, mapped, and described from published literature and qualitative observations.

All quantitative sample sites were selectively located in representative stands of each mapping unit. The vegetation and habitat type maps in Section 3.0 illustrate the location of sample sites. All quantitative sampling for cover, density, height, diameter, age, and production occurred at the same sample sites. All sampling occurred within a 5 m by 25 m rectangular shaped quadrat. A point-intercept method was used for cover sampling and quadrat methods for density and herbaceous production.

2.2 LITERATURE REVIEW

Ecological data on the vegetation of northwestern Montana was reviewed during the course of the study. Specifically, data on the forest habitat types, federal, state, and Kootenai National Forest plant species of special concern, as well as taxonomic, ecologic, and distributional data on the flora. Persons within the Kootenai National Forest and Montana Natural Heritage Program were contacted for information on the vegetation of the study area.

2.3 DELINEATION AND MAPPING OF EXISTING VEGETATION TYPES

David Johnson and Joe Elliott, plant ecologists, conducted a thorough reconnaissance of the study areas and identified existing vegetation types based upon vegetation structure, species presence, and dominance. Color photographs taken July 8, 1988, at scales of 1" = 1000′ and 1" = 2000′ were used to delineate the boundaries of each vegetation type upon a topographic base map at a scale of 1" = 400′ and a scale of 1" = 2000′ for the transmission lines. Photographs at a scale of 1" = 1000′ taken on July 24, 1982, July 27, 1982, August 8, 1982, and August 18, 1982, were used to supplement the July 8, 1988, photography in some localities. However, the status of all clearcuts is based

upon the July 8, 1988, photography. It should be noted some logging did occur following completion of field studies.

Field reconnaissance was employed to verify the boundaries of the vegetation types. The acreage of each vegetation type or mapping unit was determined by planimetering.

2.4 DELINEATION AND MAPPING OF HABITAT TYPES

Habitat types were identified and mapped utilizing the following techniques described by Deitschman (1973), Layser (1974), and Daubenmire (1973):

1) The study area was reconnoitered to determine representative stands for quantitative sampling. Areas that appeared to be "tension zones" or ecotones between adjacent habitat types were avoided.

2) Representative stands were quantitatively sampled and "keyed out" to habitat types using keys in Pfister et al. (1977) and Cooper et al. (1987).

3) Boundaries between habitat types were determined by on-the-ground surveys in conjunction with interpretation of aerial photographs. These boundaries were sketched onto U.S. Geological Service topographic maps at a scale of 1" = 2000′ for the transmission line study area and at a scale of 1" = 400′ for the plant site, tailings, and evaluation adit areas.

Sites disturbed by logging often lacked sufficient indicator species to accurately identify habitat types. In such situations, the nearest adjacent, non-logged forest community at a similar aspect, elevation, and slope was examined and the species composition and canopy cover were utilized to determine the habitat type of the logged area. Avalanche chutes were mapped as habitat types although they are maintained in perpetual disclimax by periodic snow slides. Theoretically, they could achieve climax status, but in reality they will not undergo succession to become climax or near-climax communities.

2.5 PLANT SPECIES COLLECTION AND IDENTIFICATION

Plant species were collected throughout the growing season on the following dates: May 16-20, June 20-24, July 11-22, August 28-September 2, and October 3-7, 1988. Plant species were identified by Dr. Joe C. Elliott. The Herbarium, University of Montana, was consulted regarding the identity of several species. Voucher specimens have been preserved as a reference collection. Taxonomic

nomenclature for most vascular plants follows Hitchcock et al. (1955-1969) and Hitchcock and Cronquist (1973), respectively. Willow identifications are according to Brunsfeld and Johnson (1985); mosses according to Lawton (1971) and Vitt and Andrus (1977).

The plant species list has been arranged alphabetically by species per tree, tall shrub, low shrub, subshrub, perennial graminoid, annual graminoid, perennial forb, annual and biennial forb, and cryptogam lifeform categories. For each species the common name, family, and status (introduced vs. native) has been indicated. Weedy species are identified with an asterisk and discussed in the text with specific emphasis on noxious weeds.

2.6 PLANT SPECIES OF SPECIAL CONCERN

There are no federally listed threatened or endangered plants for the State of Montana (USFWS 1987). However, there are several federal candidate species potentially present in the region of the study area in Montana (USFWS 1980). Prior to initiation of field studies, personnel in federal and state agencies having information on the occurrence and distribution of these plants were contacted and relevant literature on the ecology, distribution, and taxonomy of relevant plants reviewed.

Specifically, Shelley (1988) of the Montana Natural Heritage Program and Summerfield (1988) of the U.S. Forest Service, Kootenai National Forest, were contacted for data and Lesica et al.'s (1984) publication "Vascular Plants of Limited Distribution in Montana" reviewed.

During the course of plant species collection and during the quantitative and qualitative field inventories, special attention was directed to the potential habitat of such species.

2.7 QUANTITATIVE SAMPLING

Figure 2 illustrates the quantitative sample process. A rectangular quadrat 5 meters by 25 meters was arbitrarily located and oriented. Cover estimation occurred along the central axis. The entire quadrat was used to collect tree data. Shrub density and tree reproduction data was collected in one 1 m by 25 m quadrat located along the cover transect. Production data was collected in four 0.5 m by 2 m rectangular quadrats located in the corner of the large quadrat and labeled as A, B, C, and D. The quantitative field studies were conducted on July 11-22, August 28-September 2, and October 3-7, 1988. The quantitative data appears as summary tables in the text portion of this report, but is contained in Appendix A in its entirety.

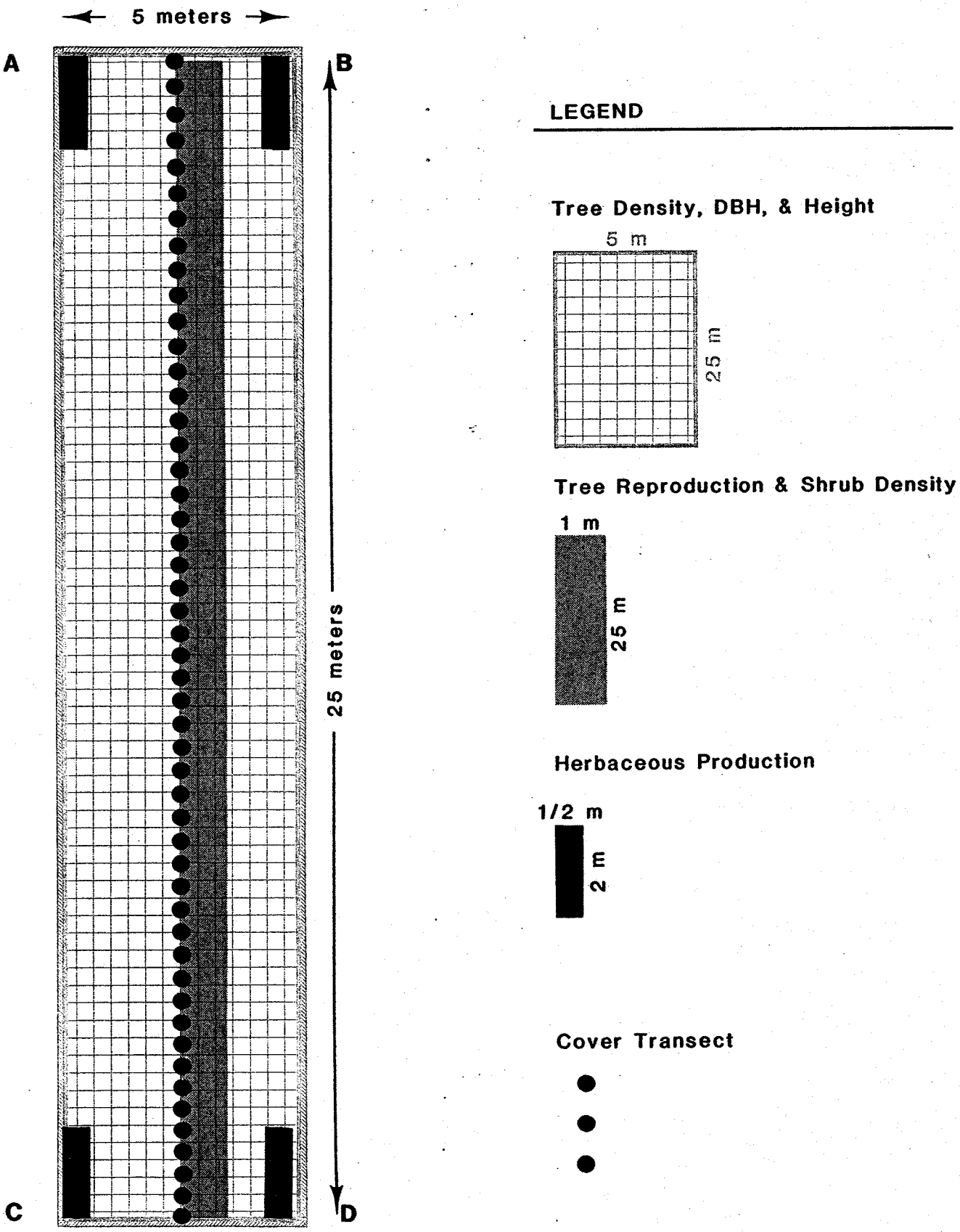

Figure 2. Quantitative Sample Process- Montana Project

2.7.1 Cover

Vegetation cover was estimated using a point-intercept method (Mueller-Dombois and Ellenberg 1974). Fifty points were recorded at one meter intervals along the 25 m central axis. At each of the 25 m marks of the cover transect, a point was recorded to the left and right of the transect and 50 cm from the transect.

A sighting device mounted on an adjustable tripod to facilitate vertical orientation and point stabilization was used for cover sampling. The sighting device has fine cross hairs and a magnified focus to provide optimum point definition. At each sample point, the sighting device was directed vertically upward if there was overstory forest vegetation and then vertically downward to shrub and herbaceous canopies. When a tree and/or shrub was intercepted, a second or third hit was taken until all vegetation canopies were sampled at that point. The first hit along a vertical line was recorded as vegetation (by species), rock litter, or soil. Vegetation intercepted below tree and shrub first hits was recorded as a second or third hit.

Each hit represents a cover of 2%. First the cover data was analyzed using first hits only. By this method, total cover can't exceed 100% and vegetation cover is always 100% or less. Next, the cover data was analyzed using all hits. By this method, vegetation cover usually exceeds 100% due to the overlap of lifeform canopies. The relative cover was determined for both the first and all hit data. Frequency was calculated based upon the percent of occurrence in sample stands. Species present in the sample quadrat but not actually "hit" during the point-intercept sampling are indicated by a "P" in the cover data tables.

2.7.2 Tree Density, Reproduction, Height, Diameter, Age, and Basal Area

Tree data was collected in the large 5 m by 25 m quadrats. To calculate density, all trees above breast height (1.3 m) in the quadrat were counted by species. Standing dead trees were inventoried separately by species where possible to provide an indication of forest health. All trees below breast height in the shrub density quadrat (1 m by 25 m) were counted by species to provide an estimate of tree reproduction. Tree density for each species and for all species is expressed as the mean number per quadrat (125 m^2) and per acre. Likewise, tree reproduction is expressed as the mean number per quadrat (25 m^2) and per acre.

The height of all trees greater than breast height was either visually estimated or calculated using an Abney clinometer and the diameter at breast height (dbh) of

each tree was measured in inches. Height and density data per tree species is expressed per mean and range, minimum to maximum. The timber volume for each tree species >10 inches in diameter was calculated based on actual diameters and heights and expressed in 1000 board feet per quadrat and acre. The basal area for each tree species and for all tree species was calculated on actual diameters and expressed as square feet per quadrat and acre. Table 34A, located in Appendix A, provides information on the formulas used for these calculations. Basal area and volume were calculated only for coniferous forest and subalpine existing vegetation types.

Within each quadrat several trees were cored and rings counted to provide an estimate of age. The older, mature trees of western hemlock (*Tsuga heterophylla*), grand fir (*Abies grandis*), and western red cedar (*Thuja plicata*) generally had "heart rot" and hence could not usually be cored. Also, the increment bore used (16") precluded sampling trees greater than 32" in diameter-at-breast-height (dbh).

2.7.3 Shrubs

Shrub density was recorded in a 1 m by 25 m quadrat constructed along the central 25 m cover transect. The number of individual shrubs (or shrub clumps for such species as common snowberry (*Symphoricarpos albus*) which form clonal patches rooted within the quadrat were recorded by species. Density is expressed for each shrub or shrub clump and for the total of all shrubs as the number per quadrat (25 m^2) and per acre. Shrub density was calculated for all tall and low shrubs and only for Oregon grape (*Berberis repens*) and thimbleberry (*Rubus parviflorus*) in the subshrub category.

2.7.4 Herbaceous Production

A quadrat system was used to estimate herbaceous production. Four production samples were collected from 0.5 m by 2 m quadrats located in each corner of the large quadrat (Figure 2). The current year's growth of all herbaceous plants was clipped by lifeform categories of annual graminoid, perennial graminoid, annual forb, and perennial forb. Cryptogams were included with the forbs. Shrubs and trees were not clipped. Plant biomass was oven dried at 105°F for 24 hours and weighed to the nearest one-tenth gram. Results are expressed as g/m^2 and pounds/acre.

SECTION 3.0

RESULTS AND DISCUSSION

3.0 RESULTS AND DISCUSSION

3.1 ENVIRONMENTAL SETTING

3.1.1 Study Area Locations

The extensive and intensive study areas are all located in the Cabinet Mountains south of Libby. Figure 3 illustrates the location of alternative plant sites, tailings areas, evaluation adits, and transmission lines. The Cabinet Mountains generally trend north-south in direction, have U-shaped valleys to the east and west, and an elevation of 7,900 feet. The three evaluation adits are located in the Rock Creek drainage on a steep west-facing slope and range in elevation from 4,000 feet (near the base of the slope) to 4,600 feet, to 5,000 feet near Rock Lake. The three sites have a total area of 72 acres. Rock Lake and runoff from these sites drain to Rock Creek Meadows, a wetlands area, and then to Rock Creek, a perennial stream.

Libby Creek on the east side of the Cabinet Mountains has two alternative plant sites identified as Libby Creek and Upper Libby Creek. The Libby Creek site is at an elevation of 4,200 feet and the Upper Libby Creek site is at an elevation of 4,400 feet. The Libby Creek Valley which trends northeast is generally less than 500 feet wide and has steep slopes which rise to surrounding peaks in excess of 7,000 feet. Avalanche chutes are common in the drainage from the side slopes. The Libby Creek site is approximately 96 acres in size while the Upper Libby Creek site which has two small ponds is about 51 acres in size.

The 54 acre Ramsey Creek plant site is located in Ramsey Creek, the stream valley just north of Libby Creek. The elevation of the plant site is about 4,400 feet. Like Libby Creek Valley, the Ramsey Creek Valley is narrow, surrounded by steep slopes, and trends gently northeast.

The Little Cherry and Poorman Creek tailings areas are located about three and one-half miles northeast of the Libby and Ramsey Creek plant sites. The 2296 acre combined study area for these two sites ranges in elevation from 3,400 to 3,800 feet. Little Cherry Creek bisects the northern portion of this study area and Poorman Creek is just south of this area. The entire site contains numerous small ridges, has intermittent drainages, and drains to the northeast. Past continental glacial activity has created a hummocky, poorly drained topography in some areas.

All of the above intensive study areas are encompassed by the extensive study area (Figure 3). The only developments planned outside the intensive study areas are a utility corridor connecting the preferred plant site

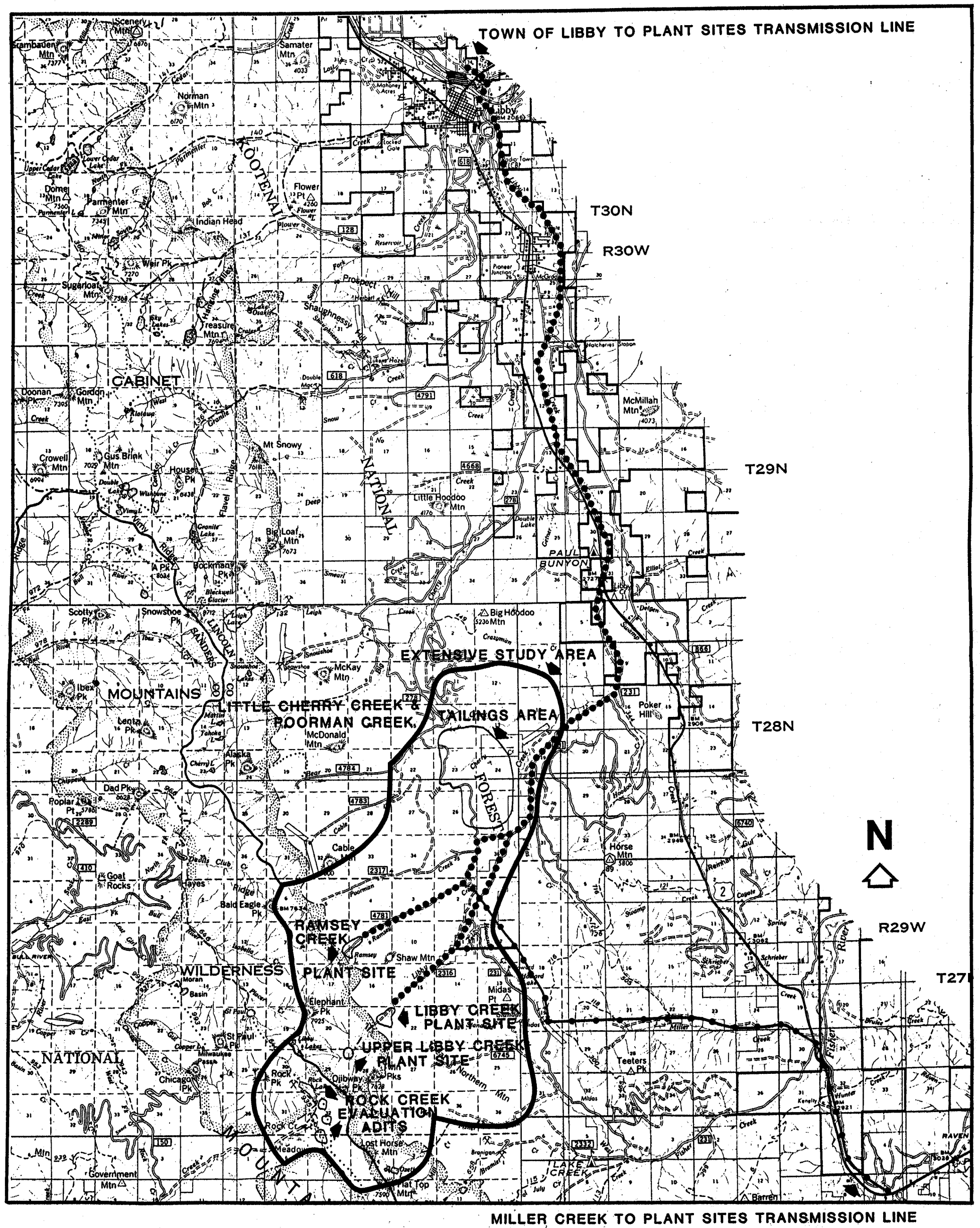

FIGURE 3.
PROJECT ALTERNATIVES LOCATION MAP

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MONTANA PROJECT

Lincoln & Sanders Counties, Montana

JAN. 1989 SCALE 1" = 2 MILES

with the preferred tailings alternative and a transmission line to provide power.

The town of Libby to plant sites transmission line alternative is about 22 miles in length considering the terminus at either Libby or Ramsey Creek plant site. The line begins at the Pacific Power and Light substation north of the town of Libby and proceeds south, crossing the Kootenai River and follows county roads which parallel Libby Creek. Approximately 13 miles south of town the transmission line crosses U.S. Highway 2 and follows U.S. Forest Service Road 231 along Libby Creek to a point just south of the tailings sites. From this point one alternative proceeds up Libby Creek to a plant site and another up Ramsey Creek to a plant site.

The Miller Creek to plant sites transmission line alternative begins at the Bonneville Power Administration transmission line which crosses U.S. Highway 2 southeast of the study area near Pleasant Valley. This transmission line proceeds north along U.S. Highway 2 for about 4.5 miles to Miller Creek where it turns west and follows a dirt road along Miller Creek. When the road ends, the transmission line proceeds further west crossing a 4,600 foot mountain, then heads northwest past Howard Lake, and then has alternative branches that proceed up Libby and Ramsey creeks. This line is about 18 miles in length with either the Libby or Ramsey Creek alternative.

3.1.2 Geology

The study area is within the northern Rocky Mountain physiographic province, an area characterized by mountain ranges and intermountain valleys. This area is underlain by Precambrian meta-sedimentary rocks of the belt series, clastic rocks generally resistant to weathering (Veseth and Montagne 1980). During the Pleistocene epoch of the Quaternary period, continental glaciers covered most of the lower elevations of the Cabinet Mountains and alpine glaciers occurred in the stream valleys. During post-glacial time volcanic ash, resulting presumably from the Mount Mazama eruption 6600 years ago covered the landscape (Nimlos 1980). The differential deposition of volcanic ash, combined with redistribution by precipitation, results in soil profiles with variable depths of ash.

3.1.3 Soils

The soils of the study area vary in age and degree of development. Young soils associated with recent fluvial and slope processes have little or no development and surface horizons with varying accumulations of organic matter. They may or may not be mantled by ash. These soils

generally have a sandy texture, abundant coarse fragments, a pH of 5-6, and are infertile.

Intermediate aged soils have horizons which exhibit alteration of the parent material through soil forming processes. The parent material of these soils has been altered through the accumulation, loss, or translocation of soil constituents and has developed a structure. Weathering of volcanic ash in the surface horizons results in development of these soils. These soils range in age from at least 6600 years (Nimlos 1980) to early Wisconsin. These soils are generally silt loams, infertile, have coarse fragments, and a pH of 5-6.

The tailings area has old soils which are probably related to one of the pre-Wisconsin glacial advances. These soils have thick subsurface horizons with accumulations of silicate clays, and have developed strong structure and distinct horizons and contain coarse fragments with substantial weathering rinds. These infertile soils have a clay to silty clay texture and a pH towards the high end of the 5-6 range.

3.1.4 Climate

The study area is characterized by a Pacific maritime climate modified by the inland continental location (USFS 1984). The prevailing westerlies carry moist Pacific air masses inland, creating cloudy, warm, wet winters. During summer, dry air masses of the prevailing westerlies create dry and warm days with cool nights. The continental location of the study area results in occasional cold periods in winter and hot intervals in the summer (USFS 1984).

Elevation has a major influence on both temperature and precipitation of the study area. Precipitation at 3,600 feet at the tailings area is approximately 30 inches, but may range to 80-90 inches on 7,303 foot Ojibway Peak near Rock Lake which is above the adit sites (USFS 1984). The majority of the precipitation falls in the November through January period. Most summer precipitation is associated with convectional storms.

The mean annual temperature for Libby is 45°F (USFS 1984). About half the days in July and August have maximum temperatures of 90°F or warmer. Summer nighttime lows are commonly in the mid 40°F. Temperature inversions are common in this area, which has a growing season of 30-50 days (Montagne et al. 1982). Extremely cold temperatures occur when arctic air masses from Canada move into the region. December and January are the coldest months of the year.

Both temperature and precipitation affect the vegetation pattern. At lower elevations, moisture is the dominant controlling factor influencing the presence of a forest type and at upper elevations temperature is the major factor (Daubenmire 1956).

3.1.5 Vegetation

The vegetation of the Kootenai National Forest has been mapped by forest habitat types by the U.S. Forest Service in the late 1970's and early 1980's. This area was mapped according the classification of Pfister et al. (1977) as presented in Forest Habitat Types of Montana. Figure 4, located in Appendix B, illustrates this forest habitat mapping for the extensive study area.

Five climax series with 15 habitat types occur within the extensive study area. Climax series present include:

- Douglas-fir
- Grand fir
- Western red cedar
- Western hemlock
- Subalpine fir (*Abies lasiocarpa*)

Each of the climax series are described below from publications of Pfister (1974, 1977) and Cooper et al. (1987).

3.1.5.1 Douglas-Fir Climax Series

The Douglas-fir climax series in northwestern Montana is bordered on the warm side by the ponderosa pine (*Pinus ponderosa*) series and on the cool side by the grand fir series or the subalpine fir series at high elevations. The Douglas-fir series occupies a broad ecological amplitude from the lower elevations of forest growth up to about 5,500 feet on southern exposures. This series occurs on all aspects, slopes, and landforms but has a tendency to occupy the warm-dry, moderately steep, south-southwest aspects at midslope on minor ridges.

Major trees in the series include Douglas-fir, ponderosa pine, western larch, and lodgepole pine (*Pinus contorta*). Douglas-fir, the climax species, can regenerate under closed canopies. However, the ponderosa pine, western larch, and lodgepole pine are all seral species in the habitat types of this climax series and do not regenerate beneath the forest canopy.

Ponderosa pine, the predominant seral species, occurs on warm, dry slopes. Lodgepole pine and western larch occur in the early seral stage on moist sites.

All four tree species are adapted to fire. Wildfires help to maintain seral species in the Douglas-fir climax series.

There are three Douglas-fir climax series habitat types in the extended study area. They include:

- Douglas-fir/bluebunch wheatgrass (*Agropyron spicatum*)
- Douglas-fir/dwarf huckleberry (*Vaccinium caespitosum*)
- Douglas-fir/ninebark (*Physocarpus malvaceus*)

Each of the habitat types occurs in the extended study area in only one location. Each occupies either a south or west-facing slope from elevations of 3,200 to 4,800 feet.

3.1.5.2 Grand Fir Climax Series

The grand fir series occurs on relatively warm exposures and excessively drained substrates in elevations just above the drier Douglas-fir series. The series occur under mild and rather moist conditions but not sufficiently moist for western red cedar, the next series in the elevation gradient. The grand fir series generally occurs near or below 5000 feet elevation.

Douglas-fir is the major seral species on nearly all grand fir habitat types. Engelmann spruce (Picea engelmannii) and lodgepole pine occur on the colder habitat types, whereas ponderosa pine is prevalent on warmer habitat types. Western larch is a major component where fire has had a significant influence and western white pine is seldom a dominant.

The extended study area has two habitat types of the grand fir series. Grand fir/queencup beadlilly (*Clintonia uniflora*) occurs on eastern and northeastern exposures of ridges between the major drainages on the east side of the Cabinet Mountains and on southern and northern exposures along upper Rock Creek on the west side of these mountains. The grand fir/beargrass (*Xerophyllum tenax*) habitat type occurs on the driest of the grand fir habitat types and has a limited occurrence in the extended study area. It is present on some northeast facing slopes of the major ridges on the east side of the Cabinets.

3.1.5.3 Western Red Cedar Climax Series

The western red cedar series occurs on all aspects and slopes at elevations of 1,500 to 5,500 feet. However, it is best developed on toe-slopes and bottomlands. On the upper elevation and cooler gradient, western red

cedar is bordered by the western hemlock climax series. The western red cedar and western hemlock series, because of similar environmental requirements, have often been classified as one series (Cooper et al. 1987).

Western hemlock is common in western red cedar habitat types and in fact, on very wet sites is the climax codominant with western red cedar. Major seral tree species include Douglas-fir, grand fir, western white pine, and Engelmann spruce on colder, wetter sites, and western larch on drier sites.

Western red cedar/queencup beadlily, the most common habitat type of this series, is the only habitat type of this series mapped by the USFS in the extended study area. This habitat type is sparsely represented along the Bear Creek and West Fisher Creek drainages.

3.1.5.4 Western Hemlock Climax Series

The western hemlock series can dominate all exposures and landforms in the elevation gradient from 2,500 to 5,500 feet. At the upper elevation limits, this series changes to either the mountain hemlock or subalpine fir series. Western hemlock has a restricted ecologic amplitude. It is the most shade tolerant tree in northwestern Montana, but is intolerant to drought, excessive moisture, and the least frost hardy. Therefore, western hemlock occupies the moist, moderate temperature sites.

All endemic trees except ponderosa pine, subalpine larch (*Larix lyallii*), whitebark pine (*Pinus albicaulis*), and mountain hemlock are seral species with western hemlock habitat types. Very long-lived species such as western red cedar often codominate sites for extended periods of time.

Western hemlock/queencup beadlily, the only western hemlock series present in the extensive study area, is the most common habitat type in the extensive study area. It occurs throughout the vicinity of the two tailings area alternatives and extends up all the major drainages.

3.1.5.5 Subalpine Fir Climax Series

The subalpine fir series includes all forests potentially dominated at climax by subalpine fir, mountain hemlock, whitebark pine, or subalpine larch. At lower elevations, the subalpine fir series borders either western hemlock, western red cedar, or grand fir series. Alpine tundra and sometimes subalpine grasslands represent the upper elevation limit of the series. Cooper et al.

(1987) recognized a mountain hemlock series which Pfister et al. (1977) includes with the subalpine fir climax series.

Along a gradient of increasingly severe climatic conditions, the elevational subdivisions to the subalpine fir series are recognized. Lower elevation habitat types, those generally warm enough to support Douglas-fir, western larch, western white pine occur over about 3,000 vertical feet up to elevations of 6,200 to 6,500 feet. Douglas-fir and lodgepole pine are the major seral tree species. Engelmann spruce is a long-lived seral tree of the moist habitat types. Western larch and western white pine are also major components in habitat types of the lower elevation subalpine fir series.

Upper elevation habitat types occur in an approximate 700 foot elevation zone from about 6,500 to 7,200 feet. Subalpine fir is the dominant tree in these habitat types. Whitebark pine is a persistent dominant seral tree on all but the moist sites, which often have Engelmann spruce as a persistent seral component.

Timberline habitat types occur in the transition zone between contiguous forest and alpine tundra at an elevation of 7,200 to 8,000 feet. Only four trees form habitat types in this zone. In order of decreasing tolerance to cold, they include the subalpine larch, whitebark pine, Engelmann spruce, and subalpine fir.

The extensive study area has five habitat types in the lower subalpine habitat type grouping, one in the upper subalpine, and two in the timberline.

The lower subalpine group includes subalpine fir/queencup beadlily, subalpine fir/menziesia (*Menziesia ferruginea*), mountain hemlock/menziesia, subalpine fir/beargrass, and mountain hemlock/beargrass. All these habitat types are common on the ridges between the major streams on the east side of the Cabinet Mountains.

Subalpine fir/smooth woodrush (*Luzula hitchockii*), the only habitat type of the upper subalpine, occurs on various aspects along the divide of the Cabinet Mountains.

The two timberline habitat types present include whitebark pine/subalpine fir and alpine larch/subalpine fir. These two habitat types occupy the highest elevations of the forested areas.

3.1.6 Land Use

Major land uses of the study area include timbering, mining, recreation, and agriculture. Timbering

began in this region in the late 1800's due to demands created by the railroad and mining industries (USFS 1984). Timbering on the lower elevations of the study area began in the 1960's and continues to present. Mining is also a historic land use. Placer mining for gold occurred in several locations along Libby Creek in the late 1800's and resulted in the development of a few dwellings and ancillary facilities. Silver was mined at the Heidelberg Mine in the Rock Creek dainage in the 1950's. The principal recreation uses of the study area include hunting, fishing, hiking, backpacking, camping, and cross country skiing and snowmobiling in the winter. Livestock grazing, the only agricultural land use, occurs only at lower elevations and is quite limited.

3.2 EXISTING AND POTENTIAL VEGETATION INTENSIVE STUDY AREA

This section describes the existing vegetation and potential forest habitat types of the alternative plant sites, tailings areas, and evaluation adits. The existing and potential vegetation types are described from quantitative data and qualitative observations conducted during the 1988 growing season. The potential forest habitat types have been mapped according to the classification systems and description of Pfister et al. (1977) and Cooper et al. (1987).

3.2.1 Existing Vegetation

The 2,296 acre intensive study area which includes tailings areas along Little Cherry Creek (Figure 5 of Appendix B), plant sites in Ramsey (Figure 6) and Libby (Figures 7 and 8) creeks, and evaluation adits in the Rock Creek (Figure 9) is characterized by four major vegetation types, small wetlands, disturbances, talus slopes, and open water. Table 1 lists the acreage of each mapping unit for each intensive study area.

Fire and logging activities have dramatically affected the presence, distribution, abundance, and dominance of tree species in the region and the study area (Arno and Davis 1980). The northern Rocky Mountains is a region of unusually high fire occurrence in forested areas. Fires of varying size and intensity have historically burned the study area, sometimes destroying the entire forest and sometimes only burning the ground litter. These fires have altered the forest environment by fostering the establishment of new seral communities and by selectively eliminating understory species and those trees least adapted to fire. These seral communities are often long-lived as development of the climax community may require hundreds of years due to advanced age of climax trees.

TABLE 1. ACREAGE OF MAPPING UNITS PER STUDY AREA - 1988
MONTANA PROJECT

Study Area	Coniferous Forest	Clear Cuts	Shrublands	Subalpine	Wetlands	Disturbed	Pond	Talus Slopes	Total
Ramsey Creek Plant Site									
acres	10.8	40.0	1.8		1.1				53.7
percent	20	75	3		2				
Libby Creek Plant Site									
acres	56.9	11.4	27.2						95.5
percent	60	12	28						
Upper Libby Creek Plant Site									
acres	21.7		25.2		1.3	2.2	0.4		50.8
percent	43		50		3	4	<1		
Rock Creek Evaluation Adit Sites									
acres	17.6		27.2	15.0				12.1	71.9
percent	24		38	21				17	
Tailings Areas									
acres	1034.0	983.6			4.6	1.8			2024.0
percent	51	49			<1	<1			
Total	1141.0	1035.0	81.4	15.0	7.0	4.0	0.4	12.1	2295.9

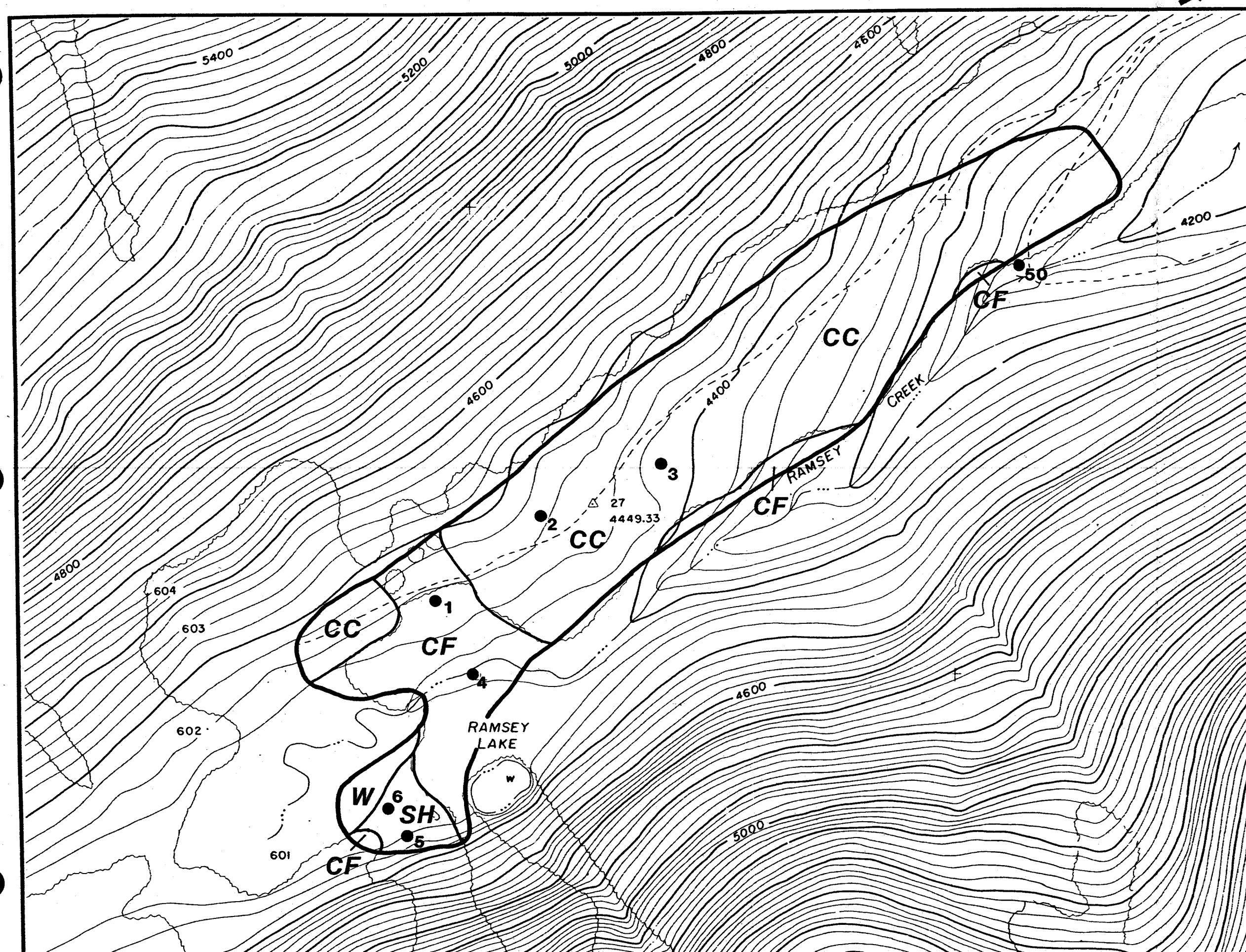

FIGURE 6.
VEGETATION TYPE MAP - RAMSEY CREEK

LEGEND

- CC Clearcut
- CF Coniferous Forest
- SH Shrubland
- W Wetlands
- ●4 Sample Site

NORANDA MINERALS CORP.

MONTANA PROJECT
Lincoln County, Montana

N

JAN. 1989
SCALE 1"= 400'

prepared by
Western Resource Development Corporation

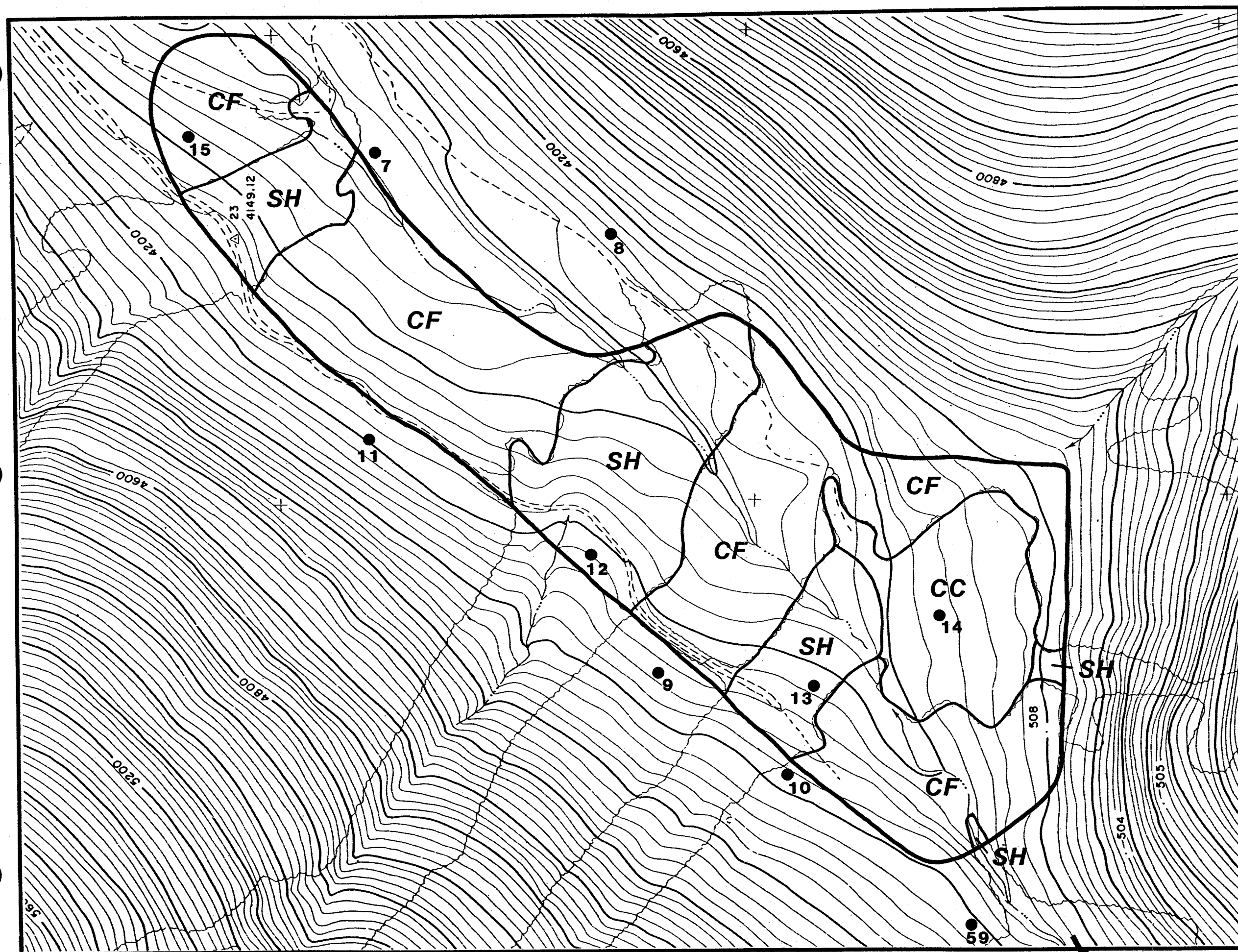

FIGURE 7.
VEGETATION TYPE MAP - LIBBY CREEK

LEGEND

- CC Clearcut
- CF Coniferous Forest
- SH Shrubland
- ●10 Sample Site

NORANDA MINERALS CORP.

MONTANA PROJECT
Lincoln County, Montana

N

JAN. 1989
SCALE 1"= 400'

prepared by
Western Resource Development Corporation

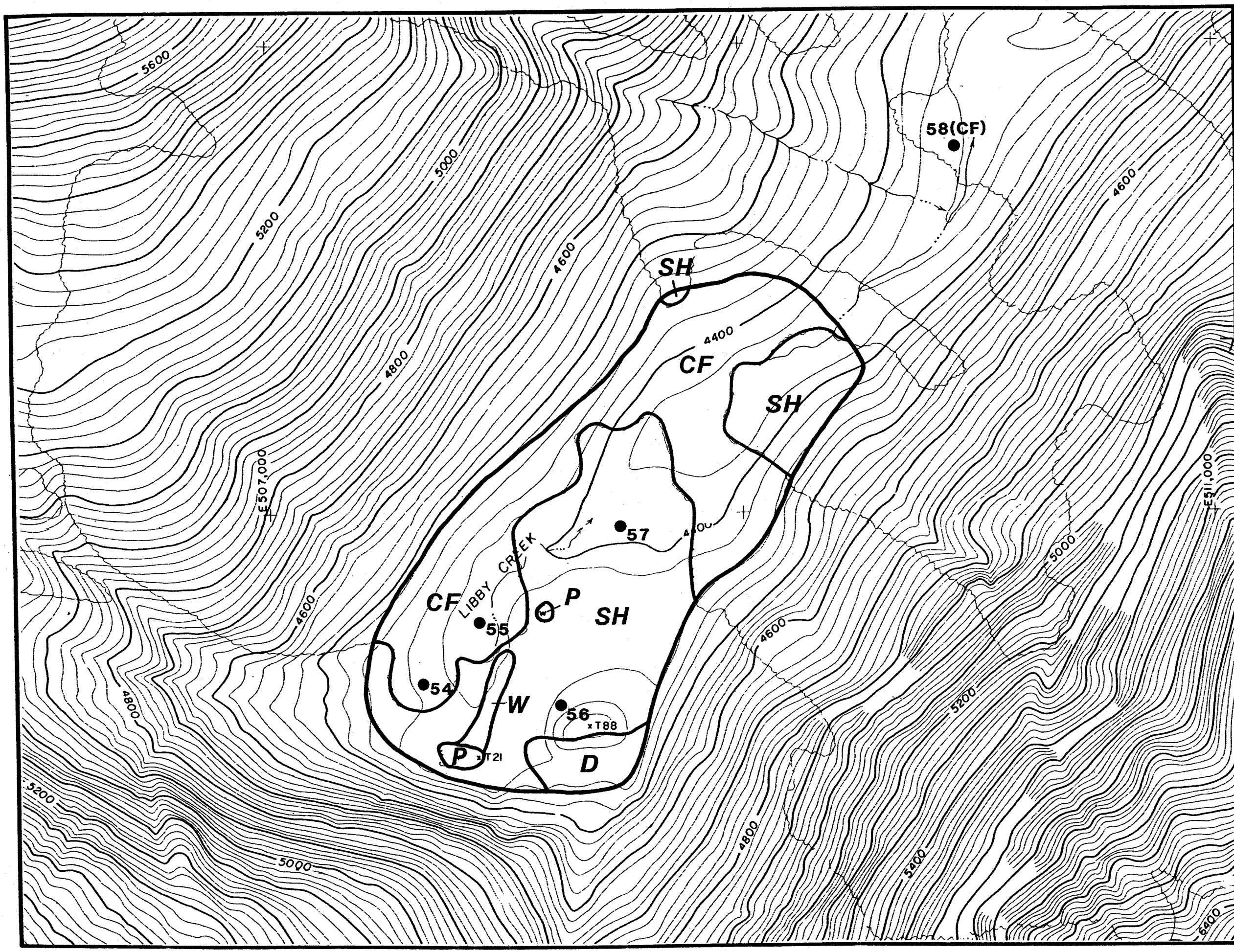

FIGURE 8.
VEGETATION TYPE MAP - UPPER LIBBY CREEK

LEGEND

- SH Shrubland
- CF Coniferous Forest
- W Wetlands
- P Pond
- D Disturbance
- ●57 Sample Site

NORANDA MINERALS CORP.

MONTANA PROJECT
Lincoln County, Montana

N

JAN. 1989
SCALE 1"= 400'

prepared by
Western Resource Development Corporation

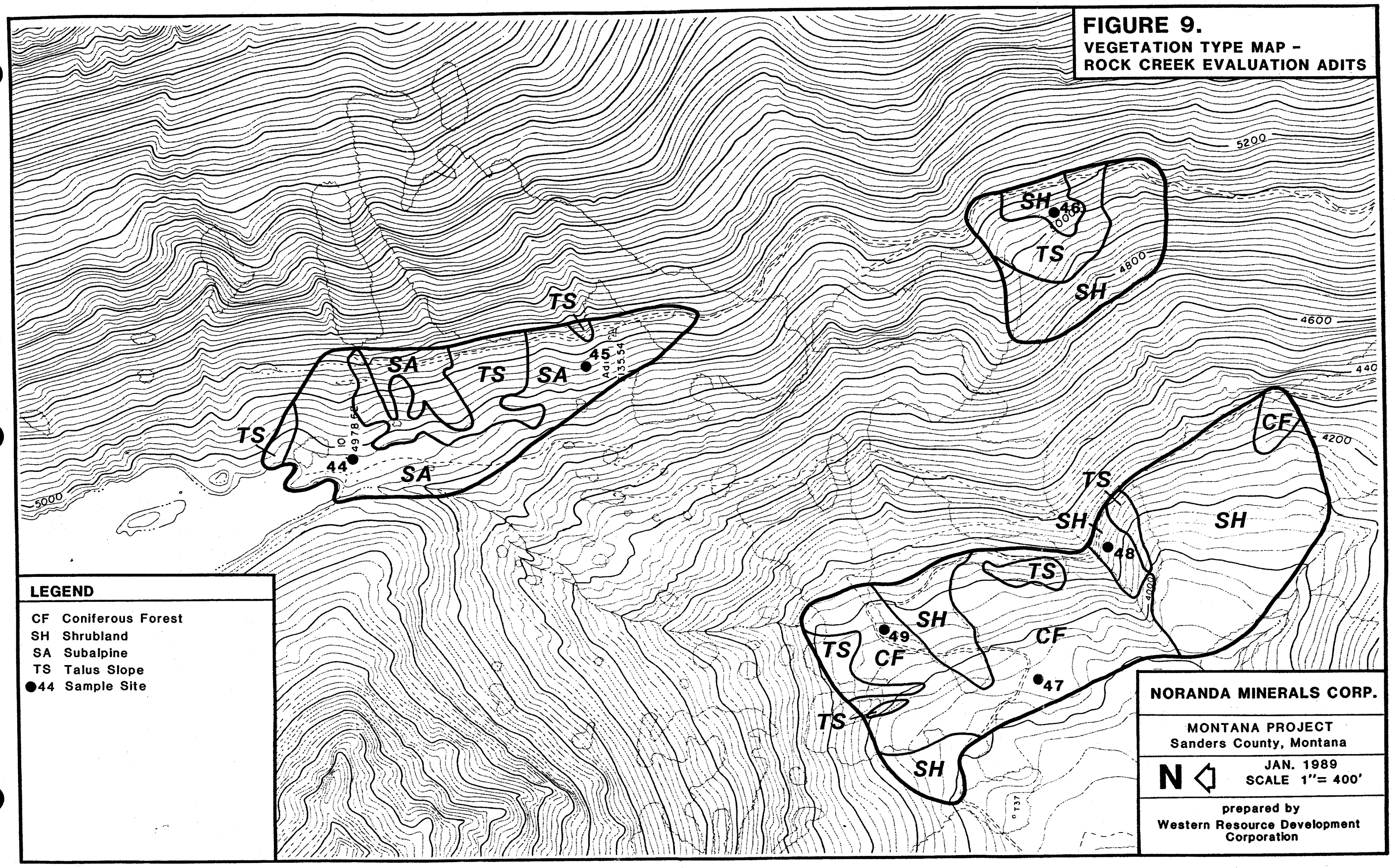
FIGURE 9.
VEGETATION TYPE MAP -
ROCK CREEK EVALUATION ADITS
LEGEND
CF Coniferous Forest
SH Shrubland
SA Subalpine
TS Talus Slope
●44 Sample Site
NORANDA MINERALS CORP.
MONTANA PROJECT
Sanders County, Montana
N
JAN. 1989
SCALE 1"= 400'
prepared by
Western Resource Development Corporation
5200
4800
4600
4200
4000
5000
44
45
46
47
48
49
SA
TS
SH
CF

Seral trees are generally adapted to fire and disturbances. Western larch, ponderosa pine, and Douglas-fir have fire resistant bark and, along with white pine have winged/or light seeds for easy travel to disturbed sites. Lodgepole pine has cones that open after exposure to fire. Species of *Abies*, *Tsuga*, and *Picea* are likely to be killed by most fires as they have thin bark and are susceptible to rot entering wounds produced by fires.

Timbering practices also result in the creation of seral communities. The logging of small, scattered patches, followed by burning of residual material has created small seral communities of varying ages throughout the study area.

Massive and successive fires often destroy tree seed sources and resulted in the development of long-persisting shrubland and forb fields. However, shrublands of the study area are due to avalanches and not the past action of fire.

3.2.1.1 Coniferous Forests (Figure 10)

Coniferous forests with a total of 129 species are the most diverse community in the study area. Past fire and a logging history in the area has created numerous different-aged seral stands to the climax forest habitat types. The ten tree species present in the 35 sample stands form numerous associations, sometimes with seven different tree species in the sample plots. Western hemlock was the only tree to form a monoculture. This occurred in three stands along drainages.

Cover (Table 2). Total vegetation cover based on all hits is 164.3%. Litter cover is 4.6% and rock cover is very low at 0.1%. Cover by lifeform is as follows: trees (86.5%), tall shrubs (9.5%), low shrubs (9.2%), subshrubs (5.5%), perennial graminoids (2.3%), perennial forbs (26.3%), annual and biennial forbs (0.1%), and cryptogams (23.4%).

Western hemlock with a cover of 26.0% and a frequency value of 88.6% is the major tree in the coniferous forests. Grand fir (18.9%) has the second highest cover and a frequency of 80.0%. Western red cedar (13.7%), third highest in cover, is followed by Engelmann spruce (8.1%) which has a high frequency (65.7%). Less abundant trees include Douglas-fir (5.6%), western larch (4.6%), subalpine fir (3.5%), lodgepole pine (2.3%), black cottonwood (*Populus trichocarpa*) (2.0%), and white pine (1.8%). Standing dead lodgepole pine has a cover of 1.4%, and standing dead grand fir a cover of 0.1%.

Figure 10. Coniferous forests are the most abundant vegetation type in the study area. Logging operations and fire have created a complex mosaic of different aged seral stands of varying vegetation composition.

TABLE 2. CONIFEROUS FOREST COVER DATA SUMMARY - 1988
MONTANA PROJECT

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
TREES					
Abies grandis	16.1%	16.9%	18.9%	11.5%	71.4%
Abies lasiocarpa	3.5%	3.7%	3.5%	2.2%	8.6%
Larix occidentalis	4.5%	4.8%	4.6%	2.8%	37.1%
Picea engelmannii	7.0%	7.4%	8.1%	4.9%	57.1%
Pinus contorta	2.3%	2.4%	2.3%	1.4%	17.1%
Pinus monticola	1.7%	1.7%	1.8%	1.1%	28.6%
Populus trichocarpa	2.0%	2.1%	2.0%	1.2%	5.7%
Pseudotsuga menziesii	4.9%	5.1%	5.6%	3.4%	40.0%
Thuja plicata	9.8%	10.2%	13.7%	8.4%	60.0%
Tsuga heterophylla	21.9%	23.0%	26.0%	15.8%	88.6%
Total % Trees	73.7%	77.3%	86.5%	52.7%	
TREES - DEAD					
Abies grandis	0.1%	0.1%	0.1%	0.0%	2.9%
Pinus contorta	1.4%	1.4%	1.4%	0.9%	5.7%
Total % Trees - Dead	1.5%	1.5%	1.5%	0.9%	
TALL SHRUBS					
Acer glabrum	3.4%	3.6%	5.0%	3.1%	31.4%
Alnus sinuata	1.7%	1.7%	1.9%	1.1%	14.3%
Sorbus scopulina	P	0.0%	0.0%	0.0%	8.6%
Sorbus sitchensis	0.1%	0.1%	0.1%	0.0%	2.9%
Taxus brevifolia	1.3%	1.4%	2.5%	1.5%	20.0%
Total % Tall Shrubs	6.5%	6.8%	9.5%	5.7%	
LOW SHRUBS					
Amelanchier alnifolia	0.0%	0.0%	0.2%	0.1%	5.7%
Cornus stolonifera	0.1%	0.1%	0.4%	0.3%	5.7%
Holodiscus discolor	0.0%	0.0%	0.1%	0.0%	2.9%
Lonicera ciliosa	P	0.0%	0.0%	0.0%	2.9%
Lonicera involucrata	0.0%	0.0%	0.1%	0.0%	2.9%
Lonicera utahensis	0.0%	0.0%	0.2%	0.1%	8.6%
Menziesia ferruginea	0.2%	0.2%	0.2%	0.2%	5.7%
Oplopanax horridum	1.2%	1.3%	3.0%	1.9%	25.7%
Pachistima myrsinites	0.0%	0.0%	0.6%	0.3%	14.3%
Rhamnus alnifolia	0.0%	0.0%	0.2%	0.1%	2.9%
Ribes lacustre	0.0%	0.0%	0.2%	0.1%	8.6%
Ribes viscosissimum	P	0.0%	0.0%	0.0%	2.9%
Rosa gymnocarpa	0.1%	0.1%	0.3%	0.2%	2.9%
Rosa nutkana	P	0.0%	0.0%	0.0%	5.7%
Rubus idaeus	P	0.0%	0.0%	0.0%	5.7%

TABLE 2. (Continued)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Salix scouleriana	0.1%	0.1%	0.1%	0.1%	2.9%
Sambucus racemosa	0.1%	0.1%	0.3%	0.2%	2.9%
Sheperdia canadensis	0.0%	0.0%	0.1%	0.0%	5.7%
Spiraea betulifolia	0.1%	0.1%	0.5%	0.3%	20.0%
Symphoricarpos albus	0.2%	0.2%	0.7%	0.5%	5.7%
Vaccinium cespitosum	P	0.0%	0.0%	0.0%	2.9%
Vaccinium globulare	0.3%	0.4%	1.5%	1.0%	28.6%
Vaccinium myrtillus	0.0%	0.0%	0.5%	0.3%	11.4%
Total % Low Shrubs	2.4%	2.5%	9.2%	5.7%	
SUBSHRUBS					
Arctostaphylos uva-ursi	P	0.0%	0.0%	0.0%	2.9%
Berberis repens	P	0.0%	0.0%	0.0%	17.1%
Chimaphila umbellata	0.3%	0.3%	1.0%	0.6%	20.0%
Cornus canadensis	0.0%	0.0%	0.1%	0.1%	2.9%
Linnaea borealis	0.4%	0.4%	2.8%	1.6%	25.7%
Penstemon ellipticus	P	0.0%	0.0%	0.0%	2.9%
Rubus parviflorus	0.2%	0.3%	1.4%	0.9%	14.3%
Rubus pedatus	0.0%	0.0%	0.2%	0.1%	2.9%
Total % Subshrubs	0.9%	1.0%	5.5%	3.3%	
PERENNIAL GRAMINOIDS					
Bromus vulgaris	0.0%	0.0%	0.1%	0.1%	5.7%
Calamagrostis canadensis	0.0%	0.0%	0.1%	0.0%	2.9%
Calamagrostis inexpansa	P	0.0%	0.0%	0.0%	2.9%
Calamagrostis rubescens	0.1%	0.1%	0.3%	0.2%	8.6%
Carex concinnoides	0.0%	0.0%	0.1%	0.1%	2.9%
Carex deweyana	P	0.0%	0.0%	0.0%	5.7%
Carex rossii	P	0.0%	0.0%	0.0%	2.9%
Carex stipata	0.0%	0.0%	0.1%	0.1%	2.9%
Deschampsia elongata	0.1%	0.1%	0.1%	0.0%	2.9%
Elymus glaucus	0.1%	0.1%	0.1%	0.1%	2.9%
Festuca occidentalis	P	0.0%	0.0%	0.0%	5.7%
Festuca subulata	0.1%	0.1%	0.1%	0.1%	2.9%
Glyceria grandis	0.1%	0.1%	1.1%	0.7%	8.6%
Luzula hitchcockii	P	0.0%	0.0%	0.0%	2.9%
Luzula parviflora	0.0%	0.0%	0.1%	0.0%	2.9%
Muhlenbergia asperifolia	0.0%	0.0%	0.1%	0.0%	2.9%
Phleum pratense	P	0.0%	0.0%	0.0%	2.9%
Scirpus maritimus	P	0.0%	0.0%	0.0%	2.9%
Total % Perennial Graminoids	0.5%	0.5%	2.3%	1.4%	

TABLE 2. (Continued)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
PERENNIAL FORBS					
Aconitum columbianum	0.1%	0.1%	0.4%	0.3%	5.7%
Actaea rubra	0.0%	0.0%	0.3%	0.2%	11.4%
Adenocaulon bicolor	0.1%	0.1%	0.3%	0.2%	14.3%
Angelica arguta	0.1%	0.1%	0.1%	0.1%	2.9%
Aralia nudicaulis	0.0%	0.0%	0.1%	0.0%	2.9%
Arnica cordifolia	0.4%	0.5%	3.0%	1.8%	34.3%
Asarum caudatum	0.0%	0.0%	0.3%	0.2%	2.9%
Cicuta douglasii	P	0.0%	0.0%	0.0%	2.9%
Circaea alpina	0.1%	0.1%	0.6%	0.3%	11.4%
Cirsium flodmanii	P	0.0%	0.0%	0.0%	2.9%
Clematis columbiana	0.1%	0.1%	0.2%	0.1%	2.9%
Clintonia uniflora	0.3%	0.4%	3.0%	1.9%	51.4%
Coptis occidentalis	0.4%	0.5%	3.0%	1.8%	40.0%
Corallorhiza maculata	P	0.0%	0.0%	0.0%	8.6%
Disporum hookeri	0.0%	0.0%	0.7%	0.4%	11.4%
Epilobium angustifolium	P	0.0%	0.0%	0.0%	2.9%
Epilobium glaberrimum	0.0%	0.0%	0.1%	0.1%	2.9%
Fragaria vesca	P	0.0%	0.0%	0.0%	2.9%
Fragaria virginiana	0.1%	0.1%	0.1%	0.0%	2.9%
Galium boreale	0.1%	0.1%	0.1%	0.0%	2.9%
Galium triflorum	0.1%	0.1%	0.3%	0.2%	5.7%
Geum macrophyllum	P	0.0%	0.0%	0.0%	2.9%
Goodyera oblongfolia	0.1%	0.1%	0.1%	0.0%	2.9%
Habenaria dilatata	P	0.0%	0.0%	0.0%	8.6%
Habenaria hyperborea	P	0.0%	0.0%	0.0%	2.9%
Habenaria obtusata	P	0.0%	0.0%	0.0%	2.9%
Hieracium albiflorum	P	0.0%	0.0%	0.0%	25.7%
Hieracium cynoglossoides	P	0.0%	0.0%	0.0%	2.9%
Ligusticum verticillatum	P	0.0%	0.0%	0.0%	5.7%
Listera convallarioides	P	0.0%	0.0%	0.0%	14.3%
Mitella breweri	0.0%	0.0%	0.1%	0.0%	2.9%
Osmorhiza chilensis	0.0%	0.0%	0.2%	0.1%	5.7%
Pedicularis bracteosa	P	0.0%	0.0%	0.0%	2.9%
Polemonium pulcherrimum	P	0.0%	0.0%	0.0%	2.9%
Pyrola asarifolia	0.1%	0.1%	0.2%	0.1%	8.6%
Pyrola chlorantha	0.0%	0.0%	0.1%	0.0%	2.9%
Pyrola minor	P	0.0%	0.0%	0.0%	2.9%
Pyrola secunda	0.0%	0.0%	0.3%	0.2%	8.6%
Pyrola uniflora	0.0%	0.0%	0.1%	0.0%	2.9%
Saxifraga ferruginea	0.0%	0.0%	0.1%	0.0%	2.9%
Senecio triangularis	0.1%	0.1%	0.4%	0.2%	2.9%
Smilacina stellata	0.2%	0.1%	2.6%	1.7%	28.6%
Streptopus amplexifolius	0.1%	0.1%	0.4%	0.2%	8.6%
Thalictrum occidentale	0.1%	0.1%	0.6%	0.3%	17.1%
Tiarella trifoliata	0.6%	0.7%	3.8%	2.8%	51.4%
Trillium ovatum	0.0%	0.0%	0.1%	0.0%	5.7%

TABLE 2. (Continued)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Urtica dioica	P	0.0%	0.0%	0.0%	5.7%
Veratrum viride	0.1%	0.0%	0.2%	0.1%	5.7%
Veronica americana	0.0%	0.0%	0.1%	0.0%	2.9%
Viola glabella	0.0%	0.0%	0.8%	0.5%	25.7%
Viola orbiculata	0.2%	0.2%	0.6%	0.3%	20.0%
Xerophyllum tenax	1.0%	1.0%	2.9%	1.9%	25.7%
Total % Perennial Forbs	4.3%	4.6%	26.3%	16.0%	
ANNUAL & BIENNIAL FORBS					
Melampyrum lineare	0.1%	0.1%	0.1%	0.1%	2.9%
Verbascum thapsus	P	0.0%	0.0%	0.0%	5.7%
Total % Annual & Biennial Forbs	0.1%	0.1%	0.1%	0.1%	
CRYPTOGAMS					
Athyrium filix-femina	3.1%	3.3%	8.2%	5.0%	45.7%
Dryopteris filix-mas	0.1%	0.1%	0.1%	0.0%	2.9%
Equisetum arvense	0.0%	0.0%	0.6%	0.4%	8.6%
Equisetum hyemale	P	0.0%	0.0%	0.0%	2.9%
Gymnocarpium dryopteris	0.6%	0.6%	5.7%	3.5%	37.1%
Lycopodium annotinum	P	0.0%	0.0%	0.0%	2.9%
Moss	1.0%	1.1%	7.0%	4.2%	80.0%
Polystichum andersonii	P	0.0%	0.0%	0.0%	2.9%
Polystichum lonchitis	P	0.0%	0.0%	0.0%	2.9%
Pteridium aquilinum	0.6%	0.6%	1.8%	1.1%	25.7%
Thelypteris phegopteris	P	0.0%	0.0%	0.0%	2.9%
Total % Cryptogams	5.4%	5.7%	23.4%	14.2%	
TOTAL % VEGETATION	95.3%	100.0%	164.3%	100.0%	
Soil	0.0%				
Litter	4.6%				
Rock	0.1%				

P = SPECIES PRESENT BUT NOT ENCOUNTERED QUANTITATIVELY

Major tall shrubs in this community include Rocky Mountain maple (*Acer glabrum*) (5.0%), Pacific yew (*Taxus brevifolia*) (2.5%), and Sitka alder (*Alnus sinuata*) (1.9%). Twenty-three low shrubs are present. However, only devil's club (*Oplopanax horridum*) (3.0%) and huckleberry (*Vaccinium globulare*) (1.5%) have cover values exceeding 1.0%. Shrubs with relatively high frequencies but with low cover include white spirea (*Spiraea betulifolia*), huckleberry (*Vaccinium globulare*), and pachistima (*Pachistima myrsinites*). Major subshrubs include western twinflower (*Linnaea borealis*) (2.8%), thimbleberry (1.4%), and little pipsissewa (*Chimaphila umbellata*) (1.0%).

Eighteen perennial graminoids provide only 2.3% cover. Reed mannagrass (*Glyceria grandis*) (1.1%), the major perennial graminoid, is restricted to wet sites. Less abundant species in this lifeform include pinegrass (*Calamagrostis rubescens*), bluejoint reedgrass (*Calamagrostis canadensis*), northwest sedge (*Carex concinnoides*), blue wildrye (*Elymus glaucus*), bearded fescue (*Festuca subulata*), smallflowered woodrush (*Luzula parviflora*), and roughleaved dropseed (*Muhlenbergia asperifolia*).

The fifty-two perennial forbs present provide 26.3% of the all hit vegetation cover. Dominant species include tiarella (*Tiarella trifoliata*) (3.8%), queencup beadlily (3.0%), heartleaf arnica (*Arnica cordifolia*) (3.0%), western goldthread (*Coptis occidentalis*) (3.0%), beargrass (2.9%), stream violet (*Viola glabella*) (0.8%), and roundleaf violet (*Viola orbiculata*) (0.6%). Narrowleaf cow wheat (*Melampyrum lineare*) (0.1%) is the only annual forb present in the cover. Flannel mullein (*Verbascum thapsus*), another annual forb, is present but provides no cover.

Cryptogamic cover is high at 23.4%. Dominant cryptogams respectively include lady fern (*Athyrium filix-femina*) (8.2%), oak fern (*Gymnocarpium dryopteris*) (5.7%), and bracken fern (*Pteridium aquilinum*) (1.8%). Mosses occur in 80.0% of the sample stands and provide a total cover of 7.0%.

<u>Trees</u> (Table 3). Table 3 presents the data on tree density, reproduction, height, dbh, basal area and volume, and age. Total tree density is 639.4 trees/acre. Grand fir (149.9 trees/acre), hemlock (138.8 trees/acre), and western red cedar (120.3 trees/acre), the trees with the greatest cover values, have the highest density. Standing dead trees have a density of 92.5 trees/acre. The most common dead trees include lodgepole pine, white pine, grand fir, and Engelmann spruce.

TABLE 3. CONIFEROUS FOREST TREE DENSITY, REPRODUCTION, HEIGHT, DBH, BASAL AREA AND VOLUME, AND AGE DATA SUMMARY - 1988 MONTANA PROJECT

DENSITY

	MEAN NO. TREES/ 125 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TREES				
Abies grandis	4.6	149.9	23.4%	
Abies lasiocarpa	0.6	19.4	3.0%	
Larix occidentalis	1.1	35.2	5.5%	
Picea engelmannii	1.4	46.3	7.2%	
Pinus contorta	1.6	52.7	8.1%	
Pinus monticola	1.1	37.0	5.8%	
Populus trichocarpa	0.1	1.9	0.2%	
Pseudotsuga menziesii	1.2	37.9	6.0%	
Thuja plicata	3.7	120.3	18.8%	
Tsuga heterophylla	4.3	138.8	22.0%	
Total Trees	19.7	639.4	100.0%	15.3
TREES (DEAD)				
Abies grandis	0.4	12.0	13.0%	
Abies lasiocarpa	0.1	2.8	3.0%	
Larix occidentalis	0.2	6.5	7.0%	
Picea engelmannii	0.3	10.2	11.0%	
Pinus contorta	1.3	40.7	44.0%	
Pinus monticola	0.5	15.7	17.0%	
Tsuga heterophylla	0.1	4.6	5.0%	
Total Trees (Dead)	2.9	92.5	100.0%	4.9

REPRODUCTION

	MEAN SHRUBS/25 SQ M	MEAN SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
Abies grandis	2.2	351.5	13.9%	
Pseudotsuga menziesii	0.1	13.9	0.5%	
Thuja plicata	1.2	208.1	8.3%	
Tsuga heterophylla	12.1	1951.8	77.3%	
Total Tree Reproduction	15.6	2525.3	100.0%	34.5

TABLE 3. (Continued)

	HEIGHT (FEET)		
	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	3	96	31.6
Abies lasiocarpa	5	94	38.7
Larix occidentalis	40	128	79.0
Picea engelmannii	5	99	45.9
Pinus contorta	20	81	49.1
Pinus monticola	6	114	25.2
Pseudotsuga menziesii	6	109	50.8
Thuja plicata	5	101	26.0
Tsuga heterophylla	1	108	34.1
Total Trees			37.1
TREES (DEAD)			
Abies grandis	38	38	38.0
Larix occidentalis	96	96	96.0
Picea engelmannii	13	42	29.0
Pinus contorta	16	16	16.0
Pinus moniticola	12	99	55.5
Total Dead Trees			47.3

TABLE 3. (Continued)

	DBH (INCHES)		
	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	0.4	25.2	5.2
Abies lasiocarpa	0.4	28.3	8.4
Larix occidentalis	3.1	26.8	10.3
Picea engelmannii	1.2	30.3	8.4
Pinus contorta	2.8	16.1	5.8
Pinus monticola	0.4	18.9	3.1
Populus trichocarpa	33.1	35.0	34.1
Pseudotsuga menziesii	0.4	31.1	8.7
Thuja plicata	0.4	26.8	4.7
Tsuga heterophylla	0.4	46.5	5.2
Total Trees			5.9
TREES (DEAD)			
Abies grandis	1.6	13.8	4.5
Abies lasiocarpa	3.5	10.2	6.0
Larix occidentalis	1.6	12.2	14.4
Picea engelmannii	1.2	11.0	3.6
Pinus contorta	1.6	9.8	5.8
Pinus moniticola	0.4	26.4	4.2
Pseudotsuga menziesii	7.9	7.9	7.9
Tsuga heterophylla	2.0	6.7	3.7
Total Dead Trees			5.1

TABLE 3. (Continued) BASAL AREA AND VOLUME

	Thousand Board Feet Per Acre	Basal Area (Sq. Feet) Per Acre	Quadratic Mean Diameter (Inches)
Abies grandis	3.8	53.0	8.1
Abies lasiocarpa	1.6	14.0	11.5
Larix occidentalis	3.3	25.5	11.6
Picea engelmannii	1.8	29.2	10.8
Pinus contorta	0.3	26.6	8.2
Pinus monticola	0.7	5.5	5.2
Populus trichocarpa	*	11.7	34.1
Pseudotsuga menziesii	3.9	27.7	11.6
Thuja plicata	1.0	35.4	7.3
Tsuga heterophylla	15.7	56.3	8.7
Total Trees	32.1	284.9	

* Tree height data not available.

TABLE 3. (Continued)

AGE

	NUMBER TREES CORED	MEAN	MINIMUM	MAXIMUM
Abies grandis	4	82	76	89
Larix occidentalis	2	229	218	240
Picea engelmannii	7	*112	37	160+
Pinus contorta	2	91	89	92
Pinus monticola	3	94	68	130
Pseudotsuga menxiesii	4	*167	110	208
Thuja plicata	1	*170	170+	170+
Tsuga heterophylla	2	82	60	104
Total Trees	24	124	37	240

* The age estimate for one or more trees in this category is too low, because the increment borer could estimate tree age only for trees of 32 inch diameter or less.

Tree reproduction rates are high at 2525.3 trees/acre. Western hemlock (1951.8 trees/acre) represents 77.3% of the total reproduction. Only three other trees are reproducing in the sample stands. They include: grand fir (351.5 trees/acre), western red cedar (208.1 trees/acre), and Douglas-fir (13.9 trees/acre).

Western larch with a mean height of 79.0 feet is the tallest tree. Other tall trees include Douglas-fir (50.8 feet), lodgepole pine (49.1 feet), and Engelmann spruce (45.9 feet). Western red cedar (26.0 feet) has the shortest mean height.

Western hemlock (46.5 inches) has the largest diameter of the trees present. Other large trees present include black cottonwood (35.0 inches), Douglas-fir (31.1 inches), Engelmann spruce (30.3 inches), and subalpine fir (28.3 inches). However, when the mean is considered, black cottonwood (34.1 inches), the largest tree, is followed by western larch (10.3 inches) and Douglas-fir (8.7 inches).

The mean age for the 24 trees cored is 124 years. Western larch (229 years) has the oldest mean age. Other old trees include western red cedar (170 years), Douglas-fir (167 years), Engelmann spruce (112 years). Grand fir, the tree with the greatest density, accordingly has the greatest basal area (2649.9 ft^2). Other trees with high basal areas, respectively, include western larch (659.1 ft^2), Douglas-fir (593.6 ft^2), western hemlock (983.9 ft^2), lodgepole pine (431.4 ft^2), and western red cedar (362.5 ft^2). With regard to tree volume, western hemlock (165.3 thousand board feet/acre) is dominant. Other major trees include Douglas-fir (135.0 thousand board feet/acre), grand fir (124.1 thousand board feet/acre), and western larch (117.0 thousand board feet/acre).

Shrubs (Table 4). Shrub density is high at 6618.4 shrubs/acre. Huckleberry (1692.8 shrubs/acre) and pachistima (1165.5 shrubs/acre) dominate the shrub density. Less abundant shrubs respectively include: baldhip rose (*Rosa gymnocarpa*) (619.8 shrubs/acre), white spirea (513.4 shrubs/acre), dwarf bilberry (*Vaccinium myrtillus*) (494.9 shrubs/acre), devil's club (407.0 shrubs/acre), common snowberry (319.1 shrubs/acre), thimbleberry (291.4 shrubs/acre), and Rocky Mountain maple (249.8 shrubs/acre).

Production (Table 5). Total herbaceous production is quite low at 145.0 lbs/acre. Perennial forbs provide 96.3% of the total biomass and perennial graminoids (5.3 lbs/acre) the remaining 3.7%.

TABLE 4. CONIFEROUS FOREST SHRUB DENSITY DATA SUMMARY - 1988
MONTANA PROJECT

	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TALL SHRUBS				
Acer glabrum	1.5	249.8	3.8%	
Alnus sinuata	0.3	41.6	0.6%	
Sorbus scopulina	0.1	23.1	0.3%	
Taxus brevifolia	0.5	78.6	1.2%	
Total Tall Shrubs	2.4	393.1	5.9%	
LOW SHRUBS				
Amelanchier alnifolia	0.94	152.6	2.3%	
Cornus stolonifera	0.09	13.9	0.2%	
Holodiscus discolor	0.09	13.9	0.2%	
Lonicera utahensis	0.83	134.1	2.0%	
Menziesia ferruginea	0.26	41.6	0.6%	
Oplopanax horridum	2.51	407.0	6.1%	
Pachistima myrsinites	7.20	1165.5	17.6%	
Rhamnus alnifolia	0.17	27.8	0.4%	
Ribes lacustre	0.26	41.6	0.6%	
Ribes viscosissiumum	0.03	4.6	0.1%	
Rosa gymnocarpa	3.83	619.8	9.4%	
Rosa nutkana	0.20	32.4	0.5%	
Rubus idaeus	0.03	4.6	0.1%	
Salix scouleriana	0.11	18.5	0.3%	
Sambucus racemosa	0.14	23.1	0.3%	
Shepheria canadensis	0.11	18.5	0.3%	
Spiraea betulifolia	3.17	513.4	7.8%	
Symphoricarops albus	1.97	319.1	4.8%	
Vaccinium globulare	10.46	1692.8	25.6%	
Vaccinium myrtillus	3.06	494.9	7.5%	
Vaccinium scoparium	0.03	4.6	0.1%	
Total Low Shrubs	35.5	5744.3	86.8%	
SUBSHRUBS				
Berberis repens	1.2	189.6	2.9%	
Rubus parviflorus	1.8	291.4	4.4%	
Total Subshrubs	3.0	481.0	7.3%	
TOTAL SHRUBS	40.9	6618.4	100.0%	35.8

TABLE 5. CONIFEROUS FOREST, CLEARCUT, SHRUBLAND, AND SUBALPINE HERBACEOUS PRODUCTION DATA SUMMARY - 1988 MONTANA PROJECT

	ABSOLUTE MEAN GRAMS/SQ M	LB/ACRE	RELATIVE PRODUCTION	STANDARD DEVIATION
CONIFEROUS FOREST				
Perennial Graminoids	0.6	5.3	3.7%	
Annual Graminoids	0.0	0.0	0.0%	
Perennial Forbs	15.7	139.7	96.3%	
Annual & Biennial Forbs	0.0	0.0	0.0%	
Total Production	16.3	145.0	100.0%	24.2
CLEARCUT				
Perennial Graminoids	14.4	127.9	36.2%	
Annual Graminoids	0.1	0.9	< 0.1	
Perennial Forbs	24.9	222.6	63.0%	
Annual & Biennial Forbs	0.3	2.9	0.8%	
Total Production	39.7	353.5	100.0%	34.4
SHRUBLAND				
Perennial Graminoids	16.5	146.5	24.1%	
Annual Graminoids	0.0	0.0	0.0%	
Perennial Forbs	51.9	462.1	75.9%	
Annual & Biennial Forbs	0.0	0.0	0.0%	
Total Production	68.4	608.6	100.0%	73.3
SUBALPINE				
Perennial Graminoids	2.1	18.8	7.2%	
Annual Graminoids	0.0	0.0	0.0%	
Perennial Forbs	27.1	241.6	92.8%	
Annual & Biennial Forbs	0.0	0.0	0.0%	
Total Production	29.2	260.4	100.0%	36.3

3.2.1.2 Clearcut (Figure 11)

A total of 14 clearcuts were sampled in the intensive study area. Tree core analysis of the oldest appearing trees in these clearcuts indicate that most of these sites were logged 10-20 years ago. Clearcuts with a total of 127 species are just slightly less diverse than the coniferous forest vegetation type.

Cover (Table 6). Total vegetation cover based on all hits is 97.6%, while soil, litter, and rock cover are 2.0%, 20.6%, and 0.6%, respectively. Cover by lifeform is as follows: trees (24.6%), tall shrubs plus low shrubs plus subshrubs (4.3% + 16.0% + 6.1% = 26.4%), perennial graminoids (16.9%), annual graminoids (0.1%), perennial forbs (23.4%), annual and biennial forbs (1.9%), and cryptogams (4.3%).

A total of 11 trees are present in the sampled clearcuts. The most frequently occurring trees and their respective cover are as follows: western larch, 100.0% (4.8%), Douglas-fir, 64.3% (3.3%), lodgepole pine, 71.4% (3.1%), and Engelmann spruce, 78.6% (3.1%). Western red cedar has the highest cover (6.5%) but a low frequency (28.6%) as it occurred with a high cover in only two sample stands. Western white pine and black cottonwood each have high frequency values and low cover values as each frequently occurs but with a low cover.

Sitka alder (4.3% cover) is the most frequently occurring tall shrub. Pachistima (4.2%), white spirea (2.7%), huckleberry (2.3%), snowbrush (*Ceanothus velutinus*) (2.1%), and dwarf bilberry (1.7%) are the most common low shrubs. Low shrubs with a high frequency but a low cover include Scouler willow (*Salix scouleriana*), baldhip rose, Utah honeysuckle (*Lonicera utahensis*), and western serviceberry (*Amelanchier alnifolia*). Kinnikinnik (*Arctostaphylos uva-ursi*) (3.1%) and western twinflower (1.1%) are the most abundant subshrubs. Subshrubs with a low cover and high frequency include thimbleberry and Oregon grape.

A total of 23 perennial graminoids are present within the sampled clearcuts. However, only four have a cover in excess of 1.0%. Pinegrass, the major perennial graminoid, has a cover of 8.6% and a frequency of 71.4%. Northwest sedge has an equal frequency (71.4%) but a lower cover (2.9%). Western fescue (*Festuca occidentalis*) with a cover of 1.6% is equal in importance to purple reedgrass (*Calamagrostis purpurascens*) (1.6%). Annual hairgrass (*Deschampsia danthonoides*), the only annual graminoid present, has a cover of 0.1%.

Figure 11. Clearcuts occur as mosaics throughout the study area in areas logged 10-20 years ago. The dominant colonizing trees in clearcuts respectively include western larch, Douglas-fir, lodgepole pine, and Engelmann spruce.

TABLE 6. CLEARCUT COVER DATA SUMMARY - 1988
MONTANA PROJECT

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
TREES					
Abies grandis	1.1%	1.5%	1.1%	1.2%	71.4%
Abies lasiocarpa	0.1%	0.2%	0.4%	0.4%	28.6%
Larix occidentalis	4.6%	6.0%	4.8%	4.9%	100.0%
Picea engelmannii	2.6%	3.3%	3.1%	3.2%	78.6%
Pinus contorta	3.0%	3.9%	3.1%	3.2%	71.4%
Pinus monticola	0.9%	1.1%	0.9%	0.9%	78.6%
Populus tremuloides	P	0.0%	0.0%	0.0%	28.6%
Populus trichocarpa	1.0%	1.3%	1.0%	1.0%	57.1%
Pseudotsuga menziesii	3.1%	4.1%	3.3%	3.4%	64.3%
Thuja plicata	4.0%	5.2%	6.5%	6.6%	28.6%
Tsuga heterophylla	0.3%	0.4%	0.4%	0.4%	35.7%
Total % Trees	20.7%	27.0%	24.6%	25.2%	
TALL SHRUBS					
Alnus sinuata	3.7%	4.8%	4.3%	4.4%	64.3%
Sorbus scopulina	P	0.0%	0.0%	0.0%	7.1%
Sorbus sitchensis	P	0.0%	0.0%	0.0%	7.1%
Total % Tall Shrubs	3.7%	4.8%	4.3%	4.4%	
LOW SHRUBS					
Amelanchier alnifolia	0.6%	0.7%	0.9%	0.9%	64.3%
Ceanothus velutinus	2.2%	2.8%	2.1%	2.3%	7.1%
Cornus stolonifera	P	0.0%	0.0%	0.0%	7.1%
Holodiscus discolor	P	0.0%	0.0%	0.0%	7.1%
Lonicera ciliosa	0.3%	0.4%	0.4%	0.4%	35.7%
Lonicera utahensis	0.1%	0.2%	0.3%	0.3%	57.1%
Pachistima myrsinites	3.2%	4.1%	4.2%	4.3%	78.6%
Ribes lacustre	P	0.0%	0.0%	0.0%	14.3%
Ribes spp.	P	0.0%	0.0%	0.0%	7.1%
Rosa gymnocarpa	0.4%	0.6%	0.4%	0.4%	42.9%
Rubus idaeus	P	0.0%	0.0%	0.0%	21.4%
Salix brachycarpa	P	0.0%	0.0%	0.0%	7.1%
Salix lutea	P	0.0%	0.0%	0.0%	7.1%
Salix scouleriana	0.6%	0.7%	0.7%	0.7%	35.7%
Salix wolfii	P	0.0%	0.0%	0.0%	7.1%
Sambucus racemosa	0.1%	0.2%	0.1%	0.1%	7.1%
Sheperdia canadensis	0.1%	0.2%	0.1%	0.1%	28.6%
Spiraea betulifolia	1.9%	2.4%	2.7%	2.7%	92.9%
Spiraea douglasii	0.1%	0.2%	0.1%	0.1%	21.4%
Symphoricarpos albus	P	0.0%	0.0%	0.0%	28.6%
Vaccinium globulare	1.7%	2.2%	2.3%	2.3%	21.4%

TABLE 6. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Vaccinium myrtillus	1.1%	1.5%	1.7%	1.8%	35.7%
Vaccinium scoparium	P	0.0%	0.0%	0.0%	7.1%
Total % Low Shrubs	12.4%	16.2%	16.0%	16.4%	
SUBSHRUBS					
Arctostaphylos uva-ursi	1.8%	2.5%	3.1%	3.2%	57.1%
Berberis repens	0.6%	0.7%	0.6%	0.6%	50.0%
Chimaphila umbellata	P	0.0%	0.0%	0.0%	14.3%
Cornus canadensis	0.3%	0.4%	0.7%	0.7%	28.6%
Linnaea borealis	1.0%	1.3%	1.1%	1.2%	50.0%
Rubus parviflorus	0.6%	0.7%	0.6%	0.6%	57.1%
Total % Subshrubs	4.3%	5.6%	6.1%	6.3%	
PERENNIAL GRAMINOIDS					
Agropyron repens	P	0.0%	0.0%	0.0%	7.1%
Agrostis alba	0.7%	0.9%	0.7%	0.7%	28.6%
Agrostis exarata	0.1%	0.2%	0.1%	0.1%	28.6%
Bromus anomalous	0.1%	0.2%	0.1%	0.1%	14.3%
Bromus vulgaris	0.3%	0.4%	0.3%	0.3%	14.3%
Calamagrostis purpurascens	1.4%	1.9%	1.5%	1.6%	14.3%
Calamagrostis rubescens	7.0%	8.8%	8.6%	8.9%	71.4%
Carex concinnoides	2.0%	2.3%	2.9%	2.9%	71.4%
Carex geyeri	P	0.0%	0.0%	0.0%	21.4%
Carex mertensii	P	0.0%	0.0%	0.0%	7.1%
Carex microptera	P	0.0%	0.0%	0.0%	14.3%
Carex rossii	0.4%	0.6%	0.6%	0.6%	7.1%
Dactylis glomerata	0.1%	0.2%	0.1%	0.1%	14.3%
Elymus glaucus	P	0.0%	0.0%	0.0%	14.3%
Festuca occidentalis	1.4%	1.7%	1.6%	1.6%	64.3%
Festuca subulata	P	0.0%	0.0%	0.0%	7.1%
Luzula glabrata	P	0.0%	0.0%	0.0%	7.1%
Melica subulata	0.1%	0.2%	0.1%	0.1%	14.3%
Phleum pratense	0.1%	0.2%	0.1%	0.1%	14.3%
Poa palustrus	P	0.0%	0.0%	0.0%	7.1%
Poa pratensis	P	0.0%	0.0%	0.0%	7.1%
Stipa occidentalis	0.1%	0.2%	0.1%	0.1%	14.3%
Trisetum canescens	0.1%	0.2%	0.1%	0.1%	7.1%
Total % Perennial Graminoids	13.9%	18.0%	16.9%	17.3%	
ANNUAL GRAMINOIDS					
Deschampsia danthoniodes	0.1%	0.2%	0.1%	0.1%	7.1%

TABLE 6. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Total % Annual Graminoids	0.1%	0.2%	0.1%	0.1%	
PERENNIAL FORBS					
Achillea millefolium	0.4%	0.6%	0.7%	0.7%	50.0%
Agoseris glauca	P	0.0%	0.0%	0.0%	21.4%
Anaphalis margaritacea	0.6%	0.7%	1.4%	1.5%	92.9%
Antennaria microphylla	P	0.0%	0.0%	0.0%	14.3%
Aralia nudicaulis	P	0.0%	0.0%	0.0%	7.1%
Arnica amplexicaulis	P	0.0%	0.0%	0.0%	7.1%
Arnica cordifolia	0.1%	0.2%	0.6%	0.6%	21.4%
Arnica latifolia	0.1%	0.2%	0.3%	0.3%	28.6%
Aster chilensis	P	0.0%	0.0%	0.0%	21.4%
Aster eatonii	P	0.0%	0.0%	0.0%	7.1%
Aster laevis	P	0.0%	0.0%	0.0%	7.1%
Campanula rotundifolia	P	0.0%	0.0%	0.0%	14.3%
Castilleja miniata	P	0.0%	0.0%	0.0%	21.4%
Cerastium arvense	P	0.0%	0.0%	0.0%	14.3%
Cirsium arvense	0.1%	0.2%	0.1%	0.1%	28.6%
Cirsium flodmanii	0.0%	0.0%	0.1%	0.1%	7.1%
Cirsium vulgare	0.1%	0.2%	0.1%	0.1%	14.3%
Clintonia uniflora	P	0.0%	0.0%	0.0%	50.0%
Coptis occidentalis	0.3%	0.4%	0.6%	0.6%	71.4%
Epilobium angustifolium	3.2%	4.0%	3.5%	3.6%	85.7%
Erigeron peregrinus	P	0.0%	0.0%	0.0%	7.1%
Fragaria virginiana	4.4%	5.5%	5.4%	5.5%	71.4%
Galium triflorum	P	0.0%	0.0%	0.0%	28.6%
Gentiana amarella	P	0.0%	0.0%	0.0%	21.4%
Geum macrophyllum	P	0.0%	0.0%	0.0%	14.3%
Goodyera oblongfolia	P	0.0%	0.0%	0.0%	7.1%
Hieracium albiflorum	0.3%	0.4%	0.4%	0.4%	78.6%
Hieracium aurantiacum	2.1%	2.5%	3.2%	3.2%	50.0%
Osmorhiza chilensis	P	0.0%	0.0%	0.0%	14.3%
Pedicularis racemosa	P	0.0%	0.0%	0.0%	7.1%
Penstemon confertus	P	0.0%	0.0%	0.0%	14.3%
Penstemon eriantherus	P	0.0%	0.0%	0.0%	7.1%
Penstemon spp.	P	0.0%	0.0%	0.0%	7.1%
Polemonium pulcherrimum	P	0.0%	0.0%	0.0%	21.4%
Prunella vulgaris	P	0.0%	0.0%	0.0%	14.3%
Pyrola asarifolia	P	0.0%	0.0%	0.0%	14.3%
Pyrola chlorantha	P	0.0%	0.0%	0.0%	7.1%
Pyrola secunda	P	0.0%	0.0%	0.0%	7.1%
Ranunculus spp.	P	0.0%	0.0%	0.0%	7.1%
Smilacina stellata	0.4%	0.6%	1.1%	1.2%	50.0%

TABLE 6. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Solidago canadensis	1.4%	1.9%	1.4%	1.5%	78.6%
Solidago multiradiata	P	0.0%	0.0%	0.0%	7.1%
Taraxacum officinale	P	0.0%	0.0%	0.0%	28.6%
Thalictrum occidentale	0.1%	0.2%	0.3%	0.3%	14.3%
Tiarella trifoliata	0.0%	0.0%	0.1%	0.1%	14.3%
Tragopogon dubius	P	0.0%	0.0%	0.0%	21.4%
Trillium ovatum	P	0.0%	0.0%	0.0%	7.1%
Trifolium pratense	0.1%	0.2%	0.1%	0.1%	7.1%
Trifolium repens	1.3%	1.7%	1.4%	1.5%	35.7%
Viola orbiculata	0.0%	0.0%	0.3%	0.3%	21.4%
Xerophyllum tenax	2.0%	2.6%	2.3%	2.3%	50.0%
Total % Perennial Forbs	17.0%	22.1%	23.4%	24.0%	
ANNUAL & BIENNIAL FORBS					
Apocynum androsaefolium	P	0.0%	0.0%	0.0%	7.1%
Epilobium paniculatum	1.0%	1.2%	1.2%	1.2%	28.6%
Gentiana amarella	P	0.0%	0.0%	0.0%	7.1%
Melampyrum lineare	0.3%	0.4%	0.3%	0.3%	21.4%
Trifolium agrarium	0.0%	0.0%	0.1%	0.1%	21.4%
Verbascum thapsus	0.3%	0.4%	0.3%	0.3%	7.1%
Total % Annual & Biennial Forbs	1.6%	2.0%	1.9%	1.9%	
CRYPTOGAMS					
Equisetum arvense	0.1%	0.2%	0.1%	0.1%	14.3%
Gymnocarpium dryopteris	P	0.0%	0.0%	0.0%	7.1%
Lichen	0.0%	0.0%	0.0%	0.1%	7.1%
Moss	2.6%	3.3%	3.6%	3.6%	64.3%
Pteridium aquilinum	0.4%	0.6%	0.6%	0.6%	28.6%
Total % Cryptogams	3.1%	4.1%	4.3%	4.4%	
TOTAL % VEGETATION	76.8%	100.0%	97.6%	100.0%	
Soil	2.0%				
Litter	20.6%				
Rock	0.6%				

P = SPECIES PRESENT, BUT NOT ENCOUNTERED QUANTITATIVELY

A total of 51 perennial forbs are present, but only eight have a cover in excess of 1.0%. They include: Virginia strawberry (*Fragaria virginiana*) (5.4%), fireweed (*Epilobium angustifolium*) (3.5%), orange hawkweed (*Hieracium aurantiacum*) (3.2%), beargrass (2.3%), Canada goldenrod (*Solidago canadensis*) (1.4%), white clover (*Trifolium repens*) (1.4%), pearly everlasting (*Anaphalis margaritacea*) (1.4%), and starry Solomon's seal (*Smilacina stellata*) (1.1%). Of the six annual graminoids present, only tall annual willowherb (*Epilobium paniculatum*) (1.1%) provided a cover in excess of 1.0%.

Mosses (3.6%) provide 84% of the total cryptogamic cover. Bracken fern provides 0.6% of the cover and common horsetail (*Equisetum arvense*) 0.1%.

Trees (Table 7). Tree density in the clearcuts is 915.8 trees/acre. Western red cedar (247.3 trees/acre) provide 26.9% of the total density. Western larch (157.3 trees/acre), Engelmann spruce (138.8 trees/acre), and lodgepole pine (120.3 trees/acre) are next most abundant. Dead lodgepole pine (18.5 trees/acre) , western red cedar (11.6 trees/acre), and white pine (2.3 trees/acre) are common in the clearcuts.

Tree reproduction rates in clearcuts at 2231.6 trees/acre are quite high. All trees except ponderosa pine (11.6 trees/acre), aspen (11.6 trees/acre), and Douglas-fir (34.7 trees/acre) have high reproduction rates. Engelmann spruce at 647.3 trees/acre account for 29.0% of all reproduction. Black cottonwood (323.8 trees/acre) is next most abundant and followed in importance by western white pine (289.1 trees/acre), western larch (219.7 trees/acre), western red cedar (196.6 trees/acre), grand fir (185.0 trees/acre), and western hemlock (185.0 trees/acre).

Western larch with a mean height of 18.9 feet is the tallest tree in the clearcuts. Lodgepole pine (15.9 feet) and Douglas-fir (15.1 feet) are only slightly shorter. Western hemlock at 6.0 feet is the shortest tree present.

With respect to dbh, western larch (2.1 inches), lodgepole pine (2.0 inches), and Douglas-fir (2.0 inches) are the largest. Western hemlock, the shortest tree, has the least dbh at 0.4 inches.

The mean age of the 12 trees cored for clearcuts is 13 years. The four western larch range in age from 10-19 years and have a mean age of 14. The two Engelmann spruce have a mean age of 10 and the six lodgepole pine a mean age of 12 years.

TABLE 7. CLEARCUT TREE DENSITY, REPRODUCTION, HEIGHT, DBH, AND AGE DATA SUMMARY - 1988
MONTANA PROJECT

DENSITY

	MEAN NO. TREES/ 125 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TREES				
Abies grandis	1.1	34.7	3.8%	
Abies lasiocarpa	0.3	9.3	1.0%	
Betula occidentalis	0.1	2.3	0.3%	
Larix occidentalis	4.9	157.3	17.1%	
Picea engelmannii	4.3	138.8	15.2%	
Pinus contorta	3.7	120.3	13.1%	
Pinus monticola	1.7	55.5	6.1%	
Pinus ponderosa	0.1	2.3	0.3%	
Populus trichocarpa	2.1	67.1	7.3%	
Pseudotsuga menziesii	2.4	78.6	8.6%	
Thuja plicata	7.5	247.3	26.9%	
Tsuga heterophylla	0.1	2.3	0.3%	
Total Trees	28.3	915.8	100.0%	29.4
TREES - DEAD				
Pinus contorta	0.6	18.5	57.2%	
Pinus monticola	0.1	2.3	7.1%	
Thuja plicata	0.4	11.6	35.7%	
Total Trees - Dead	1.1	32.4	100.0%	3.3

REPRODUCTION

	MEAN NO. TREES/ 25 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
Abies grandis	1.1	185.0	8.3%	
Larix occidentalis	1.4	219.7	9.8%	
Picea engelmannii	4.0	647.3	29.0%	
Pinus contorta	0.8	127.2	5.7%	
Pinus monticola	1.8	289.1	13.0%	
Pinus ponderosa	0.1	11.6	0.5%	
Populus tremuloides	0.1	11.6	0.5%	
Populus trichocarpa	2.0	323.8	14.5%	
Pseudotsuga menziesii	0.2	34.7	1.6%	
Thuja plicata	1.2	196.6	8.8%	
Tsuga heterophylla	1.1	185.0	8.3%	
Total Tree Reproduction	13.8	2231.6	100.0%	13.4

TABLE 7. (Continued)

HEIGHT (FEET)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	1	10	6.3
Abies lasiocarpa	7	12	9.8
Betula occidentalis	12	12	12.0
Larix occidentalis	6	70	18.9
Picea engelmannii	4	17	7.0
Pinus contorta	6	70	15.9
Pinus monticola	4	20	7.5
Pinus ponderosa	7	7	7.0
Populus trichocarpa	6	24	9.5
Pseudotsuga menziesii	5	39	15.1
Thuja plicata	5	41	12.8
Tsuga heterophylla	6	6	6.0

DBH (INCHES)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	0.4	1.2	0.7
Abies lasiocarpa	1.2	2.8	0.5
Betula occidentalis	0.8	0.8	0.8
Larix occidentalis	0.4	10.2	2.1
Picea engelmannii	0.4	3.9	0.8
Pinus contorta	0.8	7.5	2.0
Pinus monticola	0.4	2.8	0.9
Pinus ponderosa	1.2	1.2	1.2
Populus trichocarpa	0.4	2.8	0.8
Pseudotsuga menziesii	0.4	3.9	2.0
Thuja plicata	0.4	5.1	1.6
Tsuga heterophylla	0.4	0.4	0.4
Total Trees			1.5
TREES (DEAD)			
Pinus contorta	3.9	9.4	7.0
Pinus monticola	0.4	0.4	0.4
Thuja plicata	0.8	2.4	1.4
Total Trees (Dead)			4.6

TABLE 7. (Continued)

	AGE (YEARS)			
	NUMBER TREES CORED	MEAN	MINIMUM	MAXIMUM
Larix occidentalis	4	14	10	19
Picea engelmannii	2	10	10	11
Pinus contorta	6	12	10	19
Total Trees	12	13	10	19

Shrubs (Table 8). Shrub density is extremely high at 15,401.5 shrubs/acre. White spirea (3330.1 shrubs/acre) provides 21.5% of the total. Other abundant shrubs respectively include dwarf bilberry (2971.6 shrubs/acre), pachistima (2405.0 shrubs/acre), huckleberry (1688.2 shrubs/acre), and baldhip rose (1295.0 shrubs/acre).

Production (Table 5). Total herbaceous production is low at 353.5 lbs/acre. Perennial forbs (222.6 lbs/acre) provide 63.0% of the total. Perennial graminoids (127.9 lbs/acre) provide almost all of the remainder. Annual graminoids (0.9 lbs/acre) and annual and biennial forbs (2.9 lbs/acre) production are insignificant.

3.2.1.3 Shrubland (Figure 12)

Cover (Table 9). Total vegetation cover in the eight shrubland sampled is high at 156.7%. Litter and rock cover is relatively low at 4.0% and 7.2%, respectively. Shrubs as a lifeform provide 55.2% of the total vegetation cover. Cover by lifeform is as follows: trees (11.0%), tall shrubs (22.5%), low shrubs (52.8%), subshrubs (10.8%), perennial graminoids (10.3%), perennial forbs (37.3%), and cryptogams (12.0%).

The most common trees colonizing shrublands include subalpine fir (2.9%), aspen (*Populus tremuloides*) (2.8%), and grand fir (2.8%). Less abundant colonizers are Engelmann spruce, white pine, and Douglas-fir. The shade-loving western hemlock occurs infrequently.

Twenty-six shrubs occur in the shrublands. Seventeen of these shrubs provide a cover in excess of 1.0%. However, frequency values for all but six shrubs are less than 50.0%. Thus, the species composition and dominance within shrub stands is variable. Thimbleberry, a subshrub, has the highest cover (10.5%) and the second highest frequency (75.0%). Huckleberry (9.9%) the shrub with the second highest cover has the highest frequency (100.0%). Other shrubs with a high cover include pachistima (9.2%), Rocky Mountain maple (8.7%), Sitka alder (8.5%), rusty menziesia (8.5%), Scouler willow (7.7%), red raspberry (3.3%), common snowberry (2.8%), Douglas spirea (*Spiraea douglasii*) (2.5%), Sitka mountain ash (*Sorbus sitchensis*) (2.0%), and black elderberry (*Sambucus racemosa*) (2.0%).

The eight perennial graminoids provide a total cover of 10.3%. Over half of this cover is provided by bluejoint reedgrass (5.2%). Somewhat less abundant perennial graminoids present include blue wildrye (2.0%), Columbia brome (*Bromus vulgaris*) (1.5%), and bearded fescue (1.3%).

TABLE 8. CLEARCUT SHRUB DENSITY DATA SUMMARY - 1988
MONTANA PROJECT

	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TALL SHRUBS				
Acer glabrum	0.2	34.7	0.2%	
Alnus sinuata	2.3	370.0	2.4%	
Total Tall Shrubs	2.5	404.7	2.6%	
LOW SHRUBS				
Amelanchier alnifolia	1.6	265.9	1.7%	
Ceanothus velutinus	2.4	381.6	2.5%	
Lonicera utahensis	3.2	520.3	3.4%	
Pachistima myrsinites	14.9	2405.0	15.6%	
Ribes lacustre	0.5	80.9	0.5%	
Rosa gymnocarpa	8.0	1295.0	8.4%	
Rubus idaeus	0.5	80.9	0.5%	
Salix lutea	0.1	11.6	0.1%	
Salix scouleriana	0.6	104.1	0.7%	
Salix spp.	0.1	11.6	0.1%	
Spiraea betulifolia	20.6	3330.1	21.5%	
Spiraea douglasii	0.1	11.6	0.1%	
Spiraea pyramidata	1.1	185.0	1.2%	
Symphoricarpos albus	1.1	173.4	1.1%	
Vaccinium globulare	10.4	1688.2	11.0%	
Vaccinium myrtillus	18.4	2971.6	19.3%	
Vaccinium scoparium	0.1	23.1	0.2%	
Total Low Shrubs	83.7	13539.9	87.9%	
SUBSHRUBS				
Berberis repens	5.0	809.4	5.3%	
Rubus parviflorus	4.0	647.5	4.2%	
Total Subshrubs	9.0	1456.9	9.5%	
TOTAL SHRUBS	95.2	15401.5	100.0%	58.2

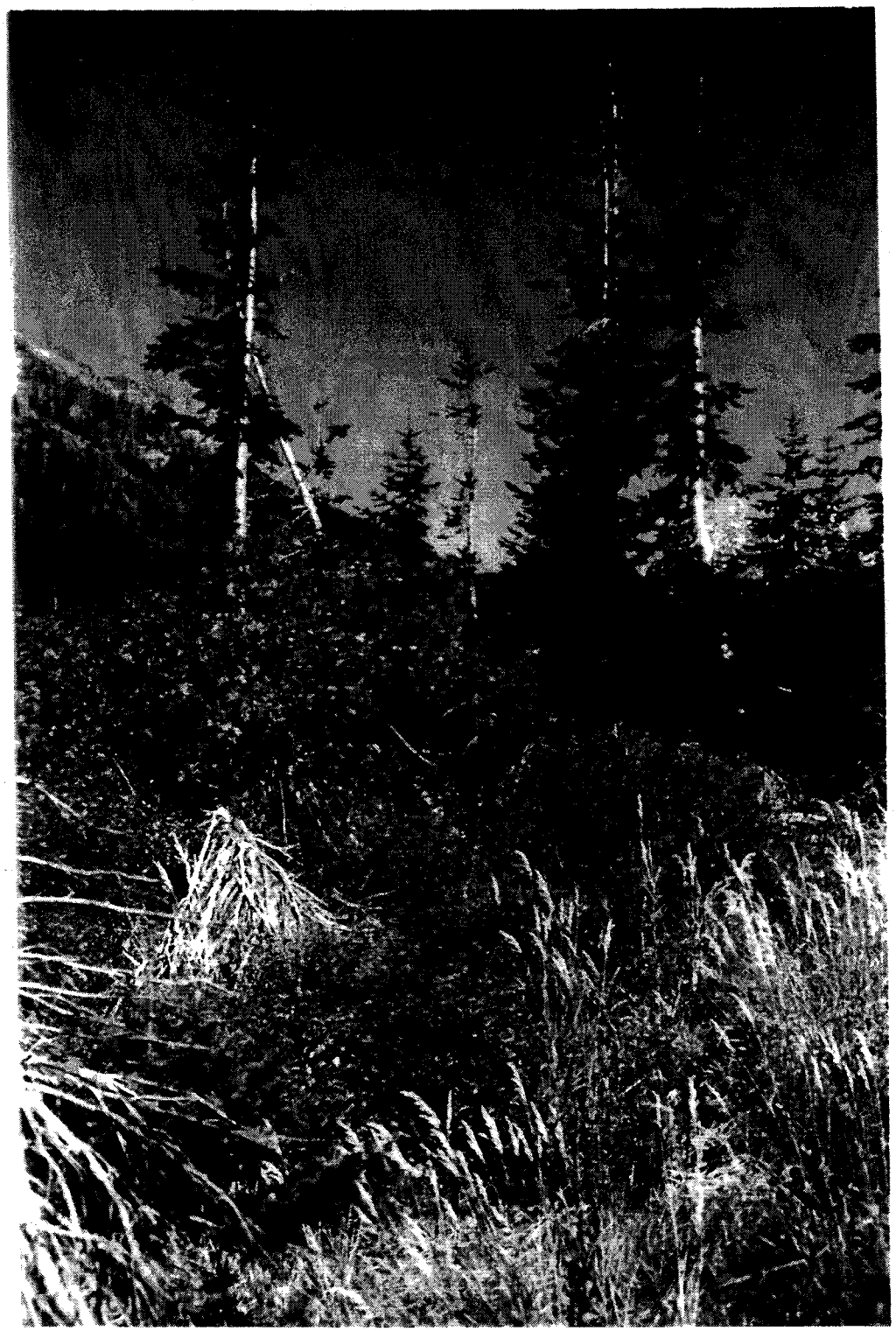

Figure 12. Shrublands are present in areas disturbed by avalanches as a thick growth of numerous species of tall and low shrubs. Shrub dominance and associations vary with site conditions.

TABLE 9. SHRUBLAND COVER DATA SUMMARY - 1988
MONTANA PROJECT

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
TREES					
Abies grandis	2.3%	2.5%	2.8%	1.8%	25.0%
Abies lasiocarpa	2.9%	3.5%	2.9%	1.9%	25.0%
Picea engelmannii	0.8%	0.8%	1.0%	0.6%	37.5%
Pinus monticola	1.0%	1.1%	1.0%	0.6%	12.5%
Populus tremuloides	2.7%	3.1%	2.8%	1.8%	12.5%
Pseudotsuga menziesii	0.3%	0.3%	0.5%	0.3%	12.5%
Tsuga heterophylla	P	0.0%	0.0%	0.0%	12.5%
Total % Trees	10.0%	11.3%	11.0%	7.0%	
TALL SHRUBS					
Acer glabrum	7.8%	8.7%	8.7%	5.6%	75.0%
Alnus sinuata	7.7%	8.7%	8.5%	5.4%	50.0%
Prunus emarginata	1.5%	1.7%	1.5%	1.0%	37.5%
Sorbus scopulina	1.5%	1.7%	1.8%	1.1%	62.5%
Sorbus sitchensis	2.0%	2.3%	2.0%	1.3%	37.5%
Total % Tall Shrubs	20.5%	23.1%	22.5%	14.4%	
LOW SHRUBS					
Amelanchier alnifolia	0.5%	0.6%	1.0%	0.6%	50.0%
Lonicera ciliosa	P	0.0%	0.0%	0.0%	12.5%
Lonicera involucrata	P	0.0%	0.0%	0.0%	12.5%
Lonicera utahensis	0.3%	0.3%	0.5%	0.3%	25.0%
Menziesia ferruginea	4.2%	4.8%	8.5%	5.4%	50.0%
Oplopanax horridum	0.5%	0.6%	0.5%	0.3%	12.5%
Pachistima myrsinites	1.8%	2.0%	9.2%	5.9%	37.5%
Ribes lacustre	1.5%	1.7%	2.3%	1.4%	25.0%
Ribes viscosissimum	0.3%	0.3%	0.3%	0.2%	12.5%
Rosa gymnocarpa	0.0%	0.0%	0.5%	0.3%	12.5%
Rubus idaeus	1.7%	2.0%	3.3%	2.1%	62.5%
Salix scouleriana	7.7%	8.6%	7.7%	5.0%	25.0%
Salix spp.	P	0.0%	0.0%	0.0%	12.5%
Sambucus racemosa	1.8%	2.0%	2.0%	1.3%	62.5%
Spiraea betulifolia	0.3%	0.3%	1.3%	0.8%	25.0%
Spiraea densiflora	0.5%	0.6%	0.5%	0.3%	12.5%
Spiraea douglasii	1.5%	1.7%	2.5%	1.6%	25.0%
Symphoricarpos albus	1.0%	1.1%	2.8%	1.8%	37.5%
Vaccinium globulare	3.4%	3.8%	9.9%	6.4%	100.0%
Total % Low Shrubs	27.0%	30.4%	52.8%	33.7%	

TABLE 9. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
SUBSHRUBS					
Berberis repens	0.0%	0.0%	0.3%	0.2%	12.5%
Rubus parviflorus	6.5%	7.3%	10.5%	6.7%	75.0%
Total % Subshrubs	6.5%	7.3%	10.8%	6.9%	
PERENNIAL GRAMINOIDS					
Agrostis alba	0.0%	0.0%	0.3%	0.2%	12.5%
Bromus vulgaris	0.8%	0.8%	1.5%	1.0%	25.0%
Calamagrostis canadensis	3.2%	3.8%	5.2%	3.2%	62.5%
Carex deweyana	P	0.0%	0.0%	0.0%	12.5%
Carex rossii	P	0.0%	0.0%	0.0%	12.5%
Elymus glaucus	0.8%	0.8%	2.0%	1.3%	37.5%
Festuca subulata	0.0%	0.0%	1.3%	0.8%	25.0%
Luzula glabrata	P	0.0%	0.0%	0.0%	12.5%
Total % Perennial Graminoids	4.8%	5.4%	10.3%	6.5%	
PERENNIAL FORBS					
Achillea millefolium	P	0.0%	0.0%	0.0%	25.0%
Aconitum columbianum	0.0%	0.0%	0.8%	0.5%	12.5%
Actaea rubra	0.0%	0.0%	0.3%	0.2%	25.0%
Adenocaulon bicolor	P	0.0%	0.0%	0.0%	12.5%
Agastache urticifolia	P	0.0%	0.0%	0.0%	12.5%
Angelica arguta	P	0.0%	0.0%	0.0%	12.5%
Angelica dawsonii	P	0.0%	0.0%	0.0%	25.0%
Arnica cordifolia	P	0.0%	0.0%	0.0%	12.5%
Campanula rotundifolia	P	0.0%	0.0%	0.0%	12.5%
Circaea alpina	0.0%	0.0%	0.5%	0.3%	25.0%
Clintonia uniflora	0.0%	0.0%	1.0%	0.6%	62.5%
Disporum hookeri	1.3%	1.4%	4.2%	2.7%	50.0%
Epilobium angustifolium	0.5%	0.6%	1.0%	0.6%	62.5%
Galium triflorum	0.8%	0.8%	2.3%	1.4%	62.5%
Heracleum lanatum	1.5%	1.7%	2.5%	1.6%	62.5%
Heuchera cylindrica	0.0%	0.0%	0.8%	0.5%	25.0%
Osmorhiza chilensis	0.0%	0.0%	0.3%	0.2%	12.5%
Polemonium pulcherrimum	0.3%	0.3%	1.8%	1.1%	50.0%
Senecio triangularis	0.3%	0.3%	0.3%	0.2%	25.0%
Smilacina stellata	1.0%	1.1%	3.5%	2.2%	75.0%
Solidado canadensis	P	0.0%	0.0%	0.0%	12.5%
Stellaria crispa	P	0.0%	0.0%	0.0%	12.5%
Thalictrum occidentale	0.3%	0.3%	2.3%	1.4%	25.0%
Tiarella trifoliata	0.0%	0.0%	0.8%	0.5%	37.5%

TABLE 9. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Trillium ovatum	P	0.0%	0.0%	0.0%	50.0%
Veratrum viride	4.2%	4.8%	4.8%	3.2%	50.0%
Viola glabella	0.5%	0.6%	1.3%	0.8%	37.5%
Viola orbiculata	P	0.0%	0.0%	0.0%	12.5%
Xerophyllum tenax	4.3%	5.0%	8.8%	5.8%	50.0%
Total % Perennial Forbs	15.0%	16.9%	37.3%	23.8%	
CRYPTOGAMS					
Athyrium filix-femina	P	0.0%	0.0%	0.0%	12.5%
Cheilanthes gracillima	P	0.0%	0.0%	0.0%	12.5%
Cryptogramma crispa	P	0.0%	0.0%	0.0%	12.5%
Dryopteris filix-mas	0.5%	0.6%	1.8%	1.1%	25.0%
Gymnocarpium dryopteris	P	0.0%	0.0%	0.0%	25.0%
Lichen	0.0%	0.0%	0.3%	0.2%	12.5%
Moss	0.8%	0.8%	5.3%	3.4%	62.5%
Pteridium aquilinum	3.7%	4.2%	4.6%	3.0%	37.5%
Total % Cryptogams	5.0%	5.6%	12.0%	7.7%	
TOTAL % VEGETATION	88.8%	100.0%	156.7%	100.0%	
Soil	0.0%				
Litter	4.0%				
Rock	7.2%				

P = SPECIES PRESENT, BUT NOT ENCOUNTERED QUANTITATIVELY

The low frequency values of most perennial forbs indicate that the presence and abundance of species per shrub stand is variable. Beargrass, the most abundant of the 29 perennial forbs present, provides 8.8% of the 37.3% perennial forb cover. Other common perennial forbs include: green false hellebore (*Veratrum viride*) (4.8%), Hooker fairybell (*Disporum hookeri*) (4.2%), starry Solomon's seal (3.5%), cow parsnip (*Heracleum lanatum*) (2.5%), sweet scented bedstraw (*Galium triflorum*) (2.3%), and western meadowrue (*Thalictrum occidentale*) (2.3%).

After mosses (5.3%), bracken fern (4.6%), and male fern (*Drypoteris filix-mas*) (1.8%) are the most common cryptogams. Infrequently occurring cryptogams present include: lady fern, lace-lip fern (*Cheilanthes gracillima*), rock-brake (*Cryptogramma crispa*), and oak fern.

Trees (Table 10). Six tree species provide a total tree density of 327.8 trees/acre. Subalpine fir (145.7 trees/acre) accounts for 44.5% of the total. Aspen, with a density of 109.3 trees/acre, is second most important. Less abundant trees present include grand fir, Douglas-fir, Engelmann spruce, and white pine.

Only two trees are reproducing in the shrubland and at low rates. Subalpine fir has a reproduction rate of 101.2 trees/acre while grand fir has a rate of 20.2 trees/acre.

The sparsely represented trees of the shrublands are generally young and have not grown very tall. Considering the mean height of trees occurring in the density quadrat, white pine (17.3 feet) is the tallest. The height of other trees present is as follows: subalpine fir (12.6 feet), Douglas-fir (12.2 feet), Engelmann spruce (11.0 feet), aspen (10.5 feet), and grand fir (9.6 feet). The mean height of all trees present in these disturbed habitats is 11.3 feet.

The short, young trees have a correspondingly small (2.0 inches) mean dbh. White pine (3.1 inches), the tallest tree, has the greatest dbh and aspen (1.0 inch), one of the shorter trees, has the smallest dbh.

A total of three trees were cored to assess age. Engelmann spruce, at 41 years is the oldest and Douglas-fir (23 years) the youngest. The grand fir cored has an age of 30 years and the mean age of all trees is 31 years.

Shrubs (Table 11). Shrub density at 17,624.4 shrubs/acre is very high. Huckleberry and thimbleberry, the two major shrubs in the cover data, are dominant in density with rates of 4148.1 and 3055.4

TABLE 10. SHRUBLAND TREE DENSITY, REPRODUCTION, HEIGHT, DBH, AND AGE DATA SUMMARY - 1988
MONTANA PROJECT

DENSITY

	MEAN NO. TREES/ 125 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TREES (>1.3 M DBH)				
Abies grandis	0.9	28.3	8.6%	
Abies lasiocarpa	4.4	145.8	44.5%	
Picea engelmannii	0.4	12.1	3.7%	
Pinus monticola	0.4	12.1	3.7%	
Populus tremuloides	3.4	109.3	33.3%	
Pseudotsuga menziesii	0.6	20.2	6.2%	
Total Trees	10.1	327.8	100.0%	17.6

REPRODUCTION

	MEAN SHRUBS/25 SQ M	MEAN SHRUBS/25 SQ M	RELATIVE DENSITY	STANDARD DEVIATION
Abies grandis	0.1	20.2	16.7%	
Abies lasiocarpa	0.6	101.2	83.3%	
Total Tree Reproduction	0.7	121.4	100.0%	1.3

HEIGHT (FEET)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	6	14	9.6
Abies lasiocarpa	4	33	12.6
Picea engelmannii	3	20	11.0
Pinus monticola	8	22	17.3
Populus tremuloides	5	18	10.5
Pseudotsuga menziesii	5	16	12.2
Total Trees			11.3

TABLE 10. (Continued)

DBH (INCHES)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	0.4	4.3	1.8
Abies lasiocarpa	0.4	6.7	2.1
Picea engelmannii	0.4	3.9	1.8
Pinus monticola	0.8	4.7	3.1
Populus tremuloides	0.4	2.0	1.0
Pseudotsuga menziesii	0.4	4.7	2.8
Total Trees			2.0

AGE (YEARS)

	NUMBER TREES CORED	MINIMUM	MAXIMUM	MEAN
Abies grandis	1	30	30	30
Picea engelmannii	1	41	41	41
Pseudotsuga menziesii	1	23	23	23
Total	3	23	41	31

TABLE 11. SHRUBLAND SHRUB DENSITY DATA SUMMARY - 1988
MONTANA PROJECT

	MEAN SHRUBS/25 SQ M	MEAN SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TALL SHRUBS				
Acer glabrum	3.0	485.6	2.8%	
Alnus sinuata	1.5	242.8	1.4%	
Prunus emarginata	0.5	80.9	0.5%	
Sorbus scopulina	4.9	789.2	4.4%	
Sorbus sitchensis	0.4	60.7	0.3%	
Total Tall Shrubs	10.3	1659.2	9.4%	
LOW SHRUBS				
Amelanchier anlifolia	3.1	505.9	2.9%	
Lonicera utahensis	1.6	263.1	1.5%	
Menziesia ferruginea	4.0	647.5	3.7%	
Oplopanax horridum	0.3	40.5	0.2%	
Pachistima myrsinites	16.4	2671.0	15.2%	
Ribes lacustre	4.4	708.2	4.0%	
Ribes viscosissimum	0.3	40.5	0.2%	
Rosa gymnocarpa	1.1	182.1	1.0%	
Rubus idaeus	7.4	1193.8	6.8%	
Salix scouleriana	2.8	445.2	2.5%	
Sambucus racemosa	1.5	242.8	1.4%	
Spiraea betulifolia	6.3	1011.7	5.7%	
Spiraea douglasii	1.0	161.9	0.9%	
Symphoricarpos albus	3.4	546.3	3.1%	
Vaccinium globulare	25.5	4148.1	23.6%	
Total Low Shrubs	79.1	12808.6	72.7%	
SUBSHRUBS				
Berberis repens	0.6	101.2	0.6%	
Rubus parviflorus	18.9	3055.4	17.3%	
Total Subshrubs	19.5	3156.6	17.9%	
TOTAL SHRUBS	108.9	17624.4	100.0%	54.1

shrubs/acre. Other abundant shrubs include pachistima (2671.0 shrubs/acre), red raspberry (1193.8 shrubs/acre), and white spirea (1011.7 shrubs/acre).

Production (Table 5). Shrublands have the highest herbaceous production (608.6 lbs/acre) of all the vegetation types in the study area. Perennial forbs provide 75.9% or 462.1 lbs/acre while perennial graminoids provide 146.5 lbs/acre.

3.2.1.4 Subalpine (Figure 13)

Cover (Table 12). Total vegetation cover in the two subalpine sample areas is 113.0%. Rock cover is high at 15.0% and litter cover low at 5.0%. Cover by lifeform is as follows: trees (24.0%), tall shrubs (2.0%), low shrubs (44.0%), subshrubs (4.0%), perennial graminoids (5.0%), perennial forbs (32.0%), and cryptogams (2.0%).

Trees occur sporadically in this shrubby community. Douglas-fir (12.0%) and subalpine fir (7.0%) are the major tree species. Also present are mountain hemlock (4.0%), grand fir (1.0%), and white pine (0.0%).

Pachistima (18.0%) is the dominant shrub in this community. Huckleberry (12.0%), dwarf bilberry (7.0%), western serviceberry (4.0%), elliptic-leaved beardtongue (*Penstemon ellipticus*) (4.0%), Utah honeysuckle (2.0%), Cascade Mountain ash (2.0%), and rusty menziesia (1.0%) are also present.

Elk sedge (4.0%) is the major perennial graminoid. Sedges (*Carex* spp.) (1.0%) are the only other perennial graminoid providing cover. Species present and not providing cover include: redtop (*Agrostis alba*), pinegrass, blue wildrye, green fescue (*Festuca viridula*), and Parry's rush (*Juncus parryi*).

Beargrass (32.0%) provides all the perennial forb cover, which comprises 28.3% of the total vegetation, and is the most abundant species in the subalpine community. Perennial forbs present and not providing cover include common yarrow (*Achillea millefolium*), fireweed, Lyall's penstemon (*Penstemon lyallii*), and western meadowrue.

Cryptogamic cover is low at 2.0%. Rock brake (1.0%) and moss (1.0%) provided all the cover.

Trees (Table 13). Tree density is low at 194.3 trees/acre. Douglas-fir (129.5 trees/acre) provides 66.7% of the density. The next most abundant

Figure 13. Subalpine woodlands occur in the Rock Creek drainage near Rock Lake at about 5,000 feet elevation. They are characterized by an open tree canopy with a dense understory of low shrubs.

TABLE 12. SUBALPINE COVER DATA SUMMARY - 1988
MONTANA PROJECT

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
TREES					
Abies grandis	0.0%	0.0%	1.0%	0.9%	50.0%
Abies lasiocarpa	7.0%	8.8%	7.0%	6.2%	100.0%
Pinus monticola	P	0.0%	0.0%	0.0%	100.0%
Pseudotsuga menziesii	12.0%	15.0%	12.0%	10.6%	100.0%
Tsuga mertensiana	4.0%	5.0%	4.0%	3.5%	100.0%
Total % Trees	23.0%	28.8%	24.0%	21.2%	
TALL SHRUBS					
Acer glabrum	P	0.0%	0.0%	0.0%	100.0%
Prunus emarginata	P	0.0%	0.0%	0.0%	50.0%
Sorbus scopulina	0.0%	0.0%	2.0%	1.8%	100.0%
Sorbus sitchensis	P	0.0%	0.0%	0.0%	50.0%
Total % Tall Shrubs	0.0%	0.0%	2.0%	1.8%	
LOW SHRUBS					
Amelanchier alnifolia	1.0%	1.3%	4.0%	3.5%	50.0%
Lonicera utahensis	2.0%	2.5%	2.0%	1.8%	50.0%
Menziesia ferruginea	1.0%	1.3%	1.0%	0.9%	50.0%
Pachistima myrsinites	13.0%	16.1%	18.0%	15.9%	100.0%
Ribes lacustre	P	0.0%	0.0%	0.0%	50.0%
Rubus idaeus	P	0.0%	0.0%	0.0%	50.0%
Salix scouleriana	P	0.0%	0.0%	0.0%	100.0%
Spiraea betulifolia	P	0.0%	0.0%	0.0%	50.0%
Spiraea douglasii	P	0.0%	0.0%	0.0%	50.0%
Vaccinium globulare	5.0%	6.3%	12.0%	10.6%	100.0%
Vaccinium myrtillus	7.0%	8.8%	7.0%	6.2%	100.0%
Total % Low Shrubs	29.0%	36.3%	44.0%	38.9%	
SUBSHRUBS					
Penstemon ellipticus	4.0%	5.0%	4.0%	3.5%	50.0%
Total % Subshrubs	4.0%	5.0%	4.0%	3.5%	
PERENNIAL GRAMINOIDS					
Agrostis alba	P	0.0%	0.0%	0.0%	50.0%
Calamagrostis rubescens	P	0.0%	0.0%	0.0%	50.0%
Carex geyeri	2.0%	2.5%	4.0%	3.5%	100.0%
Carex spp.	1.0%	1.3%	1.0%	0.9%	50.0%
Elymus glaucus	P	0.0%	0.0%	0.0%	50.0%
Festuca viridula	P	0.0%	0.0%	0.0%	50.0%
Juncus parryi	P	0.0%	0.0%	0.0%	50.0%

TABLE 12. (Continued)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Total % Perennnial Graminoids	3.0%	3.8%	5.0%	4.4%	
PERENNIAL FORBS					
Achillea millefolium	P	0.0%	0.0%	0.0%	50.0%
Epilobium angustifolium	P	0.0%	0.0%	0.0%	100.0%
Penstemon lyallii	P	0.0%	0.0%	0.0%	50.0%
Thalictrum occidentale	P	0.0%	0.0%	0.0%	50.0%
Xerophyllum tenax	19.0%	23.8%	32.0%	28.3%	100.0%
Total % Perennial Forbs	19.0%	23.8%	32.0%	28.3%	
CRYPTOGAMS					
Cheilanthes gracillima	P	0.0%	0.0%	0.0%	50.0%
Cryptogramma crispa	1.0%	1.1%	1.0%	0.9%	100.0%
Moss	1.0%	1.2%	1.0%	1.0%	50.0%
Total % Cryptogams	2.0%	2.3%	2.0%	1.9%	
TOTAL % VEGETATION	80.0%	100.0%	113.0%	100.0%	
Soil	0.0%				
Litter	5.0%				
Rock	15.0%				

P = SPECIES PRESENT BUT
NOT ENCOUNTERED QUANTITATIVELY

TABLE 13. SUBALPINE TREE DENSITY, REPRODUCTION, HEIGHT, DBH, BASAL AREA, AND AGE DATA SUMMARY - 1988
MONTANA PROJECT

DENSITY

	MEAN/ 125 SQ METERS	MEAN/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TREES (>1.3 M DBH)				
Abies lasiocarpa	1.0	32.4	16.7%	
Pinus monticola	0.5	16.2	8.3%	
Pseudotsuga menziesii	4.0	129.5	66.7%	
Tsuga mertensiana	0.5	16.2	8.3%	
Total Trees	6.0	194.3	100.0%	2.0

REPRODUCTION

	MEAN/ 25 SQ METERS	MEAN/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
Abies lasiocarpa	0.5	80.9	25.0%	
Pseudotsuga menziesii	1.5	242.9	75.0%	
Total Tree Reproduction	2.0	323.8	100.0%	1.0

HEIGHT (FEET)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies lasiocarpa	21	28	24.5
Pinus monticola	10	10	10.0
Pseudotsuga menziesii	8	18	13.1
Tsuga mertensiana	35	35	35.0
Total Trees			16.6

TABLE 13. (Continued)

DBH (INCHES)

MEAN DBH IN INCHES TRANSECT NUMBER	MINIMUM	MAXIMUM	MEAN
TREES			
Abies lasiocarpa	4.3	6.3	5.3
Pinus monticola	2.4	2.4	2.4
Pseudotsuga menziesii	2.0	3.9	3.1
Tsuga mertensiana	12.6	12.6	12.6
Total Trees			10.7

BASAL AREA AND VOLUME

	THOUSAND BOARD FEET PER ACRE	BASAL AREA (SQ FEET) ALL TREES	QUADRATIC MEAN DIAMETER (FEET)
Tsuga mertensiana	1.0	0.9	5.8

AGE (YEARS)

TRANSECT NUMBER	NUMBER TREES CORED	MINIMUM	MAXIMUM	MEAN
Abies lasiocarpa	1	45	45	45
Tsuga mertensiana	1	55	55	55
Total	2	45	55	50

trees, respectively, are subalpine fir (32.4 trees/acre), mountain hemlock (16.2 trees/acre), and white pine (16.2 trees/acre).

Douglas-fir and subalpine fir, the only trees reproducing in this community, have a seedling density of 323.8 seedlings/acre. Douglas-fir provides 75.0% of all the reproduction.

Mountain hemlock has the greatest mean height (35.0 feet). Subalpine fir (24.5 feet) is also moderately tall while the Douglas-fir (13.1 feet) and white pine (10.0 feet) are short. Correspondingly, mountain hemlock (12.6 inches) has the greatest mean dbh. The dbh of the subalpine fir, Douglas-fir, and white pine is 5.3, 3.1, and 2.4 inches, respectively. A mountain hemlock and subalpine fir were cored. Their respective ages are 55 and 45 years. Mountain hemlock has a basal area of 0.9 ft^2 and a volume of 1.0 thousand board feet/acre.

Shrubs (Table 14). Shrub density in the subalpine community is high at 14,488.1 shrubs/acre. The three major shrubs are huckleberry (6475.0 shrubs/acre), pachistima (4694.5 shrubs/acre), and dwarf bilberry (1456.9 shrubs/acre). Less abundant shrubs include Utah honeysuckle, red raspberry, white spirea, swamp gooseberry (*Ribes lacustre*), and western serviceberry.

Production (Table 5). Total production is 260.4 lbs/acre. Perennial forbs provide 92.8% of the total biomass while perennial graminoids provide the remainder.

3.2.1.5 Wetlands (Figure 14)

Wetlands are biological communities such as bogs, fens, marshes, and wet meadows which are transitional between aquatic and terrestrial ecosystems. As part of the National Wetlands Inventory, the U.S. Fish and Wildlife Service (Cowardin et al. 1979) defined wetlands as having one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained soil; and (3) the substrate is non-soil and is saturated with water or covered by shallow water at some time during the growing season.

The most widely accepted definition for wetland is published in the Clean Water Act of 1972 (P.L. 92-50) as follows: "Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions."

TABLE 14. SUBALPINE SHRUB DENSITY DATA SUMMARY - 1988
MONTANA PROJECT

	MEAN SHRUBS/25 SQ M	MEAN SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TALL SHRUBS				
Acer glabrum	1.0	161.9	1.1%	
Sorbus scopulina	1.0	161.9	1.1%	
Total Tall Shrubs	2.0	323.8	2.2%	
LOW SHRUBS				
Amelanchier anlifolia	0.5	80.9	0.6%	
Lonicera utahensis	4.5	728.5	5.0%	
Pachistima myrsinites	29.0	4694.5	32.4%	
Ribes lacustre	0.5	80.9	0.6%	
Rubus idaeus	2.0	323.8	2.2%	
Spiraea betulifolia	2.0	323.8	2.2%	
Vaccinium globulare	40.0	6475.0	44.7%	
Vaccinium myrtillus	9.0	1456.9	10.1%	
Total Low Shrubs	87.5	14164.3	97.8%	
TOTAL SHRUBS	89.5	14488.1	100.0%	19.5

Figure 14. Wetlands occur as small isolated communities in poorly drained depressions. They are generally less than one acre in size and characterized by sedges, grasses, rushes and bordered by low shrubs.

Wetlands were identified and mapped in the study areas consistent with the definition published in the Clean Water Act. The criteria for wetlands in the Corps of Engineers Wetlands Delineation Manual (U.S. Department of the Army 1987) formed the basis for wetland determinations for the Montana Project study area.

The largest wetland encountered in the study area occurred locally along the floodplain of Ramsey Creek near Ramsey Lake on wet, poorly drained soil. This forested wetland is classified as an Engelmann spruce/common horsetail habitat type (Pfister et al. 1977, Youngblood et al. 1985, Steele et al. 1981). The overstory is composed of Engelmann spruce (30% canopy cover) with scattered western white pine, subalpine fir, grand fir, and lodgepole pine present on drier microsites such as windthrow hummocks. Common horsetail dominates the understory (60% canopy cover) with bluejoint reedgrass (20% canopy cover) and arrowleaf groundsel (*Senecio triangularis*) (5% canopy cover). The moss (*Sphagnum squarrosu*) makes up about 20% of the ground cover on the wettest microsites with lesser amounts of the following obligate, wetland moss species: *Sphagnum angustifolium, Sphagnum teres, Calliergon cordifolium,* and *Calliergon stramineum.*

Common vascular plants in this wetland include: beaked sedge (*Carex rostrata*), reed mannagrass, daggerleaf rush (*Juncus ensifolius*), rough bentgrass (*Agrostis scabra*), oak fern, stiff chubmoss (*Lycopodium annotinum*), stream violet, roundleaf violet, and tiarella. Common shrubs include alder, menziesia, huckleberry, and Douglas spirea.

Small, isolated wetlands generally less than one-half acre in size occur on the tailings study areas (Figure 5). These wetlands have formed in depressions with poor drainage due to relatively impermeable soils and have water in the spring but dry during the warm summer months. Thus, plants have colonized the entire area of the wetlands. The center or wettest portion of the wetlands is dominated by sedges which are surrounded by Douglas spirea in the transition zone to forest communities.

Wetlands W1 (Figure 5) is characterized by beaked sedge, water sedge (*Carex aquatilus*), inflated sedge (*Carex vesicaria*), and knot-sheath sedge (*Carex retrorsa*),in the deep water zone. Douglas spirea surrounds the sedge and is being colonized by small willows (*Salix* sp.), cottonwoods, Engelmann spruce, and alder buckthorn (*Rhamnus alnifolia*). Common mosses in the wetlands include *Sphagnum subsecundum*, *Polytrichum juniperium*, and *Philonotis fontana*. Woolgrass (*Scirpus cyperinus*) occur in this marsh and in the ditch of the nearby forest service road. Westech

(1987) also reported that woolgrass colonized a disturbed wet site near Rock Creek in Sanders County.

Wetlands W2 has monocultures of beaked sedge and dulichium (*Dulichium arundinaceum*) in the deep water zone and inflated sedge in the mixed shallow water zone. Northern mannagrass forms mixed stands with beaked sedge, fewflowered spikerush (*Eleocharis pauciflora*), and broad-fruited burreed (*Sparganium eurycarpum*). Small bedstraw (*Galium trifidum*) is present in drier areas. The wetlands is surrounded by Douglas spirea which transcends to Sitka alder mixed with some alder buckthorn, and then western red cedar.

Wetland W3, similar to W1, has beaked sedge in the deep water zone which gives way to inflated sedge in shallow water areas. The surrounding Douglas spirea has some water sedge and rush (*Juncus* sp.) in the moist zone and Sitka alder, lodgepole pine, white pine, Engelmann spruce, and grand fir in the upland transition zone.

Wetland W4 is similar to the other wetlands in that it has beaked sedge, inflated sedge, and fewflowered spikerush, all surrounded by Douglas spirea. This wetlands also has broadleaved cattail (*Typha latifolia*).

Wetland W5 is drier and has been invaded by Douglas spirea and some alder buckthorn. Wetlands plants mixed with the shrubs include narrowspined reedgrass (*Calamagrostis inexpansa*) and winged sedge.

3.2.2 Potential Vegetation

The conceptual framework for the habitat type system of vegetation classification was developed by Daubenmire (1966) and Daubenmire and Daubenmire (1968). This sytem identifies more-or-less discrete units of vegetation as indicators of various environmental conditions. Combinations of soil, climate, and topography create environments that support characteristic associations of plants. These characteristic associations maintain themselves in a relatively stable state if the environment does not change. Stable plant communities, or those in equilibrium with environmental conditions, are called climax communities. In undisturbed northwestern Montana forests, the process of vegetation succession terminates in climax plant communities of stable predictable types. The dominant species of climax communities retain their status indefinitely as senescent species are replaced by members of the same species. The potential climax vegetation of a given site determines the habitat type.

Habitat types appear in a reasonably predictable sequence across the landscape relative to elevation, aspect, and slope. A given habitat type represents a relatively narrow "window" of environmental variation. Sites with similar environmental conditions predictably support similar habitat types. This correlation between similar environments supporting similar climax plant communities is central to the concept of habitat type mapping.

In the habitat type classification system, "habitat" is synonymous with "site," a term familiar to foresters. Pfister (1975) describes the relationship between site and habitat type in more detail. The habitat type system closely parallels the Braun-Blanquet school of phytosociology (Layser 1974) widely supported in Europe. This system essentially classifies the vegetation into identifiable units, based on dominant components.

Since the original habitat type classification was developed, the system has received increasing use, particularly by foresters. Alexander (1985) summarized the major habitat type studies that have been conducted in the Rocky Mountains. The Northern Region of the U.S. Department of Agriculture (USDA) Forest Service initiated a training program in 1971, which has greatly expanded, to teach foresters and other resource managers to correctly apply the habitat type system to timber and wildlife management. Additional impetus to adopt the habitat type system was received when the Northern Region revised its approach to multiple use planning by including the inherent capability of the land to produce resources as an integral part of management. Because the vegetation of northwestern Montana is continually changing due to logging, fire, disease, and other factors, a map showing existing vegetation has a relatively short useful life; whereas, a map portraying the productive capacity of the land is as permanent as the land itself (Daubenmire 1973).

Nine habitat types occur in the plant sites, tailings, and adit site study areas. They are as follows:

- Engelmann spruce/common horsetail (410)
- Western red cedar/lady fern (540)
- Western red cedar/devil's club (550)
- Western hemlock/oak fern (565)
- Western hemlock/queencup beadlily (570)
- Subalpine fir/queencup beadlily (620)
- Subalpine fir/menziesia (670)
- Mountain hemlock/queencup beadlily (685)
- Mountain hemlock/beargrass (710)

These habitat types are illustrated for the alternate tailings area (Figure 15), Ramsey Creek (Figure

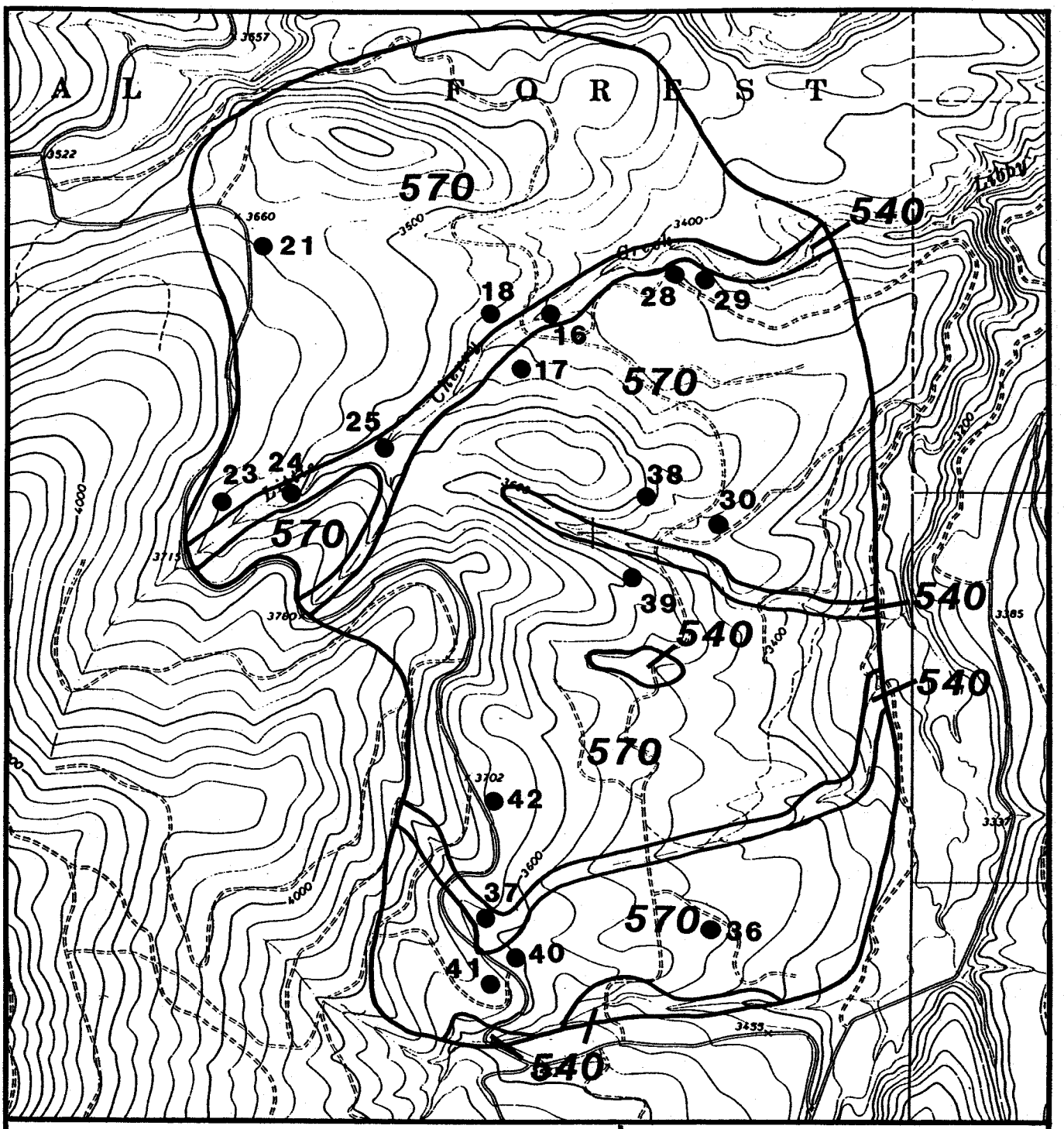

FIGURE 15.

HABITAT TYPE MAP - TAILINGS AREA

LEGEND

540 Western Red Cedar/Lady Fern
570 Western Hemlock/Queencup Beadlily
●26 Sample Site

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Lincoln County, Montana

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SCALE 1" = 2000'

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16), Libby Creek (Figure 17), Upper Libby Creek (Figure 18), and the Rock Creek evaluation adits (Figure 19).

Six of these habitat types are discussed in the following sections from quantitative data collected during the 1988 growing season. The remaining three types are described from qualitative observations either because of limited distribution in the study area or due to their presence as seral brush communities.

3.2.2.1 Western Red Cedar/Lady Fern

The western red cedar/lady fern habitat type occupies stream terraces and toe-slopes at slightly warmer exposures than the western red cedar/devil's club habitat type. It occurs in the Poorman-Cherry Creek tailings area study site as the dominant habitat type of stream drainages. The ten sample stands of the study area are characterized by dense vegetation cover (195.4%) dominated by trees (73.4%), cryptogams (46.0%), perennial forbs (37.8%), and shrubs (33.4%) (Table 15).

This habitat type is dominated by western red cedar and western hemlock, the climax codominants. Western hemlock (25.4%) provides a greater cover than western red cedar (21.0%); however, western red cedar (142.5 trees/acre) has a higher density than western hemlock (103.6 trees/acre). Many of the western red cedar are old (170 years plus), tall (101 feet), and have moderate dbh's (26.8 feet) (Tables 15 and 16). Six other conifer species are present in the habitat type but have a lower cover and density than the codominants. However, the height, dbh, and age of some of these seral tree species indicates their earlier domination of the habitat type. Douglas-fir trees are up to 105.0 feet in height, have dbh's up to 31.1 inches, and are in excess of 150 years in age. Likewise, Engelmann spruce are over 160 years in age, up to 97 feet tall, and have dbh's up to 30.3 inches. Other seral trees present include grand fir, subalpine fir, and white pine. The data on standing dead trees suggest that western hemlock (6.5 trees/acre) and Engelmann spruce (6.5 trees/acre) are not competing well. However, western hemlock (2525.3 trees/acre) provides 94.6% of the tree reproduction. Western red cedar (80.9 trees/acre) is reproducing but at low rates.

Dominant shrubs (Tables 15 and 17) in the understory are Rocky Mountain maple (12.2% cover and 323.8 shrubs/acre), Sitka alder (6.0% cover and 145.7 shrubs/ acre), devil's club (3.8% cover and 825.6 shrubs/acre), and snowberry (2.6% cover and 1068.4 shrubs/acre). Rocky Mountain maple, Sitka alder, and

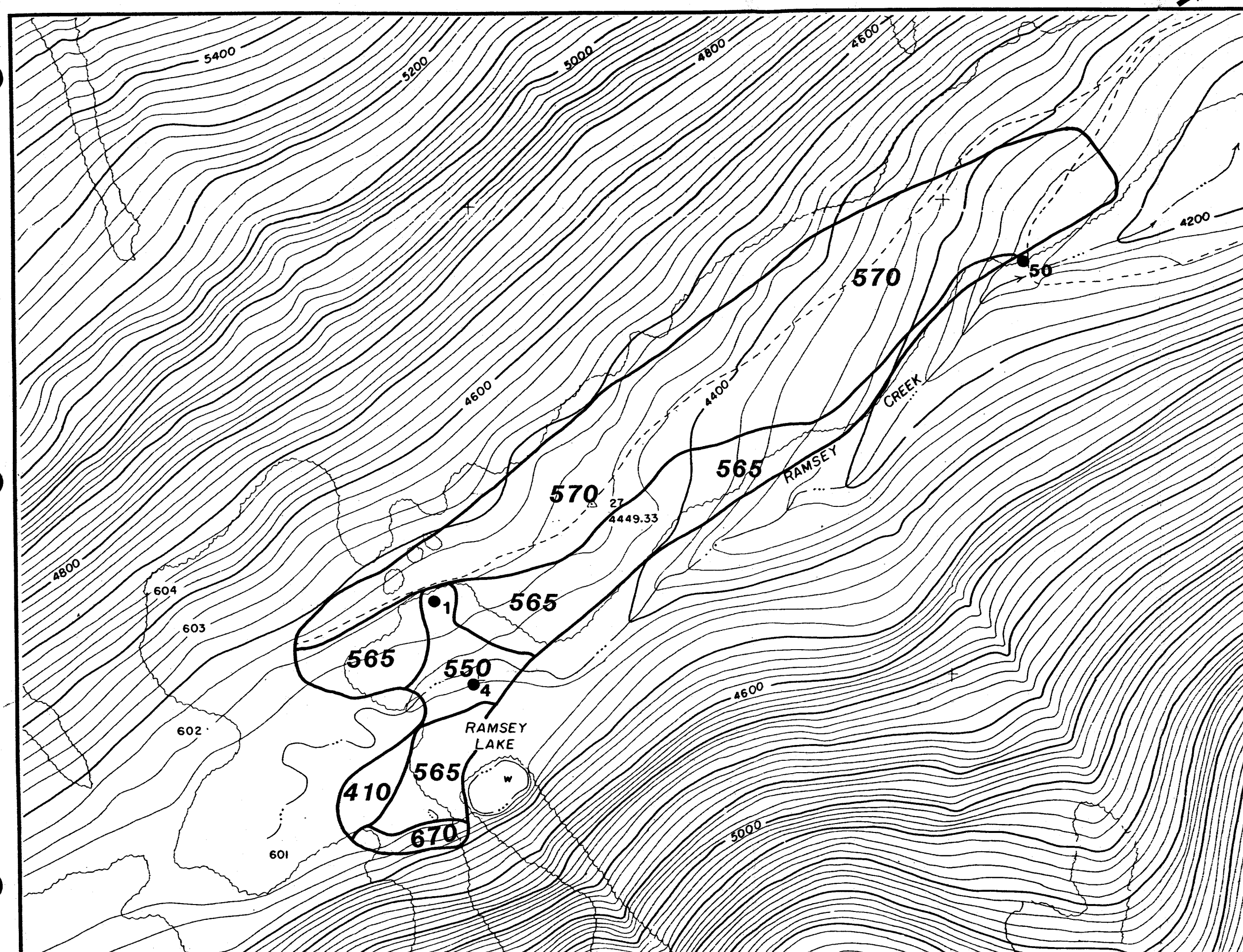

FIGURE 16.
HABITAT TYPE MAP - RAMSEY CREEK

LEGEND

- 410 Engelmann Spruce/ Common Horsetail
- 550 Western Red Cedar/ Devil's Club
- 565 Western Hemlock/Oak Fern
- 570 Western Hemlock/ Queencup Beadlily
- 670 Subalpine Fir/Menziesia
- ●4 Sample Site

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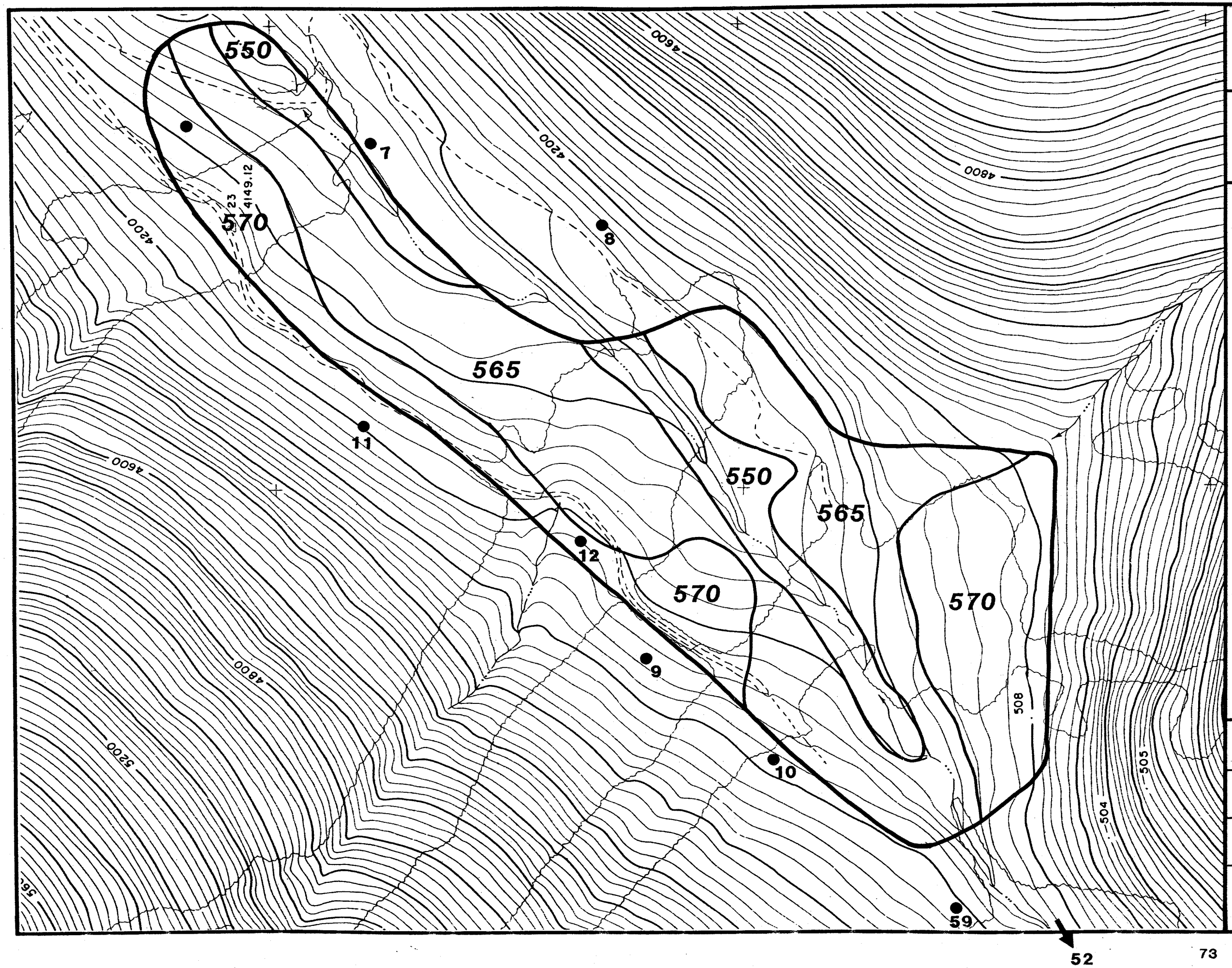

FIGURE 17.
HABITAT TYPE MAP - LIBBY CREEK

LEGEND

550 Western Red Cedar/ Devil's Club

565 Western Hemlock/Oak Fern

570 Western Hemlock/ Queencup Beadlily

● 9 Sample Site

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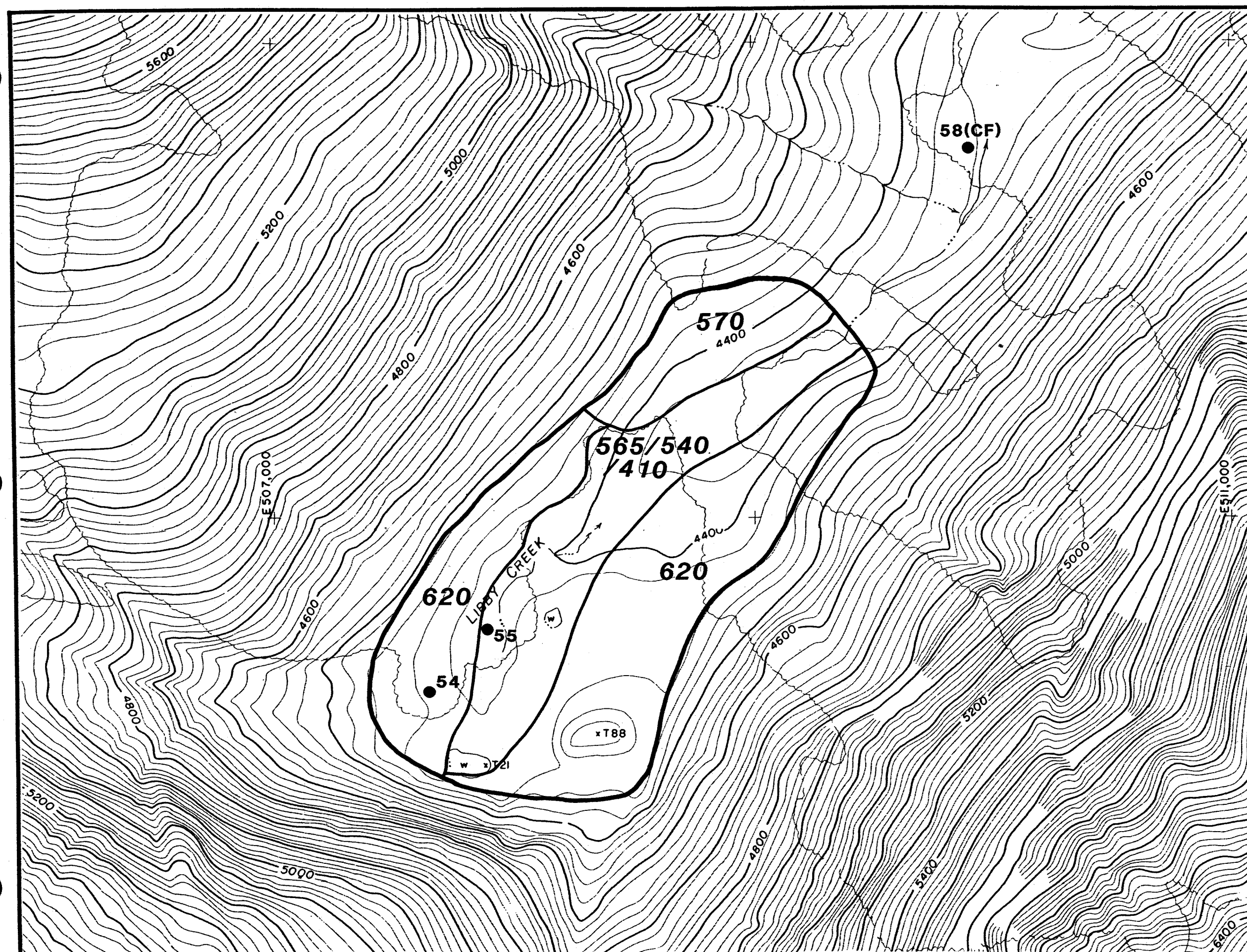

FIGURE 18.
HABITAT TYPE MAP - UPPER LIBBY CREEK

LEGEND

565/540/410 Western Hemlock/Western Red Cedar/Lady Fern/Oak Fern / Engelmann Spruce/ Common Horsetail Complex

620 Subalpine Fir/ Queencup Beadlily

●54 Sample Site

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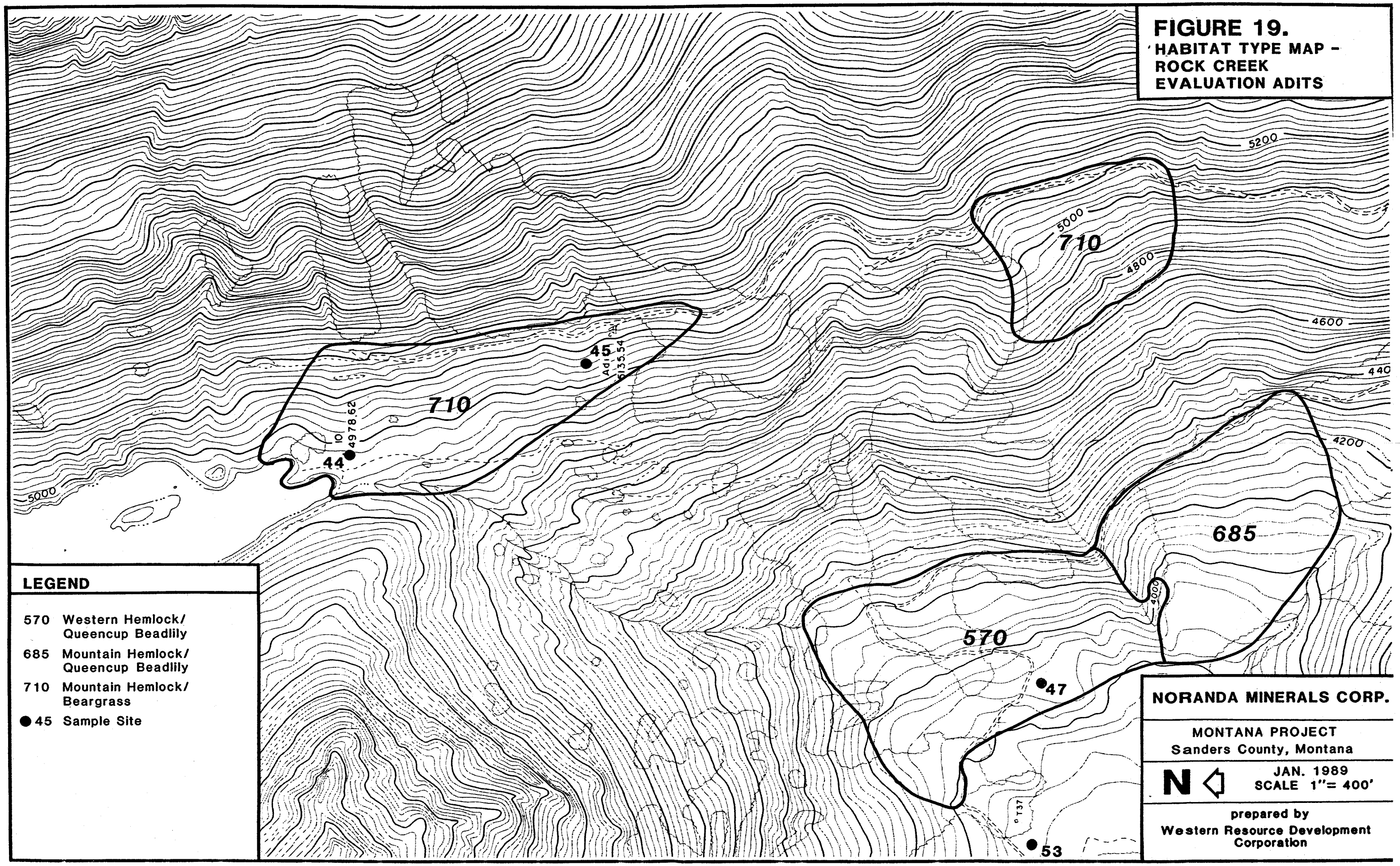

FIGURE 19.
HABITAT TYPE MAP - ROCK CREEK EVALUATION ADITS

TABLE 15. WESTERN RED CEDAR/LADY FERN COVER DATA SUMMARY - 1988
MONTANA PROJECT

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
TREES					
Abies grandis	3.6%	3.7%	4.2%	2.1%	70.0%
Abies lasiocarpa	P	0.0%	0.0%	0.0%	10.0%
Larix occidentalis	0.4%	0.4%	0.4%	0.2%	10.0%
Picea engelmannii	12.4%	12.6%	14.0%	7.2%	100.0%
Pinus monticola	0.2%	0.2%	0.2%	0.1%	20.0%
Populus trichocarpa	7.0%	7.2%	7.0%	3.6%	10.0%
Pseudotsuga menziesii	1.2%	1.2%	1.2%	0.6%	20.0%
Thuja plicata	18.8%	19.1%	21.0%	10.7%	50.0%
Tsuga heterophylla	20.4%	20.8%	25.4%	13.1%	90.0%
Total % Trees	64.0%	65.2%	73.4%	37.6%	
TALL SHRUBS					
Acer glabrum	10.2%	10.4%	12.2%	6.2%	30.0%
Alnus sinuata	5.2%	5.3%	6.0%	3.1%	50.0%
Sorbus scopulina	P	0.0%	0.0%	0.0%	10.0%
Sorbus sitchensis	P	0.0%	0.0%	0.0%	20.0%
Taxus brevifolia	0.0%	0.0%	1.4%	0.7%	30.0%
Total % Tall Shrubs	15.4%	15.7%	19.6%	10.0%	
LOW SHRUBS					
Amelanchier alnifolia	0.0%	0.0%	0.4%	0.2%	10.0%
Cornus stolonifera	0.2%	0.2%	1.4%	0.7%	20.0%
Lonicera involucrata	0.0%	0.0%	0.2%	0.1%	10.0%
Lonicera utahensis	0.0%	0.0%	0.2%	0.1%	10.0%
Menziesia ferruginea	P	0.0%	0.0%	0.0%	30.0%
Oplopanax horridum	0.6%	0.6%	3.8%	2.0%	50.0%
Pachistima myrsinites	P	0.0%	0.0%	0.0%	50.0%
Rhamnus alnifolia	0.0%	0.0%	0.6%	0.3%	20.0%
Ribes lacustre	0.0%	0.0%	0.2%	0.1%	60.0%
Rosa gymnocarpa	P	0.0%	0.0%	0.0%	30.0%
Rosa nutkana	P	0.0%	0.0%	0.0%	10.0%
Rubus idaeus	P	0.0%	0.0%	0.0%	10.0%
Sambucus racemosa	0.2%	0.2%	0.8%	0.4%	20.0%
Sheperdia canadensis	P	0.0%	0.0%	0.0%	10.0%
Symphoricarpos albus	0.6%	0.6%	2.6%	1.3%	40.0%
Vaccinium cespitosum	P	0.0%	0.0%	0.0%	10.0%
Vaccinium globulare	0.4%	0.4%	0.4%	0.2%	50.0%
Total % Low Shrubs	2.0%	2.0%	10.6%	5.4%	

TABLE 15. (Continued)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
SUBSHRUBS					
Chimaphila umbellata	P	0.0%	0.0%	0.0%	10.0%
Cornus canadensis	P	0.0%	0.0%	0.0%	20.0%
Linnaea borealis	P	0.0%	0.0%	0.0%	30.0%
Penstemon ellipticus	P	0.0%	0.0%	0.0%	10.0%
Rubus parviflorus	0.0%	0.0%	3.2%	1.6%	60.0%
Total % Subshrubs	0.0%	0.0%	3.2%	1.6%	
PERENNIAL GRAMINOIDS					
Bromus vulgaris	P	0.0%	0.0%	0.0%	70.0%
Calamagrostis canadensis	0.0%	0.0%	0.2%	0.1%	30.0%
Carex deweyana	P	0.0%	0.0%	0.0%	20.0%
Deschampsia elongata	0.2%	0.2%	0.2%	0.1%	10.0%
Elymus glaucus	P	0.0%	0.0%	0.0%	20.0%
Festuca subulata	0.2%	0.2%	0.4%	0.2%	20.0%
Glyceria grandis	0.6%	0.6%	4.0%	2.1%	40.0%
Scirpus maritimus	P	0.0%	0.0%	0.0%	10.0%
Total % Perennial Graminoids	1.0%	1.0%	4.8%	2.5%	
PERENNIAL FORBS					
Aconitum columbianum	0.4%	0.4%	1.4%	0.7%	30.0%
Actaea rubra	0.0%	0.0%	0.6%	0.3%	80.0%
Adenocaulon bicolor	0.2%	0.2%	0.6%	0.3%	40.0%
Angelica arguta	0.2%	0.2%	0.4%	0.2%	30.0%
Aralia nudicaulis	0.0%	0.0%	0.2%	0.1%	20.0%
Arnica cordifolia	0.2%	0.2%	3.4%	1.8%	60.0%
Asarum caudatum	0.0%	0.0%	1.0%	0.5%	20.0%
Cicuta douglasii	P	0.0%	0.0%	0.0%	10.0%
Circaea alpina	0.2%	0.2%	2.0%	1.0%	50.0%
Clintonia uniflora	0.2%	0.2%	2.4%	1.2%	90.0%
Coptis occidentalis	0.2%	0.2%	1.4%	0.7%	50.0%
Corallorhiza maculata	P	0.0%	0.0%	0.0%	20.0%
Disporum hookeri	0.0%	0.0%	2.2%	1.1%	70.0%
Epilobium angustifolium	P	0.0%	0.0%	0.0%	10.0%
Epilobium glaberrimum	0.0%	0.0%	0.2%	0.1%	20.0%
Fragaria vesca	P	0.0%	0.0%	0.0%	10.0%
Fragaria virginiana	P	0.0%	0.0%	0.0%	10.0%
Galium triflorum	0.0%	0.0%	0.8%	0.4%	60.0%
Geum macrophyllum	P	0.0%	0.0%	0.0%	10.0%
Goodyera oblongfolia	P	0.0%	0.0%	0.0%	10.0%
Habenaria dilatata	P	0.0%	0.0%	0.0%	30.0%

TABLE 16. WESTERN RED CEDAR/LADY FERN TREE DENSITY, REPRODUCTION, HEIGHT, DBH, AND AGE DATA SUMMARY - 1988 MONTANA PROJECT

DENSITY

	MEAN/ 125 SQ METERS	MEAN/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TREES				
Abies grandis	1.1	35.6	9.6%	
Abies lasiocarpa	0.3	9.7	2.6%	
Picea engelmannii	2.0	64.8	17.5%	
Pinus monticola	0.1	3.2	0.9%	
Populus trichocarpa	0.2	6.5	1.8%	
Pseudotsuga menziesii	0.1	3.2	0.9%	
Thuja plicata	4.4	142.5	38.6%	
Tsuga heterophylla	3.2	103.6	28.1%	
Total Trees	11.4	369.1	100.0%	8.0
TREES (DEAD)				
Picea engelmannii	0.2	6.5	50.0%	
Tsuga heterophylla	0.2	6.5	50.0%	
Total Trees (Dead)	0.4	13.0	100.0%	

REPRODUCTION

	MEAN SHRUBS/25 SQ M	MEAN SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
Abies grandis	0.3	48.6	1.8%	
Pseudotsuga menziesii	0.1	16.2	0.6%	
Thuja plicata	0.5	80.9	3.0%	
Tsuga heterophylla	15.6	2525.3	94.6%	
Total Tree Reproduction	16.5	2671.0	100.0%	36.8

TABLE 16. (Continued)

HEIGHT (FEET)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	8	90	33.2
Abies lasiocarpa	4	17	12.3
Picea engelmannii	7	97	32.1
Pinus monticola	21	21	21.0
Pseudotsuga menziesii	105	105	105.0
Thuja plicata	5	101	39.2
Tsuga heterophylla	5	95	25.8
Total Trees			33.3

DBH (INCHES)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	0.8	25.2	6.8
Abies lasiocarpa	1.2	3.1	2.0
Picea engelmannii	1.2	30.3	6.9
Pinus monticola	5.1	5.1	5.1
Populus trichocarpa	33.1	35.0	34.1
Pseudotsuga menziesii	31.1	31.1	31.1
Thuja plicata	0.4	26.8	7.9
Tsuga heterophylla	0.4	46.5	5.9
Total Trees			7.5
TREES (DEAD)			
Picea engelmannii	3.1	4.7	3.9
Tsuga heterophylla	6.7	24.4	15.6

TABLE 16. (Continued)

AGE (YEARS)

TRANSECT NUMBER	NUMBER TREES CORED	MINIMUM	MAXIMUM	MEAN
Picea engelmannii	5	37	160+	105
Pseudotsuga menziesii	1	150+	150+	150+
Thuja plicata	1	170+	170+	170+
Total	7	37	170+	142

TABLE 17. WESTERN RED CEDAR/LADY FERN SHRUB DENSITY DATA
SUMMARY - 1988
MONTANA PROJECT

	MEAN SHRUBS/25 SQ M	MEAN. SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TALL SHRUBS				
Acer glabrum	2.0	323.8	8.7%	
Alnus sinuata	0.9	145.7	3.9%	
Sorbus scopulina	0.2	32.4	0.9%	
Taxus brevifolia	0.6	97.1	2.6%	
Total Tall Shrubs	3.7	599.0	16.1%	
LOW SHRUBS				
Amelanchier alnifolia	0.1	16.2	0.4%	
Cornus stolonifera	0.3	48.5	1.3%	
Menziesia ferruginea	0.6	97.1	2.6%	
Oplopanax horridum	5.1	825.6	22.2%	
Pachistima myrsinites	0.8	129.5	3.4%	
Rhamnus alnifolia	0.6	97.1	2.6%	
Rosa gymnocarpa	0.2	32.4	0.9%	
Rosa nutkana	0.2	32.4	0.9%	
Salix scouleriana	0.1	16.2	0.4%	
Sambucus racemosa	0.2	32.4	0.9%	
Symphoricarops albus	6.6	1068.4	28.7%	
Vaccinium globulare	1.2	194.2	5.2%	
Vaccinium myrtillus	0.2	32.4	0.9%	
Total Low Shrubs	16.2	2622.4	70.4%	
SUBSHRUBS				
Rubus parviflorus	3.1	501.8	13.5%	
Total Subshrubs	3.1	501.8	13.5%	
TOTAL SHRUBS	23.0	3723.2	100.0%	17.7

Pacific yew (1.4% cover and 97.1 shrubs/acre) are sometimes common in this habitat type (Cooper et al. 1987).

Lady fern with a cover of 26.6% is the dominant plant in the habitat type. Other dominant understory species include tiarella (7.6%), oak fern (7.2%), starry Solomon's seal (6.6%), heartleaf arnica (3.4%), and queencup beadlily (2.4%). Lady fern, tiarella, and queencup beadlily have a high constancy in this habitat type (Cooper et al. 1987). Oak fern, a moisture dependent species, is also common in this habitat type. Other high moisture dependent forbs characteristic to the habitat type and present in the sample stands include enchanter's nightshade (2.0%), stream violet (1.8%), arrowleaf groundsel (1.2%), and claspingleaf twisted stalk (*Streptopus amplexifolius*) (1.0%). Additional species with a high constancy in the habitat type and present in the sample stands include goldthread (1.4%), wild ginger (*Asarum caudatum*) (1.0%), and trail plant (0.6%).

Total herbaceous production (Table 18) is low at 241.6 lbs/acre. Perennial forbs (232.9 lbs/acre) provide 96.4% of the total biomass. Perennial graminoids provide the remaining percentage.

3.2.2.2 Western Red Cedar/Devil's Club

This habitat type occupies wet sites along streams and at seeps on toe-slopes along Libby and Ramsey creeks where ground water is close to the soil surface throughout the growing season. This habitat type as represented by two sample stands is characterized by a dense vegetation cover (158.0%) dominated by shrubs (68.0%), trees (40.0%), cryptogams (28.0%), and perennial forbs (22.0%), respectively (Table 19).

These stands represent a seral stage of the climax habitat type. Western red cedar is not present and western hemlock, the climax codominant in the habitat type, has only the second highest cover (12.0%) and the third highest density (32.4 trees/acre) (Tables 19 and 20). Grand fir and Engelmann spruce, seral components of the climax, have a cover of 17.0% and 11.0%, respectively. These two trees, with a density of 80.9 and 64.8 trees/acre, are more abundant than western hemlock. Engelmann spruce is the oldest (170 years) and largest (99 foot maximum height and 28.0 inch maximum dbh) tree species. Grand fir (242.8 trees/acre), however, is the only tree with seedling reproduction.

The shrub understory (Tables 19 and 21) is dominated by devil's club (31.0% cover and 1214.1 shrubs/acre), the major shrub of the climax condition (Pfister et al. 1977). Pacific yew (20.0% cover and 404.7 shrubs/acre)

TABLE 18. POTENTIAL VEGETATION TYPE PRODUCTION DATA SUMMARY - 1988 MONTANA PROJECT

HABITAT TYPE	LIFEFORM	GRAMS/ SQ M	KG/ HECTARE	LBS/ ACRE	RELATIVE PRODUCTION	STANDARD DEVIATION
WESTERN RED CEDAR/ LADY FERN	Perennial Graminoids	1.0	9.8	8.7	3.6%	
	Annual Graminoids	0.0	0.0	0.0	0.0%	
	Perennial Forbs	26.1	261.6	232.9	96.4%	
	Annual Forbs	0.0	0.0	0.0	0.0%	
	Total Production	27.1	271.4	241.6	100.0%	29.5
WESTERN RED CEDAR/ DEVIL'S CLUB	Perennial Graminoids	0.9	9.1	8.1	5.2%	
	Annual Graminoids	0.0	0.0	0.0	0.0%	
	Perennial Forbs	16.7	167.3	148.9	94.8%	
	Annual Forbs	0.0	0.0	0.0	0.0%	
	Total Production	17.6	176.4	157.0	100.0%	19.7
WESTERN HEMLOCK/ OAK FERN	Perennial Graminoids	0.3	3.0	2.7	6.0%	
	Annual Graminoids	0.0	0.0	0.0	0.0%	
	Perennial Forbs	4.7	46.9	41.8	94.0%	
	Annual Forbs	0.0	0.0	0.0	0.0%	
	Total Production	5.0	49.9	44.5	100.0%	4.9
WESTERN HEMLOCK/ QUEENCUP BEADLILY	Perennial Graminoids	0.4	3.6	3.2	3.0%	
	Annual Graminoids	0.0	0.0	0.0	0.0%	
	Perennial Forbs	11.6	116.6	103.8	97.0%	
	Annual Forbs	0.0	0.0	0.0	0.0%	
	Total Production	12.0	120.2	107.0	100.0%	24.3
SUBALPINE FIR/ QUEENCUP BEADLILY	Perennial Graminoids	1.0	9.8	8.7	5.0%	
	Annual Graminoids	0.0	0.0	0.0	0.0%	
	Perennial Forbs	18.5	185.5	165.1	95.0%	
	Annual Forbs	0.0	0.0	0.0	0.0%	
	Total Production	19.5	195.3	173.8	100.0%	13.0
MOUNTAIN HEMLOCK/ BEARGRASS	Perennial Graminoids	2.1	21.1	18.8	7.2%	
	Annual Graminoids	0.0	0.0	0.0	0.0%	
	Perennial Forbs	27.1	271.4	241.6	92.8%	
	Annual Forbs	0.0	0.0	0.0	0.0%	
	Total Production	29.2	292.5	260.4	100.0%	36.3

TABLE 19. WESTERN RED CEDAR/DEVIL'S CLUB COVER DATA SUMMARY - 1988 MONTANA PROJECT

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
TREES					
Abies grandis	8.0%	8.6%	17.0%	10.7%	100.0%
Picea engelmannii	11.0%	11.8%	11.0%	7.0%	100.0%
Tsuga heterophylla	12.0%	12.9%	12.0%	7.6%	50.0%
Total % Trees	31.0%	33.3%	40.0%	25.3%	
TALL SHRUBS					
Acer glabrum	5.0%	5.4%	6.0%	3.8%	100.0%
Alnus sinuata	3.0%	3.2%	3.0%	1.9%	50.0%
Sorbus sitchensis	P	0.0%	0.0%	0.0%	50.0%
Taxus brevifolia	17.0%	18.3%	20.0%	12.7%	50.0%
Total % Tall Shrubs	25.0%	26.9%	29.0%	18.4%	
LOW SHRUBS					
Menziesia ferruginea	3.0%	3.2%	3.0%	1.9%	100.0%
Oplopanax horridum	20.0%	21.5%	31.0%	19.7%	100.0%
Ribes lacustre	0.0%	0.0%	1.0%	0.6%	100.0%
Sambucus racemosa	P	0.0%	0.0%	0.0%	100.0%
Symphoricarpos albus	P	0.0%	0.0%	0.0%	50.0%
Vaccinium globulare	1.0%	1.1%	4.0%	2.5%	100.0%
Total % Low Shrubs	24.0%	25.8%	39.0%	24.7%	
SUBSHRUBS					
Rubus parviflorus	P	0.0%	0.0%	0.0%	100.0%
Total % Subshrubs	0.0%	0.0%	0.0%	0.0%	
PERENNIAL GRAMINOIDS					
Bromus vulgaris	P	0.0%	0.0%	0.0%	100.0%
Festuca subulata	P	0.0%	0.0%	0.0%	50.0%
Phleum pratense	P	0.0%	0.0%	0.0%	50.0%
Total % Perennial Graminoids	0.0%	0.0%	0.0%	0.0%	
PERENNIAL FORBS					
Actaea rubra	P	0.0%	0.0%	0.0%	100.0%
Adenocaulon bicolor	P	0.0%	0.0%	0.0%	50.0%
Arnica cordifolia	0.0%	0.0%	1.0%	0.6%	100.0%
Clintonia uniflora	0.0%	0.0%	6.0%	3.8%	100.0%
Coptis occidentalis	P	0.0%	0.0%	0.0%	50.0%

TABLE 19. (Continued)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Disporum hookeri	P	0.0%	0.0%	0.0%	100.0%
Galium triflorum	P	0.0%	0.0%	0.0%	100.0%
Goodyera oblongfolia	P	0.0%	0.0%	0.0%	50.0%
Hieracium cynoglossoides	P	0.0%	0.0%	0.0%	50.0%
Osmorhiza chilensis	P	0.0%	0.0%	0.0%	100.0%
Polemonium pulcherrimum	P	0.0%	0.0%	0.0%	50.0%
Senecio triangularis	P	0.0%	0.0%	0.0%	50.0%
Smilacina stellata	0.0%	0.0%	1.0%	0.6%	100.0%
Streptopus amplexifolius	0.0%	0.0%	1.0%	0.6%	50.0%
Thalictrum occidentale	2.0%	2.1%	3.0%	1.9%	50.0%
Tiarella trifoliata	2.0%	2.2%	8.0%	5.1%	100.0%
Trillium ovatum	P	0.0%	0.0%	0.0%	100.0%
Veratrum viride	P	0.0%	0.0%	0.0%	50.0%
Viola glabella	0.0%	0.0%	2.0%	1.3%	50.0%
Viola orbiculata	P	0.0%	0.0%	0.0%	50.0%
Total % Perennial Forbs	4.0%	4.3%	22.0%	13.9%	
CRYPTOGAMS					
Athyrium filix-femina	3.0%	3.2%	5.0%	3.2%	100.0%
Gymnocarpium dryopteris	4.0%	4.3%	18.0%	11.3%	100.0%
Moss	2.0%	2.2%	5.0%	3.2%	100.0%
Total % Cryptogams	9.0%	9.7%	28.0%	17.7%	
TOTAL % VEGETATION	93.0%	100.0%	158.0%	100.0%	
Soil	0.0%				
Litter	7.0%				
Rock	0.0%				

P = SPECIES PRESENT BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 20. WESTERN RED CEDAR/DEVIL'S CLUB TREE DENSITY, REPRODUCTION, HEIGHT, DBH, AND AGE DATA SUMMARY - 1988 MONTANA PROJECT

DENSITY

	MEAN NO. TREES/ 125 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TREES				
Abies grandis	2.5	80.9	45.4%	
Picea engelmannii	2.0	64.8	36.4%	
Tsuga heterophylla	1.0	32.4	18.2%	
Total Trees	5.5	178.1	100.0%	0.5

REPRODUCTION

	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
Abies grandis	1.5	242.8	100.0%	
Total Tree Reproduction	1.5	242.8	100.0%	0.5

HEIGHT (FEET)

	RANGE IN HEIGHT (FEET) (MIN)	RANGE IN HEIGHT (FEET) (MAX)	ABSOLUTE MEAN HEIGHT IN FEET
TREES			
Abies grandis	3	35	15.6
Picea engelmannii	7	99	55.0
Tsuga heterophylla	16	46	31.0
Total Trees			32.7

TABLE 20. (Continued)

DBH (INCHES)

	RANGE IN DBH (INCHES) (MIN)	RANGE IN DBH (INCHES) (MAX)	ABSOLUTE MEAN DBH IN INCHES
TREES			
Abies grandis	0.4	5.5	2.4
Picea engelmannii	1.2	28.0	12.3
Tsuga heterophylla	4.3	11.4	7.9
Total Trees			7.0

AGE (YEARS)

	MINIMUM	MAXIMUM	MEAN
Picea engelmannii	88	170	129

TABLE 21. WESTERN RED CEDAR/DEVIL'S CLUB SHRUB DENSITY DATA SUMMARY - 1988 MONTANA PROJECT

	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TALL SHRUBS				
Acer glabrum	1.0	161.9	2.9%	
Taxus brevifolia	2.5	404.7	7.1%	
Total Tall Shrubs	3.5	566.6	10.0%	
LOW SHRUBS				
Menziesia ferruginea	1.0	161.9	2.9%	
Oplopanax horridum	7.5	1214.1	21.5%	
Ribes lacustre	2.5	404.7	7.1%	
Vaccinium globulare	19.5	3156.6	55.7%	
Vaccinium scoparium	0.5	80.9	1.4%	
Total Low Shrubs	31.0	5018.2	88.6%	
SUBSHRUBS				
Rubus parviflorus	0.5	80.9	1.4%	
Total Subshrubs	0.5	80.9	1.4%	
TOTAL SHRUBS	35.0	5665.7	100.0%	14.0

is usually only a minor species in the habitat type (Pfister et al. 1977). Other common shrubs in the sample stands include Rocky Mountain maple (6.0% cover and 161.9 shrubs/acre), huckleberry (4.0% cover and 3156.6 shrubs/acre), Sitka alder (3.0% cover and 0.0 shrubs/acre), and menziesia (3.0% cover and 161.9 shrubs/acre).

The herbaceous understory is more representative of the climax habitat type. Species diagnostic to the climax condition are dominant. These respectively include oak fern (18.0%), tiarella (8.0%), queencup beadlily (6.0%), lady fern (5.0%), and starry Solomon's seal (1.0%). Other climax components, trail plant and sweetscented bedstraw, are present but provided little cover. Other significant forbs present include western meadowrue (3.0%), stream violet (2.0%), claspingleaf twisted stalk (1.0%), and heartleaf arnica (1.0%).

Total herbaceous production (Table 18) is low at 157.0 lbs/acre. Perennial forbs (148.9 lbs/acre) and perennial graminoids (8.1 lbs/acre) provide respectively 94.8% and 5.2% of the biomass.

3.2.2.3 Western Hemlock/Oak Fern

This, the wettest western hemlock habitat type, occurs on lower slopes and benches near drainage bottoms along Libby and Ramsey creeks. Total mean vegetation cover of the four sample stands at 162.0% is high. The tree canopy at 89.0% blocks most of the sunlight. The understory is dominated by cryptogams (45.5%) and has a low shrub (15.0%) and perennial forb (11.0%) cover (Table 22).

The four sample stands of the study area are dominated by western hemlock, the climax tree of the habitat type. Western hemlock with a cover of 74.0% and a density of 453.2 trees per acre accounts for 45.7% and 83.6% of the total cover and density totals (Tables 22 and 23). Major seral components respectively present by cover include grand fir (6.0%), Engelmann spruce (5.5%), and white pine (0.0%). Subalpine fir often present in the climax on scattered individuals, is present with a cover of 3.5%.

Grand fir has the greatest mean height (60.0 feet) and the largest mean dbh (12.4 inches). Subalpine fir with a mean height of 19.7 feet and a mean dbh of 7.7 inches is second most important. A few western hemlock approach 100 feet in height and have dbh's over 25 inches. Western hemlock, the only tree reproducing, has a very high seedling density (2185.4 trees/acre). With time western hemlock will replace the shade-intolerant seral trees and become even more dominant.

TABLE 22. WESTERN HEMLOCK/OAK FERN COVER DATA SUMMARY - 1988
MONTANA PROJECT

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
TREES					
Abies grandis	5.5%	5.8%	6.0%	3.7%	50.0%
Abies lasiocarpa	3.5%	3.7%	3.5%	2.2%	25.0%
Picea engelmannii	3.5%	3.7%	5.5%	3.4%	50.0%
Pinus monticola	P	0.0%	0.0%	0.0%	25.0%
Thuja plicata	P	0.0%	0.0%	0.0%	25.0%
Tsuga heterophylla	73.5%	77.0%	74.0%	45.7%	100.0%
Total % Trees	86.0%	90.2%	89.0%	55.0%	
TALL SHRUBS					
Acer glabrum	0.0%	0.0%	2.5%	1.5%	25.0%
Taxus brevifolia	2.5%	2.6%	3.5%	2.2%	75.0%
Total % Tall Shrubs	2.5%	2.6%	6.0%	3.7%	0.0%
LOW SHRUBS					
Menziesia ferruginea	0.5%	0.5%	0.5%	0.3%	25.0%
Oplopanax horridum	0.0%	0.0%	2.0%	1.2%	50.0%
Ribes lacustre	P	0.0%	0.0%	0.0%	25.0%
Ribes viscosissimum	P	0.0%	0.0%	0.0%	25.0%
Sambucus racemosa	0.0%	0.0%	1.0%	0.6%	25.0%
Vaccinium globulare	0.0%	0.0%	2.0%	1.2%	100.0%
Total % Low Shrubs	0.5%	0.5%	5.5%	3.3%	
SUBSHRUBS					
Rubus parviflorus	1.0%	1.0%	1.5%	1.0%	25.0%
Rubus pedatus	0.0%	0.0%	2.0%	1.2%	25.0%
Total % Subshrubs	1.0%	1.0%	3.5%	2.2%	0.0%
					0.0%
PERENNIAL GRAMINOIDS					0.0%
Calamagrostis canadensis	P	0.0%	0.0%	0.0%	25.0%
Elymus glaucus	0.5%	0.5%	1.0%	0.6%	25.0%
Luzula parviflora	0.0%	0.0%	0.5%	0.3%	25.0%
Total % Perennial Graminoids	0.5%	0.5%	1.5%	0.9%	
PERENNIAL FORBS					
Arnica cordifolia	P	0.0%	0.0%	0.0%	50.0%
Clintonia uniflora	0.0%	0.0%	2.0%	1.3%	100.0%
Disporum hookeri	0.0%	0.0%	0.5%	0.3%	50.0%

TABLE 22. (Continued)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Galium boreale	0.5%	0.5%	0.5%	0.3%	25.0%
Mitella breweri	0.0%	0.0%	0.5%	0.3%	25.0%
Pyrola secunda	0.0%	0.0%	1.0%	0.6%	75.0%
Pyrola uniflora	P	0.0%	0.0%	0.0%	25.0%
Smilacina stellata	P	0.0%	0.0%	0.0%	50.0%
Streptopus amplexifolius	P	0.0%	0.0%	0.0%	25.0%
Thalictrum occidentale	P	0.0%	0.0%	0.0%	25.0%
Tiarella trifoliata	0.5%	0.5%	6.0%	3.7%	75.0%
Trillium ovatum	P	0.0%	0.0%	0.0%	25.0%
Viola glabella	0.0%	0.0%	0.5%	0.3%	25.0%
Viola orbiculata	P	0.0%	0.0%	0.0%	25.0%
Total % Perennial Forbs	1.0%	1.0%	11.0%	6.8%	
CRYPTOGAMS					
Athyrium filix-femina	0.0%	0.0%	1.0%	0.6%	50.0%
Gymnocarpium dryopteris	3.0%	3.2%	23.0%	14.2%	100.0%
Moss	1.0%	1.0%	21.5%	13.3%	100.0%
Total % Cryptogams	4.0%	4.2%	45.5%	28.1%	
TOTAL % VEGETATION	95.5%	100.0%	162.0%	100.0%	
Soil	0.0%				
Litter	4.5%				
Rock	0.0%				

P = SPECIES PRESENT BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 23. WESTERN HEMLOCK/OAK FERN TREE DENSITY, REPRODUCTION, HEIGHT, DBH, AND AGE DATA SUMMARY - 1988 MONTANA PROJECT

DENSITY

TREE DENSITY DATA TRANSECT NUMBER	MEAN NO. TREES/ 125 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TREES				
Abies grandis	0.5	16.2	3.0%	
Abies lasiocarpa	0.8	24.3	4.5%	
Picea engelmannii	1.5	48.6	8.9%	
Tsuga heterophylla	14.0	453.2	83.6%	
Total Trees	16.8	542.3	100.0%	7.9
TREES (DEAD)				
Picea engelmannii	0.5	16.2	100.0%	
Total Trees (Dead)	0.5	16.2	100.0%	0.9

REPRODUCTION

TRANSECT NUMBER	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
Tsuga heterophylla	13.5	2185.4	100.0%	
Total Tree Reproduction	13.5	2185.4	100.0%	17.7

TABLE 23. (Continued)

HEIGHT (FEET)

MEAN TREE HEIGHT IN FEET TRANSECT NUMBER	RANGE IN HEIGHT (FEET) (MIN)	RANGE IN HEIGHT (FEET) (MAX)	ABSOLUTE MEAN HEIGHT IN FEET
TREES			
Abies grandis	30	90	60.0
Abies lasiocarpa	32	76	19.7
Picea engelmannii	15	32	8.7
Tsuga heterophylla	5	100	12.4
Total Trees			28.0
TREES (DEAD)			
Picea engelmannii	13	42	27.5
Total Dead Trees			27.5

DBH (INCHES)

MEAN DIAMETER AT BREAST HEIGHT (dbh) IN INCHES TRANSECT NUMBER	RANGE IN DBH (INCHES) (MIN)	RANGE IN DBH (INCHES) (MAX)	ABSOLUTE MEAN DBH IN INCHES
TREES			
Abies grandis	3.5	21.3	12.4
Abies lasiocarpa	2.8	12.2	7.7
Picea engelmannii	1.6	4.7	3.4
Tsuga heterophylla	0.4	25.2	4.9
Total Trees			5.1
TREES (DEAD)			
Picea engelmannii	1.2	6.7	3.9
Total Dead Trees			3.9

AGE (YEARS)

TRANSECT NUMBER	NUMBER TREES CORED	MINIMUM	MAXIMUM	MEAN AGE
Tsuga heterophylla	1	104	104	104

The understory presently includes three shrubs present in low amounts in climax stands (Cooper et al. 1987) (Tables 22 and 24). They are Pacific yew (3.5% cover and 40.5 shrubs/acre), huckleberry (2.0% cover and 2954.2 shrubs/acre), and menziesia (0.5% cover and 40.5 shrubs/acre). Other abundant shrubs in the sample stands include Rocky Mountain maple (2.5% cover and 0.0% shrubs/acre), devil's club (2.0% cover and 809.4 shrubs/acre), and fiveleaved bramble (*Rubus pedatus*) (2.0% cover and 0.0 shrubs/acre).

As characteristic of the habitat type, oak fern with a cover of 23.0% is well represented. Moss cover at 21.5% is indicative of the moist condition of the sample stands. Other species of the climax conditions present include tiarella (6.0%), queencup beadlily (2.0%), lady fern (1.0%), hooker fairybell (0.5%), starry Solomon's seal (0.0%), white trillium (0.0%), and roundleaf violet (0.0%).

Herbaceous production (Table 18) in this habitat type at 44.5 lbs/acre is the lowest of the six sampled habitat types. Perennial forbs (41.8 lbs/acre) account for 94.0% of the total biomass produced. Perennial graminoids provide the remaining percentage.

3.2.2.4 Western Hemlock/Queencup Beadlily

This is the most common habitat type (17 sample stands) in the study area and occurs on benches and slopes of all aspects and exposures and in valley bottoms. This habitat type as represented by 17 sample stands is characterized by a dense tree canopy (94.0%); a sparse cover of tall shrubs (1.6%), low shrubs (4.2%), and subshrubs (8.3%); a sparse cover of perennial graminoids (1.1%), annual and biennial forbs (0.2%) and cryptogams (4.2%); but a dense cover of perennial forbs (22.0%).

This habitat type, in general, is composed of young stands that have a diverse mixture of up to eight conifer species. Based on the cover and density data (Tables 25 and 26), grand fir (31.9% cover and 262.2 trees/acre) is the dominant tree . Western hemlock with a cover of 16.7% and a tree density of 113.3 trees/acre is next most important. Western red cedar (14.7% cover and 165.1 trees/acre) is also important in this habitat type. Other conifers present include Douglas-fir, western larch, lodgepole pine, Engelmann spruce, and white pine.

Early seral trees are the largest and oldest. Western larch has a mean height of 74.2 feet, a mean dbh of 11.3 inches, and range up to 240 years in age. Engelmann spruce has a mean height of 50.2 feet and a mean dbh of 7.5 inches. Likewise, Douglas-fir which ranges up to

TABLE 24. WESTERN HEMLOCK/OAK FERN SHRUB DENSITY DATA SUMMARY - 1988 MONTANA PROJECT

	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TALL SHRUBS				
Taxus brevifolia	0.3	40.5	0.9%	
Total Tall Shrubs	0.3	40.5	0.9%	
LOW SHRUBS				
Menziesia ferruginea	0.3	40.5	0.9%	
Oplopanax horridum	5.0	809.4	18.2%	
Ribes lacustre	1.0	161.9	3.6%	
Ribes viscosissimum	0.3	40.5	0.9%	
Sambucus racemosa	0.7	121.4	2.7%	
Vaccinium globulare	18.2	2954.2	66.4%	
Total Low Shrubs	25.5	4127.9	92.7%	
SUBSHRUBS				
Rubus parviflorus	1.7	283.3	6.4%	
Total Subshrubs	1.7	283.3	6.4%	
TOTAL SHRUBS	27.5	4451.7	100.0%	18.8

TABLE 25. WESTERN HEMLOCK/QUEENCUP BEADLILY COVER DATA SUMMARY - 1988 MONTANA PROJECT

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
TREES					
Abies grandis	28.1%	30.1%	31.9%	22.9%	88.2%
Larix occidentalis	8.4%	8.9%	8.4%	6.0%	82.4%
Picea engelmannii	4.5%	4.8%	4.1%	3.0%	41.2%
Pinus contorta	4.1%	4.4%	4.2%	3.0%	35.3%
Pinus monticola	3.3%	3.5%	3.5%	2.5%	58.8%
Pseudotsuga menziesii	9.2%	9.8%	10.5%	7.5%	76.5%
Thuja plicata	9.1%	9.7%	14.7%	10.6%	88.2%
Tsuga heterophylla	14.4%	15.4%	16.7%	12.1%	88.2%
Total % Trees	79.1%	86.6%	94.0%	67.6%	
TREES - DEAD					
Abies grandis	0.1%	0.1%	0.1%	0.1%	5.9%
Pinus contorta	2.8%	3.0%	2.8%	2.0%	11.8%
Total % Trees - Dead	2.9%	3.1%	2.9%	2.1%	
TALL SHRUBS					
Acer glabrum	0.4%	0.4%	0.8%	0.6%	29.4%
Sorbus sitchensis	0.1%	0.1%	0.0%	0.0%	5.9%
Taxus brevifolia	0.1%	0.1%	0.8%	0.6%	23.5%
Total % Tall Shrubs	0.6%	0.6%	1.6%	1.2%	
LOW SHRUBS					
Amelanchier alnifolia	0.0%	0.0%	0.1%	0.1%	41.2%
Cornus stolonifera	P	0.0%	0.0%	0.0%	5.9%
Holodiscus discolor	0.0%	0.0%	0.1%	0.1%	5.9%
Lonicera ciliosa	P	0.0%	0.0%	0.0%	5.9%
Lonicera utahensis	0.0%	0.0%	0.2%	0.2%	70.6%
Menziesia ferruginea	P	0.0%	0.0%	0.0%	11.8%
Oplopanax horridum	P	0.0%	0.0%	0.0%	5.9%
Pachistima myrsinites	0.0%	0.0%	0.8%	0.6%	88.2%
Ribes lacustre	P	0.0%	0.0%	0.0%	5.9%
Rosa gymnocarpa	0.1%	0.1%	0.6%	0.4%	64.7%
Salix scouleriana	0.1%	0.1%	0.0%	0.0%	11.8%
Sheperdia canadensis	0.0%	0.0%	0.1%	0.1%	11.8%
Spiraea betulifolia	0.1%	0.1%	0.8%	0.6%	64.7%
Symphoricarpos albus	P	0.0%	0.0%	0.0%	5.9%
Vaccinium globulare	0.2%	0.3%	0.4%	0.2%	58.8%
Vaccinium myrtillus	0.0%	0.0%	1.1%	0.8%	41.2%
Total % Low Shrubs	0.5%	0.6%	4.2%	3.1%	

TABLE 25. (Continued)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
SUBSHRUBS					
Arctostaphylos uva-ursi	P	0.0%	0.0%	0.0%	5.9%
Berberis repens	P	0.0%	0.0%	0.0%	35.3%
Chimaphila umbellata	0.6%	0.6%	2.0%	1.4%	70.6%
Cornus canadensis	0.0%	0.0%	0.2%	0.2%	17.6%
Linnaea borealis	0.8%	0.9%	5.6%	4.1%	82.4%
Rubus parviflorus	0.2%	0.3%	0.5%	0.3%	17.6%
Total % Subshrubs	1.6%	1.8%	8.3%	6.0%	
PERENNIAL GRAMINOIDS					
Bromus vulgaris	0.0%	0.0%	0.2%	0.2%	17.6%
Calamagrostis rubescens	0.2%	0.3%	0.7%	0.5%	47.1%
Carex concinnoides	0.0%	0.0%	0.1%	0.1%	11.8%
Carex rossii	P	0.0%	0.0%	0.0%	11.8%
Festuca occidentalis	P	0.0%	0.0%	0.0%	11.8%
Muhlenbergia asperifolia	0.0%	0.0%	0.1%	0.1%	5.9%
Total % Perennial Graminoids	0.2%	0.3%	1.1%	0.9%	
PERENNIAL FORBS					
Actaea rubra	0.0%	0.0%	0.3%	0.2%	11.8%
Adenocaulon bicolor	0.0%	0.0%	0.1%	0.1%	35.3%
Angelica arguta	P	0.0%	0.0%	0.0%	5.9%
Aralia nudicaulis	P	0.0%	0.0%	0.0%	5.9%
Arnica cordifolia	0.8%	0.9%	3.5%	2.5%	41.2%
Cirsium flodmanii	P	0.0%	0.0%	0.0%	5.9%
Clematis columbiana	0.1%	0.1%	0.2%	0.2%	5.9%
Clintonia uniflora	0.5%	0.5%	2.1%	1.5%	94.1%
Coptis occidentalis	0.8%	0.9%	5.3%	3.8%	70.6%
Corallorhiza maculata	P	0.0%	0.0%	0.0%	5.9%
Disporum hookeri	P	0.0%	0.0%	0.0%	23.5%
Fragaria virginiana	0.1%	0.1%	0.1%	0.1%	11.8%
Galium triflorum	P	0.0%	0.0%	0.0%	23.5%
Goodyera oblongfolia	P	0.0%	0.0%	0.0%	76.5%
Hieracium albiflorum	P	0.0%	0.0%	0.0%	52.9%
Listera convallarioides	P	0.0%	0.0%	0.0%	23.5%
Osmorhiza chilensis	P	0.0%	0.0%	0.0%	29.4%
Pedicularis bracteosa	P	0.0%	0.0%	0.0%	5.9%
Pyrola asarifolia	0.2%	0.3%	0.2%	0.2%	64.7%
Pyrola chlorantha	P	0.0%	0.0%	0.0%	17.6%
Pyrola minor	P	0.0%	0.0%	0.0%	5.9%
Pyrola secunda	0.0%	0.0%	0.1%	0.1%	58.8%

TABLE 25. (Continued)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Smèlacina stellata	0.1%	0.1%	1.0%	0.6%	52.9%
Thalictrum occidentale	0.0%	0.0%	0.2%	0.2%	35.3%
Tiarella trifoliata	0.1%	0.1%	1.5%	1.1%	52.9%
Trillium ovatum	0.0%	0.0%	0.1%	0.1%	41.2%
Veratrum viride	P	0.0%	0.0%	0.0%	5.9%
Viola glabella	0.0%	0.0%	0.2%	0.2%	52.9%
Viola orbiculata	0.5%	0.5%	1.0%	0.6%	94.1%
Xerophyllum tenax	2.0%	2.1%	6.1%	4.4%	64.7%
Total % Perennial Forbs	5.2%	5.6%	22.0%	15.9%	
ANNUAL & BIENNIAL FORBS					
Melampyrum lineare	0.2%	0.3%	0.2%	0.2%	17.6%
Verbascum thapsus	P	0.0%	0.0%	0.0%	5.9%
Total % Annual & Biennial Forbs	0.2%	0.3%	0.2%	0.2%	
CRYPTOGAMS					
Athyrium filix-femina	P	0.0%	0.0%	0.0%	23.5%
Gymnocarpium dryopteris	P	0.0%	0.0%	0.0%	11.8%
Moss	0.6%	0.6%	2.8%	2.0%	58.8%
Pteridium aquilinum	0.5%	0.5%	1.4%	1.0%	47.1%
Total % Cryptogams	1.1%	1.1%	4.2%	3.0%	
TOTAL % VEGETATION	93.5%	100.0%	138.5%	100.0%	
Soil	0.0%				
Litter	6.4%				
Rock	0.1%				

P = SPECIES PRESENT BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 26. WESTERN HEMLOCK/QUEENCUP BEADLILY TREE DENSITY, REPRODUCTION, HEIGHT, DBH, AND AGE DATA SUMMARY - 1988 MONTANA PROJECT

DENSITY

	MEAN NO. TREES/ 125 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TREES				
Abies grandis	8.1	262.2	29.9%	
Larix occidentalis	2.2	71.2	8.0%	
Picea engelmannii	1.0	32.4	3.7%	
Pinus contorta	2.8	90.7	10.4%	
Pinus monticola	2.2	71.2	8.0%	
Pseudotsuga menziesii	2.3	74.5	8.6%	
Thuja plicata	5.1	165.1	18.6%	
Tsuga heterophylla	3.5	113.3	12.8%	
Total Trees	27.2	880.6	100.0%	7.5
TREES (DEAD)				
Abies grandis	0.8	25.9	14.1%	
Larix occidentalis	0.4	13.0	7.6%	
Picea engelmannii	0.4	13.0	7.6%	
Pinus contorta	2.5	80.9	47.8%	
Pinus monticola	1.0	32.3	18.5%	
Pseudotsuga menziesii	0.1	3.2	1.1%	
Tsuga heterophylla	0.2	6.5	3.3%	
Total Trees (Dead)	5.4	174.8	100.0%	6.3

REPRODUCTION

TRANSECT NUMBER	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
Abies grandis	3.8	615.1	20.4%	
Pseudotsuga menziesii	0.1	16.2	0.6%	
Thuja plicata	2.4	388.5	12.5%	
Tsuga heterophylla	12.5	2023.5	66.5%	
Total Tree Reproduction	18.8	3043.3	100.0%	5.6

TABLE 26. (Continued)

HEIGHT (FEET)

MEAN TREE HEIGHT IN FEET TRANSECT NUMBER	RANGE IN HEIGHT (FEET) (MIN)	RANGE IN HEIGHT (FEET) (MAX)	ABSOLUTE MEAN HEIGHT IN FEET
TREES			
Abies grandis	14	67	31.7
Larix occidentalis	50	113	74.2
Picea engelmannii	10	88	50.2
Pinus contorta	30	70	48.4
Pinus monticola	8	114	25.3
Pseudotsuga menziesii	6	100	49.4
Thuja plicata	6	70	19.3
Tsuga heterophylla	6	62	33.8
Total Trees			36.5
TREES (DEAD)			
Abies grandis	38	38	38.0
Larix occidentalis	96	96	96.0
Picea engelmannii	21	40	30.5
Pinus contorta	16	16	16.0
Pinus moniticola	12	99	55.5
Total Dead Trees			52.3

DBH (INCHES)

MEAN DIAMETER AT BREAST H TRANSECT NUMBER	RANGE IN DBH (INCHES) (MIN)	RANGE IN DBH (INCHES) (MAX)	ABSOLUTE MEAN DBH IN INCHES
TREES			
Abies grandis	0.8	22.4	5.0
Larix occidentalis	3.1	26.8	11.3
Picea engelmannii	1.2	15.0	7.5
Pinus contorta	2.8	16.1	5.7
Pinus monticola	0.4	18.9	3.5
Pseudotsuga menziesii	0.4	29.1	8.2
Thuja plicata	0.4	22.4	3.0
Tsuga heterophylla	0.4	26.8	5.0
Total Trees			5.3
TREES (DEAD)			
Abies grandis	1.6	13.8	4.5
Larix occidentalis	1.6	12.2	6.2
Picea engelmannii	1.2	11.0	3.4
Pinus contorta	1.6	9.8	5.8
Pinus moniticola	0.4	26.4	4.2
Pseudotsuga menziesii	7.9	7.9	7.9
Tsuga heterophylla	2.8	3.5	3.3
Total Dead Trees			12.9

TABLE 26. (CONTINUED)

AGE (YEARS)

TRANSECT NUMBER	NUMBER TREES CORED	MINIMUM	MAXIMUM	MEAN AGE
Abies grandis	4	76	82	109
Larix occidentalis	2	218	240	229
Pinus contorta	2	89	92	91
Pinus monticola	3	68	130	94
Pseudotsuga menziesii	3	110	208	172
Tsuga heterophylla	1	60	60	60
	15	60	240	126

* The age estimate for one or more trees in this category is too low, because the increment borer could estimate tree age only for trees of 32 inch diameter or less.

208 years in age has a mean height and dbh of 49.4 feet and 8.2 inches, respectively. Lodgepole pine, at 92 years, are younger, but have a mean height of 48.4 feet and a mean dbh of 5.7 inches. Western hemlock and western red cedar, the climax trees were smaller and younger. Western hemlock has a mean height of 33.8 feet and a mean dbh of 5.0 inches compared to 19.3 feet and 3.0 inches for western red cedar. The maximum age of the cored western hemlock is 60 years. Older trees are present but they have heart rot and therefore could not be cored and aged.

The data on standing dead trees and reproduction indicates a forest in the dynamics of change. Lodgepole pine, white pine, and grand fir, all seral species, represent over 80% of the standing dead trees. Western hemlock, the shade-tolerant climax accounts for only 3.3% of the standing dead. Western hemlock has an extremely high reproduction rate (2023.5 trees/acre) which accounts for 66.5% of all the tree reproduction. Western red cedar (388.5 trees/acre) has a much lower reproduction. Grand fir and Douglas-fir each are reproducing, but at relatively low rates.

The dominant shrubs (Tables 25 and 27) in the cover, respectively, include western twinflower (5.6%), common pipsissewa (2.0%), dwarf bilberry (1.1%), white spirea (0.8%), pachistima (0.8%) and Pacific yew (0.8%) and Rocky Mountain maple (0.8%). Considering density, the dominant shrubs are pachistima (1942.5 shrubs/acre), baldhip rose (1262.6 shrubs/acre), white spirea (1052.2 shrubs/acre), huckleberry (955.1 shrubs/acre, and dwarf bilberry (906.5 shrubs/acre) (Table 27). Thus, the shrub undergrowth includes the four shrub species (western twinflower, pachistima, Pacific yew, and huckleberry) listed by Pfister et al. (1977) as characteristic of the habitat type.

The herbaceous understory is characterized by 22 perennial and annual and biennial forbs which provide a cover of 22.0% and 0.2% respectively. Six perennial graminoids provide a total cover of 1.1%. Major herbaceous species include beargrass (6.1%), western goldthread (5.3%), heartleaf arnica (3.5%), queencup beadlily (2.1%), tiarella (1.5%), starry Solomon's seal (1.0%), and roundleaf violet (1.0%). Three of these species, queencup beadlily, tiarella, and roundleaf violet, plus sidebell pyrola (0.1%) according to Pfister et al. (1977) characterize the habitat type.

The herbaceous production for this habitat type is summarized in Table 18. Total production at 107.0 lbs/acre is quite low. Perennial forbs account for 97.0% of the total biomass. Perennial graminoids provide the remaining percentage.

TABLE 27. WESTERN HEMLOCK/QUEENCUP BEADLILY SHRUB DENSITY DATA SUMMARY - 1988 MONTANA PROJECT

	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TALL SHRUBS				
Acer glabrum	1.9	307.5	4.0%	
Taxus brevifolia	0.3	48.6	0.6%	
Total Tall Shrubs	2.2	356.1	4.6%	
LOW SHRUBS				
Amelanchier alnifolia	1.9	307.5	4.0%	
Holodiscus discolor	0.2	32.4	0.4%	
Lonicera utahensis	1.1	178.1	2.4%	
Oplopanax horridum	0.1	16.2	0.2%	
Pachistima myrsinites	12.0	1942.5	25.2%	
Rosa gymnocarpa	7.8	1262.6	16.4%	
Rosa nutkana	0.1	16.2	0.2%	
Salix scouleriana	0.2	32.4	0.4%	
Shepheria canadensis	0.2	32.4	0.5%	
Spiraea betulifolia	6.5	1052.2	13.8%	
Symphoricarops albus	0.2	32.4	0.4%	
Vaccinium globulare	5.9	955.1	12.5%	
Vaccinium myrtillus	5.6	906.5	11.9%	
Total Low Shrubs	41.8	6766.5	88.3%	
SUBSHRUBS				
Berberis repens	2.4	388.5	5.1%	
Rubus parviflorus	1.0	161.9	2.0%	
Total Subshrubs	3.4	550.4	7.1%	
TOTAL SHRUBS	47.4	7673.0	100.0%	6.2

3.2.2.5 Subalpine Fir/Queencup Beadlily

This subalpine habitat type occurs in the study area only in the headwaters of Libby Creek where it intergrades downslope, on warmer exposures, with the western hemlock/queencup beadlily habitat type. Total vegetation cover (159.0%) is high. Cover by lifeform is respectively trees (81.0%), perennial forbs (33.0%), shrubs (26.0%), and cryptogams (19.0%).

Subalpine fir, the climax tree, dominates the cover (55.0%) and tree density (242.8 trees/acre) in the two sampled stands (Tables 28 and 29). These figures represent 68% of the tree cover and 58% of the total tree density. Six other tree species are represented in the sample stands. They include western larch, Engelmann spruce, Douglas-fir, lodgepole pine, grand fir, and western hemlock. The first four of these six trees are major seral species of the habitat type, and grand fir is a minor component of the climax. These trees all have a low cover and low density, however, many are larger than the subalpine fir. Western larch has a mean height of 90.0 feet and a mean dbh of 14.8 inches. Likewise, lodgepole pine has a mean height and dbh of 81.0 feet and 10.6 inches. Grand fir (404.7 trees/acre) is the only tree reproducing in the sample stands.

The understory includes many shrubs characteristc to the climax (Tables 28 and 30). They are huckleberry (16.0% cover and 11,412.4 shrubs/acre), pachistima (2.0% cover and 3318.5 shrubs/acre), Utah honeysuckle (0.0% cover and 809.4 shrubs/acre), and thimbleberry (0.0% cover and 647.5 shrubs/acre). Other common shrubs include Rocky Mountain maple (5.0% cover and 0.0 shrubs/acre), and Pacific yew (2.0% cover and 0.0 shrubs/acre).

The herbaceous understory, likewise, is dominated by forbs of the climax. They include queencup beadlily (13.0%), tiarella (9.0%), sidebell pyrola (*Pyrola secunda*) (2.0%), roundleaf violet (1.0%), beargrass (1.0%), sweetscented bedstraw (1.0%), Hooker fairybell (0.0%), and western meadowrue (0.0%). Heartleaf arnica (4.0%), is the second most abundant perennial forb present. Major cryptogams include moss (13.0%), bracken fern (4.0%), and lady fern (2.0%).

Total herbaceous production (173.8 lbs/acre) is low (Table 18). Production by lifeform is 165.1 lbs/acre for perennial forbs and 8.7 lbs/acre for perennial graminoids.

TABLE 28. SUBALPINE FIR/QUEENCUP BEADLILY COVER DATA SUMMARY - 1988 MONTANA PROJECT

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
TREES					
Abies grandis	6.0%	6.3%	6.0%	3.8%	100.0%
Abies lasiocarpa	55.0%	57.3%	55.0%	34.6%	100.0%
Larix occidentalis	7.0%	7.3%	7.0%	4.4%	50.0%
Picea engelmannii	5.0%	5.2%	6.0%	3.8%	100.0%
Pinus contorta	5.0%	5.2%	5.0%	3.1%	50.0%
Pseudotsuga menziesii	1.0%	1.0%	2.0%	1.3%	50.0%
Tsuga heterophylla	P	0.0%	0.0%	0.0%	50.0%
Total % Trees	79.0%	82.3%	81.0%	51.0%	
TALL SHRUBS					
Acer glabrum	2.0%	2.1%	5.0%	3.1%	100.0%
Sorbus scopulina	P	0.0%	0.0%	0.0%	100.0%
Taxus brevifolia	0.0%	0.0%	2.0%	1.3%	100.0%
Total % Tall Shrubs	2.0%	2.1%	7.0%	4.4%	
LOW SHRUBS					
Lonicera utahensis	P	0.0%	0.0%	0.0%	100.0%
Menziesia ferruginea	P	0.0%	0.0%	0.0%	50.0%
Pachistima myrsinites	0.0%	0.0%	2.0%	1.2%	50.0%
Ribes lacustre	0.0%	0.0%	1.0%	0.6%	50.0%
Rosa gymnocarpa	P	0.0%	0.0%	0.0%	50.0%
Rosa nutkana	P	0.0%	0.0%	0.0%	50.0%
Rubus idaeus	P	0.0%	0.0%	0.0%	50.0%
Spiraea betulifolia	P	0.0%	0.0%	0.0%	100.0%
Vaccinium globulare	2.0%	2.1%	16.0%	10.1%	100.0%
Vaccinium myrtillus	P	0.0%	0.0%	0.0%	50.0%
Total % Low Shrubs	2.0%	2.1%	19.0%	11.9%	
SUBSHRUBS					
Chimaphila umbellata	P	0.0%	0.0%	0.0%	50.0%
Rubus parviflorus	P	0.0%	0.0%	0.0%	50.0%
Total % Subshrubs	0.0%	0.0%	0.0%	0.0%	
PERENNIAL GRAMINOIDS					
Calamagrostis inexpansa	P	0.0%	0.0%	0.0%	50.0%
Festuca subulata	P	0.0%	0.0%	0.0%	50.0%
Luzula hitchcockii	P	0.0%	0.0%	0.0%	50.0%
Total % Perennial Graminoids	0.0%	0.0%	0.0%	0.0%	

TABLE 28. (Continued)

TRANSECT NUMBER	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
PERENNIAL FORBS					
Arnica cordifolia	0.0%	0.0%	4.0%	2.5%	50.0%
Clintonia uniflora	1.0%	1.0%	13.0%	8.2%	100.0%
Disporum hookeri	P	0.0%	0.0%	0.0%	50.0%
Galium triflorum	1.0%	1.0%	1.0%	0.6%	50.0%
Goodyera oblongfolia	1.0%	1.0%	1.0%	0.6%	100.0%
Pyrola secunda	0.0%	0.0%	2.0%	1.3%	50.0%
Smilacina stellata	1.0%	1.0%	1.0%	0.6%	100.0%
Thalictrum occidentale	P	0.0%	0.0%	0.0%	50.0%
Tiarella trifoliata	1.0%	1.0%	9.0%	5.7%	100.0%
Viola orbiculata	0.0%	0.0%	1.0%	0.6%	50.0%
Xerophyllum tenax	0.0%	0.0%	1.0%	0.6%	100.0%
Total % Perennial Forbs	5.0%	5.2%	33.0%	20.7%	
CRYPTOGAMS					
Athyrium filix-femina	2.0%	2.1%	2.0%	1.3%	50.0%
Dryopteris filix-mas	P	0.0%	0.0%	0.0%	50.0%
Moss	5.0%	5.2%	13.0%	8.2%	100.0%
Polystichum andersonii	P	0.0%	0.0%	0.0%	50.0%
Pteridium aquilinum	1.0%	1.0%	4.0%	2.5%	50.0%
Total % Cryptogams	8.0%	8.3%	19.0%	12.0%	
TOTAL % VEGETATION	96.0%	100.0%	159.0%	100.0%	
Soil	0.0%				
Litter	4.0%				
Rock	0.0%				

P = SPECIES PRESENT, BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 29. SUBALPINE FIR/QUEENCUP BEADLILY TREE DENSITY, REPRODUCTION, HEIGHT, AND DBH DATA SUMMARY - 1988
MONTANA PROJECT

DENSITY

	MEAN NO. TREES/ 125 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TREES				
Abies grandis	2.0	64.7	15.4%	
Abies lasiocarpa	7.5	242.8	57.7%	
Larix occidentalis	1.0	32.4	7.7%	
Picea engelmannii	1.5	48.6	11.6%	
Pinus contorta	0.5	16.2	3.8%	
Tsuga heterophylla	0.5	16.2	3.8%	
Total Trees	13.0	420.9	100.0%	4.0
TREES (DEAD)				
Abies lasiocarpa	0.1	48.6	100.0%	
Total Trees (Dead)	0.1	48.6	100.0%	0.5

REPRODUCTION

	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
Abies grandis	2.5	404.7	100.0%	
Total Tree Reproduction	2.5	404.7	100.0%	2.5

TABLE 29. (Continued)

HEIGHT (FEET)

	RANGE IN HEIGHT (FEET) (MIN)	RANGE IN HEIGHT (FEET) (MAX)	ABSOLUTE MEAN HEIGHT IN FEET
TREES			
Abies grandis	8	41	26.5
Abies lasiocarpa	5	94	41.3
Larix occidentalis	90	90	90.0
Picea engelmannii	20	48	36.0
Pinus contorta	81	81	81.0
Tsuga heterophylla	10	10	10.0
Total Trees			42.5

DBH (INCHES)

	RANGE IN DBH (INCHES) (MIN)	RANGE IN DBH (INCHES) (MAX)	ABSOLUTE MEAN DBH IN INCHES
TREES			
Abies grandis	1.2	7.5	5.1
Abies lasiocarpa	0.4	28.3	9.8
Larix occidentalis	14.6	15.0	14.8
Picea engelmannii	2.0	7.1	5.2
Pinus contorta	10.6	10.6	10.6
Tsuga heterophylla	2.0	2.0	2.0
Total Trees			8.7
TREES (DEAD)			
Abies lasiocarpa	3.5	10.2	6.0

TABLE 30. SUBALPINE FIR/QUEENCUP BEADLILY SHRUB DENSITY DATA
SUMMARY - 1988
MONTANA PROJECT

	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TALL SHRUBS				
Sorbus scopulina	1.5	242.8	1.4%	
Total Tall Shrubs	1.5	242.8	1.4%	
LOW SHRUBS				
Lonicera utahensis	5.0	809.4	4.6%	
Pachistima myrsinites	20.5	3318.5	19.0%	
Rosa nutkana	1.5	242.8	1.4%	
Rubus idaeus	0.5	80.9	0.4%	
Vaccinium globulare	70.5	11412.4	65.3%	
Vaccinium myrtillus	4.5	728.5	4.2%	
Total Low Shrubs	102.5	16592.5	94.9%	
SUBSHRUBS				
Rubus parviflorus	4.0	647.5	3.7%	
Total Subshrubs	4.0	647.5	3.7%	
TOTAL SHRUBS	108.0	17482.8	100.0%	16.0

3.2.2.6 Mountain Hemlock/Beargrass

This habitat type occurs in the study area only at high elevations near Rock Lake. Due to heavy snow cover and avalanches, mountain hemlock and associated subalpine fir and Douglas-fir only attain tree stature on sites protected from snowslides.

This habitat type is characterized by an open tree canopy (24.0% cover), amid a dense cover of shrubs (50%), and perennial forbs (32.0%). Presently, the two sample stands are more characteristic of a shrubland than a mountain hemlock/beargrass habitat type.

Mountain hemlock (4.0% cover and 16.2 trees/acre), the climax tree, is presently subordinate to Douglas-fir (12.0% cover and 129.5 trees/acre) the major seral component (Tables 31 and 32). White pine (0.0% cover and 16.2 trees/acre), a seral component, and subalpine fir (7.0% cover and 32.4 trees/acre), a common dominant in the habitat type, are also present. Cored mountain hemlock and subalpine fir were 55 and 45 years old respectively.

Mountain hemlock has the tallest mean height (35.0 feet) and the largest dbh (12.6 inches). Subalpine fir with a mean height of 24.5 feet and a mean dbh of 5.3 inches is the second largest tree. Douglas-fir (242.9 trees/acre) and subalpine fir (80.9 trees/acre) are both reproducing.

The understory is dominated by pachistima (18.0% cover and 4694.5 shrubs/acre), huckleberry (12.0% cover and 6475.0 shrubs/acre), dwarf bilberry (7.0% cover and 1456.9 shrubs/acre), serviceberry (4.0% cover and 80.9 shrubs/acre), ellipticleaf beardstongue (4.0% cover and 0.0 shrubs/acre), Utah honeysuckle (2.0% cover and 728.5 shrubs/acre), and Cascade Mountain ash (2.0% cover and 161.9 shrubs/acre) (Tables 31 and 33).

Beargrass with a cover of 32.0% is the major herbaceous plant and the most abundant plant in the habitat type. Other common herbaceous plants include elk sedge (4.0%), sedges (1.0%), rockbrake (1.0%) and moss (1.0%).

Total herbaceous production (260.4 lbs/acre) is the highest of all habitat types (Table 18). Perennial forbs (241.6 lbs/acre) and perennial graminoids (18.8 lbs/acre) contribute to the biomass.

TABLE 31. MOUNTAIN HEMLOCK/BEARGRASS COVER DATA SUMMARY - 1988
MONTANA PROJECT

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
TREES					
Abies grandis	0.0%	0.0%	1.0%	0.9%	50.0%
Abies lasiocarpa	7.0%	8.8%	7.0%	6.2%	100.0%
Pinus monticola	P	0.0%	0.0%	0.0%	100.0%
Pseudotsuga menziesii	12.0%	15.0%	12.0%	10.6%	100.0%
Tsuga mertensiana	4.0%	5.0%	4.0%	3.5%	100.0%
Total % Trees	23.0%	28.8%	24.0%	21.2%	
TALL SHRUBS					
Acer glabrum	P	0.0%	0.0%	0.0%	100.0%
Prunus emarginata	P	0.0%	0.0%	0.0%	50.0%
Sorbus scopulina	0.0%	0.0%	2.0%	1.8%	100.0%
Sorbus sitchensis	P	0.0%	0.0%	0.0%	50.0%
Total % Tall Shrubs	0.0%	0.0%	2.0%	1.8%	
LOW SHRUBS					
Amelanchier alnifolia	1.0%	1.3%	4.0%	3.5%	50.0%
Lonicera utahensis	2.0%	2.5%	2.0%	1.8%	50.0%
Menziesia ferruginea	1.0%	1.3%	1.0%	0.9%	50.0%
Pachistima myrsinites	13.0%	16.1%	18.0%	15.9%	100.0%
Ribes lacustre	P	0.0%	0.0%	0.0%	50.0%
Rubus idaeus	P	0.0%	0.0%	0.0%	50.0%
Salix scouleriana	P	0.0%	0.0%	0.0%	100.0%
Spiraea betulifolia	P	0.0%	0.0%	0.0%	50.0%
Spiraea douglasii	P	0.0%	0.0%	0.0%	50.0%
Vaccinium globulare	5.0%	6.3%	12.0%	10.6%	100.0%
Vaccinium myrtillus	7.0%	8.8%	7.0%	6.2%	100.0%
Total % Low Shrubs	29.0%	36.3%	44.0%	38.9%	
SUBSHRUBS					
Penstemon ellipticus	4.0%	5.0%	4.0%	3.5%	50.0%
Total % Subshrubs	4.0%	5.0%	4.0%	3.5%	
PERENNIAL GRAMINOIDS					
Agrostis alba	P	0.0%	0.0%	0.0%	50.0%
Calamagrostis rubescens	P	0.0%	0.0%	0.0%	50.0%
Carex geyeri	2.0%	2.5%	4.0%	3.5%	100.0%
Carex spp.	1.0%	1.3%	1.0%	0.9%	50.0%
Elymus glaucus	P	0.0%	0.0%	0.0%	50.0%
Festuca viridula	P	0.0%	0.0%	0.0%	50.0%
Juncus parryi	P	0.0%	0.0%	0.0%	50.0%

TABLE 31. (Continued)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Total % Perennnial Graminoids	3.0%	3.8%	5.0%	4.4%	
PERENNIAL FORBS					
Achillea millefolium	P	0.0%	0.0%	0.0%	50.0%
Epilobium angustifolium	P	0.0%	0.0%	0.0%	100.0%
Penstemon lyallii	P	0.0%	0.0%	0.0%	50.0%
Thalictrum occidentale	P	0.0%	0.0%	0.0%	50.0%
Xerophyllum tenax	19.0%	23.8%	32.0%	28.3%	100.0%
Total % Perennial Forbs	19.0%	23.8%	32.0%	28.3%	
CRYPTOGAMS					
Cheilanthes gracillima	P	0.0%	0.0%	0.0%	50.0%
Cryptogramma crispa	1.0%	1.1%	1.0%	0.9%	100.0%
Moss	1.0%	1.2%	1.0%	1.0%	50.0%
Total % Cryptogams	2.0%	2.3%	2.0%	1.9%	
TOTAL % VEGETATION	80.0%	100.0%	113.0%	100.0%	
Soil	0.0%				
Litter	5.0%				
Rock	15.0%				

TABLE 32. MOUNTAIN HEMLOCK/BEARGRASS TREE DENSITY, REPRODUCTION, HEIGHT, DBH, AND AGE DATA SUMMARY - 1988 MONTANA PROJECT

DENSITY

	MEAN/ 125 SQ METERS	MEAN/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TREES (>1.3 M DBH)				
Abies lasiocarpa	1.0	32.4	16.7%	
Pinus monticola	0.5	16.2	8.3%	
Pseudotsuga menziesii	4.0	129.5	66.7%	
Tsuga mertensiana	0.5	16.2	8.3%	
Total Trees	6.0	194.3	100.0%	2.0

REPRODUCTION

	MEAN/ 25 SQ METERS	MEAN/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
Abies lasiocarpa	0.5	80.9	25.0%	
Pseudotsuga menziesii	1.5	242.9	75.0%	
Total Tree Reproduction	2.0	323.8	100.0%	1.0

HEIGHT (FEET)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies lasiocarpa	21	28	24.5
Pinus monticola	10	10	10.0
Pseudotsuga menziesii	8	18	13.1
Tsuga mertensiana	35	35	35.0
Total Trees			16.6

TABLE 32. (Continued)

DBH (INCHES)

MEAN DBH IN INCHES TRANSECT NUMBER	MINIMUM	MAXIMUM	MEAN
TREES			
Abies lasiocarpa	4.3	6.3	5.3
Pinus monticola	2.4	2.4	2.4
Pseudotsuga menziesii	2.0	3.9	3.1
Tsuga mertensiana	12.6	12.6	12.6
Total Trees			10.7

BASAL AREA AND VOLUME

	THOUSAND BOARD FEET PER ACRE	BASAL AREA (SQ FEET) ALL TREES	QUADRATIC MEAN DIAMETER (FEET)
Tsuga mertensiana	1.0	0.9	5.8

AGE (YEARS)

TRANSECT NUMBER	44	45	NUMBER TREES CORED	MINIMUM	MAXIMUM	MEAN
Abies lasiocarpa	45		1	45	45	45
Tsuga mertensiana		55	1	55	55	55
Total			2	45	55	50

TABLE 33. MOUNTAIN HEMLOCK/BEARGRASS SHRUB DENSITY DATA SUMMARY - 1988 MONTANA PROJECT

	MEAN SHRUBS/25 SQ M	MEAN SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TALL SHRUBS				
Acer glabrum	1.0	161.9	1.1%	
Sorbus scopulina	1.0	161.9	1.1%	
Total Tall Shrubs	2.0	323.8	2.2%	
LOW SHRUBS				
Amelanchier anlifolia	0.5	80.9	0.6%	
Lonicera utahensis	4.5	728.5	5.0%	
Pachistima myrsinites	29.0	4694.5	32.4%	
Ribes lacustre	0.5	80.9	0.6%	
Rubus idaeus	2.0	323.8	2.2%	
Spiraea betulifolia	2.0	323.8	2.2%	
Vaccinium globulare	40.0	6475.0	44.7%	
Vaccinium myrtillus	9.0	1456.9	10.1%	
Total Low Shrubs	87.5	14164.3	97.8%	
TOTAL SHRUBS	89.5	14488.1	100.0%	19.5

3.2.2.7 Minor Habitat Types

This section qualitatively describes habitat types that are very limited in area or are present in seral brush stage of development. The Ramsey Creek study area included a 1.5 acre Engelmann spruce/common horsetail habitat type. The upper Libby Creek study area has small elements of this habitat type in a complex association with western hemlock/oak fern and western red cedar/lady fern along Libby Creek. The subalpine fir/menziesia and mountain hemlock/queencup beadlily habitat types each occur in one locality at Ramsey and Rock creeks, respectively, in seral brush stands. The following sections further describe these three minor habitat types.

Engelmann Spruce/Common Horsetail. A climax stand of this habitat type was observed at only one site in the study area along Ramsey Creek near Ramsey Lake. The understory of this relatively cold wetland is dominated by common horsetail and bluejoint reedgrass. The presence of subalpine fir and Engelmann spruce with the relatively large amounts of bluejoint reedgrass (i.e., 20% canopy cover) indicate that this stand may actually be a subalpine fir/bluejoint reedgrass community type described by Steele et al. (1981) as being widespread in central Idaho.

Seral plant communities associated with the lower reaches of Libby Creek and the larger streams in the area, typically are dominated by black cottonwood, willow, alder, red-osier dogwood, and other deciduous species. Engelmann spruce and bluejoint reedgrass are usually also associated on relatively undisturbed sites.

Along Libby Creek, it is difficult to determine what the climax community would be because the vegetation is maintained in perpetual disclimax by flooding. Historically, the floodplain has been disrupted by placer mining as well as farming. Because the Engelmann spruce/common horsetail habitat type appears to develop on relatively undisturbed wetlands in association with streams, seral riparian areas dominated by deciduous species have been mapped as this habitat type, although they are dominated by black cottonwood.

Subalpine Fir/Menziesia. This habitat type occurs only as a seral brush field on steep, north-facing avalanche chutes in the Ramsey Creek drainage. Dominant shrubs are menziesia, mountain-ash, huckleberry, alder, and thimbleberry. Seedlings and saplings of subalpine fir and Engelmann spruce often form 20% or higher canopy cover, but never attain large stature because of snowslides. Common grasses include bluejoint reedgrass and wildrye. Forbs include fairybell, false hellebore,

angelica, cow parsnip, enchanter's nightshade (*Circaea alpina*), polemonium (*Polemonium pulcherrium*), and beargrass.

Mountain Hemlock/Queencup Beadlily. As with other high elevation habitat types in the study area subject to periodic avalanches, the mountain hemlock/queencup beadlily type is transitional between the mountain hemlock/beargrass habitat type downslope. The seral brush fields that occupy this habitat type are composed of the same species that characterize seral stages of the mountain hemlock/beargrass habitat type. Major shrub species in this habitat type include Rocky Mountain maple, pachistima, bittercherry, serviceberry, red raspberry, huckleberry, and menziesia.

3.3 EXISTING AND POTENTIAL VEGETATION TRANSMISSION LINE ALTERNATIVES

This section describes the existing vegetation along the transmission line alternatives and identifies and describes the potential forest habitat types for this area.

3.3.1 Existing Vegetation

Figure 20 (Appendix B) illustrates the vegetation types present in the 1000 foot wide corridor from the town of Libby to plant sites and Figure 21 (Appendix B) illustrates the existing vegetation for the Miller Creek to plant sites transmission line.

Native vegetation in these transmission line corridors include coniferous forests, clearcuts, shrublands, riparian, and wetlands types. Also present are agricultural pasturelands, industrial sites, residential areas, disturbances, talus slopes, and water. Like the intensive study area, these native vegetation types are in various stages of ecological succession as a past history of logging, fire, agricultural, or other disturbance has arrested or re-initiated the progress toward the climax. These native communities are similar to those of the intensive study area as described in section 3.2.1. In fact, the upper Libby and Ramsey Creek extension of both transmission line alternatives is a part of the intensive study area. Each of the mapping units of the two transmission line alternatives is briefly characterized in the following sections.

3.3.1.1 Coniferous Forest

The coniferous forest communities are dominated by Douglas-fir on the drier south-facing slopes along the Fisher River and Libby Creek. On the valley floor and on slopes along Miller, Libby, and Ramsey creeks, lodgepole pine, larch, grand fir, and Douglas-fir form the

forest overstory with western hemlock and western red cedar usually occurring as the subdominant tier of the canopy. The relative amounts of the composite conifer species greatly vary from site to site. Some communities, for example, along Miller Creek, are mostly lodgepole pine, whereas the dominance of other composite species reflects a continuum. The tremendous diversity in species composition, distribution, canopy structure, and seral status of existing conifer communities are factors which preclude the delineation of existing communities on the basis of one or two dominants. The quantitative description data on the coniferous forests of the intensive study are (Section 3.2.1.1) is applicable to much of the transmission line study areas.

Along upper Libby Creek and Ramsey Creek, where the proposed corridor crosses or closely parallels the stream, old growth stands of western red cedar and western hemlock form buffer zones between logged areas and the streams. Similar climax communities are described by Cooper et al. (1987) and Pfister et al. (1977).

3.3.1.2 Clearcut

Clearcuts vary in species composition and canopy structure depending on the time since cutting, timber harvesting and slash disposal methods, and sources of seed that remain. The most recent clearcuts typically have relatively large amounts of bare soil and partially burned litter. With removal of the overstory, the native graminoids present before logging such as pinegrass, tall trisetum (*Trisetum canescens*), and elk sedge usually grow vigorously and expand their canopy cover. Introduced grasses such as timothy (*Phleum pratense*), brome, and redtop usually also increase. Forbs that commonly are invaders include Canada thistle (*Cirsium arvense*), fireweed, clovers, wild strawberry, and bracken fern. Thimbleberry, serviceberry, Scouler willow, Canada buffaloberry (*Shepherdia canadensis*), and snowbrush ceanothus also are prevalent. Tree seedlings and saplings which usually predominate are western larch, lodgepole pine, Douglas-fir, and grand fir. Understory species, typical of climax or near-climax stands, are greatly reduced and often occur only on microsites where the original ground cover has not been severely altered. As with coniferous forests, the quantitative description data of the intensive study area (Section 3.2.1.2) is applicable to much of the transmission line study area.

3.3.1.3 Shrubland

Shrublands are present only in the avalanche chutes of Libby and Ramsey Creeks. They are described from quantitative data in Section 3.2.1.3.

3.3.1.4 Riparian/Wetland

Riparian communities occur along the Fisher River, Miller Creek, and Libby Creek. These cottonwood-dominated riparian communities are early successional stages. Periodic scouring by flooding and sediment deposition are essential to the maintenance of riparian vegetation. Pioneer species, such as cottonwood and willow, require recently deposited, fully exposed alluvium for seed germination and growth (Johnson et al. 1976, Fenner et al. 1985, Foote 1965, Wikum and Wali 1974, Weaver 1960). The major floods in the early 1970's have regenerated many of the cottonwood communities in the riparian areas of the study area.

The riparian community is extremely diverse ranging from pure black cottonwood stands with a shrubby understory to cottonwood stands with varying densities of Engelmann spruce, aspen, grand fir, lodgepole pine, ponderosa pine, Douglas-fir, and water birch (*Betula occidentalis*) and willows (*Salix* spp.)

This shrubby understory is dominated by numerous species such as Sitka alder and snowberry which form dense stands with varying densities of red-osier dogwood, serviceberry, thimbleberry, Douglas spirea, Nootka rose (*Rosa nutkana*), Oregon grape, Canada buffaloberry, kinnikinnik, and black hawthorn (*Crataegus douglasii*).

The understory herbaceous component, likewise, is variable and includes various associations of native plants, and introduced weedy forbs and grasses. Characteristic perennial graminoids include blue wildrye, smooth brome, elk sedge, timothy, orchardgrass (*Dactylis glomerata*), Kentucky bluegrass (*Poa pratensis*), redtop, and bluejoint reedgrass. Common perennial forbs include yarrow, Virginia strawberry, bull thistle (*Cirsium vulgare*), mullein, aster (*Aster chilensis*), and clovers (*Trifolium* spp.). Along The Fisher River and from its confluence with Libby Creek to the Kootenai River, spotted knapweed (*Centaurea maculosa*) has invaded the valley along and adjacent to the highway. Common cryptogams include bracken fern and horsetails (*Equisetum* spp.).

A wetland/riparian area in the study area corridor north of Howard Lake, along Libby Creek, differs from other riparian communities encountered. The relatively wide floodplain adjacent to Libby Creek has numerous beaver dams on the braided channels, forming a wetland mosaic composed of old and new beaver dams. Standing dead trees and snags indicate that flooding from beaver activity has followed cycles which allow trees to become established during dry periods. This wetland is

maintained in disclimax due to beaver activity and spring floods.

This wetland has stands of beaked and inflated sedge containing daggerleaf rush , bluejoint bentgrass, and rough bentgrass. A population of woolgrass occurs around the beaver pond. Less common herbaceous species include water horsetail (*Equisetum fluviatile*), and Canada goldenrod. Sphagnum moss species present include *Sphagnum angustifolium* and *Sphagnum teres*. Sitka alder, Douglas-fir, Engelmann spruce, and lodgepole pine occur in in the drier habitats.

3.3.1.5 Agricultural

Numerous small pasturelands and hayfields occur along the transmission line from the town of Libby to plant sites. These small clearings are dominated by pasture grasses and weedy forbs. Common pasture grasses include smooth brome, timothy, orchardgrass, redtop, and Kentucky bluegrass. Characteristic forbs include clovers, aster, yarrow, spotted knapweed, and bull thistle.

3.3.1.6 Other Mapping Units

Disturbed areas include sites in which the vegetation has been removed by scraping, landslides, erosion, filling, etc. The industrial mapping unit includes areas now used as a lumber mill. The residential mappings include the housing area in Libby and the outlying sub-divisions. Talus slopes include the rocky areas on steep landscapes generally along Ramsey and Libby Creeks. Stream crossings and ponds were mapped as water.

3.3.2 Potential Vegetation

Seven major habitat types occur along the two transmission line alternatives. They include:

- Douglas-fir/snowberry (310)
- Douglas-fir/pinegrass (320)
- Engelmann spruce/common horsetail (410)
- Grand fir/queencup beadlily (520)
- Western red cedar/devil's club (550)
- Western hemlock/oak fern (565)
- Western hemlock/queencup beadlily (570)

The Engelmann spruce/common horsetail, western red cedar/devil's club, western hemlock/oak fern, and western hemlock/queencup beadlily types have been described in Section 3.2.2. The remaining types are described below and illustrated by Figures 22 and 23 located in the Appendix B.

3.3.2.1 Douglas-fir/Snowberry

This, the driest habitat type encountered in the study area, occurs on south and west facing slopes in relatively broad river valleys. Douglas-fir dominates most stages of succession, but ponderosa pine also is present. The dominant shrub species is snowberry (20% canopy cover) with serviceberry, white spirea, and kinnikinnik making up about 15% of the shrub understory. The dominant grasses are elk sedge and pinegrass.

3.3.2.2 Douglas-fir/Pinegrass

This habitat type occurs on relatively flat areas in broad valleys of the Kootenai River and Libby Creek. The stands in the study area are relatively open with the overstory of ponderosa pine (70% canopy cover) with western larch and lodgepole pine minor associates. Douglas-fir seedlings and saplings are the dominant tree reproduction. Pinegrass makes up from 20% to 40% of the understory canopy. Common associated species are kinnikinnik, balsamroot (*Balsamorhiza sagittata*), serviceberry, and snowberry.

3.3.2.3 Grand Fir/Queencup Beadlily

This habitat type was infrequently encountered in the transmission line study area along Miller Creek. The dominant trees in this habitat type are lodgepole pine, grand fir, western white pine, western larch, and Douglas-fir. The understory is comprised of twinflower, buffaloberry, bunchberry dogwood (*Cornus canadensis*), kinnikinnik, wild sarsaparilla (*Aralia nudicaulis*), and pinegrass.

3.4 FLORA

3.4.1 Environmental Factors

The species composition, successional status, and spatial distribution of plant communities of the study area reflect the integrated influences of geography, landform, fire, and past disturbance. The strong influence of geography on the flora is demonstrated by the large number of dominant plants whose distribution is directly associated with the Pacific Maritime climatic influence. Oceanic air masses move inland to northwestern Montana providing abundant rain and snowfall and generally humid, cloudy conditions except in midsummer (Arno 1979). Relatively mild winter temperatures, even at high elevations, allow coastal forest species to survive and become dominant members of the flora (Daubenmire 1969).

Pacific coastal species which are common components of the vegetation of the study area are: western

hemlock, western red cedar, grand fir, mountain hemlock, western white pine, Pacific yew, wild ginger, and queencup beadlily. A second major floristic element comprising the flora of the study area are species whose distribution is associated with the Rocky Mountains. These species include: western larch, subalpine fir, Engelmann spruce, mountain ash, goldthread, shinleaf (Pyrola spp.), Rocky Mountain maple, beargrass, and menziesia.

The major landform features that strongly influence environmental conditions and, consequently, plant distribution are elevation, aspect, and slope configuration (Deitschman 1973). These landform characteristics, in turn, determine soil development, moisture infiltration and retention, evapotranspiration, growing season, wind exposure, and cold air drainage.

Fire has been a major determinant of successional status of plant communities in northwestern Montana. Lightning and human-caused fires have been instrumental in perpetuating the abundance of seral species that dominate many sites of the study area (i.e., western larch, lodgepole pine, Douglas-fir, western white pine, bracken fern, snowbush ceanothus, and fireweed. Arno and Peterson (1983) reported that fires usually recur about every 6 years in dry ponderosa pine and Douglas-fir communities and about every 40 or more years in subalpine habitats. On wet sites dominated by western red cedar, western hemlock, and Engelmann spruce, only one or two significant fires per century can be expected (Arno and Davis 1980).

Logging, currently the major human influence on the vegetation, began in the early 1900's and reached its "boom years" during and after World War II. Typically, timber is clearcut and the slash is piled and burned. Seed trees are left standing to promote forest reproduction.

3.4.2 Flora of the Study Area

During the 1988 growing season, approximately 302 species of vascular plants were collected and identified from the study area including 13 trees, 10 tall shrubs, 35 low shrubs, 9 subshrubs, 60 grasses and grass-like plants, 148 forbs, and 31 cryptogams (Table 34). Of the 306 vascular plants identified, 281 or 92% are native to northwestern Montana.

3.4.3 Plant Species of Special Concern

Special status plant species (i.e., threatened, endangered, rare, or relatively unknown) that could occur in the study area have been identified by the USDA Forest Service (1988), Lesica et al. (1984), and the Montana

TABLE 34. PLANT SPECIES LIST - 1988
MONTANA PROJECT

Scientific Name	Common Name	Family	Status (N) Native (I) Introduced (*) Weedy Species
TREES			
Abies grandis	Grand Fir	Pinaceae	N
Abies lasiocarpa	Subalpine Fir	Pinacea	N
Larix occidentalis	Western Larch	Pinaceae	N
Picea engelmannii	Engelmann Spruce	Pinaceae	* N
Pinus contorta	Lodgepole Pine	Pinaceae	N
Pinus monticola	Western White Pine	Pinaceae	* N
Pinus ponderosa	Ponderosa Pine	Pinaceae	* N
Populus tremuloides	Quaking Aspen	Salicaceae	N
Populus trichocarpa	Black Cottonwood	Salicaceae	N
Pseudotsuga menziesii	Douglas-fir	Pinaceae	* N
Thuja plicata	Western Red Cedar	Cupressaceae	N
Tsuga heterophylla	Western Hemlock	Pinaceae	N
Tsuga mertensiana	Mountain Hemlock	Pinaceae	N
TALL SHRUBS			
Acer glabrum	Rocky Mountain Maple	Aceraceae	* N
Alnus sinuata	Sitka Alder	Betulaceae	* N
Betula occidentalis	Water Birch	Betulaceae	N
Betula papyrifera	Paper Birch	Betulaceae	* N
Crataegus douglasii	Black Hawthorn	Rosaceae	N
Prunus emarginata	Bittercherry	Rosaceae	* N
Pyrus malus	Apple	Rosaceae	I
Sorbus scopulina	Cascade Mountain Ash	Rosaceae	* N
Sorbus sitchensis	Sitka Mountain Ash	Rosaceae	* N
Taxus brevifolia	Pacific Yew	Taxaceae	N
LOW SHRUBS			
Amelanchier alnifolia	Western Serviceberry	Rosaceae	N
Ceanothus velutinus	Snowbrush ceanothus	Rhamnaceae	* N
Cornus stolonifera	Red-osier Dogwood	Cornaceae	N
Holodiscus discolor	Creambrush Ocean Spray	Rosaceae	N
Lonicera ciliosa	Trumpet Honeysuckle	Caprifoliaceae	N
Lonicera involucrata	Bearberry Honeysuckle	Caprifoliaceae	N
Lonicera utahensis	Utah Honeysuckle	Caprifoliaceae	N
Menziesia ferruginea	Rusty Menziesia	Ericaceae	N
Oplopanax horridum	Devil's Club	Araliaceae	N
Pachistima myrsinites	Pachistima	Celastraceae	N
Philadelphus lewisii	Mockorange	Hydrangeaceae	N
Physocarpus malvaceus	Mallow Ninebark	Rosaceae	N
Potentilla fruticosa	Shrubby Cinquefoil	Rosaceae	N
Rhamnus alnifolia	Alder Buchthorn	Rhamnaceae	N
Ribes lacustre	Swamp Gooseberry	Grossulariaceae	N
Ribes viscosissimum	Sticky Currant	Grossulariaceae	N
Rosa gymnocarpa	Baldhip Rose	Rosaceae	N

TABLE 34. Continued

Scientific Name	Common Name	Family	Status (N) Native (I) Introduced (*) Weedy Species
LOW SHRUBS (cont.)			
Rosa nutkana	Nootka Rose	Rosaceae	N
Rubus idaeus	Red Raspberry	Rosaceae	* N
Salix barclayi	Barclay's Willow	Salicaceae	N
Salix brachycarpa	Short-fruited Willow	Salicaceae	N
Salix drummondiana	Drummond Willow	Salicaceae	N
Salix eastwoodiae	Eastwood Willow	Salicaceae	N
Salix lutea	Yellow Willow	Salicaceae	N
Salix scouleriana	Scouler Willow	Salicaceae	N
Salix wolfii	Wolf's Willow	Salicaceae	N
Sambucus racemos	Black Elderberry	Caprifoliaceae	N
Shepherdia canadensis	Canada Buffaloberry	Elaeagnaceae	N
Spiraea betulifolia	White Spirea	Rosaceae	N
Spiraea densiflora	Subalpine Spirea	Rosaceae	N
Spiraea douglasii	Douglas' Spirea	Rosaceae	N
Symphoricarpos albus	Common Snowberry	Caprifoliaceae	N
Vaccinium globulare	Huckleberry	Ericaceae	* N
Vaccinium myrtillus	Dwarf Bilberry	Ericaceae	N
Vaccinium scoparium	Grouse Whortleberry	Ericaceae	N
SUBSHRUBS			
Arctostaphylos uva-ursi	Kinnikinnik	Ericaceae	N
Berberis repens	Oregon Grape	Berberidaceae	N
Chimaphila menziesii	Little Pipsissewa	Ericaceae	N
Chimaphila umbellata	Common Pipsissewa	Ericaceae	N
Cornus canadensis	Bunchberry Dogwood	Cornaceae	N
Linnaea borealis	Western Twinflower	Caprifoliaceae	N
Penstemon ellipticus	Elliptic-leaved Beardtongue	Scorphulariaceae	N
Rubus parviflorus	Thimbleberry	Rosaceae	N
Rubus pedatus	Fiveleaved Bramble	Rosaceae	N
PERENNIAL GRAMINOIDS			
Agropyron caninum	Bearded Wheatgrass	Poaceae	N
Agropyron repens	Quackgrass	Poaceae	* I
Agropyron spicatum	Bluebunch Wheatgrass	Poaceae	N
Agrostis alba	Redtop	Poaceae	* I
Agrostis exarata	Spike Bentgrass	Poaceae	N
Agrostis scabra	Rough Bentgrass	Poaceae	N
Bromus anomalous	Brome Grass	Poaceae	N
Bromus inermis	Smooth Brome	Poaceae	I
Bromus vulgaris	Columbia Brome	Poaceae	N
Calamagrostis canadensis	Bluejoint Reedgrass	Poaceae	N
Calamagrostis inexpansa	Narrow-spined Reedgrass	Poaceae	N
Calamagrostis purpurascens	Purple Reedgrass	Poaceae	N
Calamagrostis rubescens	Pinegrass	Poaceae	N

TABLE 34. Continued

Scientific Name	Common Name	Family	Status (N) Native (I) Introduced (*) Weedy Species
PERENNIAL GRAMINOIDS (cont.)			
Carex aquatilus	Water Sedge	Cyperaceae	N
Carex bebbii	Bebb's Sedge	Cyperaceae	N
Carex canescens	Gray Sedge	Cyperaceae	N
Carex concinnoides	Northwest Sedge	Cyperaceae	N
Carex deweyana	Dewey's Sedge	Cyperaceae	N
Carex geyeri	Elk Sedge	Cyperaceae	N
Carex mertensii	Mertens' Sedge	Cyperaceae	N
Carex microptera	Winged Sedge	Cyperaceae	N
Carex retrorsa	Knot-sheath Sedge	Cyperaceae	N
Carex rossii	Ross Sedge	Cyperaceae	N
Carex rostrata	Beaked Sedge	Cyperaceae	N
Carex stipata	Sawbeak Sedge	Cyperaceae	N
Carex vesicaria	Inflated Sedge	Cyperaceae	N
Dactylis glomerata	Orchardgrass	Poaceae	I
Danthonia intermedia	Timber Danthonia	Poaceae	N
Deschampsia elongata	Slender Hairgrass	Poaceae	N
Dulichium arundinaceum	Dulichium	Cyperaceae	N
Eleocharis pauciflora	Few-flowered Spike-rush	Cyperaceae	N
Elymus canadensis	Canada Wildrye	Poaceae	N
Elymus glaucus	Blue Wildrye	Poaceae	N
Festuca idahoensis	Idaho Fescue	Poaceae	N
Festuca occidentalis	Western Fescue	Poaceae	N
Festuca ovina	Sheep Fescue	Poaceae	N
Festuca subulata	Bearded Fescue	Poaceae	N
Festuca viridula	Green Fescue	Poaceae	N
Glyceria borealis	Northern Mannagrass	Poaceae	N
Glyceria grandis	Reed Mannagrass	Poaceae	N
Juncus acuminatus	Tapered Rush	Juncaceae	N
Juncus confusus	Colorado Rush	Juncaceae	N
Juncus effusus	Soft Rush	Juncaceae	N
Juncus ensifolius	Dagger-leaf Rush	Juncaceae	N
Juncus parryi	Perry's Rush	Juncaceae	N
Juncus regelii	Regel's Rush	Juncaceae	N
Luzula hitchcockii	Smooth Woodrush	Juncaceae	N
Luzula parviflora	Smallflowered Woodrush	Juncaceae	N
Melica subulata	Onion Grass	Poaceae	N
Muhlenbergia asperifolia	Rough-leaved Dropseed	Poaceae	N
Oryzopsis exigua	Little Ricegrass	Poaceae	N
Phleum pratense	Common Timothy	Poaceae	I
Poa palustris	Fowl Bluegrass	Poaceae	N
Poa pratensis	Kentucky Bluegrass	Poaceae	* I
Scirpus cyperinus	Woolgrass	Cyperaceae	N

TABLE 34. Continued

Scientific Name	Common Name	Family	Status (N) Native (I) Introduced (*) Weedy Species
PERENNIAL GRAMINOIDS (cont.)			
Scirpus maritimus	Seacoast Bulrush	Cyperaceae	N
Scirpus microcarpus	Small-fruited Bulrush	Cyperaceae	N
Stipa occidentalis	Western Needlegrass	Poaceae	N
Trisetum canescens	Tall Trisetum	Poaceae	N
ANNUAL GRAMINOIDS			
Deschampsia danthonioides	Annual Hairgrass	Poaceae	N
PERENNIAL FORBS			
Achillea millefolium	Common Yarrow	Asteraceae	* N
Aconitum columbianum	Columbian Monkshood	Ranunculaceae	N
Actaea rubra	Red Baneberry	Ranunculaceae	N
Adenocaulon bicolor	Trail Plant	Asteraceae	N
Agastache urticifolia	Nettle-leafed Horsemint	Lamiaceae	N
Agoseris glauca	Short-beaked Agoseris	Asteraceae	N
Anaphalis margaritacea	Pearly Everlasting	Asteraceae	* N
Anemone piperi	Piper's Anemone	Ranunculaceae	N
Angelica arguta	Sharptooth Angelica	Apiaceae	N
Angelica dawsonii	Dawson's Angelica	Apiaceae	N
Antennaria microphylla	Rosy Pussytoes	Asteraceae	N
Antennaria neglecta	Field Pussytoes	Asteraceae	N
Antennaria racemosa	Raceme Pussytoes	Asteraceae	N
Apocynum androsaemifolium	Spreading Dogbane	Apocynaceae	* N
Aralia nudicaulis	Wild Sarsaparilla	Araliaceae	N
Arnica amplexicaulis	Streamband Arnica	Asteraceae	N
Arnica cordifolia	Heartleaf Arnica	Asteraceae	N
Arnica latifolia	Mountain Arnica	Asteraceae	N
Asarum caudatum	Wild Ginger	Aristolochiaceae	N
Aster chilensis	Aster	Asteraceae	N
Aster eatonii	Eaton's Aster	Asteraceae	N
Aster engelmannii	Engelmann's Aster	Asteraceae	N
Aster laevis	Smooth Aster	Asteraceae	N
Aster modestus	Great Northern Aster	Asteraceae	N
Aster sibiricus	Arctic Aster	Asteraceae	N
Balsamorhiza sagittata	Sagittata Balsamroot	Asteraceae	N
Brodiaea sp.	Brodiaea	Liliaceae	N
Calypso bulbosa	Fairy Slipper	Orchidaceae	N
Campanula rotundifolia	Roundleaf Harebell	Campanulaceae	N
Castilleja miniata	Scarlet Paintbrush	Scrophulariaceae	N
Castilleja rhexifolia	Rhexia-leaved Paintbrush	Scrophulariaceae	N
Cerastium arvense	Mouse-ear Chickweed	Caryophyllaceae	N
Centaurea maculosa	Spotted Knapweed	Asteraceae	* I
Chrysanthemum leucanthemum	Oxeye Daisy	Asteraceae	I
Cicuta douglasii	Water Hemlock	Apiaceae	N

TABLE 34. Continued

Scientific Name	Common Name	Family	Status (N) Native (I) Introduced (*) Weedy Species
PERENNIAL FORBS (cont.)			
Circaea alpina	Enchanter's Nightshade	Onagraceae	N
Cirsium arvense	Canada Thistle	Asteraceae	* I
Cirsium flodmanii	Flodman's Thistle	Asteraceae	N
Cirsium vulgare	Bull Thistle	Asteraceae	* I
Claytonia lanceolata	Western Springbeauty	Portulacaceae	N
Clematis columbiana	Rock Clematis	Ranunculaceae	N
Clematis ligusticifolia	Western Clematis	Ranunculaceae	N
Clintonia uniflora	Queencup Beadlily	Liliaceae	N
Coptis occidentalis	Western Goldthread	Ranunculaceae	N
Corallorhiza maculata	Spotted Coral-root	Orchidaceae	N
Disporum hookeri	Hooker Fairybell	Liliaceae	N
Disporum trachycarpum	Wartberry Fairybell	Liliaceae	N
Epilobium angustifolium	Fireweed	Onagraceae	* N
Epilobium glaberrimum	Smooth Willowherb	Onagraceae	N
Erigeron compositus	Cut-leaved Fleabane	Asteraceae	N
Erigeron peregrinus	Wandering Fleabane	Asteraceae	N
Erigeron pumilus	Shaggy Fleabane	Asteraceae	N
Eriogonum flavum	Yellow Buckwheat	Polygonaceae	N
Eriogonum umbellatum	Sulfur Buckwheat	Polygonaceae	N
Erythronium grandiflorum	Glacier Lily	Liliaceae	N
Fragaria vesca	Woodland Strawberry	Rosaceae	N
Fragaria virginiana	Virginia Strawberry	Rosaceae	N
Galium boreale	Northern Bedstraw	Rubiaceae	N
Galium trifidum	Small bedstraw	Rubiaceae	N
Galium triflorum	Sweet-scented Bedstraw	Rubiaceae	N
Geum macrophyllum	Largeleaf Avens	Rosaceae	N
Gnaphalium microcephalum	White Cudweed	Asteraceae	N
Goodyera oblongfolia	Rattlesnake Plantain	Orchidaceae	N
Habenaria dilatata	White Bog-Orchard	Orchidaceae	N
Habenaria hyperborea	Northern Green Bog Orchard	Orchidaceae	N
Habenaria obtusata	One-leaved Bog Orchard	Orchidaceae	N
Heracleum lanatum	Cow Parsnip	Apiaceae	N
Heuchera cylindrica	Roundleaved Allumroot	Saxifragraceae	N
Hieracium albertinum	Western Hawkweed	Asteraceae	N
Hieracium albiflorum	White Flowered Hawkweed	Asteraceae	N
Hieracium aurantiacum	Orange Hawkweed	Asteraceae	N
Hieracium canadense	Canada Hawkweed	Asteraceae	N
Hieracium cynoglossoides	Houndstongue Hawkweed	Asteraceae	N
Hydrophyllum capitatum	Waterleaf	Hydrophyllaceae	N
Hypericum perforatum	Common St. John's-wort	Hypericaceae	* I
Hypopitys monotropa	Fringed Pinesap	Ericaceae	N
Ligusticum verticellatum	Lovae	Apiaceae	N
Listera convallarioides	Broad-lipped Twayblade	Orchidaceae	N
Lomatium triternatum	Nineleaf Lomatium	Apiaceae	N
Mimulus moschatus	Musk Monkeyflower	Scrophulariaceae	N

TABLE 34. Continued

Scientific Name	Common Name	Family	Status (N) Native (I) Introduced (*) Weedy Species
PERENNIAL FORBS (cont.)			
Mitella breweri	Brewer's Mitrewort	Saxifragaceae	N
Montia parvifolia	Small-leaved Montia	Portulacaceae	N
Nuphar variegatum	Yellow Water Lily	Nymphaeaceae	N
Osmorhiza chilensis	Mountain Sweetroot	Apiaceae	N
Pedicularis bracteosa	Bracted Lousewort	Scrophulariaceae	N
Pedicularis racemosa	Leafy Lousewort	Scrophulariaceae	N
Penstemon albertinus	Alberta Penstemon	Scrophulariaceae	N
Penstemon confertus	Yellow Penstemon	Scrophulariaceae	N
Penstemon eriantherus	Fuzzytongue Penstemon	Scrophulariaceae	N
Penstemon lyallii	Lyall's Penstemon	Scrophulariaceae	N
Penstemon procerus	Small-flowered Penstemon	Scrophulariaceae	N
Penstemon wilcoxii	Wilcox's Penstemon	Scrophulariaceae	N
Phacelia hastata	Silverleaf Phacelia	Hydrophyllaceae	N
Plantago major	Broadleaf Plantain	Plantaginaceae	* I
Polemonium pulcherrimum	Showy Polemonium	Polemoniaceae	N
Potentilla glandulosa	Glandular Cinquefoil	Rosaceae	N
Potentilla palustris	Purple Cinquefoil	Rosaceae	N
Prunella vulgaris	Self-heal	Lamiaceae	* I
Pterospora andromeda	Woodland Pinedrops	Ericaceae	N
Pyrola asarifolia	Common Pink Wintergreen	Ericaceae	N
Pyrola chlorantha	Green Pyrola	Ericaceae	N
Pyrola minor	Lesser Pyrola	Ericaceae	N
Pyrola picta	White-vein Pyrola	Ericaceae	N
Pyrola secunda	Sidebells Pyrola	Ericaceae	N
Pyrola uniflora	Single Delight	Ericaceae	N
Ranunculus acris	Meadow Buttercup	Ranunculaceae	I
Ranunculus glaberrimus	Sagebrush Buttercup	Ranunculaceae	N
Rumex acetosella	Sheep Sorrel	Polygonaceae	* I
Sagina procumbens	Procumbent Pearlwort	Caryophyllaceae	N
Saxifraga ferruginea	Rusty Saxifrage	Saxifragaceae	N
Sedum stenopetalum	Wormleaf Stonecrop	Crassulaceae	N
Senecio fremontii	Dwarf Groundsel	Asteraceae	N
Senecio triangularis	Arrowleaf Groundsel	Asteraceae	N
Smilacina stellata	Starry Solomon's Seal	Liliaceae	N
Solidago canadensis	Canada Goldenrod	Asteraceae	* N
Solidago multiradiata	Northern Goldenrod	Asteraceae	N
Sparganium eurycarpum	Broadfruited Bur-reed	Sparganiaceae	N
Spiranthes romanzofianna	Ladies Tresses	Orchidaceae	N
Stellaria crispa	Crisped Starwort	Caryophyllaceae	N
Streptopus amplexifolius	Clasping-leaf Twisted Stalk	Liliaceae	N
Taraxacum officinale	Common Dandelion	Asteraceae	* I
Thalictrum occidentale	Western Meadowrue	Ranunculaceae	N
Tiarella trifoliata	Tiarella	Saxifragaceae	N
Tragopogon dubius	Salsify	Asteraceae	I
Trifolium pratense	Red Clover	Fabaceae	I

TABLE 34. Continued

Scientific Name	Common Name	Family	Status (N) Native (I) Introduced (*) Weedy Species
PERENNIAL FORBS (cont.)			
Trifolium repens	White Clover	Fabaceae	I
Trillium ovatum	White Trillium	Liliaceae	N
Typha latifolia	Cattail	Typhaceae	* N
Urtica dioica	Stinging Nettle	Urticaceae	N
Valeriana sitchensis	Sitka Valeriana	Valerianaceae	N
Veratrum viride	Green False Hellebore	Liliaceae	N
Veronica americana	American Speedwell	Scrophulariaceae	N
Veronica serpyllifolia	Thyme-leaved Speedwell	Scrophulariaceae	N
Viola adunca	Early Blue Violet	Violaceae	N
Viola glabella	Stream Violet	Violaceae	N
Viola orbiculata	Roundleaf Violet	Violaceae	N
Viola palustris	Marsh Violet	Violaceae	N
Xerophyllum tenax	Beargrass	Liliaceae	N
ANNUAL & BIENNNIAL FORBS			
Collinsia parviflora	Blue-eyed Mary	Scrophulariaceae	N
Epilobium paniculatum	Tall Annual Willowherb	Onagraceae	N
Erigeron strigosus	Daisy Fleabane	Asteraceae	* N
Gentiana amarella	Northern Gentian	Gentianaceae	N
Melampyrum lineare	Narrowleaf Cow Wheat	Scrophulariaceae	N
Melilotus alba	White Sweetclover	Fabaceae	* I
Melilotus officinalis	Yellow Sweetclover	Fabaceae	* I
Trifolium agrarium	Yellow Clover	Fabaceae	I
Trifolium arvense	Hare's Foot Clover	Fabaceae	I
Verbascum thapsus	Flannel Mullein	Scrophulariaceae	* I
CRYPTOGAMS			
Athyrium filix-femina	Lady Fern	Polypodiaceae	N
Aulacomnium palustre	Moss	Aulacomniaceae	N
Calliergon cordifolium	Moss	Amblystegiaceae	N
Calliergon stramineum	Moss	Amblystegiaceae	N
Cheilanthes gracillima	Lace Lip-fern	Polypodiaceae	N
Cryptogramma crispa	Rock-brake	Polypodiaceae	N
Drepanocladus fluitans	Moss	Amblystegiaceae	N
Drepanocladus uncinatus	Moss	Amblystegiaceae	N
Drypoteris filix-mas	Male Fern	Polypodiaceae	N
Equisetum arvense	Common Horsetail	Equisetaceae	N
Equisetum fluviatile	Water Horsetail	Equisetaceae	N
Equisetum hyemale	Tall Horsetail	Equisetaceae	N
Gymnocarpium dryopteris	Oak Fern	Polypodiaceae	N
Hypnum circinale	Moss	Hypnaceae	N
Lycopodium annotinum	Stiff Clubmoss	Lycopodiaceae	N
Lycopodium complanatum	Ground Cedar	Lycopodiaceae	N

TABLE 34. Continued

Scientific Name	Common Name	Family	Status (N) Native (I) Introduced (*) Weedy Species
CRYPTOGAMS (cont.)			
Mnium spinulosum	Moss	Mniaceae	N
Philonotis fontana	Moss	Bartramiaceae	N
Polystichum andersonii	Anderson's Sword Fern	Polypodiaceae	N
Polystichum lonchitis	Mountain Holly Fern	Polypodiaceae	N
Polystichum munitum	Sword Fern	Polypodiaceae	N
Polytrichum longisetum	Moss	Polytrichaceae	N
Pteridium aquilinum	Bracken Fern	Polypodiaceae	* N
Rhizomnium nudum	Moss	Mniaceae	N
Sphagnum angustifolium	Moss	Sphagnaceae	N
Sphagnum girgensohnii	Moss	Sphagnaceae	N
Sphagnum russowii	Moss	Sphagnaceae	N
Sphagnum squarrosum	Moss	Sphagnaceae	N
Sphagnum subsecundum	Moss	Sphagnaceae	N
Sphagnum teres	Moss	Sphagnaceae	N
Thelypteris phegopteris	Northern Wood Fern	Polypodiaceae	N

Natural Heritage Program. The U.S. Fish and Wildlife Service has not listed any federally classified threatened or endangered plant species for Montana, pursuant to the Endangered Species Act.

Table 35 lists "sensitive species" that the USDA Forest Service expects may occur in the Kootenai National Forest. One plant, woolgrass, as illustrated by Figure 24, was found in the study area at two locations. Small populations (i.e., one to two dozen plants) of woolgrass grow in and near wetlands near the tailings areas (Figure 4). A large population (i.e., several thousand plants) occurs in a beaver dam-wetland complex along Libby Creek (Figure 24). Small populations of this species have been reported from along Rock Creek in Sanders County on an area that has been disturbed by logging (Westech 1987). A large woolgrass population, with thousands of individuals, occurs along Noxon Reservoir near Trout Creek and Noxon.

The Montana Natural Heritage Program has identified two species thought to be rare, threatened, or endangered that could occur in the study area--Yerba buena (*Satureja douglasii*) and Pacific blackberry (*Rubus ursinus*). The Montana Natural Heritage Program lists these species as occurring near the Noxon Rapids Dam. Westech (1987) reported the occurrence of both species along Rock Creek in Sanders County. Neither of these plants were found in the Montana Project study area.

3.4.4 Weedy Species

Weeds are the initial colonizers of plant communities following human-caused or natural disturbance of canopy structure and/or soil. Weedy species or "ruderals" (Grime 1979) typically have reproductive, morphological, and physiological attributes which impart to them the ability to effectively occupy vacant growing space and compete with climax and late successional species. Most weeds have at least several of the following characteristics:

1) Continuous seed production for as long as growing conditions permit
2) Effective ways of dispersing seeds
3) Ability of seeds to remain dormant in the soil for long periods of time
4) Ability to grow under adverse environmental conditions
5) Adaptations to a wide variety of soil and climatic conditions
6) Ability to effectively compete for soil moisture, nutrients, and sunlight
7) Genetic adaptability

Weedy species are not necessarily environmental or economic liabilities. Native species which dominate in

TABLE 35. SENSITIVE PLANT SPECIES FOR THE KOOTENAI NATIONAL FOREST MONTANA PROJECT

Common Name	Scientific Name
Fringed Onion	*Allium fibrillum*
Cascade Reedgrass	*Calamagrostis tweedyi*
Pale Sedge	*Carex livida*
Northern Golden Carpet	*Chrysosplenium tetrandrum*
Common Clarkia	*Clarkia rhomboidea*
Small Yellow Lady's Slipper	*Cypripedium calceolus*
Sparrow's-egg Lady's Slipper	*Cypripedium passerinum*
Western Boneset	*Eupatorium occidentale*
Bastard Toad-flax	*Geocaulon lividum*
Howell's Gum-weed	*Grindelia howellii*
Geyer's Biscuit Root	*Lomatium geyeri*
Round-leaved Orchis	*Orchis rotundifolia*
Columbia River Crazyweed	*Oxytropis columbiana*
Yerba Buena	*Satureja douglasii*
Kidney-leaved Violet	*Viola renifolia*

Source: U.S. Department of Agriculture, Forest Service, Region 1, Missoula, Montana, 1988

Figure 24. Woolgrass (Scirpus cyperinus) is a U.S. Forest Service "sensitive plant", which occurs in three locations in the study area. A large population occurs outside the study area along Noxon Reservoir near the town of Noxon.

the primary stages of ecological succession rapidly stabilize soil and provide large amounts of biomass which provides important food and cover for wildlife. Some exotic plant species, however, have become "noxious" weeds, invading disturbed areas and replacing native species.

According to the County Noxious Weed Management Act (MCA 7-22-2101 et seq.), a noxious weed is any exotic plant species that is established or which may be introduced in Montana which may render the land unfit for agriculture, forestry, wildlife, livestock, or other beneficial uses. The District Weed Board of both Lincoln and Sanders counties have identified noxious weeds for their areas (Table 36).

Three noxious weeds were identified for the study area--Canada thistle, St. Johnswort (*Hypericum perforatum*), and spotted knapweed. St. Johnswort and spotted knapweed are primarily restricted to roadsides and have not yet become dominant components of the flora on disturbed sites such as clearcuts. Canada thistle is a dominant roadside and pastureland weed and rapidly invades clearcuts the first year or two after logging and slash burning. According to French and Lacey (1983), spotted kanpweed is the number one weed problem in western Montana because it reduces livestock forage and causes soil erosion when it invades rangeland. Lacey et al. (1986) reports that the current annual loss to the Montana range livestock industry due to knapweed is $4.5 million. Spotted knapweed infestations on the Bitterroot National Forest are predicted to cause the elk herd to decline by 200 animals annually due to loss of forage. St. Johnswort is unpalatable to livestock and animals do not eat the plant unless forced to by lack of suitable forage. Ingestion of the plant causes photosensitization in livestock and should be regarded as poisonous (Lacey and Lacey 1986).

Common invader species (i.e., early successional) in the study area which are not noxious weeds include: lodgepole pine, western larch, black cottonwood, western white pine, alder, snowbush ceanothus, red raspberry, huckleberry, redtop, Kentucky bluegrass (*Poa pratensis*), timothy, yarrow, goldenrod, white sweet clover (*Melilotus alba*), yellow sweet clover (*Melilotus officinalis*), fireweed, clover (*Trifolium* spp.), bracken fern, and possibly woolgrass.

Dominant seral species should be considered candidates for use in reclamation following mining. Rapid colonizaton by desirable species following mining is essential to reduce the potential for noxious weed invasion. A dense, vigorous stand of perennial species, particularly grasses, reduces the probability that noxious weeds will proliferate on disturbed areas.

TABLE 36. NOXIOUS WEEDS OF LINCOLN AND/OR SANDERS COUNTY MONTANA PROJECT

Common Name	Scientific Name
Canada Thistle	*Cirsium arvense*
Field Bindweed	*Convolvulus arvensis*
Whitetop	*Cardaria draba*
Leafy Spurge	*Euphorbia esula*
Russian Knapweed	*Centaurea repens*
Spotted Knapweed	*Centaurea maculosa*
Diffuse Knapweed	*Centaurea diffusa*
Dalmation Toadflax	*Linaria dalmatica*
St. Johnswort	*Hypericum perforatum*
Dyers Woad	*Isatis tinctoria*
Yellow Starthistle	*Centaurea solstitialis*
Common Crupina	*Crupina vulgaris*
Tansy Ragwort	*Senecio jacobaea*
Burdock	*Arctium minor*
Eurasian Milfoil	*Myriophyllum spicatum*
Hounds Tongue	*Cynoglossum officinale*
Musk Thistle	*Carduus nutans*
Yellow Toadflax	*Linaria vulgaris*

Sources: 1) Lincoln County Weed Board, 1988
2) Montana Department of Agriculture, 1988

SECTION 4.0

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4.0 LITERATURE CITED

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SECTION 5.0

VEGETATION PLAN OF STUDY

WESTERN RESOURCE DEVELOPMENT CORP.
P.O. Box 467
711 Walnut Street
Boulder, Colorado 80306
(303) 449-9009

August 15, 1988

Mr. Kenneth M. Reim
Manager, Mining Development
U.S. Borax
3075 Wilshire Boulevard
Los Angeles, CA 90010-1294

Re: Plans of Study

Dear Ken:

We have reviewed the Plans of Study Section 5 (Wildlife and Aquatic Biology), Section 6 (Vegetation), and Section 8 (Soils) as provided in your letter of July 11, 1988. Since development of the Plans of Study numerous changes have occurred. The U.S. Forest Service and the Montana Department of Fish, Wildlife, and Parks have modified details of the wildlife and aquatic biology. Field conditions of the area have resulted in minor changes to all Plans of Study.

These changes have been incorporated into the Plans of Study and they have been retyped. The enclosed document now represents what the agencies would like implemented.

Please call if you have questions.

Sincerely,

David

David L. Johnson
Ecologist

DLJ:ei
Enclosures

cc:
Gary Fletcher

5

FLETCHER
ASSOCIATES

17740 East Hinsdale Avenue
Aurora, Colorado 80016
(303) 693-2516

November 15, 1988

Jim Rathbun
Forest Supervisor
Kootenai National Forest
506 U.S. Highway 2 West
Libby, MT 59923

Kit Walther, Chief
Hard Rock Bureau
Montana Dept. of State Lands
1625 Eleventh Avenue
Helena, MT 59620

Re: Montana Mining Venture

Gentlemen:

Enclosed are the modified sections of the Plan of Study for:

1. Section 5 - Wildlife and Aquatic Biology
2. Statement of Work - Fisheries, Section 5.1.1
3. Section 6 - Vegetation

The Wildlife, Aquatic Biology, and Fisheries sections were prepared, modified, and completed in the field after consultations with the following agency personnel:

1. U.S. Forest Service - Al Bratkovich
   Doug Perkinson
2. Water Quality Bureau - Gary Ingman
3. Fish, Wildlife & Parks - Terry Hightower
   Joe Huston
   Jim Vashro

Also enclosed are the "marked up" sections of Wildlife, Aquatic Biology, and Vegetation, enabling you to see the changes, as well as have clean copies of the finals.

Briefly, the changes were:

1. completed fish study
2. increased number of reaches and techniques for aquatic biology, and
3. reduction of area for birds and small mammals.

If you have any questions, please contact me.

Sincerely,

Gary J. Fletcher

Gary J. Fletcher
GJF:af
Enclosures
cc: Joe Scheuering (w/o enclosures)
Brent Bailey (w/o enclosures)

United States Department of Agriculture | Forest Service | Kootenai NF | 506 US Highway 2 West
Libby, MT 59923

Reply to: 2810

Date: January 9, 1989

Joe Scheuering
Noranda Minerals Corp.
P.O. Box 7176
Reno, NV 89510

Re: Plan of Study (POS) - Wildlife, Vegetation and Soils

Dear Joe,

Per letter of November 15 from Gary Fletcher, the agencies accept your proposed modifications/additions to the following sections:

a. Section 5, Wildlife and Aquatic Biology,
b. Section 6, Vegetation,
c. Section 8, Soils.

The agencies request that the proposed modifications be reflected as an addendum to the POS. The addendum should be revised Sections 5, 6 and 8 with appropriate signature page and cover.

If you have any questions, please contact either Kit or me.

Sincerely,

Ron Erickson

Ron Erickson
FS Project Coordinator

cc: Kit Walther, DSL
Brent Bailey
Gary Fletcher

Section 6

VEGETATION

A detailed plan of study for a baseline vegetation inventory is presented in the following sections. The plan represents present understanding of state and federal requirements for mine development. Specifically, the plan is based upon the National Environmental Policy Act (NEPA), Montana Environmental Policy Act (MEPA), Montana Metal Mine Reclamation Act (MMMRA), guidelines to these acts, interactions with Kootenai National Forest and Montana Department of State Lands (MDSL), and MDSL guidelines for metal mines.

Major objectives of the inventory are to identify, map, and quantitatively and qualitatively describe the vegetation resources of the project permit area and a surrounding buffer zone. The vegetation information will be used for an alternatives analysis, for a mine permit application to the Forest Service and MDSL, and for preparation of reclamation plans for all disturbed areas. Additionally, this data may be used for a description of existing conditions and identification of potential impacts and development of mitigation for state (MEPA) and federal (NEPA) environmental impact statements.

6.1 DATA COLLECTION PROGRAM DESIGN

The vegetation of the entire permit area will be defined by existing data and supplemented where necessary by mapping existing vegetation type and/or potential habitat type where appropriate. Vegetation cover; herbaceous production; shrub density; tree density and reproduction; and tree height, diameter-at-breast height (dbh), and age will be quantified for all vegetation types/habitat types to be affected by mining activities.

All sample sites will be selectively located in homogeneous undisturbed areas within each mapping unit. All quantitative sampling for cover, production, density, height, and dbh will occur at the same sample sites. A point-intercept method will be used for cover sampling and quadrat methods for density and herbaceous production sampling. A total of 2-10 samples will be completed for each affected area vegetation type depending on the prevalence of the type in the affected area. Sample size will increase with increased acreage in the affected area.

6.1.1 Task 1. Literature Review

The objective of the literature review will be to assemble and review ecological data on the terrestrial vegetation of

the permit area. Data will be collected on the habitat types present, their location, species composition, ecology, and potential for including species of high state and federal concern.

Agencies and organizations to be contacted for ecological information and input into the vegetation inventory process include: Kootenai National Forest, U.S. Forest Service, U.S. Bureau of Land Management, Montana Department of State Lands, U.S. Fish and Wildlife Service, Nature Conservancy, Montana Heritage Program, Curator of the Herbarium at University of Montana Herbarium (Missoula), and government and university ecologists knowledgeable of the local flora and ecology.

6.1.2 Task 2. Delineation and Mapping of Vegetation Types

It is understood that a habitat type map has been prepared for the Kootenai National Forest and extends to the study area. However, the mapping includes potential, not existing, vegetation and requires refinement. Therefore, we will identify and map existing vegetation types (seral communities) supplementing existing data as necessary for those areas disturbed in recent history and habitat types for those areas with older and more mature vegetation. Potential habitat units will be based on the classifications of Cooper et al. (1985) and Pfister et al. (1977).

A plant ecologist will conduct a thorough reconnaissance of the permit area and identify habitat types or seral communities based upon vegetation structure, species presence, and dominance, supplementing existing data as necessary. Color photography will be used to precisely delineate the boundaries of each vegetation type, rock outcrop, or disturbed areas upon a topographic base map at a scale of 1 inch equals 400 feet. Extensive field reconnaissance will be employed to verify the boundaries of mapping units. The acreage of each mapping unit in the permit and affected areas will be determined by planimetering. Special attention will be given to plants which have naturally reclaimed disturbed sites.

6.1.3 Task 3. Vascular Plant Species Collection and Identification

Plant species will be collected and identified in early spring, during the summer quantitative sampling, and in late summer/early fall. Plants will be identified by the ecologists conducting the study and confirmed by the Curator of the Herbarium, University of Montana. Voucher specimens will be preserved in a reference collection. Taxonomic nomenclature will follow Dorn (1984), Hitchcock et al. (1955-1969), Hitchcock and Cronquist (1973), Booth and Wright (1966), and Han (1977).

The plant species list will be arranged alphabetically by species per tree, low shrub, tall shrub, perennial graminoid, annual graminoid, perennial forb, and annual forb categories. Nonvascular plants will be listed in alphabetical order as the last lifeform category. For each species the family, common name and status (introduced vs. native) will be indicated. Weedy species will be identified with an asterisk. Weedy species will be discussed and noxious weeds specifically addressed as defined by the Lincoln County Weed Board.

6.1.4 Task 4. Plant Species of Special Concern

There are no federally listed threatened or endangered plants for the State of Montana (USFWS 1987). However, there are several federal candidate species such as *Calamagrostis tweedyii*, *Grindelia howellii*, and *Silene spaldingii* potentially present in this region of Montana (USFWS 1980). Lesica's (1984) publication "Vascular Plants of Rare and Undetermined Status for the State of Montana" provides information on these plants and species of state concern. The Montana Heritage Program provides additional information on rare plants. Examples of species of state concern include *Rubus ursinus* and *Satureja douglasii*.

Federal and state agencies and knowledgeable taxonomists in governmental agencies and universities will be contacted in the process of assembling ecologic, distributional, and taxonomic information on species of state and federal concern. Herbarium specimens of these plants will be reviewed prior to field studies. Field inventories for these plants will be conducted in all potential habitats at the appropriate flowering and fruiting season.

6.1.5 Task 5. Quantitative Sampling

Figure 6-1 illustrates the quantitative sample process. A rectangular quadrat 5 meters (m) by 25 m will be arbitrarily located and oriented. Cover estimation will occur along the central axis. The entire quadrat will be used to collect tree data. Shrub density and tree reproduction data will be collected in one 1 m by 25 m quadrat located along the cover transect. Production data will be collected in four 0.5 m by 2 m rectangular quadrats located in the corner of the large quadrat.

Cover Data. Vegetation cover will be estimated using a point-intercept method (Mueller-Dombois and Ellenberg 1974). Fifty points will be recorded at one meter intervals along both sides of the 25 m central axis. This system will provide data on absolute and relative vegetation cover and frequency for all lifeforms from trees to small forbs.

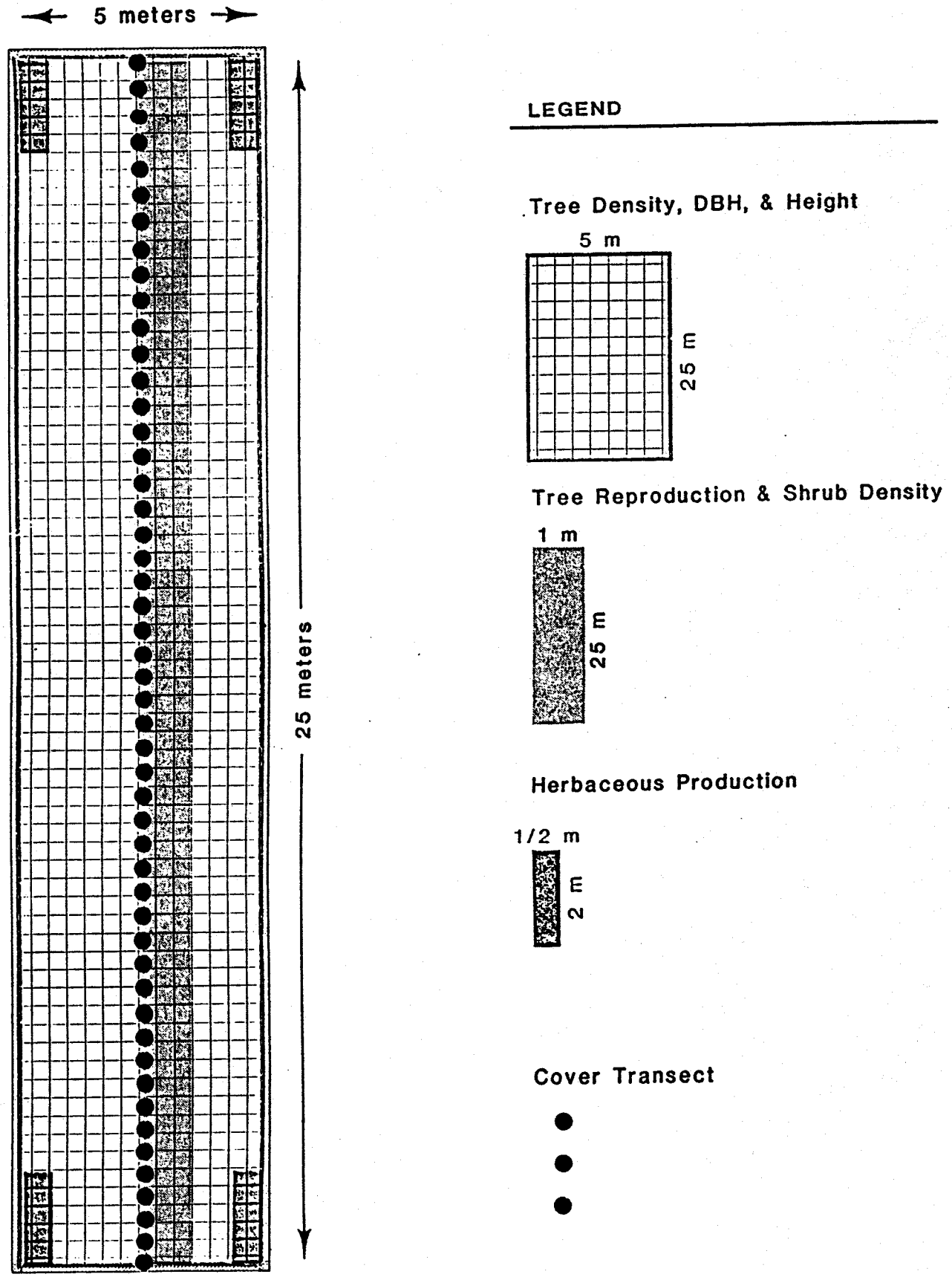

Figure 6.1. Quantitative Sample Process

A sighting device mounted on an adjustable tripod to facilitate vertical orientation and point stabilization will be used for cover sampling. Fine cross hairs are used in the sighting device to provide optimum point definition. At each sample point, the sighting device will be directed vertically upward if there is overstory forest vegetation and then vertically downward to shrub and herbaceous canopies. If a tree and/or shrub is intercepted, a second or third hit will be taken. The first hit along a vertical line is recorded as vegetation (by species), rock, litter, or soil. Vegetation intercepted below tree and shrub first hits will be recorded as a second or third hit. Only first hits will be used in calculating absolute cover, percent vegetation, rock, bare soil, and litter. All hits are used to calculate relative vegetation cover.

Species present in the sample quadrat but not actually "hit" during the point-intercept sampling will be indicated by a "P" in the cover data tables. Frequency values will be calculated on the percent of occurrence in sample stands.

Shrub Data. A quadrat system will be used for sampling shrub density. One quadrat 1 m by 25 m will be set up on the side of the central 5 m by 25 m cover transect. The vegetation specialist will record by species the number of individual shrubs rooted within the quadrat. The specialist will express density for each shrub and for the total of all shrubs per vegetation type in the survey area as the number per quadrat (50 m^2), acre, and hectare.

Tree Data. Tree density, dbh, height, and age data will be collected in the large 5 m by 25 m quadrat. To calculate density all trees above breast height (1.3 m) in the quadrat will be counted by species. Tree density for each tree and for the total of all trees will be expressed as the average number per quadrat (125 m^2) and per acre and hectare.

Tree reproduction will be determined by counting all trees below breast height (1.3 m) in the shrub density quadrat. Tree reproduction will be expressed as the average number per quadrat (50 m^2), acre, and hectare.

The dbh of all trees in the large quadrat will be measured to the nearest centimeter. The data analysis will illustrate the total number of each tree species and the number per diameter size class (5 cm increments). Basal area for each tree species and for all tree species will be calculated and expressed as $cm^2/125\ m^2$ and million board feet (mbf) per acre.

The height of trees in the quadrat will be visually estimated and frequently checked using an Abney inclinometer. Height data will be recorded to the nearest

foot and data on mean, maximum, and range expressed for each tree species in the data tables.

The oldest appearing tree of each species in each large quadrat will be cored and rings counted to provide an estimate of age.

Production. A quadrat system will be used to estimate herbaceous production. Four production samples will be collected from 0.5 m by 2 m quadrats located in each corner of the large quadrat (Figure 6-1). The current year's growth of all herbaceous plants will be clipped by lifeform categories of annual graminoid, perennial graminoid, annual forb, and perennial forb. Shrubs and trees will not be clipped. Plant biomass will be oven dried at 105°F for 24 hours and weighed to the nearest one-tenth gram. Results will be expressed as g/m^2, pounds/acre, and kilograms/hectare.

6.2 TECHNICAL REPORT

The report will be a comprehensive document that includes individual sample and summary data tables, a plant species list, a vegetation type map, text, and a photograph of each sampled vegetation type.

The text of the report will include an introduction that explains the objectives of the vegetation program; a methods section which thoroughly documents all sample procedures; and a results and discussion section which presents the quantitative cover, production, and density data and provides an interpretive discussion of the ecology of each vegetation type with emphasis on relationships to the regional environment.

Vegetation descriptions will include comments on the spatial distribution of the community (i.e., relationship and interspersion with other types), soil types, aspects, slopes, as well as a comprehensive discussion of the cover, production, and density data. The specialist will discuss the potential or actual occurrence of threatened or endangered species (USFWS 1980 and 1983) or other species of particular importance or concern, such as noxious weeds.

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BASELINE VEGETATION STUDY

Montana Project

LINCOLN & SANDERS COUNTIES, MONTANA

APPENDIX A.
QUANTITATIVE VEGETATION DATA

prepared for

Noranda Minerals Corp.
65 N. Edison Way Suite 4 P.O. Box 7176 Reno, Nevada 89501

prepared by

Western Resource Development Corporation
711 Walnut St. P.O. Box 467 Boulder, Colorado 80306

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TABLE 1A. TREE AGE DATA - 1988
MONTANA PROJECT

(AGE IN YEARS)

TRANSECT NUMBER	1	4	7	8	9	10	11	15	16	17	18	21	23	24	25	28	29	30	36	37	38	39	40	41	42
CONIFEROUS FOREST																									
Abies grandis					76						82													80	89
Larix occidentalis																			240				218		
Picea engelmannii	88	170				160+			70						150+		37			110+					
Pinus contorta																					89	92			
Pinus monticola										68		130	85												
Populus trichocarpa																									
Pseudotsuga menziesii				150+			208	110										198							
Thuja plicata														170+											
Tsuga heterophylla			104													60									

TRANSECT NUMBER	2	3	14	19	20	22	26	27	31	32	33	34	35	43
CLEARCUT														
Larix occidentalis			10	12		16	170					19		
Picea engelmannii	10	11												
Pinus contorta					10			17	10	11	7		19	
TREES														
Larix occidentalis														
Picea engelmannii														
Pinus contorta														

TRANSECT NUMBER	6	12	46
SHRUBLANDS			
Abies grandis	30		
Picea engelmannii			41
Pseudotsuga menziesii		23	

TRANSECT NUMBER	44	45
SUBALPINE		
Abies lasiocarpa	45	
Tsuga mertensiana		55

TABLE 2A. CONIFEROUS FOREST COVER DATA - 1988
MONTANA PROJECT

TRANSECT NUMBER	1		4		7		8	
	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits
TREES								
Abies grandis	10	12	6	22			8	8
Abies lasiocarpa								
Larix occidentalis								
Picea engelmannii	12	12	10	10			8	8
Pinus contorta								
Pinus monticola								
Populus trichocarpa								
Pseudotsuga menziesii							8	8
Thuja plicata								
Tsuga heterophylla			24	24	88	88	62	74
Total % Trees	22	24	40	56	88	88	86	98
TREES - DEAD								
Abies grandis								
Pinus contorta								
Total % Trees - Dead	0	0	0	0	0	0	0	0
TALL SHRUBS								
Acer glabrum		2	10	10				
Alnus sinuata	6	6						
Sorbus scopulina								
Sorbus sitchensis			P					
Taxus brevifolia	34	40			P			
Total % Tall Shrubs	40	48	10	10	0	0	0	0
LOW SHRUBS								
Amelanchier alnifolia								
Cornus stolonifera								
Holodiscus discolor								
Lonicera ciliosa								
Lonicera involucrata								
Lonicera utahensis								
Menziesia ferruginea	6	6	P					
Oplopanax horridum	14	26	26	36	P		2	2
Pachistima myrsinites								
Rhamnus alnifolia								
Ribes lacustre	P			2				
Ribes viscosissimum								
Rosa gymnocarpa								
Rosa nutkana								
Rubus idaeus								

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	1		4		7		8	
	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits
Salix scouleriana								
Sambucus racemosa	P		P					
Sheperdia canadensis								
Spiraea betulifolia								
Symphoricarpos albus	P							
Vaccinium cespitosum								
Vaccinium globulare		2	2	6		2		
Vaccinium myrtillus								
Total % Low Shrubs	20	34	28	44	0	2	2	2
SUBSHRUBS								
Arctostaphylos uva-ursi								
Berberis repens								
Chimaphila umbellata								
Cornus canadensis								
Linnaea borealis								
Penstemon ellipticus								
Rubus parviflorus	P		P					
Rubus pedatus								
Total % Subshrubs	0	0	0	0	0	0	0	0
PERENNIAL GRAMINOIDS								
Bromus vulgaris	P		P					
Calamagrostis canadensis								
Calamagrostis inexpansa								
Calamagrostis rubescens								
Carex concinnoides								
Carex deweyana								
Carex rossii								
Carex stipata								
Deschampsia elongata								
Elymus canadensis								
Elymus glaucus								
Festuca occidentalis								
Festuca subulata	P							
Glyceria grandis								
Luzula hitchcockii								
Luzula parviflora								
Muhlenbergia asperifolia								
Phleum pratense	P							
Scirpus maritimus								
Total % Perennial Graminoids	0	0	0	0	0	0	0	0

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	1		4		7		8	
	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits
PERENNIAL FORBS								
Aconitum columbianum								
Actaea rubra	P		P					P
Adenocaulon bicolor	P							
Angelica arguta								
Aralia nudicaulis								
Arnica cordifolia	P			2	P			
Asarum caudatum								
Cicuta douglasii								
Circaea alpina								
Cirsium flodmanii								
Clematis columbiana								
Clintonia uniflora		10		2		2		2
Coptis occidentalis			P					
Corallorhiza maculata								P
Disporum hookeri	P		P					4
Epilobium angustifolium								
Epilobium glaberrimum								
Fragaria vesca								
Fragaria virginiana								
Galium boreale								
Galium triflorum	P		P					
Geum macrophyllum								
Goodyera oblongfolia	P							P
Habenaria dilatata								
Habenaria hyperborea								
Habenaria obtusata								
Hieracium albiflorum								
Hieracium cynoglossoides	P							
Ligusticum verticillatum								
Listera convallarioides								
Mitella breweri								
Osmorhiza chilensis	P		P					
Pedicularis bracteosa								
Polemonium pulcherrimum			P					
Pyrola asarifolia								
Pyrola chlorantha								
Pyrola minor								
Pyrola secunda						4		
Pyrola uniflora								
Saxifraga ferruginea								
Senecio triangularis	P							
Smilacina stellata		2		P		P		P
Streptopus amplexifolius				2		P		P
Thalictrum occidentale	4	6						P
Tiarella trifoliata		4	4	12	2	12		4

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	1		4		7		8	
	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits
Trillium ovatum	P		P					P
Urtica dioica								
Veratrum viride	P							
Veronica americana								
Viola glabella		4						P
Viola orbiculata	P					P		2
Xerophyllum tenax								
Total % Perennial Forbs	4	26	4	18	2	18	0	12
ANNUAL & BIENNIAL FORBS								
Melampyrum lineare								
Verbascum thapsus								
Total % Annual & Biennial Forbs	0	0	0	0	0	0	0	0
CRYPTOGAMS								
Athyrium filix-femina		4	6	6			6	14
Dryopteris filix-mas								
Equisetum arvense								
Equisetum hyemale								
Gymnocarpium dryopteris	2	8	6	28	4	36		10
Lycopodium annotinum								
Moss	4	6		4		32	4	10
Polystichum andersonii								
Polystichum lonchitis								
Pteridium aquilinum								
Thelypteris phegopteris								
Total % Cryptogams	6	18	12	38	4	68	10	34
TOTAL % VEGETATION	92	150	94	166	94	176	98	146
Soil								
Litter	8	8	6	6	6	6	2	2
Rock								

P = SPECIES PRESENT BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	9		10		11		15	
	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits	1st Hits	All Hits
TREES								
Abies grandis	58	62			50	58	8	10
Abies lasiocarpa								
Larix occidentalis	4	4			2	2	18	18
Picea engelmannii	P		20	20			12	14
Pinus contorta					2	2		
Pinus monticola		4						
Populus trichocarpa								
Pseudotsuga menziesii	8	14			22	22	50	60
Thuja plicata							P	
Tsuga heterophylla			38	44	8	10	P	
Total % Trees	70	84	58	64	84	94	88	102
TREES - DEAD								
Abies grandis								
Pinus contorta								
Total % Trees - Dead	0	0	0	0	0	0	0	0
TALL SHRUBS								
Acer glabrum	6	6	12	16		2		6
Alnus sinuata			2	6				
Sorbus scopulina			P					
Sorbus sitchensis			P					
Taxus brevifolia	P				P			
Total % Tall Shrubs	6	6	14	22	0	2	0	6
LOW SHRUBS								
Amelanchier alnifolia							P	
Cornus stolonifera							P	
Holodiscus discolor								
Lonicera ciliosa								
Lonicera involucrata								
Lonicera utahensis					P		P	
Menziesia ferruginea							P	
Oplopanax horridum				2				
Pachistima myrsinites		4	P		P			8
Rhamnus alnifolia								
Ribes lacustre			P				P	
Ribes viscosissimum								
Rosa gymnocarpa					P		P	
Rosa nutkana								
Rubus idaeus								

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	9		10		11		15	
	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits	1st Hits	All Hits
Salix scouleriana								
Sambucus racemosa								
Sheperdia canadensis								
Spiraea betulifolia		2						2
Symphoricarpos albus			6	8				
Vaccinium cespitosum								
Vaccinium globulare	4	4	2	2	P		P	
Vaccinium myrtillus								
Total % Low Shrubs	4	10	8	12	0	0	0	10
SUBSHRUBS								
Arctostaphylos uva-ursi								
Berberis repens								
Chimaphila umbellata	P					4		
Cornus canadensis								
Linnaea borealis						2		2
Penstemon ellipticus								
Rubus parviflorus	P		P					8
Rubus pedatus								
Total % Subshrubs	0	0	0	0	0	6	0	10
PERENNIAL GRAMINOIDS								
Bromus vulgaris			P					2
Calamagrostis canadensis								
Calamagrostis inexpansa								
Calamagrostis rubescens								
Carex concinnoides								
Carex deweyana								
Carex rossii								
Carex stipata								
Deschampsia elongata								
Elymus canadensis								
Elymus glaucus								
Festuca occidentalis								
Festuca subulata			P					
Glyceria grandis								
Luzula hitchcockii								
Luzula parviflora								
Muhlenbergia asperifolia								
Phleum pratense								
Scirpus maritimus								
Total % Perennial Graminoids	0	0	0	0	0	0	0	2

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	9		10		11		15	
	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits	1st Hits	All Hits
PERENNIAL FORBS								
Aconitum columbianum								
Actaea rubra			P					4
Adenocaulon bicolor			2	2	P		P	
Angelica arguta							P	
Aralia nudicaulis								
Arnica cordifolia	P			14				14
Asarum caudatum								
Cicuta douglasii								
Circaea alpina								
Cirsium flodmanii								
Clematis columbiana							2	4
Clintonia uniflora		2		2	4	6	2	10
Coptis occidentalis								
Corallorhiza maculata							P	
Disporum hookeri	P			10			P	
Epilobium angustifolium			P					
Epilobium glaberrimum								
Fragaria vesca								
Fragaria virginiana								
Galium boreale								
Galium triflorum					P		P	
Geum macrophyllum								
Goodyera oblongfolia	P				P			
Habenaria dilatata								
Habenaria hyperborea								
Habenaria obtusata								
Hieracium albiflorum	P						P	
Hieracium cynoglossoides								
Ligusticum verticillatum								
Listera convallarioides								
Mitella breweri								
Osmorhiza chilensis				4			P	
Pedicularis bracteosa								
Polemonium pulcherrimum								
Pyrola asarifolia					P			
Pyrola chlorantha					P			
Pyrola minor								
Pyrola secunda		2			P		P	
Pyrola uniflora								
Saxifraga ferruginea								
Senecio triangularis								
Smilacina stellata				2	P		2	14
Streptopus amplexifolius			P					
Thalictrum occidentale	P			2	P			2
Tiarella trifoliata		2		4	P		2	18

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	9		10		11		15	
	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits	1st Hits	All Hits
Trillium ovatum			P		P		P	
Urtica dioica								
Veratrum viride				2				
Veronica americana								
Viola glabella				2			P	
Viola orbiculata		2			4	4		2
Xerophyllum tenax		6			P			
Total % Perennial Forbs	0	14	2	44	8	10	8	68
ANNUAL & BIENNIAL FORBS								
Melampyrum lineare								
Verbascum thapsus							P	
Total % Annual & Biennial Forbs	0	0	0	0	0	0	0	0
CRYPTOGAMS								
Athyrium filix-femina			12	16			P	
Dryopteris filix-mas								
Equisetum arvense								
Equisetum hyemale								
Gymnocarpium dryopteris				18				
Lycopodium annotinum								
Moss	2	4	2	6		8		2
Polystichum andersonii								
Polystichum lonchitis								
Pteridium aquilinum			2	12			P	
Thelypteris phegopteris								
Total % Cryptogams	2	4	16	52	0	8	0	2
TOTAL % VEGETATION	82	118	98	194	92	120	96	200
Soil								
Litter	18	18	2	2	8	8	2	2
Rock							2	2

P = SPECIES PRESENT BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	16		17		18		21	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
TREES								
Abies grandis	2	4	10	12	40	42	P	
Abies lasiocarpa								
Larix occidentalis			4	4	4	4		
Picea engelmannii	6	6					8	8
Pinus contorta					6	6		
Pinus monticola	P		14	14	4	4	10	10
Populus trichocarpa								
Pseudotsuga menziesii			10	10	10	10	2	2
Thuja plicata	74	76	16	20		2	36	52
Tsuga heterophylla		10	P		4	6	34	44
Total % Trees	82	96	54	60	68	74	90	116
TREES - DEAD								
Abies grandis								
Pinus contorta								
Total % Trees - Dead	0	0	0	0	0	0	0	0
TALL SHRUBS								
Acer glabrum								
Alnus sinuata								
Sorbus scopulina								
Sorbus sitchensis								
Taxus brevifolia								
Total % Tall Shrubs	0	0	0	0	0	0	0	0
LOW SHRUBS								
Amelanchier alnifolia			P		P			
Cornus stolonifera								
Holodiscus discolor						2		
Lonicera ciliosa								
Lonicera involucrata								
Lonicera utahensis						2	P	
Menziesia ferruginea								
Oplopanax horridum								
Pachistima myrsinites	P		P		P		P	
Rhamnus alnifolia								
Ribes lacustre	P							
Ribes viscosissimum								
Rosa gymnocarpa	P				P			
Rosa nutkana								
Rubus idaeus								

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	16		17		18		21	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
Salix scouleriana								
Sambucus racemosa								
Sheperdia canadensis						2		
Spiraea betulifolia			2	2	P			
Symphoricarpos albus			P					
Vaccinium cespitosum								
Vaccinium globulare	P		P		P		P	
Vaccinium myrtillus				10	P		P	
Total % Low Shrubs	0	0	2	12	0	6	0	0
SUBSHRUBS								
Arctostaphylos uva-ursi								
Berberis repens					P			
Chimaphila umbellata	P		P		2	2		
Cornus canadensis								
Linnaea borealis	P		2	6		14	P	
Penstemon ellipticus	P							
Rubus parviflorus								
Rubus pedatus								
Total % Subshrubs	0	0	2	6	2	16	0	0
PERENNIAL GRAMINOIDS								
Bromus vulgaris	P							
Calamagrostis canadensis								
Calamagrostis inexpansa								
Calamagrostis rubescens			2	4	2	4		
Carex concinnoides			P			2		
Carex deweyana								
Carex rossii							P	
Carex stipata								
Deschampsia elongata								
Elymus canadensis								
Elymus glaucus								
Festuca occidentalis			P		P			
Festuca subulata								
Glyceria grandis								
Luzula hitchcockii								
Luzula parviflora								
Muhlenbergia asperifolia								
Phleum pratense								
Scirpus maritimus								
Total % Perennial Graminoids	0	0	2	4	2	6	0	0

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	16		17		18		21	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
PERENNIAL FORBS								
Aconitum columbianum								
Actaea rubra								
Adenocaulon bicolor								
Angelica arguta								
Aralia nudicaulis		2						
Arnica cordifolia		2	12	24			P	
Asarum caudatum								
Cicuta douglasii								
Circaea alpina								
Cirsium flodmanii								
Clematis columbiana								
Clintonia uniflora	2	4	P			4	P	
Coptis occidentalis	2	10	2	10	4	16		2
Corallorhiza maculata	P							
Disporum hookeri	P							
Epilobium angustifolium								
Epilobium glaberrimum								
Fragaria vesca								
Fragaria virginiana			2	2	P			
Galium boreale								
Galium triflorum	P							
Geum macrophyllum								
Goodyera oblongfolia			P				P	
Habenaria dilatata								
Habenaria hyperborea								
Habenaria obtusata								
Hieracium albiflorum			P		P		P	
Hieracium cynoglossoides								
Ligusticum verticillatum								
Listera convallarioides	P				P			
Mitella breweri								
Osmorhiza chilensis	P				P			
Pedicularis bracteosa							P	
Polemonium pulcherrimum								
Pyrola asarifolia			2	2	P		P	
Pyrola chlorantha					P			
Pyrola minor								
Pyrola secunda	P						P	
Pyrola uniflora		2						
Saxifraga ferruginea								
Senecio triangularis								
Smilacina stellata						2		
Streptopus amplexifolius								
Thalictrum occidentale								
Tiarella trifoliata		6						

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	16		17		18		21	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
Trillium ovatum	P		P					
Urtica dioica								
Veratrum viride	P							
Veronica americana								
Viola glabella	P					4	P	
Viola orbiculata	P		2	4	P		P	
Xerophyllum tenax			10	12	14	30		2
Total % Perennial Forbs	4	26	30	54	18	56	0	4
ANNUAL & BIENNIAL FORBS								
Melampyrum lineare			P					
Verbascum thapsus								
Total % Annual & Biennial Forbs	0	0	0	0	0	0	0	0
CRYPTOGAMS								
Athyrium filix-femina	6	14	P					
Dryopteris filix-mas	2	2						
Equisetum arvense	P							
Equisetum hyemale								
Gymnocarpium dryopteris		2						
Lycopodium annotinum								
Moss		2				2	2	6
Polystichum andersonii								
Polystichum lonchitis								
Pteridium aquilinum					4	10	P	
Thelypteris phegopteris								
Total % Cryptogams	8	20	0	0	4	12	2	6
TOTAL % VEGETATION	94	142	90	136	94	170	92	126
Soil								
Litter	6	6	10	10	6	6	8	8
Rock								

P = SPECIES PRESENT BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	23		24		25		28	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
TREES								
Abies grandis			10	12	2	2		
Abies lasiocarpa								
Larix occidentalis	20	20					P	
Picea engelmannii			2	4	8	10	18	18
Pinus contorta								
Pinus monticola	10	10			2	2		
Populus trichocarpa								
Pseudotsuga menziesii	24	30						
Thuja plicata	4	12	54	58	48	50	24	26
Tsuga heterophylla	36	68	20	32	20	28	58	60
Total % Trees	94	140	86	106	80	92	100	104
TREES - DEAD								
Abies grandis								
Pinus contorta								
Total % Trees - Dead	0	0	0	0	0	0	0	0
TALL SHRUBS								
Acer glabrum								
Alnus sinuata					P			
Sorbus scopulina								
Sorbus sitchensis								
Taxus brevifolia	P			4				
Total % Tall Shrubs	0	0	0	4	0	0	0	0
LOW SHRUBS								
Amelanchier alnifolia							P	
Cornus stolonifera								
Holodiscus discolor								
Lonicera ciliosa								
Lonicera involucrata					P			
Lonicera utahensis							P	
Menziesia ferruginea			P		P			
Oplopanax horridum			4	18		2		
Pachistima myrsinites	P				P		P	
Rhamnus alnifolia			P					
Ribes lacustre						2		
Ribes viscosissimum								
Rosa gymnocarpa					P		P	
Rosa nutkana								
Rubus idaeus								

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	23		24		25		28	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
Salix scouleriana								
Sambucus racemosa								
Sheperdia canadensis								
Spiraea betulifolia							P	
Symphoricarpos albus								
Vaccinium cespitosum					P			
Vaccinium globulare			P		P			
Vaccinium myrtillus								
Total % Low Shrubs	0	0	4	18	0	4	0	0
SUBSHRUBS								
Arctostaphylos uva-ursi								
Berberis repens	P							
Chimaphila umbellata								
Cornus canadensis			P					4
Linnaea borealis	P		P		P		P	
Penstemon ellipticus								
Rubus parviflorus			P					
Rubus pedatus								
Total % Subshrubs	0	0	0	0	0	0	0	4
PERENNIAL GRAMINOIDS								
Bromus vulgaris					P			
Calamagrostis canadensis			P					
Calamagrostis inexpansa								
Calamagrostis rubescens								
Carex concinnoides								
Carex deweyana								
Carex rossii								
Carex stipata								
Deschampsia elongata					2	2		
Elymus canadensis								
Elymus glaucus								
Festuca occidentalis								
Festuca subulata								
Glyceria grandis				2	4	6		
Luzula hitchcockii								
Luzula parviflora								
Muhlenbergia asperifolia								
Phleum pratense								
Scirpus maritimus								
Total % Perennial Graminoids	0	0	0	2	6	8	0	0

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	23		24		25		28	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
PERENNIAL FORBS								
Aconitum columbianum								
Actaea rubra			P			2		
Adenocaulon bicolor					P			
Angelica arguta					P			
Aralia nudicaulis					P			
Arnica cordifolia				6	2	8		
Asarum caudatum								
Cicuta douglasii								
Circaea alpina			P					
Cirsium flodmanii								
Clematis columbiana								
Clintonia uniflora	P		P			2	P	
Coptis occidentalis	P		P			2		2
Corallorhiza maculata								
Disporum hookeri								
Epilobium angustifolium								
Epilobium glaberrimum			P					
Fragaria vesca								
Fragaria virginiana								
Galium boreale								
Galium triflorum			P					
Geum macrophyllum								
Goodyera oblongfolia	P							
Habenaria dilatata			P		P			
Habenaria hyperborea								
Habenaria obtusata			P					
Hieracium albiflorum								
Hieracium cynoglossoides								
Ligusticum verticillatum			P		P			
Listera convallarioides	P							
Mitella breweri								
Osmorhiza chilensis			P			2		
Pedicularis bracteosa								
Polemonium pulcherrimum								
Pyrola asarifolia	P		P				P	
Pyrola chlorantha								
Pyrola minor								
Pyrola secunda	P		P				P	
Pyrola uniflora			P					
Saxifraga ferruginea				2				
Senecio triangularis			P					
Smilacina stellata				2	P		P	
Streptopus amplexifolius			2	6	P			
Thalictrum occidentale								
Tiarella trifoliata	P			6		6	P	

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	23		24		25		28	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
Trillium ovatum			P		P			
Urtica dioica								
Veratrum viride					P			
Veronica americana			P					
Viola glabella				2		2	P	
Viola orbiculata	P							
Xerophyllum tenax								
Total % Perennial Forbs	0	0	2	24	2	24	0	2
ANNUAL & BIENNIAL FORBS								
Melampyrum lineare								
Verbascum thapsus								
Total % Annual & Biennial Forbs	0	0	0	0	0	0	0	0
CRYPTOGAMS								
Athyrium filix-femina			8	18	12	28	P	
Dryopteris filix-mas								
Equisetum arvense				4		16		
Equisetum hyemale								
Gymnocarpium dryopteris				18		6	P	
Lycopodium annotinum			P					
Moss				4		22		
Polystichum andersonii								
Polystichum lonchitis								
Pteridium aquilinum	P							
Thelypteris phegopteris					P			
Total % Cryptogams	0	0	8	44	12	72	0	0
TOTAL % VEGETATION	94	140	100	198	100	200	100	110
Soil								
Litter	6	6						
Rock								

P = SPECIES PRESENT BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	29		30		36		37	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
TREES								
Abies grandis	P		30	32	12	24		
Abies lasiocarpa								
Larix occidentalis	4	4	2	2	38	38		
Picea engelmannii	4	4	10	14	12	16	2	12
Pinus contorta								
Pinus monticola			10	10	P			
Populus trichocarpa							70	70
Pseudotsuga menziesii	4	4	4	4	P			
Thuja plicata	P		14	18	P		12	26
Tsuga heterophylla			18	24	28	32	P	
Total % Trees	12	12	88	104	90	110	84	108
TREES - DEAD								
Abies grandis								
Pinus contorta								
Total % Trees - Dead	0	0	0	0	0	0	0	0
TALL SHRUBS								
Acer glabrum								
Alnus sinuata	28	28					12	14
Sorbus scopulina								
Sorbus sitchensis								
Taxus brevifolia								6
Total % Tall Shrubs	28	28	0	0	0	0	12	20
LOW SHRUBS								
Amelanchier alnifolia						2		4
Cornus stolonifera	2	6						8
Holodiscus discolor								
Lonicera ciliosa								
Lonicera involucrata		2						
Lonicera utahensis		2		2				
Menziesia ferruginea								
Oplopanax horridum							P	
Pachistima myrsinites	P		P					
Rhamnus alnifolia								6
Ribes lacustre	P						P	
Ribes viscosissimum								
Rosa gymnocarpa			P		2	10	P	
Rosa nutkana	P							
Rubus idaeus	P							

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	29		30		36		37	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
Salix scouleriana								
Sambucus racemosa	P							
Sheperdia canadensis								
Spiraea betulifolia			P			2		
Symphoricarpos albus	P							18
Vaccinium cespitosum								
Vaccinium globulare						2		
Vaccinium myrtillus				4	P			
Total % Low Shrubs	2	10	0	6	2	16	0	36
SUBSHRUBS								
Arctostaphylos uva-ursi								
Berberis repens			P					
Chimaphila umbellata				6	P			
Cornus canadensis	P		P		P			
Linnaea borealis				4	P			
Penstemon ellipticus								
Rubus parviflorus	P						P	
Rubus pedatus								
Total % Subshrubs	0	0	0	10	0	0	0	0
PERENNIAL GRAMINOIDS								
Bromus vulgaris	P					2	P	
Calamagrostis canadensis	P							
Calamagrostis inexpansa								
Calamagrostis rubescens			P		P			
Carex concinnoides								
Carex deweyana	P							
Carex rossii			P					
Carex stipata		4						
Deschampsia elongata								
Elymus canadensis								
Elymus glaucus							P	
Festuca occidentalis								
Festuca subulata								
Glyceria grandis	2	32					P	
Luzula hitchcockii								
Luzula parviflora								
Muhlenbergia asperifolia						2		
Phleum pratense								
Scirpus maritimus	P							
Total % Perennial Graminoids	2	36	0	0	0	4	0	0

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	29		30		36		37	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
PERENNIAL FORBS								
Aconitum columbianum	2	4					2	10
Actaea rubra	P							2
Adenocaulon bicolor			P		P			
Angelica arguta							2	4
Aralia nudicaulis	P		P					
Arnica cordifolia		2			2	18		
Asarum caudatum								
Cicuta douglasii							P	
Circaea alpina	2	12						2
Cirsium flodmanii			P					
Clematis columbiana								
Clintonia uniflora	P			2		10		
Coptis occidentalis	P			10	4	20		2
Corallorhiza maculata								
Disporum hookeri							P	
Epilobium angustifolium								
Epilobium glaberrimum		2						
Fragaria vesca								
Fragaria virginiana	P							
Galium boreale								
Galium triflorum		8	P				P	
Geum macrophyllum	P							
Goodyera oblongfolia			P					
Habenaria dilatata							P	
Habenaria hyperborea							P	
Habenaria obtusata								
Hieracium albiflorum			P					
Hieracium cynoglossoides								
Ligusticum verticillatum								
Listera convallarioides					P			
Mitella breweri								
Osmorhiza chilensis	P				P		P	
Pedicularis bracteosa								
Polemonium pulcherrimum								
Pyrola asarifolia		2					P	
Pyrola chlorantha								2
Pyrola minor			P					
Pyrola secunda								
Pyrola uniflora								
Saxifraga ferruginea								
Senecio triangularis	4	12					P	
Smilacina stellata		2			P			46
Streptopus amplexifolius		4						
Thalictrum occidentale	P					2		4
Tiarella trifoliata	P				P			

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	29		30		36		37	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
Trillium ovatum			P			2		
Urtica dioica								
Veratrum viride								
Veronica americana		2						
Viola glabella		4	P		P			2
Viola orbiculata			P		2	2	P	
Xerophyllum tenax					P			
Total % Perennial Forbs	8	54	0	12	8	54	4	74
ANNUAL & BIENNIAL FORBS								
Melampyrum lineare								
Verbascum thapsus							P	
Total % Annual & Biennial Forbs	0	0	0	0	0	0	0	0
CRYPTOGAMS								
Athyrium filix-femina	40	74						10
Dryopteris filix-mas								
Equisetum arvense								2
Equisetum hyemale							P	
Gymnocarpium dryopteris	P							
Lycopodium annotinum								
Moss		2		2				4
Polystichum andersonii								
Polystichum lonchitis								
Pteridium aquilinum	8	10						8
Thelypteris phegopteris								
Total % Cryptogams	48	86	0	2	0	0	0	24
TOTAL % VEGETATION	100	226	88	134	100	184	100	262
Soil								
Litter			12	12				
Rock								

P = SPECIES PRESENT BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	38		39		40		41	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
TREES								
Abies grandis	40	44	4	12	66	76	50	60
Abies lasiocarpa								
Larix occidentalis	P		28	28	14	14	8	8
Picea engelmannii								
Pinus contorta	12	12	28	30			18	18
Pinus monticola	2	2						
Populus trichocarpa								
Pseudotsuga menziesii					P		12	12
Thuja plicata	P		18	44	P		8	54
Tsuga heterophylla		4	4	12	2	2		14
Total % Trees	54	62	82	126	82	92	96	166
TREES - DEAD								
Abies grandis					2	2		
Pinus contorta	26	26						
Total % Trees - Dead	26	26	0	0	2	2	0	0
TALL SHRUBS								
Acer glabrum								
Alnus sinuata								
Sorbus scopulina								
Sorbus sitchensis								
Taxus brevifolia					2	14		
Total % Tall Shrubs	0	0	0	0	2	14	0	0
LOW SHRUBS								
Amelanchier alnifolia								
Cornus stolonifera								
Holodiscus discolor								
Lonicera ciliosa								
Lonicera involucrata								
Lonicera utahensis	P				P		P	
Menziesia ferruginea								
Oplopanax horridum								
Pachistima myrsinites	P			2			P	
Rhamnus alnifolia								
Ribes lacustre								
Ribes viscosissimum								
Rosa gymnocarpa	P		P		P			
Rosa nutkana								
Rubus idaeus								

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	38		39		40		41	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
Salix scouleriana	P							
Sambucus racemosa								
Sheperdia canadensis	P							
Spiraea betulifolia		4	P					
Symphoricarpos albus								
Vaccinium cespitosum								
Vaccinium globulare	P		P		P			
Vaccinium myrtillus				2				
Total % Low Shrubs	0	4	0	4	0	0	0	0
SUBSHRUBS								
Arctostaphylos uva-ursi			P					
Berberis repens	P		P		P			
Chimaphila umbellata	4	8	2	6		2		
Cornus canadensis								
Linnaea borealis	2	26	4	16		10	P	
Penstemon ellipticus								
Rubus parviflorus								
Rubus pedatus								
Total % Subshrubs	6	34	6	22	0	12	0	0
PERENNIAL GRAMINOIDS								
Bromus vulgaris								
Calamagrostis canadensis								
Calamagrostis inexpansa								
Calamagrostis rubescens	P		P		P			
Carex concinnoides								
Carex deweyana								
Carex rossii								
Carex stipata								
Deschampsia elongata								
Elymus canadensis								
Elymus glaucus								
Festuca occidentalis								
Festuca subulata								
Glyceria grandis								
Luzula hitchcockii								
Luzula parviflora								
Muhlenbergia asperifolia								
Phleum pratense								
Scirpus maritimus								
Total % Perennial Graminoids	0	0	0	0	0	0	0	0

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	38		39		40		41	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
PERENNIAL FORBS								
Aconitum columbianum								
Actaea rubra								
Adenocaulon bicolor								
Angelica arguta								
Aralia nudicaulis								
Arnica cordifolia						4		
Asarum caudatum								
Cicuta douglasii								
Circaea alpina								
Cirsium flodmanii								
Clematis columbiana								
Clintonia uniflora	P				P		P	
Coptis occidentalis		4		4		4		6
Corallorhiza maculata								
Disporum hookeri								
Epilobium angustifolium								
Epilobium glaberrimum								
Fragaria vesca								
Fragaria virginiana								
Galium boreale								
Galium triflorum								
Geum macrophyllum								
Goodyera oblongfolia	P		P		P		P	
Habenaria dilatata								
Habenaria hyperborea								
Habenaria obtusata								
Hieracium albiflorum	P				P			
Hieracium cynoglossoides								
Ligusticum verticillatum								
Listera convallarioides								
Mitella breweri								
Osmorhiza chilensis								
Pedicularis bracteosa								
Polemonium pulcherrimum								
Pyrola asarifolia			P		P		P	
Pyrola chlorantha								
Pyrola minor								
Pyrola secunda	P		P				P	
Pyrola uniflora								
Saxifraga ferruginea								
Senecio triangularis								
Smilacina stellata					P		P	
Streptopus amplexifolius								
Thalictrum occidentale								
Tiarella trifoliata						2		

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	38		39		40		41	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
Trillium ovatum							P	
Urtica dioica								
Veratrum viride								
Veronica americana								
Viola glabella					P		P	
Viola orbiculata	P			2	P		P	
Xerophyllum tenax		10		10		4		
Total % Perennial Forbs	0	14	0	16	0	14	0	6
ANNUAL & BIENNIAL FORBS								
Melampyrum lineare	4	4	P					
Verbascum thapsus								
Total % Annual & Biennial Forbs	4	4	0	0	0	0	0	0
CRYPTOGAMS								
Athyrium filix-femina								
Dryopteris filix-mas								
Equisetum arvense								
Equisetum hyemale								
Gymnocarpium dryopteris								
Lycopodium annotinum								
Moss			4	20				
Polystichum andersonii								
Polystichum lonchitis								
Pteridium aquilinum	4	12			P			
Thelypteris phegopteris								
Total % Cryptogams	4	12	4	20	0	0	0	0
TOTAL % VEGETATION	94	156	92	188	86	134	96	172
Soil								
Litter	6	6	8	8	14	14	4	4
Rock								

P = SPECIES PRESENT BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	42		47		49		50	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
TREES								
Abies grandis	28	30	6	8	14	14	P	
Abies lasiocarpa								
Larix occidentalis								
Picea engelmannii			16	18	6	8	P	
Pinus contorta	4	4						
Pinus monticola	4	4						
Populus trichocarpa								
Pseudotsuga menziesii	2	2						
Thuja plicata	8	12	20	22			P	
Tsuga heterophylla	6	8	46	48	P		100	100
Total % Trees	52	60	88	96	20	22	100	100
TREES - DEAD								
Abies grandis								
Pinus contorta	22	22						
Total % Trees - Dead	22	22	0	0	0	0	0	0
TALL SHRUBS								
Acer glabrum				8	72	78		
Alnus sinuata								
Sorbus scopulina								
Sorbus sitchensis			2	2	P			
Taxus brevifolia			P			4		
Total % Tall Shrubs	0	0	2	10	72	82	0	0
LOW SHRUBS								
Amelanchier alnifolia	P		P					
Cornus stolonifera								
Holodiscus discolor								
Lonicera ciliosa	P							
Lonicera involucrata								
Lonicera utahensis	P		P					
Menziesia ferruginea			P					
Oplopanax horridum				4				8
Pachistima myrsinites	P			2	P			
Rhamnus alnifolia								
Ribes lacustre					P			
Ribes viscosissimum								
Rosa gymnocarpa	P							
Rosa nutkana								
Rubus idaeus								

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	42		47		49		50	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
Salix scouleriana			2	2				
Sambucus racemosa					2	8		
Sheperdia canadensis								
Spiraea betulifolia		2		2				
Symphoricarpos albus					P			
Vaccinium cespitosum								
Vaccinium globulare							P	
Vaccinium myrtillus		2						
Total % Low Shrubs	0	4	2	10	2	8	0	8
SUBSHRUBS								
Arctostaphylos uva-ursi								
Berberis repens								
Chimaphila umbellata	2	6	P					
Cornus canadensis								
Linnaea borealis	6	16						
Penstemon ellipticus								
Rubus parviflorus			4	4		30		
Rubus pedatus								
Total % Subshrubs	8	22	4	4	0	30	0	0
PERENNIAL GRAMINOIDS								
Bromus vulgaris					P			
Calamagrostis canadensis								
Calamagrostis inexpansa								
Calamagrostis rubescens		4						
Carex concinnoides								
Carex deweyana								
Carex rossii								
Carex stipata								
Deschampsia elongata								
Elymus glaucus					P			
Festuca occidentalis								
Festuca subulata								
Glyceria grandis								
Luzula hitchcockii								
Luzula parviflora								2
Muhlenbergia asperifolia								
Phleum pratense								
Scirpus maritimus								
Total % Perennial Graminoids	0	4	0	0	0	0	0	2
PERENNIAL FORBS								

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	42		47		49		50	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
Aconitum columbianum								
Actaea rubra			P		P			
Adenocaulon bicolor				2		2		
Angelica arguta					P			
Aralia nudicaulis								
Arnica cordifolia			P			2		
Asarum caudatum						10		
Cicuta douglasii								
Circaea alpina						2		
Cirsium flodmanii								
Clematis columbiana								
Clintonia uniflora	P			4		6	P	
Coptis occidentalis	4	12						
Corallorhiza maculata								
Disporum hookeri			P			2	P	
Epilobium angustifolium								
Epilobium glaberrimum								
Fragaria vesca					P			
Fragaria virginiana								
Galium boreale								
Galium triflorum					P			
Geum macrophyllum								
Goodyera oblongfolia	P		P					
Habenaria dilatata								
Habenaria hyperborea								
Habenaria obtusata								
Hieracium albiflorum	P							
Hieracium cynoglossoides								
Ligusticum verticillatum								
Listera convallarioides	P							
Mitella breweri								
Osmorhiza chilensis			P		P			
Pedicularis bracteosa								
Polemonium pulcherrimum								
Pyrola asarifolia	2	2	P					
Pyrola chlorantha			P					
Pyrola minor								
Pyrola secunda			P				P	
Pyrola uniflora								
Saxifraga ferruginea								
Senecio triangularis								
Smilacina stellata				8	2	14	P	
Streptopus amplexifolius					P			
Thalictrum occidentale			P			2		
Tiarella trifoliata				4			P	
Trillium ovatum			P		P		P	

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	42		47		49		50	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
Urtica dioica					P			
Veratrum viride			P					
Veronica americana								
Viola glabella			P			6		
Viola orbiculata	P		P					
Xerophyllum tenax	10	30	P					
Total % Perennial Forbs	16	44	0	18	2	46	0	0
ANNUAL & BIENNIAL FORBS								
Melampyrum lineare								
Verbascum thapsus								
Total % Annual & Biennial Forbs	0	0	0	0	0	0	0	0
CRYPTOGAMS								
Athyrium filix-femina				2	4	16		2
Dryopteris filix-mas								
Equisetum arvense								
Equisetum hyemale								
Gymnocarpium dryopteris			P					18
Lycopodium annotinum								
Moss		2	2	8		2		8
Polystichum andersonii								
Polystichum lonchitis					P			
Pteridium aquilinum		2	P			2		
Thelypteris phegopteris								
Total % Cryptogams	0	4	2	10	4	20	0	28
TOTAL % VEGETATION	98	160	98	148	100	208	100	138
Soil								
Litter	2	2	2	2				
Rock								

P = SPECIES PRESENT BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	51		52		53		54	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
TREES								
Abies grandis	76	80					4	4
Abies lasiocarpa							70	70
Larix occidentalis	P							
Picea engelmannii					6	6	P	
Pinus contorta								
Pinus monticola	2	2	P					
Populus trichocarpa								
Pseudotsuga menziesii	12	12						
Thuja plicata	6	8						
Tsuga heterophylla		2	94	94	60	60	P	
Total % Trees	96	104	94	94	66	66	74	74
TREES - DEAD								
Abies grandis								
Pinus contorta								
Total % Trees - Dead	0	0	0	0	0	0	0	0
TALL SHRUBS								
Acer glabrum	P				18	28	4	10
Alnus sinuata								
Sorbus scopulina							P	
Sorbus sitchensis								
Taxus brevifolia			P					2
Total % Tall Shrubs	0	0	0	0	18	28	4	12
LOW SHRUBS								
Amelanchier alnifolia								
Cornus stolonifera								
Holodiscus discolor								
Lonicera ciliosa								
Lonicera involucrata								
Lonicera utahensis	P				P		P	
Menziesia ferruginea							P	
Oplopanax horridum						14		
Pachistima myrsinites	P							
Rhamnus alnifolia								
Ribes lacustre								2
Ribes viscosissimum								
Rosa gymnocarpa	P							
Rosa nutkana								
Rubus idaeus							P	

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	51		52		53		54	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
Salix scouleriana								
Sambucus racemosa								
Sheperdia canadensis					P			
Spiraea betulifolia							P	
Symphoricarpos albus								
Vaccinium cespitosum								
Vaccinium globulare				6				6
Vaccinium myrtillus							P	
Total % Low Shrubs	0	0	0	6	0	14	0	8
SUBSHRUBS								
Arctostaphylos uva-ursi								
Berberis repens								
Chimaphila umbellata	P							
Cornus canadensis								
Linnaea borealis								
Penstemon ellipticus								
Rubus parviflorus						2	P	
Rubus pedatus				8				
Total % Subshrubs	0	0	0	8	0	2	0	0
PERENNIAL GRAMINOIDS								
Bromus vulgaris	P					P		
Calamagrostis canadensis								
Calamagrostis inexpansa							P	
Calamagrostis rubescens								
Carex concinnoides								
Carex deweyana								
Carex rossii								
Carex stipata								
Deschampsia elongata								
Elymus canadensis								
Elymus glaucus								
Festuca occidentalis								
Festuca subulata					2	4	P	
Glyceria grandis								
Luzula hitchcockii							P	
Luzula parviflora								
Muhlenbergia asperifolia								
Phleum pratense								
Scirpus maritimus								
Total % Perennial Graminoids	0	0	0	0	2	4	0	0

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	51		52		53		54	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
PERENNIAL FORBS								
Aconitum columbianum					P			
Actaea rubra						2		
Adenocaulon bicolor		2				2		
Angelica arguta								
Aralia nudicaulis								
Arnica cordifolia								
Asarum caudatum					P			
Cicuta douglasii								
Circaea alpina						4		
Cirsium flodmanii								
Clematis columbiana								
Clintonia uniflora	2	2	P			8	2	20
Coptis occidentalis								
Corallorhiza maculata								
Disporum hookeri	P					6		
Epilobium angustifolium								
Epilobium glaberrimum								
Fragaria vesca								
Fragaria virginiana								
Galium boreale								
Galium triflorum	P				P		2	2
Geum macrophyllum								
Goodyera oblongfolia	P						P	
Habenaria dilatata								
Habenaria hyperborea								
Habenaria obtusata								
Hieracium albiflorum								
Hieracium cynoglossoides								
Ligusticum verticillatum								
Listera convallarioides								
Mitella breweri					P			
Osmorhiza chilensis	P				P			
Pedicularis bracteosa								
Polemonium pulcherrimum								
Pyrola asarifolia								
Pyrola chlorantha								
Pyrola minor								
Pyrola secunda	P							
Pyrola uniflora								
Saxifraga ferruginea								
Senecio triangularis								
Smilacina stellata	P				P		2	2
Streptopus amplexifolius								
Thalictrum occidentale	P						P	
Tiarella trifoliata		4			6	28	2	10

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	51		52		53		54	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
Trillium ovatum					P			
Urtica dioica					P			
Veratrum viride					2	2		
Veronica americana								
Viola glabella					P			
Viola orbiculata	P							
Xerophyllum tenax								2
Total % Perennial Forbs	2	8	0	0	8	52	8	36
ANNUAL & BIENNIAL FORBS								
Melampyrum lineare								
Verbascum thapsus								
Total % Annual & Biennial Forbs	0	0	0	0	0	0	0	0
CRYPTOGAMS								
Athyrium filix-femina					6	46	4	4
Dryopteris filix-mas							P	
Equisetum arvense								
Equisetum hyemale								
Gymnocarpium dryopteris				6		14		
Lycopodium annotinum								
Moss		2		14		4	8	24
Polystichum andersonii							P	
Polystichum lonchitis								
Pteridium aquilinum								
Thelypteris phegopteris								
Total % Cryptogams	0	2	0	20	6	64	12	28
TOTAL % VEGETATION	98	114	94	128	100	230	98	158
Soil								
Litter	2	2	6	6			2	2
Rock								

P = SPECIES PRESENT BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	55		58		59	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
TREES						
Abies grandis		2	22	24	8	8
Abies lasiocarpa	P		14	14	40	40
Larix occidentalis					14	14
Picea engelmannii	62	62	14	22	10	12
Pinus contorta					10	10
Pinus monticola						
Populus trichocarpa						
Pseudotsuga menziesii					2	4
Thuja plicata						
Tsuga heterophylla	4	6	12	14		
Total % Trees	66	70	62	74	84	88
TREES - DEAD						
Abies grandis						
Pinus contorta						
Total % Trees - Dead	0	0	0	0	0	0
TALL SHRUBS						
Acer glabrum				10	P	
Alnus sinuata	10	12				
Sorbus scopulina					P	
Sorbus sitchensis						
Taxus brevifolia			10	14		2
Total % Tall Shrubs	10	12	10	24	0	2
LOW SHRUBS						
Amelanchier alnifolia						
Cornus stolonifera						
Holodiscus discolor						
Lonicera ciliosa						
Lonicera involucrata						
Lonicera utahensis					P	
Menziesia ferruginea	P		2	2		
Oplopanax horridum						
Pachistima myrsinites						4
Rhamnus alnifolia						
Ribes lacustre			P			
Ribes viscosissimum			P			
Rosa gymnocarpa					P	
Rosa nutkana					P	
Rubus idaeus						

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	55		58		59	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
Salix scouleriana						
Sambucus racemosa				4		
Sheperdia canadensis						
Spiraea betulifolia					P	
Symphoricarpos albus						
Vaccinium cespitosum						
Vaccinium globulare	2	2	P		4	26
Vaccinium myrtillus						
Total % Low Shrubs	2	2	2	6	4	30
SUBSHRUBS						
Arctostaphylos uva-ursi						
Berberis repens						
Chimaphila umbellata					P	
Cornus canadensis						
Linnaea borealis						
Penstemon ellipticus						
Rubus parviflorus			4	6		
Rubus pedatus						
Total % Subshrubs	0	0	4	6	0	0
PERENNIAL GRAMINOIDS						
Bromus vulgaris						
Calamagrostis canadensis		2	P			
Calamagrostis inexpansa						
Calamagrostis rubescens						
Carex concinnoides						
Carex deweyana	P					
Carex rossii						
Carex stipata						
Deschampsia elongata						
Elymus canadensis						
Elymus glaucus			2	4		
Festuca occidentalis						
Festuca subulata						
Glyceria grandis						
Luzula hitchcockii						
Luzula parviflora						
Muhlenbergia asperifolia						
Phleum pratense						
Scirpus maritimus						
Total % Perennial Graminoids	0	2	2	4	0	0

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	55		58		59	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
PERENNIAL FORBS						
Aconitum columbianum						
Actaea rubra						
Adenocaulon bicolor						
Angelica arguta						
Aralia nudicaulis						
Arnica cordifolia				P		8
Asarum caudatum						
Cicuta douglasii						
Circaea alpina						
Cirsium flodmanii						
Clematis columbiana						
Clintonia uniflora	P			6		6
Coptis occidentalis						
Corallorhiza maculata						
Disporum hookeri	P			2	P	
Epilobium angustifolium						
Epilobium glaberrimum						
Fragaria vesca						
Fragaria virginiana						
Galium boreale			2	2		
Galium triflorum						
Geum macrophyllum						
Goodyera oblongfolia					2	2
Habenaria dilatata						
Habenaria hyperborea						
Habenaria obtusata						
Hieracium albiflorum						
Hieracium cynoglossoides						
Ligusticum verticillatum						
Listera convallarioides						
Mitella breweri				2		
Osmorhiza chilensis						
Pedicularis bracteosa						
Polemonium pulcherrimum						
Pyrola asarifolia						
Pyrola chlorantha						
Pyrola minor						
Pyrola secunda			P			4
Pyrola uniflora	P		P			
Saxifraga ferruginea						
Senecio triangularis						
Smilacina stellata	P				P	
Streptopus amplexifolius						
Thalictrum occidentale			P			
Tiarella trifoliata	4	22		8		8

TABLE 2A. (CONTINUED)

TRANSECT NUMBER	55		58		59	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
Trillium ovatum						
Urtica dioica						
Veratrum viride						
Veronica americana						
Viola glabella	P			2		
Viola orbiculata						2
Xerophyllum tenax	P				P	
Total % Perennial Forbs	4	22	2	22	2	30
ANNUAL & BIENNIAL FORBS						
Melampyrum lineare						
Verbascum thapsus						
Total % Annual & Biennial Forbs	0	0	0	0	0	0
CRYPTOGAMS						
Athyrium filix-femina	6	30		2		
Dryopteris filix-mas						
Equisetum arvense	P					
Equisetum hyemale						
Gymnocarpium dryopteris	2	4	8	32		
Lycopodium annotinum						
Moss	2	10	4	32	2	2
Polystichum andersonii						
Polystichum lonchitis						
Pteridium aquilinum					2	8
Thelypteris phegopteris						
Total % Cryptogams	10	44	12	66	4	10
TOTAL % VEGETATION	92	152	94	202	94	160
Soil						
Litter	8	8	6	6	6	6
Rock						

P = SPECIES PRESENT BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 2A. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
TREES					
Abies grandis	16.1%	16.9%	18.9%	11.5%	71.4%
Abies lasiocarpa	3.5%	3.7%	3.5%	2.2%	8.6%
Larix occidentalis	4.5%	4.8%	4.6%	2.8%	37.1%
Picea engelmannii	7.0%	7.4%	8.1%	4.9%	57.1%
Pinus contorta	2.3%	2.4%	2.3%	1.4%	17.1%
Pinus monticola	1.7%	1.7%	1.8%	1.1%	28.6%
Populus trichocarpa	2.0%	2.1%	2.0%	1.2%	5.7%
Pseudotsuga menziesii	4.9%	5.1%	5.6%	3.4%	40.0%
Thuja plicata	9.8%	10.2%	13.7%	8.4%	60.0%
Tsuga heterophylla	21.9%	23.0%	26.0%	15.8%	88.6%
Total % Trees	73.7%	77.3%	86.5%	52.7%	
TREES - DEAD					
Abies grandis	0.1%	0.1%	0.1%	0.0%	2.9%
Pinus contorta	1.4%	1.4%	1.4%	0.9%	5.7%
Total % Trees - Dead	1.5%	1.5%	1.5%	0.9%	
TALL SHRUBS					
Acer glabrum	3.4%	3.6%	5.0%	3.1%	31.4%
Alnus sinuata	1.7%	1.7%	1.9%	1.1%	14.3%
Sorbus scopulina	P	0.0%	0.0%	0.0%	8.6%
Sorbus sitchensis	0.1%	0.1%	0.1%	0.0%	2.9%
Taxus brevifolia	1.3%	1.4%	2.5%	1.5%	20.0%
Total % Tall Shrubs	6.5%	6.8%	9.5%	5.7%	
LOW SHRUBS					
Amelanchier alnifolia	0.0%	0.0%	0.2%	0.1%	5.7%
Cornus stolonifera	0.1%	0.1%	0.4%	0.3%	5.7%
Holodiscus discolor	0.0%	0.0%	0.1%	0.0%	2.9%
Lonicera ciliosa	P	0.0%	0.0%	0.0%	2.9%
Lonicera involucrata	0.0%	0.0%	0.1%	0.0%	2.9%
Lonicera utahensis	0.0%	0.0%	0.2%	0.1%	8.6%
Menziesia ferruginea	0.2%	0.2%	0.2%	0.2%	5.7%
Oplopanax horridum	1.2%	1.3%	3.0%	1.9%	25.7%
Pachistima myrsinites	0.0%	0.0%	0.6%	0.3%	14.3%
Rhamnus alnifolia	0.0%	0.0%	0.2%	0.1%	2.9%
Ribes lacustre	0.0%	0.0%	0.2%	0.1%	8.6%
Ribes viscosissimum	P	0.0%	0.0%	0.0%	2.9%
Rosa gymnocarpa	0.1%	0.1%	0.3%	0.2%	2.9%
Rosa nutkana	P	0.0%	0.0%	0.0%	5.7%
Rubus idaeus	P	0.0%	0.0%	0.0%	5.7%

TABLE 2A. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Salix scouleriana	0.1%	0.1%	0.1%	0.1%	2.9%
Sambucus racemosa	0.1%	0.1%	0.3%	0.2%	2.9%
Sheperdia canadensis	0.0%	0.0%	0.1%	0.0%	5.7%
Spiraea betulifolia	0.1%	0.1%	0.5%	0.3%	20.0%
Symphoricarpos albus	0.2%	0.2%	0.7%	0.5%	5.7%
Vaccinium cespitosum	P	0.0%	0.0%	0.0%	2.9%
Vaccinium globulare	0.3%	0.4%	1.5%	1.0%	28.6%
Vaccinium myrtillus	0.0%	0.0%	0.5%	0.3%	11.4%
Total % Low Shrubs	2.4%	2.5%	9.2%	5.7%	
SUBSHRUBS					
Arctostaphylos uva-ursi	P	0.0%	0.0%	0.0%	2.9%
Berberis repens	P	0.0%	0.0%	0.0%	17.1%
Chimaphila umbellata	0.3%	0.3%	1.0%	0.6%	20.0%
Cornus canadensis	0.0%	0.0%	0.1%	0.1%	2.9%
Linnaea borealis	0.4%	0.4%	2.8%	1.6%	25.7%
Penstemon ellipticus	P	0.0%	0.0%	0.0%	2.9%
Rubus parviflorus	0.2%	0.3%	1.4%	0.9%	14.3%
Rubus pedatus	0.0%	0.0%	0.2%	0.1%	2.9%
Total % Subshrubs	0.9%	1.0%	5.5%	3.3%	
PERENNIAL GRAMINOIDS					
Bromus vulgaris	0.0%	0.0%	0.1%	0.1%	5.7%
Calamagrostis canadensis	0.0%	0.0%	0.1%	0.0%	2.9%
Calamagrostis inexpansa	P	0.0%	0.0%	0.0%	2.9%
Calamagrostis rubescens	0.1%	0.1%	0.3%	0.2%	8.6%
Carex concinnoides	0.0%	0.0%	0.1%	0.1%	2.9%
Carex deweyana	P	0.0%	0.0%	0.0%	5.7%
Carex rossii	P	0.0%	0.0%	0.0%	2.9%
Carex stipata	0.0%	0.0%	0.1%	0.1%	2.9%
Deschampsia elongata	0.1%	0.1%	0.1%	0.0%	2.9%
Elymus glaucus	0.1%	0.1%	0.1%	0.1%	2.9%
Festuca occidentalis	P	0.0%	0.0%	0.0%	5.7%
Festuca subulata	0.1%	0.1%	0.1%	0.1%	2.9%
Glyceria grandis	0.1%	0.1%	1.1%	0.7%	8.6%
Luzula hitchcockii	P	0.0%	0.0%	0.0%	2.9%
Luzula parviflora	0.0%	0.0%	0.1%	0.0%	2.9%
Muhlenbergia asperifolia	0.0%	0.0%	0.1%	0.0%	2.9%
Phleum pratense	P	0.0%	0.0%	0.0%	2.9%
Scirpus maritimus	P	0.0%	0.0%	0.0%	2.9%
Total % Perennial Graminoids	0.5%	0.5%	2.3%	1.4%	
PERENNIAL FORBS					

TABLE 2A. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Aconitum columbianum	0.1%	0.1%	0.4%	0.3%	5.7%
Actaea rubra	0.0%	0.0%	0.3%	0.2%	11.4%
Adenocaulon bicolor	0.1%	0.1%	0.3%	0.2%	14.3%
Angelica arguta	0.1%	0.1%	0.1%	0.1%	2.9%
Aralia nudicaulis	0.0%	0.0%	0.1%	0.0%	2.9%
Arnica cordifolia	0.4%	0.5%	3.0%	1.8%	34.3%
Asarum caudatum	0.0%	0.0%	0.3%	0.2%	2.9%
Cicuta douglasii	P	0.0%	0.0%	0.0%	2.9%
Circaea alpina	0.1%	0.1%	0.6%	0.3%	11.4%
Cirsium flodmanii	P	0.0%	0.0%	0.0%	2.9%
Clematis columbiana	0.1%	0.1%	0.2%	0.1%	2.9%
Clintonia uniflora	0.3%	0.4%	3.0%	1.9%	51.4%
Coptis occidentalis	0.4%	0.5%	3.0%	1.8%	40.0%
Corallorhiza maculata	P	0.0%	0.0%	0.0%	8.6%
Disporum hookeri	0.0%	0.0%	0.7%	0.4%	11.4%
Epilobium angustifolium	P	0.0%	0.0%	0.0%	2.9%
Epilobium glaberrimum	0.0%	0.0%	0.1%	0.1%	2.9%
Fragaria vesca	P	0.0%	0.0%	0.0%	2.9%
Fragaria virginiana	0.1%	0.1%	0.1%	0.0%	2.9%
Galium boreale	0.1%	0.1%	0.1%	0.0%	2.9%
Galium triflorum	0.1%	0.1%	0.3%	0.2%	5.7%
Geum macrophyllum	P	0.0%	0.0%	0.0%	2.9%
Goodyera oblongfolia	0.1%	0.1%	0.1%	0.0%	2.9%
Habenaria dilatata	P	0.0%	0.0%	0.0%	8.6%
Habenaria hyperborea	P	0.0%	0.0%	0.0%	2.9%
Habenaria obtusata	P	0.0%	0.0%	0.0%	2.9%
Hieracium albiflorum	P	0.0%	0.0%	0.0%	25.7%
Hieracium cynoglossoides	P	0.0%	0.0%	0.0%	2.9%
Ligusticum verticillatum	P	0.0%	0.0%	0.0%	5.7%
Listera convallarioides	P	0.0%	0.0%	0.0%	14.3%
Mitella breweri	0.0%	0.0%	0.1%	0.0%	2.9%
Osmorhiza chilensis	0.0%	0.0%	0.2%	0.1%	5.7%
Pedicularis bracteosa	P	0.0%	0.0%	0.0%	2.9%
Polemonium pulcherrimum	P	0.0%	0.0%	0.0%	2.9%
Pyrola asarifolia	0.1%	0.1%	0.2%	0.1%	8.6%
Pyrola chlorantha	0.0%	0.0%	0.1%	0.0%	2.9%
Pyrola minor	P	0.0%	0.0%	0.0%	2.9%
Pyrola secunda	0.0%	0.0%	0.3%	0.2%	8.6%
Pyrola uniflora	0.0%	0.0%	0.1%	0.0%	2.9%
Saxifraga ferruginea	0.0%	0.0%	0.1%	0.0%	2.9%
Senecio triangularis	0.1%	0.1%	0.4%	0.2%	2.9%
Smilacina stellata	0.2%	0.1%	2.6%	1.7%	28.6%
Streptopus amplexifolius	0.1%	0.1%	0.4%	0.2%	8.6%
Thalictrum occidentale	0.1%	0.1%	0.6%	0.3%	17.1%
Tiarella trifoliata	0.6%	0.7%	3.8%	2.8%	51.4%
Trillium ovatum	0.0%	0.0%	0.1%	0.0%	5.7%

TABLE 2A. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Urtica dioica	P	0.0%	0.0%	0.0%	5.7%
Veratrum viride	0.1%	0.0%	0.2%	0.1%	5.7%
Veronica americana	0.0%	0.0%	0.1%	0.0%	2.9%
Viola glabella	0.0%	0.0%	0.8%	0.5%	25.7%
Viola orbiculata	0.2%	0.2%	0.6%	0.3%	20.0%
Xerophyllum tenax	1.0%	1.0%	2.9%	1.9%	25.7%
Total % Perennial Forbs	4.3%	4.6%	26.3%	16.0%	
ANNUAL & BIENNIAL FORBS					
Melampyrum lineare	0.1%	0.1%	0.1%	0.1%	2.9%
Verbascum thapsus	P	0.0%	0.0%	0.0%	5.7%
Total % Annual & Biennial Forbs	0.1%	0.1%	0.1%	0.1%	
CRYPTOGAMS					
Athyrium filix-femina	3.1%	3.3%	8.2%	5.0%	45.7%
Dryopteris filix-mas	0.1%	0.1%	0.1%	0.0%	2.9%
Equisetum arvense	0.0%	0.0%	0.6%	0.4%	8.6%
Equisetum hyemale	P	0.0%	0.0%	0.0%	2.9%
Gymnocarpium dryopteris	0.6%	0.6%	5.7%	3.5%	37.1%
Lycopodium annotinum	P	0.0%	0.0%	0.0%	2.9%
Moss	1.0%	1.1%	7.0%	4.2%	80.0%
Polystichum andersonii	P	0.0%	0.0%	0.0%	2.9%
Polystichum lonchitis	P	0.0%	0.0%	0.0%	2.9%
Pteridium aquilinum	0.6%	0.6%	1.8%	1.1%	25.7%
Thelypteris phegopteris	P	0.0%	0.0%	0.0%	2.9%
Total % Cryptogams	5.4%	5.7%	23.4%	14.2%	
TOTAL % VEGETATION	95.3%	100.0%	164.3%	100.0%	
Soil	0.0%				
Litter	4.6%				
Rock	0.1%				

P = SPECIES PRESENT BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 3A. CONIFEROUS FOREST TREE DENSITY, REPRODUCTION, HEIGHT, DBH, BASAL AREA AND VOLUME, AND AGE DATA - 1988
MONTANA PROJECT

DENSITY

TRANSECT NUMBER	1	4	7	8	9	10	11	15	16	17	18	21	23	24	25
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TREES															
Abies grandis	1	4		1	10	1	14	1	1	14	9	2		2	
Abies lasiocarpa															
Larix occidentalis					4		1	8		1	1		8		
Picea engelmannii	3	1		1	1	1		2	1			1		1	3
Pinus contorta							1				8				
Pinus monticola					1					11	6	1	4		1
Populus trichocarpa															
Pseudotsuga menziesii				1	4		2	13		4	5	1	4		
Thuja plicata									16	7	1	6	2	9	13
Tsuga heterophylla	1	1	6	6		2			5	2	2	6	15	10	7
Total Trees	5	6	6	9	20	4	18	24	23	39	32	17	33	22	24
TREES (DEAD)															
Abies grandis										1		1			
Abies lasiocarpa															
Larix occidentalis										1			4		
Picea engelmannii												2			
Pinus contorta										3	2				
Pinus monticola										3	1		11		
Tsuga heterophylla													2	1	1
Total Trees (Dead)	0	0	0	0	0	0	0	0	0	8	3	3	17	1	1

TABLE 3A. (CONTINUED)

DENSITY

TRANSECT NUMBER	28	29	30	36	37	38	39	40	41	42	47	49	50	51	52
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TREES															
Abies grandis		5	4	5		5	5	16	32	13	3			7	
Abies lasiocarpa															
Larix occidentalis				4			6	1	2						
Picea engelmannii	5	1	2	3	1						3	4			
Pinus contorta						17	17		8	5					
Pinus monticola			1			5	1		1	8					
Populus trichocarpa					2										
Pseudotsuga menziesii				1			1		2	1				2	
Thuja plicata	4		2		6	1	35		22	3	3				
Tsuga heterophylla	7		7	1		1	3		4	2	8		27	1	21
Total Trees	16	6	16	14	9	29	68	17	71	32	17	4	27	10	21
TREES (DEAD)															
Abies grandis			2	1				1	2	4				1	
Abies lasiocarpa															
Larix occidentalis			2												
Picea engelmannii	4		1												
Pinus contorta						17	5		4	13					
Pinus monticola						1								1	
Tsuga heterophylla										1					
Total Trees (Dead)	4	0	5	1	0	18	5	1	6	18	0	0	0	2	0

TABLE 3A. (CONTINUED)

DENSITY

TRANSECT NUMBER	53	54	55	58	59
	--	--	--	--	--
TREES					
Abies grandis		3	1	2	1
Abies lasiocarpa		13	3	3	2
Larix occidentalis					2
Picea engelmannii	1		6	6	3
Pinus contorta					1
Pinus monticola					
Populus trichocarpa					
Pseudotsuga menziesii					
Thuja plicata					
Tsuga heterophylla	1	1	1	2	
Total Trees	2	17	11	13	9
TREES (DEAD)					
Abies grandis					
Abies lasiocarpa		2			1
Larix occidentalis					
Picea engelmannii			2	2	
Pinus contorta					
Pinus monticola					
Tsuga heterophylla					
Total Trees (Dead)	0	2	2	2	1

TABLE 3A. (CONTINUED)

DENSITY

	MEAN NO. TREES/ 125 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TREES				
Abies grandis	4.6	149.9	23.4%	
Abies lasiocarpa	0.6	19.4	3.0%	
Larix occidentalis	1.1	35.2	5.5%	
Picea engelmannii	1.4	46.3	7.2%	
Pinus contorta	1.6	52.7	8.1%	
Pinus monticola	1.1	37.0	5.8%	
Populus trichocarpa	0.1	1.9	0.2%	
Pseudotsuga menziesii	1.2	37.9	6.0%	
Thuja plicata	3.7	120.3	18.8%	
Tsuga heterophylla	4.3	138.8	22.0%	
Total Trees	19.7	639.4	100.0%	15.3
TREES (DEAD)				
Abies grandis	0.4	12.0	13.0%	
Abies lasiocarpa	0.1	2.8	3.0%	
Larix occidentalis	0.2	6.5	7.0%	
Picea engelmannii	0.3	10.2	11.0%	
Pinus contorta	1.3	40.7	44.0%	
Pinus monticola	0.5	15.7	17.0%	
Tsuga heterophylla	0.1	4.6	5.0%	
Total Trees (Dead)	2.9	92.5	100.0%	4.9

TABLE 3A. (CONTINUED)

REPRODUCTION

TRANSECT NUMBER	1	4	7	8	9	10	11	15	16	17	18	21	23	24	25	28	29	30	36
Abies grandis	2	1		1		1		7		22	5							6	1
Pseudotsuga menziesii				1							2								
Thuja plicata									2			1		1	1			2	
Tsuga heterophylla			4			123	2	3		13	3	P			28			161	17
Total Tree Reproduction	2	1	4	2	0	124	2	10	2	35	10	1	0	1	29	0	0	169	18

TRANSECT NUMBER	37	38	39	40	41	42	47	49	50	51	52	53	54	55	58	59
Abies grandis		6	9	2		4	3							1		5
Pseudotsuga menziesii																
Thuja plicata	1		22		11	2	2									
Tsuga heterophylla	5	3	3	3			1		6	3	44					
Total Tree Reproduction	6	9	34	5	11	6	6	0	6	3	44	0	0	1	0	5

	MEAN SHRUBS/25 SQ M	MEAN SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
Abies grandis	2.2	351.5	13.9%	
Pseudotsuga menziesii	0.1	13.9	0.5%	
Thuja plicata	1.2	208.1	8.3%	
Tsuga heterophylla	12.1	1951.8	77.3%	
Total Tree Reproduction	15.6	2525.3	100.0%	34.5

TABLE 3A. (CONTINUED)

HEIGHT (FEET)

TRANSECT NUMBER	1	4	7	8	9	10	11	15	16	17	18	21	23	24	25
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TREES															
Abies grandis	3	19		90	40	85	37	51	8	14	29	24		61	
Abies lasiocarpa															
Larix occidentalis					55		50	76		87	72		75		
Picea engelmannii	40	99		38	10	97		45	90			88		62	35
Pinus contorta							70				30				
Pinus monticola					32					14	13	78	73		21
Pseudotsuga menziesii				105	48		100	55		18	18	87	67		
Thuja plicata									42	14	6	58	63	47	42
Tsuga heterophylla	16	46	46	24		43			21	12	10	27	40	29	8
Total Trees															
TREES (DEAD)															
Abies grandis												38			
Larix occidentalis															
Picea engelmannii												31			
Pinus contorta															
Pinus moniticola										12					
Total Dead Trees															

TABLE 3A. (CONTINUED)

HEIGHT (FEET)

TRANSECT NUMBER	28	29	30	36	37	38	39	40	41	42	47	49	50	51	52
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TREES															
Abies grandis		9	66	44		20	17	27	33	23	17			67	
Abies lasiocarpa															
Larix occidentalis				113			73	102							
Picea engelmannii	57	12	39	70							32	24			
Pinus contorta						54	38		60	45					
Pinus monticola			114			19	8		20	20					
Pseudotsuga menziesii				68			6		50	9				88	
Thuja plicata	45		46	70	16	8	10		14	23	31				
Tsuga heterophylla	62		24			6	18		23	18	41		30	7	12
Total Trees															
TREES (DEAD)															
Abies grandis															
Larix occidentalis			96												
Picea engelmannii															
Pinus contorta										16					
Pinus moniticola														99	
Total Dead Trees															

TABLE 3A. (CONTINUED)

HEIGHT (FEET)

TRANSECT NUMBER	53	54	55	58	59		MINIMUM	MAXIMUM	MEAN
	--	--	--	--	--		---	---	---
TREES						TREES			
Abies grandis		22	16	60	41	Abies grandis	3	96	31.6
Abies lasiocarpa		35	11	54	82	Abies lasiocarpa	5	94	38.7
Larix occidentalis					90	Larix occidentalis	40	128	79.0
Picea engelmannii	80		58	24	36	Picea engelmannii	5	99	45.9
Pinus contorta					81	Pinus contorta	20	81	49.1
Pinus monticola						Pinus monticola	6	114	25.2
Pseudotsuga menziesii						Pseudotsuga menziesii	6	109	50.8
Thuja plicata						Thuja plicata	5	101	26.0
Tsuga heterophylla	95	1	39	60		Tsuga heterophylla	1	108	34.1
Total Trees						Total Trees			37.1
TREES (DEAD)						TREES (DEAD)			
Abies grandis						Abies grandis	38	38	38.0
Larix occidentalis						Larix occidentalis	96	96	96.0
Picea engelmannii				28		Picea engelmannii	13	42	29.0
Pinus contorta						Pinus contorta	16	16	16.0
Pinus moniticola						Pinus moniticola	12	99	55.5
Total Dead Trees						Total Dead Trees			47.3

TABLE 3A. (CONTINUED)

DBH (INCHES)

MEAN DIAMETER AT BREAST HEIGHT (DBH) IN INCHES

TRANSECT NUMBER	1	4	7	8	9	10	11	15	16	17	18	21	23	24	25
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TREES															
Abies grandis	0.4	3.0		18.1	7.5	25.2	6.1	7.5	1.2	1.7	4.0	4.5		11.0	
Abies lasiocarpa															
Larix occidentalis					7.7		5.9	10.5		15.4	9.4		8.1		
Picea engelmannii	7.1	28.0		8.3	1.6	24.4		6.7	8.7			14.2		9.8	7.0
Pinus contorta							16.1				3.1				
Pinus monticola					3.1					1.8	1.5	12.2	8.8		5.1
Populus trichocarpa															
Pseudotsuga menziesii				31.1	8.4		25.2	8.3		2.5	2.3	16.5	8.9		
Thuja plicata									7.2	2.0	0.4	12.2	13.6	10.7	9.1
Tsuga heterophylla	4.3	11.4	10.4	5.0		14.8			3.1	1.2	0.8	5.7	4.9	4.5	2.2
Total Trees															
TREES (DEAD)															
Abies grandis										2.8		7.9			
Abies lasiocarpa															
Larix occidentalis										10.2			2.2		
Picea engelmannii												7.3			
Pinus contorta										9.3	8.7				
Pinus moniticola										2.4	0.4		3.3		
Pseudotsuga menziesii													7.9		
Tsuga heterophylla													3.1	2.0	6.7
Total Dead Trees															

TABLE 3A. (CONTINUED)

DBH (INCHES)

MEAN DBH IN INCHES TRANSECT NUMBER	28	29	30	36	37	38	39	40	41	42	47	49	50	51	52
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TREES															
Abies grandis		1.1	8.9	6.9		4.7	2.5	4.7	4.2	3.5	3.7			12.0	
Abies lasiocarpa															
Larix occidentalis				19.6			6.9	16.5	6.9						
Picea engelmannii	5.8	2.0	6.5	13.3	30.3						5.4	4.6			
Pinus contorta						6.3	4.7		6.5	4.5					
Pinus monticola			18.9			2.5	0.8		2.0	3.0					
Populus trichocarpa					34.1										
Pseudotsuga menziesii				9.8			0.4		5.9	0.8				20.1	
Thuja plicata	5.9		5.3		2.8	1.2	1.2		1.7	3.7	5.5				
Tsuga heterophylla	8.5		3.2	14.2		0.4	2.1		3.0	3.7	7.6		6.1	1.2	1.5
Total Trees															
TREES (DEAD)															
Abies grandis			3.3	8.3				13.8	2.4	2.9				2.4	
Abies lasiocarpa															
Larix occidentalis			12.2												
Picea engelmannii	1.7		2.4												
Pinus contorta						5.8	3.7		3.3	6.1					
Pinus moniticola						1.2								26.4	
Pseudotsuga menziesii															
Tsuga heterophylla										3.5					
Total Dead Trees															

TABLE 3A. (CONTINUED)

MEAN DBH IN INCHES

TRANSECT NUMBER	53	54	55	58	59
	--	--	--	--	--
TREES					
Abies grandis		5.0	2.4	12.4	5.5
Abies lasiocarpa		8.9	2.0	7.7	15.9
Larix occidentalis					14.8
Picea engelmannii	22.0		10.4	3.4	5.2
Pinus contorta					10.6
Pinus monticola					
Populus trichocarpa					
Pseudotsuga menziesii					
Thuja plicata					
Tsuga heterophylla	46.5	2.0	8.7	7.7	
TREES (DEAD)					
Abies grandis					
Abies lasiocarpa		7.3			3.5
Larix occidentalis					
Picea engelmannii			3.9	3.9	
Pinus contorta					
Pinus moniticola					
Pseudotsuga menziesii					
Tsuga heterophylla					

DBH (INCHES)

	MINIMUM	MAXIMUM	MEAN
	---	---	---
TREES			
Abies grandis	0.4	25.2	5.2
Abies lasiocarpa	0.4	28.3	8.4
Larix occidentalis	3.1	26.8	10.3
Picea engelmannii	1.2	30.3	8.4
Pinus contorta	2.8	16.1	5.8
Pinus monticola	0.4	18.9	3.1
Populus trichocarpa	33.1	35.0	34.1
Pseudotsuga menziesii	0.4	31.1	8.7
Thuja plicata	0.4	26.8	4.7
Tsuga heterophylla	0.4	46.5	5.2
Total Trees			5.9
TREES (DEAD)			
Abies grandis	1.6	13.8	4.5
Abies lasiocarpa	3.5	10.2	6.0
Larix occidentalis	1.6	12.2	14.4
Picea engelmannii	1.2	11.0	3.6
Pinus contorta	1.6	9.8	5.8
Pinus moniticola	0.4	26.4	4.2
Pseudotsuga menziesii	7.9	7.9	7.9
Tsuga heterophylla	2.0	6.7	3.7
Total Dead Trees			5.1

TABLE 3A. (CONTINUED)

BASAL AREA AND VOLUME

	THOUSAND BOARD FEET PER ACRE	BASAL AREA (SQ FEET) ALL TREES
Abies grandis	124.1	2649.9
Abies lasiocarpa	44.9	273.3
Larix occidentalis	117.0	659.1
Picea engelmannii	61.2	108.2
Pinus controta	10.2	431.4
Pinus monticola	23.6	95.4
Populus tremuloides	--	3.9
Pseudotsuga menziesii	135.0	593.6
Thuja plicata	34.4	362.5
Tsuga heterophylla	165.3	983.9
Total Trees	715.7	6161.2

TABLE 3A. (CONTINUED)

AGE (YEARS)

TRANSECT NUMBER	1	4	7	8	9	10	11	15	16	17	18	21	23	24	25	28	29	30	36	37	38	39	40	41	42
CONIFEROUS FOREST																									
Abies grandis					76						82													80	89
Larix occidentalis																			240				218		
Picea engelmannii	88	170				160+			70						150+		37			110+					
Pinus contorta																					89	92			
Pinus monticola										68		130	85												
Populus trichocarpa																									
Pseudotsuga menziesii				150+			208	110										198							
Thuja plicata														170+											
Tsuga heterophylla			104													60									

	NUMBER TREES CORED	MEAN	MINIMUM	MAXIMUM
Abies grandis	4	82	76	89
Larix occidentalis	2	229	218	240
Picea engelmannii	7	*112	37	160+
Pinus contorta	2	91	89	92
Pinus monticola	3	94	68	130
Pseudotsuga menxiesii	4	*167	110	208
Thuja plicata	1	*170	170+	170+
Tsuga heterophylla	2	82	60	104
Total Trees	24	124	37	240

* The age estimate for one or more trees in this category is too low, because the increment borer could estimate tree age only for trees of 32 inch diameter or less.

TABLE 4A. CONIFEROUS FOREST SHRUB DENSITY DATA - 1988
MONTANA PROJECT

TRANSECT NUMBER	1	4	7	8	9	10	11	15	16	17	18	21	23	24	25	28	29	30
TALL SHRUBS																		
Acer glabrum	1	1			8	3	2	18										
Alnus sinuata						3											5	
Sorbus scopulina						2												
Taxus brevifolia	5													3				
Total Tall Shrubs	6	1	0	0	8	8	2	18	0	0	0	0	0	3	0	0	5	0
LOW SHRUBS																		
Amelanchier alnifolia					1			1		2	12					2		
Cornus stolonifera																	3	
Holodiscus discolor											3							
Lonicera utahensis					1		2	6			9	P						
Menziesia ferruginea	1	1												1				
Oplopanax horridum	9	6	2	6		4			2					17	11			
Pachistima myrsinites					30	1	27	36		12	24							3
Rhamnus alnifolia																		
Ribes lacustre	4	1																
Ribes viscosissiumum																		
Rosa gymnocarpa							14	2			8							4
Rosa nutkana					1												2	
Rubus idaeus																		
Salix scouleriana				1						2								
Sambucus racemosa						1												
Shepheria canadensis											4							
Spiraea betulifolia					6		1			5	7					1		7
Symphoricarops albus						10		3									5	
Vaccinium globulare		39	1		28	2	24	3	2		12	6		1	P			
Vaccinium myrtillus										36		27			P			14
Vaccinium scoparium	1																	
Total Low Shrubs	15	47	3	7	67	18	68	51	4	57	79	33	0	19	11	3	10	28

TABLE 4A. (CONTINUED)

TRANSECT NUMBER	1	4	7	8	9	10	11	15	16	17	18	21	23	24	25	28	29	30
SUBSHRUBS																		
Berberis repens																		3
Rubus parviflorus		1				1		12	2								P	
Total Subshrubs	0	1	0	0	0	1	0	12	2	0	0	0	0	0	0	0	0	3
TOTAL SHRUBS	21	49	3	7	75	27	70	81	6	57	79	33	0	22	11	3	15	31

TABLE 4A. (CONTINUED)

TRANSECT NUMBER	36	37	38	39	40	41	42	47	49	50	51	52	53	54	55	58	59
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TALL SHRUBS																	
Acer glabrum								2	11		2		6				
Alnus sinuata		P													1		
Sorbus scopulina																	3
Taxus brevifolia		3			5			P	P							1	
Total Tall Shrubs	0	3	0	0	5	0	0	2	11	0	2	0	6	0	1	1	3
LOW SHRUBS																	
Amelanchier alnifolia	13	1					1	P									
Cornus stolonifera																	
Holodiscus discolor																	
Lonicera utahensis				P	P	1								10			
Menziesia ferruginea															5	1	
Oplopanax horridum		1						2		18			10				
Pachistima myrsinites			1	44			4	16	7		6						41
Rhamnus alnifolia		6															
Ribes lacustre																4	
Ribes viscosissimum																1	
Rosa gymnocarpa	54	2	33	11	2		2				2						
Rosa nutkana	1																3
Rubus idaeus														1			
Salix scouleriana			1														
Sambucus racemosa									1							3	
Shepheria canadensis			P														
Spiraea betulifolia	9		59	9	1		6										
Symphoricarops albus		51							P								
Vaccinium globulare	13		7	P	6					P	2	53		67	7	19	74
Vaccinium myrtillus	3			16										9	2		
Vaccinium scoparium																	
Total Low Shrubs	93	61	101	80	9	1	13	18	8	18	10	53	10	87	14	28	118

TABLE 4A. (CONTINUED)

TRANSECT NUMBER	36	37	38	39	40	41	42	47	49	50	51	52	53	54	55	58	59
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SUBSHRUBS																	
Berberis repens			36	2													
Rubus parviflorus								4	28					5		7	3
Total Subshrubs	0	0	36	2	0	0	0	4	28	0	0	0	0	5	0	7	3
TOTAL SHRUBS	93	64	137	82	14	1	13	24	47	18	12	53	16	92	15	36	124

TABLE 4A. (CONTINUED)

	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TALL SHRUBS				
Acer glabrum	1.5	249.8	3.8%	
Alnus sinuata	0.3	41.6	0.6%	
Sorbus scopulina	0.1	23.1	0.3%	
Taxus brevifolia	0.5	78.6	1.2%	
Total Tall Shrubs	2.4	393.1	5.9%	
LOW SHRUBS				
Amelanchier alnifolia	0.94	152.6	2.3%	
Cornus stolonifera	0.09	13.9	0.2%	
Holodiscus discolor	0.09	13.9	0.2%	
Lonicera utahensis	0.83	134.1	2.0%	
Menziesia ferruginea	0.26	41.6	0.6%	
Oplopanax horridum	2.51	407.0	6.1%	
Pachistima myrsinites	7.20	1165.5	17.6%	
Rhamnus alnifolia	0.17	27.8	0.4%	
Ribes lacustre	0.26	41.6	0.6%	
Ribes viscosissiumum	0.03	4.6	0.1%	
Rosa gymnocarpa	3.83	619.8	9.4%	
Rosa nutkana	0.20	32.4	0.5%	
Rubus idaeus	0.03	4.6	0.1%	
Salix scouleriana	0.11	18.5	0.3%	
Sambucus racemosa	0.14	23.1	0.3%	
Shepheria canadensis	0.11	18.5	0.3%	
Spiraea betulifolia	3.17	513.4	7.8%	
Symphoricarops albus	1.97	319.1	4.8%	
Vaccinium globulare	10.46	1692.8	25.6%	
Vaccinium myrtillus	3.06	494.9	7.5%	
Vaccinium scoparium	0.03	4.6	0.1%	
Total Low Shrubs	35.5	5744.3	86.8%	
SUBSHRUBS				
Berberis repens	1.2	189.6	2.9%	
Rubus parviflorus	1.8	291.4	4.4%	
Total Subshrubs	3.0	481.0	7.3%	
TOTAL SHRUBS	40.9	6618.4	100.0%	35.8

TABLE 5A. HERBACEOUS PRODUCTION DATA FOR CONIFEROUS FORESTS, CLEARCUTS, SUBALPINE, AND SHRUBLANDS - 1988 MONTANA PROJECT

CONIFEROUS FOREST

SAMPLE NUMBER	1A	1B	1C	1D	MEAN	4A	4B	4C	4D	MEAN	7A	7B	7C	7D	MEAN
Perennial Graminoids	7.3				1.8										
Annual Graminoids															
Perennial Forbs	55.7	11.4	3.5	3.3	18.5	1.4	31.4	21.5	5.6	15.0	10.2	7.5	0.8	1.5	5.0
Annual & Biennial Forbs															
Total Production	63.0	11.4	3.5	3.3	20.3	1.4	31.4	21.5	5.6	15.0	10.2	7.5	0.8	1.5	5.0

SAMPLE NUMBER	8A	8B	8C	8D	MEAN	9A	9B	9C	9D	MEAN	10A	10B	10C	10D	MEAN
Perennial Graminoids															
Annual Graminoids															
Perennial Forbs	2.3	1.2	2.0	0.0	1.4	1.0	4.7	0.1	0.3	1.5	93.8	26.1	8.7	28.7	39.3
Annual & Biennial Forbs															
Total Production	2.3	1.2	2.0	0.0	1.4	1.0	4.7	0.1	0.3	1.5	93.8	26.1	8.7	28.7	39.3

SAMPLE NUMBER	11A	11B	11C	11D	MEAN	15A	15B	15C	15D	MEAN	16A	16B	16C	16D	MEAN
Perennial Graminoids						0.4	0.1			0.1					
Annual Graminoids															
Perennial Forbs	3.6	30.0	0.7	46.7	20.3	9.2	15.2	15.8	7.4	11.9	15.0	4.5	10.5	4.7	8.7
Annual & Biennial Forbs															
Total Production	3.6	30.0	0.7	46.7	20.3	9.6	15.3	15.8	7.4	12.0	15.0	4.5	10.5	4.7	8.7

TABLE 5A. (CONTINUED)

CONIFEROUS FOREST

SAMPLE NUMBER	17A	17B	17C	17D	MEAN	18A	18B	18C	18D	MEAN	21A	21B	21C	21D	MEAN
Perennial Graminoids	0.1	3.2	0.1	1.7	1.3			0.9		0.2					
Annual Graminoids															
Perennial Forbs	12.2	164.7	11.1	16.4	51.1	36.7	10.3	2.3	42.2	22.9	0.5	1.2	2.9	0.5	1.3
Annual & Biennial Forbs															
Total Production	12.3	167.9	11.2	18.1	52.4	36.7	10.3	3.2	42.2	23.1	0.5	1.2	2.9	0.5	1.3

SAMPLE NUMBER	23A	23B	23C	23D	MEAN	24A	24B	24C	24D	MEAN	25A	25B	25C	25D	MEAN
Perennial Graminoids						0.1				0.03	1.5				0.4
Annual Graminoids															
Perennial Forbs	0.0	0.0	0.0	0.0	0.0	25.2	5.9	0.5	18.2	12.5	5.7	11.0	7.0	25.7	12.4
Annual & Biennial Forbs															
Total Production	0.0	0.0	0.0	0.0	0.0	25.3	5.9	0.5	18.2	12.5	7.2	11.0	7.0	25.7	12.7

SAMPLE NUMBER	28A	28B	28C	28D	MEAN	29A	29B	29C	29D	MEAN	30A	30B	30C	30D	MEAN
Perennial Graminoids						1.5		5.5	15.9	5.7	8.3				2.1
Annual Graminoids															
Perennial Forbs	3.9	1.3	0.2	0.6	1.5	51.6	101.3	43.4	106.2	75.6	1.4	5.2	1.4	0.4	2.1
Annual & Biennial Forbs															
Total Production	3.9	1.3	0.2	0.6	1.5	53.1	101.3	48.9	122.1	81.4	9.7	5.2	1.4	0.4	4.2

TABLE 5A. (CONTINUED)

CONIFEROUS FOREST

SAMPLE NUMBER	36A	36B	36C	36D	MEAN	37A	37B	37C	37D	MEAN	38A	38B	38C	38D	MEAN
Perennial Graminoids							1.3	2.1	1.6	1.3			7.3	0.9	2.1
Annual Graminoids															
Perennial Forbs	13.2	13.9	35.4	35.3	24.5	52.6	63.9	4.4	59.6	45.1	6.6	18.4	1.2	14.6	10.2
Annual & Biennial Forbs															
Total Production	13.2	13.9	35.4	35.3	24.5	52.6	65.2	6.5	61.2	46.4	6.6	18.4	8.5	15.5	12.3

SAMPLE NUMBER	39A	39B	39C	39D	MEAN	40A	40B	40C	40D	MEAN	41A	41B	41C	41D	MEAN
Perennial Graminoids															
Annual Graminoids															
Perennial Forbs	1.1	0.7	3.5	1.4	1.7	29.0	18.8	12.9	1.8	15.6	0.1	1.0	0.1	0.0	0.3
Annual & Biennial Forbs															
Total Production	1.1	0.7	3.5	1.4	1.7	29.0	18.8	12.9	1.8	15.6	0.1	1.0	0.1	0.0	0.3

SAMPLE NUMBER	42A	42B	42C	42D	MEAN	47A	47B	47C	47D	MEAN	49A	49B	49C	49D	MEAN
Perennial Graminoids	1.0	0.1			0.3		0.1			0.03					
Annual Graminoids															
Perennial Forbs	20.0	6.8	45.7	6.9	19.9	8.3	17.1	1.3	20.5	11.8	0.0	4.9	0.0	0.0	1.2
Annual & Biennial Forbs															
Total Production	21.0	6.9	45.7	6.9	20.1	8.3	17.2	1.3	20.5	11.8	0.0	4.9	0.0	0.0	1.2

TABLE 5A. (CONTINUED)

CONIFEROUS FOREST

SAMPLE NUMBER	50A	50B	50C	50D	MEAN	51A	51B	51C	51D	MEAN	52A	52B	52C	52D	MEAN
Perennial Graminoids															
Annual Graminoids															
Perennial Forbs	8.1	0.5	12.3	0.5	5.4	3.2	3.4	0.4	0.1	1.8	1.0	0.1	0.0	0.0	0.3
Annual & Biennial Forbs															
Total Production	8.1	0.5	12.3	0.5	5.4	3.2	3.4	0.4	0.1	1.8	1.0	0.1	0.0	0.0	0.3

SAMPLE NUMBER	53A	53B	53C	53D	MEAN	54A	54B	54C	54D	MEAN	55A	55B	55C	55D	MEAN
Perennial Graminoids			2.0		0.5	1.0		3.5	3.3	2.0		5.2		2.6	2.0
Annual Graminoids															
Perennial Forbs	28.5	48.3	20.3	49.3	36.6	17.7	37.3	31.1	10.0	24.0	10.3	35.0	34.5	35.4	28.8
Annual & Biennial Forbs															
Total Production	28.5	48.3	22.3	49.3	37.1	18.7	37.3	34.6	13.3	26.0	10.3	40.2	34.5	38.0	30.8

SAMPLE NUMBER	58A	58B	58C	58D	MEAN	59A	59B	59C	59D	MEAN
Perennial Graminoids			4.7	0.1	1.2					
Annual Graminoids										
Perennial Forbs	12.8	7.1	8.4	4.3	8.2	1.1	0.5	25.4	25.3	13.1
Annual & Biennial Forbs										
Total Production	12.8	7.1	13.1	4.4	9.4	1.1	0.5	25.4	25.3	13.1

TABLE 5A. (CONTINUED)

CLEARCUT

SAMPLE NUMBER	2A	2B	2C	2D	MEAN	3A	3B	3C	3D	MEAN	14A	14B	14C	14D	MEAN
Perennial Graminoids	24.2	6.8	1.2	28.0	15.1		1.4	0.6	1.5	0.9				1.3	0.3
Annual Graminoids				0.5	0.1										
Perennial Forbs	46.4	11.3	37.2	183.0	69.5	20.8	83.3	38.5	19.7	40.6	13.9	6.4	14.1	8.0	10.6
Annual & Biennial Forbs															
Total Production	70.6	18.1	38.4	211.5	84.7	20.8	84.7	39.1	21.2	41.5	13.9	6.4	14.1	9.3	10.9

SAMPLE NUMBER	19A	19B	19C	19D	MEAN	20A	20B	20C	20D	MEAN	22A	22B	22C	22D	MEAN
Perennial Graminoids	52.6	31.2	8.4	10.4	25.7	13.9	47.7	1.7	4.9	17.1	3.9				1.0
Annual Graminoids															
Perennial Forbs	1.6	25.6	0.6	13.3	10.3	15.4	2.4	13.2	5.1	9.0	59.0	104.7	92.4	44.8	75.2
Annual & Biennial Forbs															
Total Production	54.2	56.8	9.0	23.7	35.9	29.3	50.1	14.9	10.0	26.1	62.9	104.7	92.4	44.8	76.2

TABLE 5A. (CONTINUED)

CLEARCUT

SAMPLE NUMBER	26A	26B	26C	26D	MEAN	27A	27B	27C	27D	MEAN	31A	31B	31C	31D	MEAN
Perennial Graminoids	6.2	5.4	30.1	78.9	30.2	41.5	35.0	34.9	23.9	33.8	1.3	7.8	11.1	28.3	12.1
Annual Graminoids															
Perennial Forbs	19.3	16.8	28.7	17.8	20.7	15.3	18.5	10.3	10.4	13.6	11.7	7.1	24.9	19.0	15.7
Annual & Biennial Forbs		0.5	16.4		4.2								0.9		0.2
Total Production	25.5	22.7	75.2	96.7	55.0	56.8	53.5	45.2	34.3	47.5	13.0	14.9	36.9	47.3	28.0

SAMPLE NUMBER	32A	32B	32C	32D	MEAN	33A	33B	33C	33D	MEAN	34A	34B	34C	34D	MEAN
Perennial Graminoids	25.2	32.6	39.9	22.2	30.0	0.2	10.5	29.1	60.2	25.0	2.1	5.4	7.5	5.7	5.2
Annual Graminoids															
Perennial Forbs	16.4	27.9	15.4	10.3	17.5	62.4	25.7	6.8	3.3	24.6	39.0	2.5	5.6	6.1	13.3
Annual & Biennial Forbs			0.4		0.1										
Total Production	41.6	60.5	55.7	32.5	47.6	62.6	36.2	35.9	63.5	49.6	41.1	7.9	13.1	11.8	18.5

SAMPLE NUMBER	35A	35B	35C	35D	MEAN	43A	43B	43C	43D	MEAN
Perennial Graminoids	5.0	3.2	0.9	10.8	5.0					
Annual Graminoids										
Perennial Forbs	19.0	37.0	50.0	11.6	29.4	0.3	0.4	0.1	0.0	0.2
Annual & Biennial Forbs										
Total Production	24.0	40.2	50.9	22.4	34.4	0.3	0.4	0.1	0.0	0.2

TABLE 5A. (CONTINUED)

SHRUBLAND

SAMPLE NUMBER	5A	5B	5C	5D	MEAN	6A	6B	6C	6D	MEAN	12A	12B	12C	12D	MEAN
Perennial Graminoids			0.3	2.0	0.6			63.1		15.8		23.8			23.8
Annual Graminoids															
Perennial Forbs	44.2	208.9	1.8	2.6	64.4	4.8	2.4	58.6	4.9	17.7	253.2	14.5	108.3	172.9	137.2
Annual & Biennial Forbs															
Total Production	44.2	208.9	2.1	4.6	65.0	4.8	2.4	121.7	4.9	33.5	253.2	38.3	108.3	172.9	143.2

SAMPLE NUMBER	13A	13B	13C	13D	MEAN	46A	46B	46C	46D	MEAN	48A	48B	48C	48D	MEAN
Perennial Graminoids	42.6	30.7	12.7	12.5	24.6		0.4			0.1			0.2		0.1
Annual Graminoids															
Perennial Forbs	67.1	140.0	237.4	171.0	153.9	6.9	0.1	0.1	0.0	1.8	6.0	39.7	12.3	22.0	20.0
Annual & Biennial Forbs															
Total Production	109.7	170.7	250.1	183.5	178.5	6.9	0.5	0.1	0.0	1.9	6.0	39.7	12.5	22.0	20.1

SAMPLE NUMBER	56A	56B	56C	56D	MEAN	57A	57B	57C	57D	MEAN
Perennial Graminoids	2.3	0.4	177.2	13.1	48.3	63.5	49.6	32.1		36.3
Annual Graminoids										
Perennial Forbs	18.8	12.8	0.0	33.4	16.3	10.6	3.5	0.0	2.2	4.1
Annual & Biennial Forbs										
Total Production	21.1	13.2	177.2	46.5	64.5	74.1	53.1	32.1	2.2	40.4

TABLE 5A. (CONTINUED)

SUBALPINE

SAMPLE NUMBER	44A	44B	44C	44D	MEAN	45A	45B	45C	45D	MEAN
Perennial Graminoids	1.7	6.2		1.6	2.4	5.9		1.5		1.9
Annual Graminoids										
Perennial Forbs	1.6	0.1	0.5	3.5	1.4	11.9	18.4	90.9	90.2	52.9
Annual & Biennial Forbs										
Total Production	3.3	6.3	0.5	5.1	3.8	17.8	18.4	92.4	90.2	54.7

TABLE 5A. (CONTINUED)

	ABSOLUTE MEAN GRAMS/SQ M	LB/ACRE	RELATIVE PRODUCTION	STANDARD DEVIATION
CONIFEROUS FOREST				
Perennial Graminoids	0.6	5.3	3.7%	
Annual Graminoids	0.0	0.0	0.0%	
Perennial Forbs	15.7	139.7	96.3%	
Annual & Biennial Forbs	0.0	0.0	0.0%	
Total Production	16.3	145.0	100.0%	24.2
CLEARCUT				
Perennial Graminoids	14.4	127.9	36.2%	
Annual Graminoids	0.1	0.9	< 0.1	
Perennial Forbs	24.9	222.6	63.0%	
Annual & Biennial Forbs	0.3	2.9	0.8%	
Total Production	39.7	353.5	100.0%	34.4
SHRUBLAND				
Perennial Graminoids	16.5	146.5	24.1%	
Annual Graminoids	0.0	0.0	0.0%	
Perennial Forbs	51.9	462.1	75.9%	
Annual & Biennial Forbs	0.0	0.0	0.0%	
Total Production	68.4	608.6	100.0%	73.3
SUBALPINE				
Perennial Graminoids	2.1	18.8	7.2%	
Annual Graminoids	0.0	0.0	0.0%	
Perennial Forbs	27.1	241.6	92.8%	
Annual & Biennial Forbs	0.0	0.0	0.0%	
Total Production	29.2	260.4	100.0%	36.3

TABLE 6A. CLEARCUT COVER DATA - 1988
MONTANA PROJECT

TRANSECT NUMBER	2		3		14		19	
	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits
TREES								
Abies grandis					2	2	P	
Abies lasiocarpa		2	2	4	P			
Larix occidentalis	P		P		2	2	10	10
Picea engelmannii	4	4	22	22	6	12	P	
Pinus contorta							P	
Pinus monticola	2	2	P		2	2	2	2
Populus tremuloides								
Populus trichocarpa							P	
Pseudotsuga menziesii	2	2	4	6	2	2	8	8
Thuja plicata					P		P	
Tsuga heterophylla			P		P			
Total % Trees	8	10	28	32	14	20	20	20
TALL SHRUBS								
Alnus sinuata	2	2	6	8	34	40		
Sorbus scopulina	P							
Sorbus sitchensis					P			
Total % Tall Shrubs	2	2	6	8	34	40	0	0
LOW SHRUBS								
Amelanchier alnifolia		2					2	2
Ceanothus velutinus							30	32
Cornus stolonifera								
Holodiscus discolor								
Lonicera ciliosa							2	8
Lonicera utahensis	P						P	
Pachistima myrsinites	6	6	22	30	P		2	6
Ribes lacustre			P					
Ribes spp.	P							
Rosa gymnocarpa							P	
Rubus idaeus					P			
Salix brachycarpa								
Salix lutea								
Salix scouleriana			P		6	6		
Salix wolfii								
Sambucus racemosa			2	2				
Sheperdia canadensis								
Spiraea betulifolia	6	6	2	2	P		6	16
Spiraea douglasii								
Symphoricarpos albus								
Vaccinium globulare	18	24	4	6	2	2		

TABLE 6A. (CONTINUED)

TRANSECT NUMBER	2		3		14		19	
	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits
Vaccinium myrtillus								
Vaccinium scoparium								
Total % Low Shrubs	30	38	30	40	8	8	42	64
SUBSHRUBS								
Arctostaphylos uva-ursi							8	8
Berberis repens							6	12
Chimaphila umbellata								
Cornus canadensis								
Linnaea borealis							2	2
Rubus parviflorus	6	6	P		P		P	
Total % Subshrubs	6	6	0	0	0	0	16	22
PERENNIAL GRAMINOIDS								
Agropyron repens								
Agrostis alba					P			
Agrostis exarata					P			
Bromus anomalous	P							
Bromus vulgaris	P		4	4				
Calamagrostis purpurascens								
Calamagrostis rubescens	P						8	34
Carex concinnoides							P	
Carex geyeri	P				P			
Carex mertensii			P					
Carex microptera								
Carex rossii								
Dactylis glomerata	2	2	P					
Elymus glaucus								
Festuca occidentalis							P	
Festuca subulata			P					
Luzula glabrata			P					
Melica subulata								
Phleum pratense	2	2	P					
Poa palustrus								
Poa pratensis	P							
Stipa occidentalis								
Trisetum canescens								
Total % Perennial Graminoids	4	4	4	4	0	0	8	34
ANNUAL GRAMINOIDS								
Deschampsia danthoniodes								

TABLE 6A. (CONTINUED)

TRANSECT NUMBER	2		3		14		19	
	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits
Total % Annual Graminoids	0	0	0	0	0	0	0	0
PERENNIAL FORBS								
Achillea millefolium			P		P		P	
Agoseris glauca								
Anaphalis margaritacea	P			8	6	6	P	
Antennaria microphylla								
Aralia nudicaulis			P					
Arnica amplexicaulis					P			
Arnica cordifolia	2	6	P			2		
Arnica latifolia								
Aster chilensis							P	
Aster eatonii								
Aster laevis								
Campanula rotundifolia								
Castilleja miniata								
Cerastium arvense								
Cirsium arvense							P	
Cirsium flodmanii								
Cirsium vulgare								
Clintonia uniflora	P		P		P			
Coptis occidentalis					2			
Epilobium angustifolium	14	14	8	8	4	6		2
Erigeron peregrinus					P			
Fragaria virginiana								2
Galium triflorum	P		P		P			
Gentiana amarella								
Geum macrophyllum								
Goodyera oblongfolia								
Hieracium albiflorum	P		P				P	
Hieracium aurantiacum							P	
Osmorhiza chilensis							P	
Pedicularis racemosa								
Penstemon confertus								
Penstemon eriantherus								
Penstemon spp.								
Polemonium pulcherrimum	P		P		P			
Prunella vulgaris								
Pyrola asarifolia					P			
Pyrola chlorantha								
Pyrola secunda			P					
Ranunculus spp.								
Smilacina stellata			2	10	P			

TABLE 6A. (CONTINUED)

TRANSECT NUMBER	2		3		14		19	
	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits
Solidago canadensis					P		P	
Solidago multiradiata			P					
Taraxacum officinale							P	
Thalictrum occidentale								
Tiarella trifoliata			P			2		
Tragopogon dubius								
Trillium ovatum								
Trifolium pratense								
Trifolium repens								
Viola orbiculata		2	P			2		
Xerophyllum tenax	P							2
Total % Perennial Forbs	16	22	10	26	12	18	0	6
ANNUAL & BIENNIAL FORBS								
Apocynum androsaefolium								
Epilobium paniculatum								
Gentiana amarella								
Melampyrum lineare								
Trifolium agrarium								
Verbascum thapsus								
Total % Annual & Biennial Forbs	0	0	0	0	0	0	0	0
CRYPTOGAMS								
Equisetum arvense								
Gymnocarpium dryopteris			P					
Lichen								
Moss	8	8	6	8	4	10		
Pteridium aquilinum		2					2	8
Total % Cryptogams	8	10	6	8	4	10	2	8
TOTAL % VEGETATION	74	92	84	118	72	96	88	154
Soil								
Litter	22	22	16	16	24	24	12	12
Rock	4	4			4	4		

P = SPECIES PRESENT, BUT
NOT ENCOUNTERED QUANTITATIVELY

TABLE 6A. (CONTINUED)

TRANSECT NUMBER	20		22		26		27	
	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits	1st Hits	All Hits
TREES								
Abies grandis	2	2			P		P	
Abies lasiocarpa			P					
Larix occidentalis	P		18	18	P		P	
Picea engelmannii	2	2	P				P	
Pinus contorta	2	2	P				4	4
Pinus monticola	2	2	2	2	P		2	2
Populus tremuloides	P							
Populus trichocarpa	2	2	P					
Pseudotsuga menziesii	22	22	2	2			P	
Thuja plicata			2	2				
Tsuga heterophylla				2				
Total % Trees	32	32	24	26	0	0	6	6
TALL SHRUBS								
Alnus sinuata	6	6	4	4	P			
Sorbus scopulina								
Sorbus sitchensis								
Total % Tall Shrubs	6	6	4	4	0	0	0	0
LOW SHRUBS								
Amelanchier alnifolia	2	2					2	2
Ceanothus velutinus								
Cornus stolonifera								
Holodiscus discolor							P	
Lonicera ciliosa	P				P		2	4
Lonicera utahensis	P		P		2	4	P	
Pachistima myrsinites	6	10	6	8	2	2		
Ribes lacustre								
Ribes spp.								
Rosa gymnocarpa	P		P		4	4	2	2
Rubus idaeus								
Salix brachycarpa							P	
Salix lutea								
Salix scouleriana			2	2				
Salix wolfii								
Sambucus racemosa								
Sheperdia canadensis	P				P		P	
Spiraea betulifolia	2	6		2	P		P	
Spiraea pyramidata					P			
Symphoricarpos albus					P			
Vaccinium globulare								

TABLE 6A. (CONTINUED)

TRANSECT NUMBER	20		22		26		27	
	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits	1st Hits	All Hits
Vaccinium myrtillus						2	10	12
Vaccinium scoparium	P							
Total % Low Shrubs	10	18	8	12	8	12	16	20
SUBSHRUBS								
Arctostaphylos uva-ursi	P						P	
Berberis repens					P			
Chimaphila umbellata								
Cornus canadensis						2	2	4
Linnaea borealis	P				2	2	2	4
Rubus parviflorus			2	2				
Total % Subshrubs	0	0	2	2	2	4	4	8
PERENNIAL GRAMINOIDS								
Agropyron repens					P			
Agrostis alba					8	8	2	2
Agrostis exarata					P			
Bromus anomalous					2	2		
Bromus vulgaris								
Calamagrostis purpurascens					12	12		
Calamagrostis rubescens	12	16	P				14	16
Carex concinnoides	2	2	P		P		2	8
Carex geyeri								
Carex mertensii								
Carex microptera							P	
Carex rossii								
Dactylis glomerata								
Elymus glaucus					P			
Festuca occidentalis	P		P			2	4	4
Festuca subulata								
Luzula glabrata								
Melica subulata					2	2	P	
Phleum pratense								
Poa palustrus					P			
Poa pratensis								
Stipa occidentalis							2	2
Trisetum canescens					2	2		
Total % Perennial Graminoids	14	18	0	0	26	28	24	32
ANNUAL GRAMINOIDS								
Deschampsia danthoniodes					2	2		

TABLE 6A. (CONTINUED)

TRANSECT NUMBER	20		22		26		27	
	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits	1st Hits	All Hits
Total % Annual Graminoids	0	0	0	0	2	2	0	0
PERENNIAL FORBS								
Achillea millefolium			P		P		4	4
Agoseris glauca					P			
Anaphalis margaritacea	P		2	6	P		P	
Antennaria microphylla								
Aralia nudicaulis								
Arnica amplexicaulis								
Arnica cordifolia								
Arnica latifolia					2	4		
Aster chilensis	P				P			
Aster eatonii								
Aster laevis							P	
Campanula rotundifolia					P		P	
Castilleja miniata			P					
Cerastium arvense					P		P	
Cirsium arvense					P			
Cirsium flodmanii								
Cirsium vulgare					2	2		
Clintonia uniflora	P		P					
Coptis occidentalis	2	4	P				P	
Epilobium angustifolium	2	2	4	6	P		P	
Erigeron peregrinus								
Fragaria virginiana	10	10	P		6	6	8	10
Galium triflorum								
Gentiana amarella							P	
Geum macrophyllum					P			
Goodyera oblongfolia								
Hieracium albiflorum		2			2	2	P	
Hieracium aurantiacum			22	36			P	
Osmorhiza chilensis					P			
Pedicularis racemosa							P	
Penstemon confertus								
Penstemon eriantherus							P	
Penstemon spp.								
Polemonium pulcherrimum								
Prunella vulgaris					P			
Pyrola asarifolia							P	
Pyrola chlorantha								
Pyrola secunda								
Ranunculus spp.								
Smilacina stellata			2	2	2	4	P	

TABLE 6A. (CONTINUED)

TRANSECT NUMBER	20		22		26		27	
	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits	1st Hits	All Hits
Solidago canadensis	4	4	6	6	2	2	P	
Solidago multiradiata								
Taraxacum officinale								
Thalictrum occidentale					P		2	4
Tiarella trifoliata								
Tragopogon dubius					P			
Trillium ovatum			P					
Trifolium pratense					2	2		
Trifolium repens	P				P		P	
Viola orbiculata								
Xerophyllum tenax	P						6	8
Total % Perennial Forbs	18	22	36	56	18	22	20	26
ANNUAL & BIENNIAL FORBS								
Apocynum androsaefolium								
Epilobium paniculatum					6	6		
Gentiana amarella							P	
Melampyrum lineare							P	
Trifolium agrarium							P	
Verbascum thapsus					4	4		
Total % Annual & Biennial Forbs	0	0	0	0	10	10	0	0
CRYPTOGAMS								
Equisetum arvense			P					
Gymnocarpium dryopteris								
Lichen								
Moss			4	6		2	4	4
Pteridium aquilinum	4	4						
Total % Cryptogams	4	4	4	6	0	2	4	4
TOTAL % VEGETATION	84	100	78	106	66	80	74	96
Soil	8	8			8	8		
Litter	8	8	22	22	26	26	26	26
Rock								

P = SPECIES PRESENT, BUT
NOT ENCOUNTERED QUANTITATIVELY

TABLE 6A. (CONTINUED)

TRANSECT NUMBER	31		32		33		34	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
TREES								
Abies grandis			P		P		P	
Abies lasiocarpa								
Larix occidentalis	4	4	4	4	P		8	8
Picea engelmannii	P		P					2
Pinus contorta	14	14	2	2	4	4	P	
Pinus monticola			P		P		P	
Populus tremuloides	P		P				P	
Populus trichocarpa	P		2	2	4	4	4	4
Pseudotsuga menziesii							P	
Thuja plicata							P	
Tsuga heterophylla							P	
Total % Trees	18	18	8	8	8	8	12	14
TALL SHRUBS								
Alnus sinuata	P		P				P	
Sorbus scopulina								
Sorbus sitchensis								
Total % Tall Shrubs	0	0	0	0	0	0	0	0
LOW SHRUBS								
Amelanchier alnifolia	P		P			2	P	
Ceanothus velutinus								
Cornus stolonifera	P							
Holodiscus discolor								
Lonicera ciliosa					P			
Lonicera utahensis					P			
Pachistima myrsinites			P		P		P	
Ribes lacustre					P			
Ribes spp.								
Rosa gymnocarpa	P		P				P	
Rubus idaeus	P		P					
Salix brachycarpa								
Salix lutea	P							
Salix scouleriana				2	P			
Salix wolfii					P			
Sambucus racemosa								
Sheperdia canadensis					2	2		
Spiraea betulifolia	2	6	2	2	4	4	2	2
Spiraea pyramidata							P	
Symphoricarpos albus	P						P	
Vaccinium globulare								

TABLE 6A. (CONTINUED)

TRANSECT NUMBER	31		32		33		34	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
Vaccinium myrtillus			P		P		6	10
Vaccinium scoparium								
Total % Low Shrubs	2	6	2	4	6	8	8	12
SUBSHRUBS								
Arctostaphylos uva-ursi	2	4	4	8		6	12	14
Berberis repens	2	2	P		P			
Chimaphila umbellata							P	
Cornus canadensis							2	4
Linnaea borealis			4	4			2	2
Rubus parviflorus	P		P		P			
Total % Subshrubs	4	6	8	12	0	6	16	20
PERENNIAL GRAMINOIDS								
Agropyron repens								
Agrostis alba	P							
Agrostis exarata	P							
Bromus anomalous								
Bromus vulgaris								
Calamagrostis purpurascens			8	8				
Calamagrostis rubescens	4	4	12	16	32	42	4	4
Carex concinnoides	6	6	6	10	4	4	4	6
Carex geyeri								
Carex mertensii								
Carex microptera	P							
Carex rossii	6	8						
Dactylis glomerata								
Elymus glaucus	P							
Festuca occidentalis	2	2	8	10	4	4		
Festuca subulata								
Luzula glabrata								
Melica subulata								
Phleum pratense								
Poa palustrus								
Poa pratensis								
Stipa occidentalis	P							
Trisetum canescens								
Total % Perennial Graminoids	18	20	34	44	40	50	8	10
ANNUAL GRAMINOIDS								
Deschampsia danthoniodes								

TABLE 6A. (CONTINUED)

TRANSECT NUMBER	31		32		33		34	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
Total % Annual Graminoids	0	0	0	0	0	0	0	0
PERENNIAL FORBS								
Achillea millefolium								
Agoseris glauca	P		P					
Anaphalis margaritacea	P		P		P		P	
Antennaria microphylla	P						P	
Aralia nudicaulis								
Arnica amplexicaulis								
Arnica cordifolia								
Arnica latifolia	P		P		P			
Aster chilensis								
Aster eatonii								
Aster laevis								
Campanula rotundifolia								
Castilleja miniata	P		P					
Cerastium arvense								
Cirsium arvense			P					
Cirsium flodmanii		2						
Cirsium vulgare			P					
Clintonia uniflora			P		P			
Coptis occidentalis	P		P			2	P	
Epilobium angustifolium	2	2	4	4	6	6	P	
Erigeron peregrinus								
Fragaria virginiana	14	20	8	14	4	4	P	
Galium triflorum	P							
Gentiana amarella	P				P			
Geum macrophyllum	P							
Goodyera oblongfolia								
Hieracium albiflorum	P		P		P		P	
Hieracium aurantiacum	6	6	P		P			
Osmorhiza chilensis								
Pedicularis racemosa								
Penstemon confertus	P		P					
Penstemon eriantherus								
Penstemon spp.					P			
Polemonium pulcherrimum								
Prunella vulgaris	P							
Pyrola asarifolia								
Pyrola chlorantha					P			
Pyrola secunda								
Ranunculus spp.	P							
Smilacina stellata	P							

TABLE 6A. (CONTINUED)

TRANSECT NUMBER	31		32		33		34	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
Solidago canadensis	P		P		P		6	6
Solidago multiradiata								
Taraxacum officinale	P		P					
Thalictrum occidentale								
Tiarella trifoliata								
Tragopogon dubius	P		P					
Trillium ovatum								
Trifolium pratense								
Trifolium repens	10	10					P	
Viola orbiculata								
Xerophyllum tenax					4	6	12	12
Total % Perennial Forbs	32	40	12	18	14	18	18	18
ANNUAL & BIENNIAL FORBS								
Apocynum androsaefolium							P	
Epilobium paniculatum	4	6	4	4	P			
Gentiana amarella								
Melampyrum lineare					P		4	4
Trifolium agrarium	P							
Verbascum thapsus								
Total % Annual & Biennial Forbs	4	6	4	4	0	0	4	4
CRYPTOGAMS								
Equisetum arvense	2	2						
Gymnocarpium dryopteris								
Lichen								
Moss	2	2	6	6				
Pteridium aquilinum			P					
Total % Cryptogams	4	4	6	6	0	0	0	0
TOTAL % VEGETATION	82	100	74	96	68	90	66	78
Soil	2	2			4	4		
Litter	16	16	26	26	28	28	34	34
Rock								

P = SPECIES PRESENT, BUT
NOT ENCOUNTERED QUANTITATIVELY

TABLE 6A. (CONTINUED)

TRANSECT NUMBER	35		43	
	1st Hits	All Hits	1st Hits	All Hits
TREES				
Abies grandis	P		12	12
Abies lasiocarpa				
Larix occidentalis	6	8	12	12
Picea engelmannii	2	2		
Pinus contorta	4	6	12	12
Pinus monticola				
Populus tremuloides				
Populus trichocarpa	2	2		
Pseudotsuga menziesii			4	4
Thuja plicata			54	88
Tsuga heterophylla			4	4
Total % Trees	14	18	98	132
TALL SHRUBS				
Alnus sinuata				
Sorbus scopulina				
Sorbus sitchensis				
Total % Tall Shrubs	0	0	0	0
LOW SHRUBS				
Amelanchier alnifolia	2	2		
Ceanothus velutinus				
Cornus stolonifera				
Holodiscus discolor				
Lonicera ciliosa				
Lonicera utahensis			P	
Pachistima myrsinites			P	
Ribes lacustre				
Ribes spp.				
Rosa gymnocarpa	P		P	
Rubus idaeus				
Salix brachycarpa				
Salix lutea				
Salix scouleriana				
Salix wolfii				
Sambucus racemosa				
Sheperdia canadensis				
Spiraea betulifolia	P			
Spiraea pyramidata	2	2		
Symphoricarpos albus	P			
Vaccinium globulare				

TABLE 6A. (CONTINUED)

TRANSECT NUMBER	35		43	
	1st Hits	All Hits	1st Hits	All Hits
Vaccinium myrtillus				
Vaccinium scoparium				
Total % Low Shrubs	4	4	0	0
SUBSHRUBS				
Arctostaphylos uva-ursi		4		
Berberis repens	P		P	
Chimaphila umbellata			P	
Cornus canadensis	P			
Linnaea borealis			2	2
Rubus parviflorus				
Total % Subshrubs	0	4	2	2
PERENNIAL GRAMINOIDS				
Agropyron repens				
Agrostis alba				
Agrostis exarata	2	2		
Bromus anomalous				
Bromus vulgaris				
Calamagrostis purpurascens				
Calamagrostis rubescens	10	12		
Carex concinnoides	2	4		
Carex geyeri	P			
Carex mertensii				
Carex microptera				
Carex rossii				
Dactylis glomerata				
Elymus glaucus				
Festuca occidentalis	P			
Festuca subulata				
Luzula glabrata				
Melica subulata				
Phleum pratense				
Poa palustrus				
Poa pratensis				
Stipa occidentalis				
Trisetum canescens				
Total % Perennial Graminoids	14	18	0	0
ANNUAL GRAMINOIDS				
Deschampsia danthoniodes				

TABLE 6A. (CONTINUED)

TRANSECT NUMBER	35		43	
	1st Hits	All Hits	1st Hits	All Hits
Total % Annual Graminoids	0	0	0	0
PERENNIAL FORBS				
Achillea millefolium	2	6		
Agoseris glauca				
Anaphalis margaritacea	P			
Antennaria microphylla				
Aralia nudicaulis				
Arnica amplexicaulis				
Arnica cordifolia				
Arnica latifolia				
Aster chilensis				
Aster eatonii	P			
Aster laevis				
Campanula rotundifolia				
Castilleja miniata				
Cerastium arvense				
Cirsium arvense	2	2		
Cirsium flodmanii				
Cirsium vulgare				
Clintonia uniflora				
Coptis occidentalis	P			2
Epilobium angustifolium				
Erigeron peregrinus				
Fragaria virginiana	10	10		
Galium triflorum				
Gentiana amarella				
Geum macrophyllum				
Goodyera oblongfolia			P	
Hieracium albiflorum	2	2		
Hieracium aurantiacum		2		
Osmorhiza chilensis				
Pedicularis racemosa				
Penstemon confertus				
Penstemon eriantherus				
Penstemon spp.				
Polemonium pulcherrimum				
Prunella vulgaris	P			
Pyrola asarifolia				
Pyrola chlorantha				
Pyrola secunda				
Ranunculus spp.				
Smilacina stellata	P			

TABLE 6A. (CONTINUED)

TRANSECT NUMBER	35		43	
	1st Hits	All Hits	1st Hits	All Hits
Solidago canadensis	2	2		
Solidago multiradiata				
Taraxacum officinale	P			
Thalictrum occidentale				
Tiarella trifoliata				
Tragopogon dubius				
Trillium ovatum				
Trifolium pratense				
Trifolium repens	8	10		
Viola orbiculata				
Xerophyllum tenax	6	6		
Total % Perennial Forbs	32	40	0	2
ANNUAL & BIENNIAL FORBS				
Apocynum androsaefolium				
Epilobium paniculatum				
Gentiana amarella				
Melampyrum lineare				
Trifolium agrarium		2		
Verbascum thapsus				
Total % Annual & Biennial Forbs	0	2	0	0
CRYPTOGAMS				
Equisetum arvense				
Gymnocarpium dryopteris				
Lichen	2	2		
Moss				2
Pteridium aquilinum				
Total % Cryptogams	2	2	0	2
TOTAL % VEGETATION	66	88	100	138
Soil	6	6		
Litter	28	28		
Rock				

P = SPECIES PRESENT, BUT
NOT ENCOUNTERED QUANTITATIVELY

TABLE 6A. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
TREES					
Abies grandis	1.1%	1.5%	1.1%	1.2%	71.4%
Abies lasiocarpa	0.1%	0.2%	0.4%	0.4%	28.6%
Larix occidentalis	4.6%	6.0%	4.8%	4.9%	100.0%
Picea engelmannii	2.6%	3.3%	3.1%	3.2%	78.6%
Pinus contorta	3.0%	3.9%	3.1%	3.2%	71.4%
Pinus monticola	0.9%	1.1%	0.9%	0.9%	78.6%
Populus tremuloides	P	0.0%	0.0%	0.0%	28.6%
Populus trichocarpa	1.0%	1.3%	1.0%	1.0%	57.1%
Pseudotsuga menziesii	3.1%	4.1%	3.3%	3.4%	64.3%
Thuja plicata	4.0%	5.2%	6.5%	6.6%	28.6%
Tsuga heterophylla	0.3%	0.4%	0.4%	0.4%	35.7%
Total % Trees	20.7%	27.0%	24.6%	25.2%	
TALL SHRUBS					
Alnus sinuata	3.7%	4.8%	4.3%	4.4%	64.3%
Sorbus scopulina	P	0.0%	0.0%	0.0%	7.1%
Sorbus sitchensis	P	0.0%	0.0%	0.0%	7.1%
Total % Tall Shrubs	3.7%	4.8%	4.3%	4.4%	
LOW SHRUBS					
Amelanchier alnifolia	0.6%	0.7%	0.9%	0.9%	64.3%
Ceanothus velutinus	2.2%	2.8%	2.1%	2.3%	7.1%
Cornus stolonifera	P	0.0%	0.0%	0.0%	7.1%
Holodiscus discolor	P	0.0%	0.0%	0.0%	7.1%
Lonicera ciliosa	0.3%	0.4%	0.4%	0.4%	35.7%
Lonicera utahensis	0.1%	0.2%	0.3%	0.3%	57.1%
Pachistima myrsinites	3.2%	4.1%	4.2%	4.3%	78.6%
Ribes lacustre	P	0.0%	0.0%	0.0%	14.3%
Ribes spp.	P	0.0%	0.0%	0.0%	7.1%
Rosa gymnocarpa	0.4%	0.6%	0.4%	0.4%	42.9%
Rubus idaeus	P	0.0%	0.0%	0.0%	21.4%
Salix brachycarpa	P	0.0%	0.0%	0.0%	7.1%
Salix lutea	P	0.0%	0.0%	0.0%	7.1%
Salix scouleriana	0.6%	0.7%	0.7%	0.7%	35.7%
Salix wolfii	P	0.0%	0.0%	0.0%	7.1%
Sambucus racemosa	0.1%	0.2%	0.1%	0.1%	7.1%
Sheperdia canadensis	0.1%	0.2%	0.1%	0.1%	28.6%
Spiraea betulifolia	1.9%	2.4%	2.7%	2.7%	92.9%
Spiraea douglasii	0.1%	0.2%	0.1%	0.1%	21.4%
Symphoricarpos albus	P	0.0%	0.0%	0.0%	28.6%
Vaccinium globulare	1.7%	2.2%	2.3%	2.3%	21.4%

TABLE 6A. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Vaccinium myrtillus	1.1%	1.5%	1.7%	1.8%	35.7%
Vaccinium scoparium	P	0.0%	0.0%	0.0%	7.1%
Total % Low Shrubs	12.4%	16.2%	16.0%	16.4%	
SUBSHRUBS					
Arctostaphylos uva-ursi	1.8%	2.5%	3.1%	3.2%	57.1%
Berberis repens	0.6%	0.7%	0.6%	0.6%	50.0%
Chimaphila umbellata	P	0.0%	0.0%	0.0%	14.3%
Cornus canadensis	0.3%	0.4%	0.7%	0.7%	28.6%
Linnaea borealis	1.0%	1.3%	1.1%	1.2%	50.0%
Rubus parviflorus	0.6%	0.7%	0.6%	0.6%	57.1%
Total % Subshrubs	4.3%	5.6%	6.1%	6.3%	
PERENNIAL GRAMINOIDS					
Agropyron repens	P	0.0%	0.0%	0.0%	7.1%
Agrostis alba	0.7%	0.9%	0.7%	0.7%	28.6%
Agrostis exarata	0.1%	0.2%	0.1%	0.1%	28.6%
Bromus anomalous	0.1%	0.2%	0.1%	0.1%	14.3%
Bromus vulgaris	0.3%	0.4%	0.3%	0.3%	14.3%
Calamagrostis purpurascens	1.4%	1.9%	1.5%	1.6%	14.3%
Calamagrostis rubescens	7.0%	8.8%	8.6%	8.9%	71.4%
Carex concinnoides	2.0%	2.3%	2.9%	2.9%	71.4%
Carex geyeri	P	0.0%	0.0%	0.0%	21.4%
Carex mertensii	P	0.0%	0.0%	0.0%	7.1%
Carex microptera	P	0.0%	0.0%	0.0%	14.3%
Carex rossii	0.4%	0.6%	0.6%	0.6%	7.1%
Dactylis glomerata	0.1%	0.2%	0.1%	0.1%	14.3%
Elymus glaucus	P	0.0%	0.0%	0.0%	14.3%
Festuca occidentalis	1.4%	1.7%	1.6%	1.6%	64.3%
Festuca subulata	P	0.0%	0.0%	0.0%	7.1%
Luzula glabrata	P	0.0%	0.0%	0.0%	7.1%
Melica subulata	0.1%	0.2%	0.1%	0.1%	14.3%
Phleum pratense	0.1%	0.2%	0.1%	0.1%	14.3%
Poa palustrus	P	0.0%	0.0%	0.0%	7.1%
Poa pratensis	P	0.0%	0.0%	0.0%	7.1%
Stipa occidentalis	0.1%	0.2%	0.1%	0.1%	14.3%
Trisetum canescens	0.1%	0.2%	0.1%	0.1%	7.1%
Total % Perennial Graminoids	13.9%	18.0%	16.9%	17.3%	
ANNUAL GRAMINOIDS					
Deschampsia danthoniodes	0.1%	0.2%	0.1%	0.1%	7.1%

TABLE 6A. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Total % Annual Graminoids	0.1%	0.2%	0.1%	0.1%	
PERENNIAL FORBS					
Achillea millefolium	0.4%	0.6%	0.7%	0.7%	50.0%
Agoseris glauca	P	0.0%	0.0%	0.0%	21.4%
Anaphalis margaritacea	0.6%	0.7%	1.4%	1.5%	92.9%
Antennaria microphylla	P	0.0%	0.0%	0.0%	14.3%
Aralia nudicaulis	P	0.0%	0.0%	0.0%	7.1%
Arnica amplexicaulis	P	0.0%	0.0%	0.0%	7.1%
Arnica cordifolia	0.1%	0.2%	0.6%	0.6%	21.4%
Arnica latifolia	0.1%	0.2%	0.3%	0.3%	28.6%
Aster chilensis	P	0.0%	0.0%	0.0%	21.4%
Aster eatonii	P	0.0%	0.0%	0.0%	7.1%
Aster laevis	P	0.0%	0.0%	0.0%	7.1%
Campanula rotundifolia	P	0.0%	0.0%	0.0%	14.3%
Castilleja miniata	P	0.0%	0.0%	0.0%	21.4%
Cerastium arvense	P	0.0%	0.0%	0.0%	14.3%
Cirsium arvense	0.1%	0.2%	0.1%	0.1%	28.6%
Cirsium flodmanii	0.0%	0.0%	0.1%	0.1%	7.1%
Cirsium vulgare	0.1%	0.2%	0.1%	0.1%	14.3%
Clintonia uniflora	P	0.0%	0.0%	0.0%	50.0%
Coptis occidentalis	0.3%	0.4%	0.6%	0.6%	71.4%
Epilobium angustifolium	3.2%	4.0%	3.5%	3.6%	85.7%
Erigeron peregrinus	P	0.0%	0.0%	0.0%	7.1%
Fragaria virginiana	4.4%	5.5%	5.4%	5.5%	71.4%
Galium triflorum	P	0.0%	0.0%	0.0%	28.6%
Gentiana amarella	P	0.0%	0.0%	0.0%	21.4%
Geum macrophyllum	P	0.0%	0.0%	0.0%	14.3%
Goodyera oblongfolia	P	0.0%	0.0%	0.0%	7.1%
Hieracium albiflorum	0.3%	0.4%	0.4%	0.4%	78.6%
Hieracium aurantiacum	2.1%	2.5%	3.2%	3.2%	50.0%
Osmorhiza chilensis	P	0.0%	0.0%	0.0%	14.3%
Pedicularis racemosa	P	0.0%	0.0%	0.0%	7.1%
Penstemon confertus	P	0.0%	0.0%	0.0%	14.3%
Penstemon eriantherus	P	0.0%	0.0%	0.0%	7.1%
Penstemon spp.	P	0.0%	0.0%	0.0%	7.1%
Polemonium pulcherrimum	P	0.0%	0.0%	0.0%	21.4%
Prunella vulgaris	P	0.0%	0.0%	0.0%	14.3%
Pyrola asarifolia	P	0.0%	0.0%	0.0%	14.3%
Pyrola chlorantha	P	0.0%	0.0%	0.0%	7.1%
Pyrola secunda	P	0.0%	0.0%	0.0%	7.1%
Ranunculus spp.	P	0.0%	0.0%	0.0%	7.1%
Smilacina stellata	0.4%	0.6%	1.1%	1.2%	50.0%

TABLE 6A. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Solidago canadensis	1.4%	1.9%	1.4%	1.5%	78.6%
Solidago multiradiata	P	0.0%	0.0%	0.0%	7.1%
Taraxacum officinale	P	0.0%	0.0%	0.0%	28.6%
Thalictrum occidentale	0.1%	0.2%	0.3%	0.3%	14.3%
Tiarella trifoliata	0.0%	0.0%	0.1%	0.1%	14.3%
Tragopogon dubius	P	0.0%	0.0%	0.0%	21.4%
Trillium ovatum	P	0.0%	0.0%	0.0%	7.1%
Trifolium pratense	0.1%	0.2%	0.1%	0.1%	7.1%
Trifolium repens	1.3%	1.7%	1.4%	1.5%	35.7%
Viola orbiculata	0.0%	0.0%	0.3%	0.3%	21.4%
Xerophyllum tenax	2.0%	2.6%	2.3%	2.3%	50.0%
Total % Perennial Forbs	17.0%	22.1%	23.4%	24.0%	
ANNUAL & BIENNIAL FORBS					
Apocynum androsaefolium	P	0.0%	0.0%	0.0%	7.1%
Epilobium paniculatum	1.0%	1.2%	1.2%	1.2%	28.6%
Gentiana amarella	P	0.0%	0.0%	0.0%	7.1%
Melampyrum lineare	0.3%	0.4%	0.3%	0.3%	21.4%
Trifolium agrarium	0.0%	0.0%	0.1%	0.1%	21.4%
Verbascum thapsus	0.3%	0.4%	0.3%	0.3%	7.1%
Total % Annual & Biennial Forbs	1.6%	2.0%	1.9%	1.9%	
CRYPTOGAMS					
Equisetum arvense	0.1%	0.2%	0.1%	0.1%	14.3%
Gymnocarpium dryopteris	P	0.0%	0.0%	0.0%	7.1%
Lichen	0.0%	0.0%	0.0%	0.1%	7.1%
Moss	2.6%	3.3%	3.6%	3.6%	64.3%
Pteridium aquilinum	0.4%	0.6%	0.6%	0.6%	28.6%
Total % Cryptogams	3.1%	4.1%	4.3%	4.4%	
TOTAL % VEGETATION	76.8%	100.0%	97.6%	100.0%	
Soil	2.0%				
Litter	20.6%				
Rock	0.6%				

P = SPECIES PRESENT, BUT
NOT ENCOUNTERED QUANTITATIVELY

TABLE 7A. CLEARCUT TREE DENSITY, REPRODUCTION, HEIGHT, DBH, AND AGE DATA - 1988
MONTANA PROJECT

DENSITY

TRANSECT NUMBER	2	3	14	19	20	22	26	27	31	32	33	34	35	43
	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TREES														
Abies grandis		3	2				3	5		1			1	
Abies lasiocarpa	3	1												
Betula occidentalis			1											
Larix occidentalis		1	5	12	5	10		1	7	7	1	7	7	5
Picea engelmannii	3	38	12		2	2							2	1
Pinus contorta					5	1		3	14	12	8		3	6
Pinus monticola	3	5		1	1	5		1				6	2	
Pinus ponderosa								1						
Populus trichocarpa				2	7	3				3		12	2	
Pseudotsuga menziesii	1	7	3	3	8	4						1		7
Thuja plicata						1								106
Tsuga heterophylla		1												
Total Trees	10	56	23	18	28	26	3	11	21	23	9	26	17	125
TREES - DEAD														
Pinus contorta														8
Pinus monticola						1								
Thuja plicata														5
Total Trees - Dead	0	0	0	0	0	1	0	0	0	0	0	0	0	13

TABLE 7A. (CONTINUED)

DENSITY

	MEAN NO. TREES/ 125 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TREES				
Abies grandis	1.1	34.7	3.8%	
Abies lasiocarpa	0.3	9.3	1.0%	
Betula occidentalis	0.1	2.3	0.3%	
Larix occidentalis	4.9	157.3	17.1%	
Picea engelmannii	4.3	138.8	15.2%	
Pinus contorta	3.7	120.3	13.1%	
Pinus monticola	1.7	55.5	6.1%	
Pinus ponderosa	0.1	2.3	0.3%	
Populus trichocarpa	2.1	67.1	7.3%	
Pseudotsuga menziesii	2.4	78.6	8.6%	
Thuja plicata	7.5	247.3	26.9%	
Tsuga heterophylla	0.1	2.3	0.3%	
Total Trees	28.3	915.8	100.0%	29.4
TREES - DEAD				
Pinus contorta	0.6	18.5	57.2%	
Pinus monticola	0.1	2.3	7.1%	
Thuja plicata	0.4	11.6	35.7%	
Total Trees - Dead	1.1	32.4	100.0%	3.3

TABLE 7A. (CONTINUED)

REPRODUCTION

TRANSECT NUMBER	2	3	14	19	20	22	26	27	31	32	33	34	35	43
	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Abies grandis		2	4	1					1	2	1	2	3	
Larix occidentalis			8		1				4	1	1	2	2	
Picea engelmannii	3	12	37		1				1		1	1		
Pinus contorta								2	1		3		5	
Pinus monticola	1		1	5	5	5				1		6	1	
Pinus ponderosa							1							
Populus tremuloides										1				
Populus trichocarpa					10					2	3	7	6	
Pseudotsuga menziesii	1					2								
Thuja plicata						9						1		7
Tsuga heterophylla			5			11								
Total Tree Reproduction	5	14	55	6	17	27	1	2	7	7	9	19	17	7

	MEAN NO. TREES/ 25 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
Abies grandis	1.1	185.0	8.3%	
Larix occidentalis	1.4	219.7	9.8%	
Picea engelmannii	4.0	647.3	29.0%	
Pinus contorta	0.8	127.2	5.7%	
Pinus monticola	1.8	289.1	13.0%	
Pinus ponderosa	0.1	11.6	0.5%	
Populus tremuloides	0.1	11.6	0.5%	
Populus trichocarpa	2.0	323.8	14.5%	
Pseudotsuga menziesii	0.2	34.7	1.6%	
Thuja plicata	1.2	196.6	8.8%	
Tsuga heterophylla	1.1	185.0	8.3%	
Total Tree Reproduction	13.8	2231.6	100.0%	13.4

TABLE 7A. (CONTINUED)

HEIGHT (FEET)

TRANSECT NUMBER	2	3	14	19	20	22	26	27	31	32	33	34	35	43
	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TREES														
Abies grandis		4.3	6.0				6.0	7.2		6.0			10.0	
Abies lasiocarpa	9.0	12.0												
Betula occidentalis			12.0											
Larix occidentalis	6.0	13.0	12.0	16.1	7.2	21.8		28.0	7.9	10.6	6.0	21.7	17.7	65.6
Picea engelmannii		6.5	6.4		12.5	9.5							9.0	15.0
Pinus contorta					12.8	12.0		11.3	10.1	8.4	6.9		20.3	59.5
Pinus monticola	6.0	7.4		5.0	6.0	6.2		20.0				9.3	8.0	
Pinus ponderosa								7.0						
Populus trichocarpa				13.0	12.9	12.3				7.0		7.5	5.5	
Pseudotsuga menziesii	11.0	8.6	6.7	16.7	15.1	11.8						6.0		28.3
Thuja plicata						8.0								12.8
Tsuga heterophylla		6.0												

	MINIMUM	MAXIMUM	MEAN
	---	---	---
TREES			
Abies grandis	1	10	6.3
Abies lasiocarpa	7	12	9.8
Betula occidentalis	12	12	12.0
Larix occidentalis	6	70	18.9
Picea engelmannii	4	17	7.0
Pinus contorta	6	70	15.9
Pinus monticola	4	20	7.5
Pinus ponderosa	7	7	7.0
Populus trichocarpa	6	24	9.5
Pseudotsuga menziesii	5	39	15.1
Thuja plicata	5	41	12.8
Tsuga heterophylla	6	6	6.0

TABLE 7A. (CONTINUED)

DBH (INCHES)

MEAN DBH IN INCHES TRANSECT NUMBER	2	3	14	19	20	22	26	27	31	32	33	34	35	43
	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TREES														
Abies grandis		0.4	0.4				0.8	0.9		0.8			0.8	
Abies lasiocarpa	1.8	2.0												
Betula occidentalis			0.8											
Larix occidentalis		2.0	1.1	2.0	0.5	2.4		4.3	0.7	0.9	0.4	2.5	2.2	7.2
Picea engelmannii	0.8	0.8	0.6		1.4	1.8							0.6	1.6
Pinus contorta					2.0	1.6		1.6	1.3	1.0	0.7		3.5	6.7
Pinus monticola	0.7	1.0		0.4	0.4	0.6		2.8				1.0	1.0	
Pinus ponderosa								1.2						
Populus trichocarpa				1.6	1.3	1.0				0.4		0.5	0.4	
Pseudotsuga menziesii	2.0	1.1	0.7	2.2	2.4	1.9						0.4		2.9
Thuja plicata						1.6								1.6
Tsuga heterophylla		0.4												
TREES (DEAD)														
Pinus contorta														7.0
Pinus monticola						0.4								
Thuja plicata														1.4

TABLE 7A. (CONTINUED)

	DBH (INCHES)		
	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	0.4	1.2	0.7
Abies lasiocarpa	1.2	2.8	0.5
Betula occidentalis	0.8	0.8	0.8
Larix occidentalis	0.4	10.2	2.1
Picea engelmannii	0.4	3.9	0.8
Pinus contorta	0.8	7.5	2.0
Pinus monticola	0.4	2.8	0.9
Pinus ponderosa	1.2	1.2	1.2
Populus trichocarpa	0.4	2.8	0.8
Pseudotsuga menziesii	0.4	3.9	2.0
Thuja plicata	0.4	5.1	1.6
Tsuga heterophylla	0.4	0.4	0.4
Total Trees			1.5
TREES (DEAD)			
Pinus contorta	3.9	9.4	7.0
Pinus monticola	0.4	0.4	0.4
Thuja plicata	0.8	2.4	1.4
Total Trees (Dead)			4.6

TABLE 7A. (CONTINUED)

AGE (YEARS)

TREES	NUMBER TREES CORED	MEAN	MINIMUM	MAXIMUM
Larix occidentalis	4	14	10	19
Picea engelmannii	2	10	10	11
Pinus contorta	6	12	10	19
Total Trees	12	13	10	19

TABLE 8A. CLEARCUT SHRUB DENSITY DATA - 1988
MONTANA PROJECT

TRANSECT NUMBER	2	3	14	19	20	22	26	27	31	32	33	34	35	43
TALL SHRUBS														
Acer glabrum			3											
Alnus sinuata		1	4		5	22								
Total Tall Shrubs	0	1	7	0	5	22	0	0	0	0	0	0	0	0
LOW SHRUBS														
Amelanchier alnifolia								16		3		1	3	
Ceanothus velutinus				33										
Lonicera utahensis	1						39	3			1			1
Pachistima myrsinites	11	93	1	29	26	17	16			3	4	5		3
Ribes lacustre	4								1		2			
Rosa gymnocarpa				1	3		60	12	12	7	5	4	6	2
Rubus idaeus									6		1			
Salix lutea										1				
Salix scouleriana		1	3			2				2		1		
Salix spp.										1				
Spiraea betulifolia	39		4	64	72	1	2		33	12	29	23	9	
Spiraea douglasii			1											
Spiraea pyramidata							8	8						
Symphoricarpos albus							7		7			1		
Vaccinium globulare	82	44	20											
Vaccinium myrtillus							9	127			3	118		
Vaccinium scoparium					2									
Total Low Shrubs	137	138	29	127	103	20	141	166	59	29	45	153	18	6
SUBSHRUBS														
Berberis repens				50			1		6				13	
Rubus parviflorus	13	11	1	1		1			8	15	3	3		
Total Subshrubs	13	11	1	51	0	1	1	0	14	15	3	3	13	0
TOTAL SHRUBS	150	150	37	178	108	43	142	166	73	44	48	156	31	6

TABLE 8A. (CONTINUED)

TRANSECT NUMBER	2	3	14	19	20	22	26	27	31	32	33	34	35	43
	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TALL SHRUBS														
Total Subshrubs	13	11	1	51	0	1	1	0	14	15	3	3	13	0
TOTAL SHRUBS	150	150	37	178	108	43	142	166	73	44	48	156	31	6

TABLE 8A. (CONTINUED)

	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TALL SHRUBS				
Acer glabrum	0.2	34.7	0.2%	
Alnus sinuata	2.3	370.0	2.4%	
Total Tall Shrubs	2.5	404.7	2.6%	
LOW SHRUBS				
Amelanchier alnifolia	1.6	265.9	1.7%	
Ceanothus velutinus	2.4	381.6	2.5%	
Lonicera utahensis	3.2	520.3	3.4%	
Pachistima myrsinites	14.9	2405.0	15.6%	
Ribes lacustre	0.5	80.9	0.5%	
Rosa gymnocarpa	8.0	1295.0	8.4%	
Rubus idaeus	0.5	80.9	0.5%	
Salix lutea	0.1	11.6	0.1%	
Salix scouleriana	0.6	104.1	0.7%	
Salix spp.	0.1	11.6	0.1%	
Spiraea betulifolia	20.6	3330.1	21.5%	
Spiraea douglasii	0.1	11.6	0.1%	
Spiraea pyramidata	1.1	185.0	1.2%	
Symphoricarpos albus	1.1	173.4	1.1%	
Vaccinium globulare	10.4	1688.2	11.0%	
Vaccinium myrtillus	18.4	2971.6	19.3%	
Vaccinium scoparium	0.1	23.1	0.2%	
Total Low Shrubs	83.7	13539.9	87.9%	
SUBSHRUBS				
Berberis repens	5.0	809.4	5.3%	
Rubus parviflorus	4.0	647.5	4.2%	
Total Subshrubs	9.0	1456.9	9.5%	
TOTAL SHRUBS	95.2	15401.5	100.0%	58.2

TABLE 9A. SHRUBLAND COVER DATA - 1988
MONTANA PROJECT

TRANSECT NUMBER	5		6		12		13	
	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits
TREES								
Abies grandis			10	12	8	10		
Abies lasiocarpa								
Picea engelmannii			2	2	4	6		
Pinus monticola					8	8		
Populus tremuloides					22	22		
Pseudotsuga menziesii					2	4		
Tsuga heterophylla			P					
Total % Trees	0	0	12	14	44	50	0	0
TALL SHRUBS								
Acer glabrum	18	18	P				12	12
Alnus sinuata			P				P	
Prunus emarginata					P		10	10
Sorbus scopulina	2	2			2	2	P	
Sorbus sitchensis	P				P			
Total % Tall Shrubs	20	20	0	0	2	2	22	22
LOW SHRUBS								
Amelanchier alnifolia			P		2	4		
Lonicera ciliosa								
Lonicera involucrata							P	
Lonicera utahensis			2	4	P			
Menziesia ferruginea	12	32	12	18				
Oplopanax horridum	4	4						
Pachistima myrsinites						2		
Ribes lacustre			10	14				
Ribes viscosissimum								
Rosa gymnocarpa								
Rubus idaeus			6	12			2	4
Salix scouleriana					P			
Salix spp.								
Sambucus racemosa	8	10	2	2			4	4
Spiraea betulifolia						6		
Spiraea densiflora								
Spiraea douglasii	8	10						
Symphoricarpos albus					P		8	18
Vaccinium globulare	2	8	6	10	8	24		4
Total % Low Shrubs	34	64	38	60	10	36	14	30

TABLE 9A. (CONTINUED)

TRANSECT NUMBER	5		6		12		13	
	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits
SUBSHRUBS								
Berberis repens								
Rubus parviflorus	10	14	4	6			28	46
Total % Subshrubs	10	14	4	6	0	0	28	46
PERENNIAL GRAMINOIDS								
Agrostis alba						2		
Bromus vulgaris	P		6	12				
Calamagrostis canadensis	P		2	4			4	4
Carex deweyana	P							
Carex rossii								
Elymus glaucus	P	4						2
Festuca subulata	P							10
Luzula glabrata	P							
Total % Perennial Graminoids	0	4	8	16	0	2	4	16
PERENNIAL FORBS								
Achillea millefolium							P	
Aconitum columbianum								6
Actaea rubra		2	P					
Adenocaulon bicolor			P					
Agastache urticifolia							P	
Angelica arguta								
Angelica dawsonii							P	
Arnica cordifolia			P					
Campanula rotundifolia					P			
Circaea alpina		4						
Clintonia uniflora			P		P			2
Disporum hookeri								10
Epilobium angustifolium			P		2		2	6
Galium triflorum	P		2	8				4
Heracleum lanatum	P		4	4			8	16
Heuchera cylindrica		4		2				
Osmorhiza chilensis								2
Polemonium pulcherrimum	2	2		10				
Senecio triangularis			P					
Smilacina stellata		6	8	16	P			6
Solidado canadensis								
Stellaria crispa	P							
Thalictrum occidentale					2			18
Tiarella trifoliata				4				

TABLE 9A. (CONTINUED)

TRANSECT NUMBER	5		6		12		13	
	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits
Trillium ovatum	P		P		P		P	
Veratrum viride	24	28	8	8				
Viola glabella		2	2	4			2	4
Viola orbiculata								
Xerophyllum tenax					36	70		
Total % Perennial Forbs	26	48	24	56	40	70	12	74
CRYPTOGAMS								
Athyrium filix-femina								
Cheilanthes gracillima								
Cryptogramma crispa								
Dryopteris filix-mas	4	12		2				
Gymnocarpium dryopteris			P					
Lichen								
Moss	2	22		4		2		
Pteridium aquilinum			12	16			18	22
Total % Cryptogams	6	34	12	22	0	2	18	22
TOTAL % VEGETATION	96	184	98	174	96	162	98	210
Soil								
Litter	2	2	2	2	4	4	2	2
Rock	2	2						

P = SPECIES PRESENT, BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 9A. (CONTINUED)

TRANSECT NUMBER	46		48		56		57	
	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits	1st Hits	All Hits
TREES								
Abies grandis								
Abies lasiocarpa					P		24	24
Picea engelmannii							P	
Pinus monticola								
Populus tremuloides								
Pseudotsuga menziesii								
Tsuga heterophylla								
Total % Trees	0	0	0	0	0	0	24	24
TALL SHRUBS								
Acer glabrum	14	14	18	26	P			
Alnus sinuata					26	26	36	42
Prunus emarginata	2	2						
Sorbus scopulina					8	8		2
Sorbus sitchensis					16	16		
Total % Tall Shrubs	16	16	18	26	50	50	36	44
LOW SHRUBS								
Amelanchier alnifolia	P		2	4				
Lonicera ciliosa								
Lonicera involucrata								
Lonicera utahensis								
Menziesia ferruginea	P						10	18
Oplopanax horridum								
Pachistima myrsinites	6	6	8	66				
Ribes lacustre							2	4
Ribes viscosissimum			2	2				
Rosa gymnocarpa				4				
Rubus idaeus	6	10			P		P	
Salix scouleriana			62	62				
Salix spp.							P	
Sambucus racemosa					P		P	
Spiraea betulifolia			2	4				
Spiraea densiflora					4	4		
Spiraea douglasii							4	10
Symphoricarpos albus				4				
Vaccinium globulare	2	2	P		8	26	2	6
Total % Low Shrubs	14	18	76	146	12	30	18	38

TABLE 9A. (CONTINUED)

TRANSECT NUMBER	46		48		56		57	
	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits	1st Hits	All Hits
SUBSHRUBS								
Berberis repens				2				
Rubus parviflorus			4	12	6	6	P	
Total % Subshrubs	0	0	4	14	6	6	0	0
PERENNIAL GRAMINOIDS								
Agrostis alba								
Bromus vulgaris								
Calamagrostis canadensis					10	14	10	20
Carex deweyana								
Carex rossii	P							
Elymus glaucus	P						6	10
Festuca subulata								
Luzula glabrata								
Total % Perennial Graminoids	0	0	0	0	10	14	16	30
PERENNIAL FORBS								
Achillea millefolium					P			
Aconitum columbianum								
Actaea rubra								
Adenocaulon bicolor								
Agastache urticifolia								
Angelica arguta					P			
Angelica dawsonii					P			
Arnica cordifolia								
Campanula rotundifolia								
Circaea alpina					P			
Clintonia uniflora					P			6
Disporum hookeri			P		10	24	P	
Epilobium angustifolium	P			2				
Galium triflorum	4	6			P			
Heracleum lanatum					P		P	
Heuchera cylindrica								
Osmorhiza chilensis								
Polemonium pulcherrimum						2	P	
Senecio triangularis							2	2
Smilacina stellata					P		P	
Solidado canadensis					P			
Stellaria crispa								
Thalictrum occidentale								
Tiarella trifoliata					P			2

TABLE 9A. (CONTINUED)

TRANSECT NUMBER	46		48		56		57	
	1st Hit	All Hits	1st Hit	All Hits	1st Hit	All Hits	1st Hits	All Hits
Trillium ovatum								
Veratrum viride					2	2		2
Viola glabella								
Viola orbiculata					P			
Xerophyllum tenax		2	P		P			
Total % Perennial Forbs	4	8	0	2	12	28	2	12
CRYPTOGAMS								
Athyrium filix-femina					P			
Cheilanthes gracillima	P							
Cryptogramma crispa	P							
Dryopteris filix-mas								
Gymnocarpium dryopteris							P	
Lichen		2						
Moss					4	8		6
Pteridium aquilinum			P					
Total % Cryptogams	0	2	0	0	4	8	0	6
TOTAL % VEGETATION	34	44	98	188	94	136	96	154
Soil								
Litter	10	10	2	2	6	6	4	4
Rock	56	56						

P = SPECIES PRESENT, BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 9A. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
TREES					
Abies grandis	2.3%	2.5%	2.8%	1.8%	25.0%
Abies lasiocarpa	2.9%	3.5%	2.9%	1.9%	25.0%
Picea engelmannii	0.8%	0.8%	1.0%	0.6%	37.5%
Pinus monticola	1.0%	1.1%	1.0%	0.6%	12.5%
Populus tremuloides	2.7%	3.1%	2.8%	1.8%	12.5%
Pseudotsuga menziesii	0.3%	0.3%	0.5%	0.3%	12.5%
Tsuga heterophylla	P	0.0%	0.0%	0.0%	12.5%
Total % Trees	10.0%	11.3%	11.0%	7.0%	
TALL SHRUBS					
Acer glabrum	7.8%	8.7%	8.7%	5.6%	75.0%
Alnus sinuata	7.7%	8.7%	8.5%	5.4%	50.0%
Prunus emarginata	1.5%	1.7%	1.5%	1.0%	37.5%
Sorbus scopulina	1.5%	1.7%	1.8%	1.1%	62.5%
Sorbus sitchensis	2.0%	2.3%	2.0%	1.3%	37.5%
Total % Tall Shrubs	20.5%	23.1%	22.5%	14.4%	
LOW SHRUBS					
Amelanchier alnifolia	0.5%	0.6%	1.0%	0.6%	50.0%
Lonicera ciliosa	P	0.0%	0.0%	0.0%	12.5%
Lonicera involucrata	P	0.0%	0.0%	0.0%	12.5%
Lonicera utahensis	0.3%	0.3%	0.5%	0.3%	25.0%
Menziesia ferruginea	4.2%	4.8%	8.5%	5.4%	50.0%
Oplopanax horridum	0.5%	0.6%	0.5%	0.3%	12.5%
Pachistima myrsinites	1.8%	2.0%	9.2%	5.9%	37.5%
Ribes lacustre	1.5%	1.7%	2.3%	1.4%	25.0%
Ribes viscosissimum	0.3%	0.3%	0.3%	0.2%	12.5%
Rosa gymnocarpa	0.0%	0.0%	0.5%	0.3%	12.5%
Rubus idaeus	1.7%	2.0%	3.3%	2.1%	62.5%
Salix scouleriana	7.7%	8.6%	7.7%	5.0%	25.0%
Salix spp.	P	0.0%	0.0%	0.0%	12.5%
Sambucus racemosa	1.8%	2.0%	2.0%	1.3%	62.5%
Spiraea betulifolia	0.3%	0.3%	1.3%	0.8%	25.0%
Spiraea densiflora	0.5%	0.6%	0.5%	0.3%	12.5%
Spiraea douglasii	1.5%	1.7%	2.5%	1.6%	25.0%
Symphoricarpos albus	1.0%	1.1%	2.8%	1.8%	37.5%
Vaccinium globulare	3.4%	3.8%	9.9%	6.4%	100.0%
Total % Low Shrubs	27.0%	30.4%	52.8%	33.7%	

TABLE 9A. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
SUBSHRUBS					
Berberis repens	0.0%	0.0%	0.3%	0.2%	12.5%
Rubus parviflorus	6.5%	7.3%	10.5%	6.7%	75.0%
Total % Subshrubs	6.5%	7.3%	10.8%	6.9%	
PERENNIAL GRAMINOIDS					
Agrostis alba	0.0%	0.0%	0.3%	0.2%	12.5%
Bromus vulgaris	0.8%	0.8%	1.5%	1.0%	25.0%
Calamagrostis canadensis	3.2%	3.8%	5.2%	3.2%	62.5%
Carex deweyana	P	0.0%	0.0%	0.0%	12.5%
Carex rossii	P	0.0%	0.0%	0.0%	12.5%
Elymus glaucus	0.8%	0.8%	2.0%	1.3%	37.5%
Festuca subulata	0.0%	0.0%	1.3%	0.8%	25.0%
Luzula glabrata	P	0.0%	0.0%	0.0%	12.5%
Total % Perennial Graminoids	4.8%	5.4%	10.3%	6.5%	
PERENNIAL FORBS					
Achillea millefolium	P	0.0%	0.0%	0.0%	25.0%
Aconitum columbianum	0.0%	0.0%	0.8%	0.5%	12.5%
Actaea rubra	0.0%	0.0%	0.3%	0.2%	25.0%
Adenocaulon bicolor	P	0.0%	0.0%	0.0%	12.5%
Agastache urticifolia	P	0.0%	0.0%	0.0%	12.5%
Angelica arguta	P	0.0%	0.0%	0.0%	12.5%
Angelica dawsonii	P	0.0%	0.0%	0.0%	25.0%
Arnica cordifolia	P	0.0%	0.0%	0.0%	12.5%
Campanula rotundifolia	P	0.0%	0.0%	0.0%	12.5%
Circaea alpina	0.0%	0.0%	0.5%	0.3%	25.0%
Clintonia uniflora	0.0%	0.0%	1.0%	0.6%	62.5%
Disporum hookeri	1.3%	1.4%	4.2%	2.7%	50.0%
Epilobium angustifolium	0.5%	0.6%	1.0%	0.6%	62.5%
Galium triflorum	0.8%	0.8%	2.3%	1.4%	62.5%
Heracleum lanatum	1.5%	1.7%	2.5%	1.6%	62.5%
Heuchera cylindrica	0.0%	0.0%	0.8%	0.5%	25.0%
Osmorhiza chilensis	0.0%	0.0%	0.3%	0.2%	12.5%
Polemonium pulcherrimum	0.3%	0.3%	1.8%	1.1%	50.0%
Senecio triangularis	0.3%	0.3%	0.3%	0.2%	25.0%
Smilacina stellata	1.0%	1.1%	3.5%	2.2%	75.0%
Solidado canadensis	P	0.0%	0.0%	0.0%	12.5%
Stellaria crispa	P	0.0%	0.0%	0.0%	12.5%
Thalictrum occidentale	0.3%	0.3%	2.3%	1.4%	25.0%
Tiarella trifoliata	0.0%	0.0%	0.8%	0.5%	37.5%

TABLE 9A. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Trillium ovatum	P	0.0%	0.0%	0.0%	50.0%
Veratrum viride	4.2%	4.8%	4.8%	3.2%	50.0%
Viola glabella	0.5%	0.6%	1.3%	0.8%	37.5%
Viola orbiculata	P	0.0%	0.0%	0.0%	12.5%
Xerophyllum tenax	4.3%	5.0%	8.8%	5.8%	50.0%
Total % Perennial Forbs	15.0%	16.9%	37.3%	23.8%	
CRYPTOGAMS					
Athyrium filix-femina	P	0.0%	0.0%	0.0%	12.5%
Cheilanthes gracillima	P	0.0%	0.0%	0.0%	12.5%
Cryptogramma crispa	P	0.0%	0.0%	0.0%	12.5%
Dryopteris filix-mas	0.5%	0.6%	1.8%	1.1%	25.0%
Gymnocarpium dryopteris	P	0.0%	0.0%	0.0%	25.0%
Lichen	0.0%	0.0%	0.3%	0.2%	12.5%
Moss	0.8%	0.8%	5.3%	3.4%	62.5%
Pteridium aquilinum	3.7%	4.2%	4.6%	3.0%	37.5%
Total % Cryptogams	5.0%	5.6%	12.0%	7.7%	
TOTAL % VEGETATION	88.8%	100.0%	156.7%	100.0%	
Soil	0.0%				
Litter	4.0%				
Rock	7.2%				

P = SPECIES PRESENT, BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 10A. SHRUBLAND TREE DENSITY, REPRODUCTION, HEIGHT, DBH, AND AGE DATA - 1988
MONTANA PROJECT

DENSITY

TRANSECT NUMBER	5	6	12	13	46	48	56	57
	--	--	--	--	--	--	--	--
TREES								
Abies grandis			7					
Abies lasiocarpa			2				1	33
Picea engelmannii			3					
Pinus monticola			3					
Populus tremuloides			27					
Pseudotsuga menziesii			5					
Total Trees	0	0	47	0	0	0	1	33

	MEAN NO. TREES/ 125 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TREES (>1.3 M DBH)				
Abies grandis	0.9	28.3	8.6%	
Abies lasiocarpa	4.5	145.7	44.4%	
Picea engelmannii	0.4	12.1	3.7%	
Pinus monticola	0.4	12.1	3.7%	
Populus tremuloides	3.4	109.3	33.3%	
Pseudotsuga menziesii	0.6	20.2	6.2%	
Total Trees	10.1	327.8	100.0%	17.6

TABLE 10A. (CONTINUED)

REPRODUCTION

TREE REPRODUCTION (<1.3 M DBH)

TRANSECT NUMBER	5	6	12	13	46	48	56	57
Abies grandis			1					
Abies lasiocarpa							1	4
Total Tree Reproduction	0	0	1	0	0	0	1	4

	MEAN/25 SQ M	MEAN/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
Abies grandis	0.1	20.2	16.7%	
Abies lasiocarpa	0.6	101.2	83.3%	
Total Tree Reproduction	0.7	121.4	100.0%	1.3

HEIGHT (FEET)

MEAN TREE HEIGHT IN FEET

TRANSECT NUMBER	5	6	12	13	46	48	56	57
TREES								
Abies grandis			9.6					
Abies lasiocarpa		12.6	12.5				18.0	14.9
Picea engelmannii		6.5	17.0					
Pinus monticola			17.3					
Populus tremuloides			10.5					
Pseudotsuga menziesii			12.2					
Total Trees								

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	6	14	9.6
Abies lasiocarpa	4	33	12.6
Picea engelmannii	3	20	11.0
Pinus monticola	8	22	17.3
Populus tremuloides	5	18	10.5
Pseudotsuga menziesii	5	16	12.2
Total Trees			11.3

TABLE 10A. (CONTINUED)

DBH (INCHES)

MEAN DBH IN INCHES TRANSECT NUMBER	5	6	12	13	46	48	56	57
TREES								
Abies grandis			1.8					
Abies lasiocarpa		1.6	1.8				3.1	2.2
Picea engelmannii		0.9	3.0					
Pinus monticola			3.1					
Populus tremuloides			1.0					
Pseudotsuga menziesii			2.8					
Total Trees								

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	0.4	4.3	1.8
Abies lasiocarpa	0.4	6.7	2.1
Picea engelmannii	0.4	3.9	1.8
Pinus monticola	0.8	4.7	3.1
Populus tremuloides	0.4	2.0	1.0
Pseudotsuga menziesii	0.4	4.7	2.8
Total Trees			2.0

TABLE 10A. (CONTINUED)

AGE (YEARS)

TRANSECT NUMBER	6	12	46
Abies grandis	30		
Picea engelmannii			41
Pseudotsuga menziesii		23	

	NUMBER TREES CORED	MINIMUM	MAXIMUM	MEAN
Abies grandis	1	30	30	30
Picea engelmannii	1	41	41	41
Pseudotsuga menziesii	1	23	23	23
Total	3	23	41	31

TABLE 11A. SHRUBLAND SHRUB DENSITY DATA - 1988
MONTANA PROJECT

TRANSECT NUMBER	5	6	12	13	46	48	56	57
	--	--	--	--	--	--	--	--
TALL SHRUBS								
Acer glabrum	8		1	9	3	3		
Alnus sinuata							4	8
Prunus emarginata					4			
Sorbus scopulina	1		15				18	5
Sorbus sitchensis	2		1					
Total Tall Shrubs	11	0	17	9	7	3	22	13
LOW SHRUBS								
Amelanchier anlifolia		1	21		1	2		
Lonicera utahensis		6	7					
Menziesia ferruginea	6	19						7
Oplopanax horridum	2							
Pachistima myrsinites			45		4	83		
Ribes lacustre	1	18						16
Ribes viscosissimum						2		
Rosa gymnocarpa						9		
Rubus idaeus	4	10		5	39		1	
Salix scouleriana						22		
Sambucus racemosa	7	1		1			1	2
Spiraea betulifolia			27			23		
Spiraea douglasii	3						2	3
Symphoricarpos albus			9	15		3		
Vaccinium globulare	11	40	78	1	1		70	4
Total Low Shrubs	34	95	187	22	45	144	74	32
SUBSHRUBS								
Berberis repens						5		
Rubus parviflorus	16	11		88		25	11	
Total Subshrubs	16	11	0	88	0	30	11	0
TOTAL SHRUBS	61	106	204	119	52	177	107	45

TABLE 11A. (CONTINUED)

	MEAN SHRUBS/25 SQ M	MEAN SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TALL SHRUBS				
Acer glabrum	3.0	485.6	2.8%	
Alnus sinuata	1.5	242.8	1.4%	
Prunus emarginata	0.5	80.9	0.5%	
Sorbus scopulina	4.9	789.2	4.4%	
Sorbus sitchensis	0.4	60.7	0.3%	
Total Tall Shrubs	10.3	1659.2	9.4%	
LOW SHRUBS				
Amelanchier anlifolia	3.1	505.9	2.9%	
Lonicera utahensis	1.6	263.1	1.5%	
Menziesia ferruginea	4.0	647.5	3.7%	
Oplopanax horridum	0.3	40.5	0.2%	
Pachistima myrsinites	16.4	2671.0	15.2%	
Ribes lacustre	4.4	708.2	4.0%	
Ribes viscosissimum	0.3	40.5	0.2%	
Rosa gymnocarpa	1.1	182.1	1.0%	
Rubus idaeus	7.4	1193.8	6.8%	
Salix scouleriana	2.8	445.2	2.5%	
Sambucus racemosa	1.5	242.8	1.4%	
Spiraea betulifolia	6.3	1011.7	5.7%	
Spiraea douglasii	1.0	161.9	0.9%	
Symphoricarpos albus	3.4	546.3	3.1%	
Vaccinium globulare	25.5	4148.1	23.6%	
Total Low Shrubs	79.1	12808.6	72.7%	
SUBSHRUBS				
Berberis repens	0.6	101.2	0.6%	
Rubus parviflorus	18.9	3055.4	17.3%	
Total Subshrubs	19.5	3156.6	17.9%	
TOTAL SHRUBS	108.9	17624.4	100.0%	54.1

TABLE 12A. SUBALPINE COVER DATA - 1988
MONTANA PROJECT

TRANSECT NUMBER	44		45	
	1st Hit	All Hits	1st Hit	All Hits
TREES				
Abies grandis		2		
Abies lasiocarpa	10	10	4	4
Pinus monticola	P		P	
Pseudotsuga menziesii	6	6	18	18
Tsuga mertensiana	P		8	8
Total % Trees	16	18	30	30
TALL SHRUBS				
Acer glabrum	P		P	
Prunus emarginata			P	
Sorbus scopulina	P			4
Sorbus sitchensis			P	
Total % Tall Shrubs	0	0	0	4
LOW SHRUBS				
Amelanchier alnifolia			2	8
Lonicera utahensis	4	4		
Menziesia ferruginea			2	2
Pachistima myrsinites	14	20	12	16
Ribes lacustre	P			
Rubus idaeus	P			
Salix scouleriana	P		P	
Spiraea betulifolia	P			
Spiraea douglasii	P			
Vaccinium globulare	10	20		4
Vaccinium myrtillus	14	14	P	
Total % Low Shrubs	42	58	16	30
SUBSHRUBS				
Penstemon ellipticus	8	8		
Total % Subshrubs	8	8	0	0
PERENNIAL GRAMINOIDS				
Agrostis alba	P			
Calamagrostis rubescens	P			
Carex geyeri	4	8	P	
Carex spp.	2	2		
Elymus glaucus	P			
Festuca viridula			P	
Juncus parryi	P			

TABLE 12A. (CONTINUED)

TRANSECT NUMBER	44		45	
	1st Hit	All Hits	1st Hit	All Hits
Total % Perennnial Graminoids	6	10	0	0
PERENNIAL FORBS				
Achillea millefolium	P			
Epilobium angustifolium	P		P	
Penstemon lyallii	P			
Thalictrum occidentale	P			
Xerophyllum tenax	8	20	30	44
Total % Perennial Forbs	8	20	30	44
CRYPTOGAMS				
Cheilanthes gracillima	P			
Cryptogramma crispa	P		2	2
Moss			2	2
Total % Cryptogams	0	0	4	4
TOTAL % VEGETATION	80	114	80	112
Soil				
Litter	6	6	4	4
Rock	14	14	16	16

P = SPECIES PRESENT BUT
NOT ENCOUNTERED QUANTITATIVELY

TABLE 12A. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
TREES					
Abies grandis	0.0%	0.0%	1.0%	0.9%	50.0%
Abies lasiocarpa	7.0%	8.8%	7.0%	6.2%	100.0%
Pinus monticola	P	0.0%	0.0%	0.0%	100.0%
Pseudotsuga menziesii	12.0%	15.0%	12.0%	10.6%	100.0%
Tsuga mertensiana	4.0%	5.0%	4.0%	3.5%	100.0%
Total % Trees	23.0%	28.8%	24.0%	21.2%	
TALL SHRUBS					
Acer glabrum	P	0.0%	0.0%	0.0%	100.0%
Prunus emarginata	P	0.0%	0.0%	0.0%	50.0%
Sorbus scopulina	0.0%	0.0%	2.0%	1.8%	100.0%
Sorbus sitchensis	P	0.0%	0.0%	0.0%	50.0%
Total % Tall Shrubs	0.0%	0.0%	2.0%	1.8%	
LOW SHRUBS					
Amelanchier alnifolia	1.0%	1.3%	4.0%	3.5%	50.0%
Lonicera utahensis	2.0%	2.5%	2.0%	1.8%	50.0%
Menziesia ferruginea	1.0%	1.3%	1.0%	0.9%	50.0%
Pachistima myrsinites	13.0%	16.1%	18.0%	15.9%	100.0%
Ribes lacustre	P	0.0%	0.0%	0.0%	50.0%
Rubus idaeus	P	0.0%	0.0%	0.0%	50.0%
Salix scouleriana	P	0.0%	0.0%	0.0%	100.0%
Spiraea betulifolia	P	0.0%	0.0%	0.0%	50.0%
Spiraea douglasii	P	0.0%	0.0%	0.0%	50.0%
Vaccinium globulare	5.0%	6.3%	12.0%	10.6%	100.0%
Vaccinium myrtillus	7.0%	8.8%	7.0%	6.2%	100.0%
Total % Low Shrubs	29.0%	36.3%	44.0%	38.9%	
SUBSHRUBS					
Penstemon ellipticus	4.0%	5.0%	4.0%	3.5%	50.0%
Total % Subshrubs	4.0%	5.0%	4.0%	3.5%	
PERENNIAL GRAMINOIDS					
Agrostis alba	P	0.0%	0.0%	0.0%	50.0%
Calamagrostis rubescens	P	0.0%	0.0%	0.0%	50.0%
Carex geyeri	2.0%	2.5%	4.0%	3.5%	100.0%
Carex spp.	1.0%	1.3%	1.0%	0.9%	50.0%
Elymus glaucus	P	0.0%	0.0%	0.0%	50.0%
Festuca viridula	P	0.0%	0.0%	0.0%	50.0%
Juncus parryi	P	0.0%	0.0%	0.0%	50.0%

TABLE 12A. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Total % Perennnial Graminoids	3.0%	3.8%	5.0%	4.4%	
PERENNIAL FORBS					
Achillea millefolium	P	0.0%	0.0%	0.0%	50.0%
Epilobium angustifolium	P	0.0%	0.0%	0.0%	100.0%
Penstemon lyallii	P	0.0%	0.0%	0.0%	50.0%
Thalictrum occidentale	P	0.0%	0.0%	0.0%	50.0%
Xerophyllum tenax	19.0%	23.8%	32.0%	28.3%	100.0%
Total % Perennial Forbs	19.0%	23.8%	32.0%	28.3%	
CRYPTOGAMS					
Cheilanthes gracillima	P	0.0%	0.0%	0.0%	50.0%
Cryptogramma crispa	1.0%	1.1%	1.0%	0.9%	100.0%
Moss	1.0%	1.2%	1.0%	1.0%	50.0%
Total % Cryptogams	2.0%	2.3%	2.0%	1.9%	
TOTAL % VEGETATION	80.0%	100.0%	113.0%	100.0%	
Soil	0.0%				
Litter	5.0%				
Rock	15.0%				

P = SPECIES PRESENT BUT
NOT ENCOUNTERED QUANTITATIVELY

TABLE 13A. SUBALPINE TREE DENSITY, REPRODUCTION, HEIGHT, DBH, BASAL AREA AND VOLUME, AND AGE DATA- 1988
MONTANA PROJECT

DENSITY

	44	45	MEAN/ 125 SQ METERS	MEAN/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TREES (>1.3 M DBH)						
Abies lasiocarpa	1	1	1.0	32.4	16.7%	
Pinus monticola	1		0.5	16.2	8.3%	
Pseudotsuga menziesii	2	6	4.0	129.5	66.7%	
Tsuga mertensiana		1	0.5	16.2	8.3%	
Total Trees	4	8	6.0	194.3	100.0%	2.0

REPRODUCTION

	44	45	MEAN/ 25 SQ METERS	MEAN/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
Abies lasiocarpa		1	0.5	80.9	25.0%	
Pseudotsuga menziesii	1	2	1.5	242.9	75.0%	
Total Tree Reproduction	1	3	2.0	323.8	100.0%	1.0

HEIGHT (FEET)

MEAN TREE HEIGHT IN FEET

	44	45	MINIMUM	MAXIMUM	MEAN
TREES					
Abies lasiocarpa	21.0	28.0	21	28	24.5
Pinus monticola	10.0		10	10	10.0
Pseudotsuga menziesii	17.0	11.8	8	18	13.1
Tsuga mertensiana		35.0	35	35	35.0
Total Trees					16.6

TABLE 13A. (CONTINUED)

DBH (INCHES)

MEAN DBH IN INCHES TRANSECT NUMBER	44	45	MINIMUM	MAXIMUM	MEAN
TREES					
Abies lasiocarpa	4.3	6.3	4.3	6.3	5.3
Pinus monticola	2.4		2.4	2.4	2.4
Pseudotsuga menziesii	3.9	2.8	2.0	3.9	3.1
Tsuga mertensiana		12.6	12.6	12.6	12.6
Total Trees					10.7

BASAL AREA AND VOLUME

	THOUSAND BOARD FEET PER ACRE	BASAL AREA (SQ FEET) ALL TREES
Tsuga mertensiana	1.0	0.9

AGE (YEARS)

TRANSECT NUMBER	44	45	MINIMUM	MAXIMUM	MEAN
SUBALPINE					
Abies lasiocarpa	45		45	45	45
Tsuga mertensiana		55	55	55	55

TABLE 14A. SUBALPINE SHRUB DENSITY DATA- 1988
MONTANA PROJECT

TRANSECT NUMBER	44 --	45 --	MEAN SHRUBS/25 SQ M	MEAN SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TALL SHRUBS						
Acer glabrum		2	1.0	161.9	1.1%	
Sorbus scopulina		2	1.0	161.9	1.1%	
Total Tall Shrubs	0	4	2.0	323.8	2.2%	
LOW SHRUBS						
Amelanchier anlifolia		1	0.5	80.9	0.6%	
Lonicera utahensis	6	3	4.5	728.5	5.0%	
Pachistima myrsinites	30	28	29.0	4694.5	32.4%	
Ribes lacustre	1		0.5	80.9	0.6%	
Rubus idaeus	4		2.0	323.8	2.2%	
Spiraea betulifolia	3	1	2.0	323.8	2.2%	
Vaccinium globulare	49	31	40.0	6475.0	44.7%	
Vaccinium myrtillus	16	2	9.0	1456.9	10.1%	
Total Low Shrubs	109	66	87.5	14164.3	97.8%	
TOTAL SHRUBS	109	70	89.5	14488.1	100.0%	19.5

TABLE 15. (Continued)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Habenaria hyperborea	P	0.0%	0.0%	0.0%	10.0%
Habenaria obtusata	P	0.0%	0.0%	0.0%	10.0%
Ligusticum verticillatum	P	0.0%	0.0%	0.0%	20.0%
Listera convallarioides	P	0.0%	0.0%	0.0%	10.0%
Mitella breweri	P	0.0%	0.0%	0.0%	10.0%
Osmorhiza chilensis	0.0%	0.0%	0.6%	0.3%	80.0%
Pyrola asarifolia	0.0%	0.0%	0.2%	0.1%	30.0%
Pyrola chlorantha	0.0%	0.0%	0.2%	0.1%	10.0%
Pyrola secunda	P	0.0%	0.0%	0.0%	20.0%
Pyrola uniflora	0.0%	0.0%	0.2%	0.1%	30.0%
Saxifraga ferruginea	0.0%	0.0%	0.2%	0.1%	10.0%
Senecio triangularis	0.4%	0.5%	1.2%	0.6%	30.0%
Smilacina stellata	0.2%	0.2%	6.6%	3.5%	90.0%
Streptopus amplexifolius	0.2%	0.2%	1.0%	0.5%	60.0%
Thalictrum occidentale	0.0%	0.0%	0.8%	0.4%	50.0%
Tiarella trifoliata	1.0%	1.0%	7.6%	3.9%	80.0%
Trillium ovatum	P	0.0%	0.0%	0.0%	70.0%
Urtica dioica	P	0.0%	0.0%	0.0%	20.0%
Veratrum viride	0.2%	0.2%	0.4%	0.2%	40.0%
Veronica americana	0.0%	0.0%	0.2%	0.1%	20.0%
Viola glabella	0.0%	0.0%	1.8%	1.0%	100.0%
Viola orbiculata	0.0%	0.0%	0.2%	0.1%	30.0%
Xerophyllum tenax	P	0.0%	0.0%	0.0%	10.0%
Total % Perennial Forbs	3.6%	3.7%	37.8%	19.4%	
ANNUAL & BIENNIAL FORBS					
Verbascum thapsus	P	0.0%	0.0%	0.0%	10.0%
Total % Annual & Biennial Forbs	0.0%	0.0%	0.0%	0.0%	
CRYPTOGAMS					
Athyrium filix-femina	10.0%	10.2%	26.6%	13.6%	100.0%
Dryopteris filix-mas	0.2%	0.2%	0.2%	0.1%	10.0%
Equisetum arvense	0.0%	0.0%	2.2%	1.1%	50.0%
Equisetum hyemale	P	0.0%	0.0%	0.0%	10.0%
Gymnocarpium dryopteris	0.2%	0.2%	7.2%	3.7%	70.0%
Lycopodium annotinum	P	0.0%	0.0%	0.0%	10.0%
Moss	0.8%	0.8%	6.6%	3.4%	100.0%
Pteridium aquilinum	1.0%	1.0%	3.2%	1.6%	40.0%
Thelypteris phegopteris	P	0.0%	0.0%	0.0%	10.0%
Total % Cryptogams	12.2%	12.4%	46.0%	23.5%	

TABLE 15. (Continued)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
TOTAL % VEGETATION	98.2%	100.0%	195.4%	100.0%	
Soil	0.0%				
Litter	1.8%				
Rock	0.0%				

P = SPECIES PRESENT BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 15A. WESTERN RED CEDAR/LADY FERN COVER DATA- 1988
MONTANA PROJECT

TRANSECT NUMBER	8		10		16		24	
	1st Hit	All Hits	1st Hit	All Hits	1st Hits	All Hits	1st Hits	All Hits
TREES								
Abies grandis	8	8			2	4	10	12
Abies lasiocarpa								
Larix occidentalis								
Picea engelmannii	8	8	20	20	6	6	2	4
Pinus monticola					P			
Populus trichocarpa								
Pseudotsuga menziesii	8	8						
Thuja plicata					74	76	54	58
Tsuga heterophylla	62	74	38	44		10	20	32
Total % Trees	86	98	58	64	82	96	86	106
TALL SHRUBS								
Acer glabrum			12	16				
Alnus sinuata			2	6				
Sorbus scopulina			P					
Sorbus sitchensis			P					
Taxus brevifolia								4
Total % Tall Shrubs	0	0	14	22	0	0	0	4
LOW SHRUBS								
Amelanchier alnifolia								
Cornus stolonifera								
Lonicera involucrata								
Lonicera utahensis								
Menziesia ferruginea							P	
Oplopanax horridum	2	2		2			4	18
Pachistima myrsinites			P		P			
Rhamnus alnifolia							P	
Ribes lacustre			P		P			
Rosa gymnocarpa					P			
Rosa nutkana								
Rubus idaeus								
Sambucus racemosa								
Sheperdia canadensis								
Symphoricarpos albus			6	8				
Vaccinium cespitosum								
Vaccinium globulare			2	2	P		P	
Total % Low Shrubs	2	2	8	12	0	0	4	18

TABLE 15A. (CONTINUED)

TRANSECT NUMBER	8		10		16		24	
	1st Hit	All Hits	1st Hit	All Hits	1st Hits	All Hits	1st Hits	All Hits
SUBSHRUBS								
Chimaphila umbellata					P			
Cornus canadensis							P	
Linnaea borealis					P		P	
Penstemon ellipticus					P			
Rubus parviflorus			P				P	
Total % Subshrubs	0	0	0	0	0	0	0	0
PERENNIAL GRAMINOIDS								
Bromus vulgaris			P		P			
Calamagrostis canadensis							P	
Carex deweyana								
Deschampsia elongata								
Elymus glaucus								
Festuca subulata			P					
Glyceria grandis								2
Scirpus maritimus								
Total % Perennial Graminoids	0	0	0	0	0	0	0	2
PERENNIAL FORBS								
Aconitum columbianum								
Actaea rubra	P		P				P	
Adenocaulon bicolor			2	2				
Angelica arguta								
Aralia nudicaulis						2		
Arnica cordifolia				14		2		6
Asarum caudatum								
Cicuta douglasii								
Circaea alpina							P	
Clintonia uniflora		2		2	2	4	P	
Coptis occidentalis					2	10	P	
Corallorhiza maculata	P				P			
Disporum hookeri		4		10	P			
Epilobium angustifolium			P					
Epilobium glaberrimum							P	
Fragaria vesca								
Fragaria virginiana								
Galium triflorum					P		P	
Geum macrophyllum								
Goodyera oblongfolia	P							
Habenaria dilatata							P	

TABLE 15A. (CONTINUED)

TRANSECT NUMBER	8		10		16		24	
	1st Hit	All Hits	1st Hit	All Hits	1st Hits	All Hits	1st Hits	All Hits
Habenaria hyperborea								
Habenaria obtusata							P	
Ligusticum verticillatum							P	
Listera convallarioides					P			
Mitella breweri								
Osmorhiza chilensis				4	P		P	
Pyrola asarifolia							P	
Pyrola chlorantha								
Pyrola secunda					P		P	
Pyrola uniflora						2	P	
Saxifraga ferruginea								2
Senecio triangularis							P	
Smilacina stellata	P			2				2
Streptopus amplexifolius	P		P				2	6
Thalictrum occidentale	P			2				
Tiarella trifoliata		4		4		6		6
Trillium ovatum	P		P		P		P	
Urtica dioica								
Veratrum viride				2	P			
Veronica americana							P	
Viola glabella	P			2	P			2
Viola orbiculata		2			P			
Xerophyllum tenax								
Total % Perennial Forbs	0	12	2	44	4	26	2	24
ANNUAL & BIENNIAL FORBS								
Verbascum thapsus								
Total % Annual & Biennial Forbs	0	0	0	0	0	0	0	0
CRYPTOGAMS								
Athyrium filix-femina	6	14	12	16	6	14	8	18
Dryopteris filix-mas					2	2		
Equisetum arvense					P			4
Equisetum hyemale								
Gymnocarpium dryopteris		10		18		2		18
Lycopodium annotinum							P	
Moss	4	10	2	6		2		4
Pteridium aquilinum			2	12				
Thelypteris phegopteris								
Total % Cryptogams	10	34	16	52	8	20	8	44

TABLE 15A. (CONTINUED)

TRANSECT NUMBER	8		10		16		24	
	1st Hit	All Hits	1st Hit	All Hits	1st Hits	All Hits	1st Hits	All Hits
TOTAL % VEGETATION	98	146	98	194	94	142	100	198
Soil								
Litter	2	2	2	2	6	6		
Rock								

P = SPECIES PRESENT BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 15A. (CONTINUED)

TRANSECT NUMBER	25		29		37		49	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
TREES								
Abies grandis	2	2	P				14	14
Abies lasiocarpa								
Larix occidentalis			4	4				
Picea engelmannii	8	10	4	4	2	12	6	8
Pinus monticola	2	2						
Populus trichocarpa					70	70		
Pseudotsuga menziesii			4	4				
Thuja plicata	48	50	P		12	26		
Tsuga heterophylla	20	28			P		P	
Total % Trees	80	92	12	12	84	108	20	22
TALL SHRUBS								
Acer glabrum							72	78
Alnus sinuata	P		28	28	12	14		
Sorbus scopulina								
Sorbus sitchensis							P	
Taxus brevifolia						6		4
Total % Tall Shrubs	0	0	28	28	12	20	72	82
LOW SHRUBS								
Amelanchier alnifolia						4		
Cornus stolonifera			2	6		8		
Lonicera involucrata	P			2				
Lonicera utahensis				2				
Menziesia ferruginea	P							
Oplopanax horridum		2			P			
Pachistima myrsinites	P		P				P	
Rhamnus alnifolia						6		
Ribes lacustre		2	P		P		P	
Rosa gymnocarpa	P				P			
Rosa nutkana			P					
Rubus idaeus			P					
Sambucus racemosa			P				2	8
Sheperdia canadensis								
Symphoricarpos albus			P			18	P	
Vaccinium cespitosum	P							
Vaccinium globulare	P							
Total % Low Shrubs	0	4	2	10	0	36	2	8

TABLE 15A. (CONTINUED)

TRANSECT NUMBER	25		29		37		49	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
SUBSHRUBS								
Chimaphila umbellata								
Cornus canadensis			P					
Linnaea borealis	P							
Penstemon ellipticus								
Rubus parviflorus			P		P			30
Total % Subshrubs	0	0	0	0	0	0	0	30
PERENNIAL GRAMINOIDS								
Bromus vulgaris	P		P		P		P	
Calamagrostis canadensis			P					
Carex deweyana			P					
Deschampsia elongata	2	2						
Elymus glaucus					P		P	
Festuca subulata								
Glyceria grandis	4	6	2	32	P			
Scirpus maritimus			P					
Total % Perennial Graminoids	6	8	2	32	0	0	0	0
PERENNIAL FORBS								
Aconitum columbianum			2	4	2	10		
Actaea rubra		2	P			2	P	
Adenocaulon bicolor	P							2
Angelica arguta	P				2	4	P	
Aralia nudicaulis	P		P					
Arnica cordifolia	2	8		2				2
Asarum caudatum								10
Cicuta douglasii					P			
Circaea alpina			2	12		2		2
Clintonia uniflora		2	P					6
Coptis occidentalis		2	P			2		
Corallorhiza maculata								
Disporum hookeri					P			2
Epilobium angustifolium								
Epilobium glaberrimum				2				
Fragaria vesca							P	
Fragaria virginiana			P					
Galium triflorum				8	P		P	
Geum macrophyllum			P					
Goodyera oblongfolia								
Habenaria dilatata	P				P			

TABLE 15A. (CONTINUED)

TRANSECT NUMBER	25		29		37		49	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
Habenaria hyperborea					P			
Habenaria obtusata								
Ligusticum verticillatum	P							
Listera convallarioides								
Mitella breweri								
Osmorhiza chilensis		2	P		P		P	
Pyrola asarifolia				2	P			
Pyrola chlorantha						2		
Pyrola secunda								
Pyrola uniflora								
Saxifraga ferruginea								
Senecio triangularis			4	12	P			
Smilacina stellata	P			2		46	2	14
Streptopus amplexifolius	P			4			P	
Thalictrum occidentale			P			4		2
Tiarella trifoliata		6	P					
Trillium ovatum	P						P	
Urtica dioica							P	
Veratrum viride	P							
Veronica americana				2				
Viola glabella		2		4		2		6
Viola orbiculata					P			
Xerophyllum tenax								
Total % Perennial Forbs	2	24	8	54	4	74	2	46
ANNUAL & BIENNIAL FORBS								
Verbascum thapsus					P			
Total % Annual & Biennial Forbs	0	0	0	0	0	0	0	0
CRYPTOGAMS								
Athyrium filix-femina	12	28	40	74		10	4	16
Dryopteris filix-mas								
Equisetum arvense		16				2		
Equisetum hyemale					P			
Gymnocarpium dryopteris		6	P					
Lycopodium annotinum								
Moss		22		2		4		2
Pteridium aquilinum			8	10		8		2
Thelypteris phegopteris	P							
Total % Cryptogams	12	72	48	86	0	24	4	20

TABLE 15A. (CONTINUED)

TRANSECT NUMBER	25		29		37		49	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
TOTAL % VEGETATION	100	200	100	222	100	262	100	208
Soil								
Litter								
Rock								

P = SPECIES PRESENT BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 15A. (CONTINUED)

TRANSECT NUMBER	53		55	
	1st Hits	All Hits	1st Hits	All Hits
TREES				
Abies grandis				2
Abies lasiocarpa			P	
Larix occidentalis				
Picea engelmannii	6	6	62	62
Pinus monticola				
Populus trichocarpa				
Pseudotsuga menziesii				
Thuja plicata				
Tsuga heterophylla	60	60	4	6
Total % Trees	66	66	66	70
TALL SHRUBS				
Acer glabrum	18	28		
Alnus sinuata			10	12
Sorbus scopulina				
Sorbus sitchensis				
Taxus brevifolia				
Total % Tall Shrubs	18	28	10	12
LOW SHRUBS				
Amelanchier alnifolia				
Cornus stolonifera				
Lonicera involucrata				
Lonicera utahensis	P			
Menziesia ferruginea			P	
Oplopanax horridum		14		
Pachistima myrsinites				
Rhamnus alnifolia				
Ribes lacustre				
Rosa gymnocarpa				
Rosa nutkana				
Rubus idaeus				
Sambucus racemosa				
Sheperdia canadensis	P			
Symphoricarpos albus				
Vaccinium cespitosum				
Vaccinium globulare			2	2
Total % Low Shrubs	0	14	2	2

TABLE 15A. (CONTINUED)

TRANSECT NUMBER	53		55	
	1st Hits	All Hits	1st Hits	All Hits
SUBSHRUBS				
Chimaphila umbellata				
Cornus canadensis				
Linnaea borealis				
Penstemon ellipticus				
Rubus parviflorus		2		
Total % Subshrubs	0	2	0	0
PERENNIAL GRAMINOIDS				
Bromus vulgaris		P		
Calamagrostis canadensis				2
Carex deweyana			P	
Deschampsia elongata				
Elymus glaucus				
Festuca subulata	2	4		
Glyceria grandis				
Scirpus maritimus				
Total % Perennial Graminoids	2	4	0	2
PERENNIAL FORBS				
Aconitum columbianum	P			
Actaea rubra		2		
Adenocaulon bicolor		2		
Angelica arguta				
Aralia nudicaulis				
Arnica cordifolia				
Asarum caudatum	P			
Cicuta douglasii				
Circaea alpina		4		
Clintonia uniflora		8	P	
Coptis occidentalis				
Corallorhiza maculata				
Disporum hookeri		6	P	
Epilobium angustifolium				
Epilobium glaberrimum				
Fragaria vesca				
Fragaria virginiana				
Galium triflorum	P			
Geum macrophyllum				
Goodyera oblongfolia				
Habenaria dilatata				

TABLE 15A. (CONTINUED)

TRANSECT NUMBER	53		55	
	1st Hits	All Hits	1st Hits	All Hits
Habenaria hyperborea				
Habenaria obtusata				
Ligusticum verticillatum				
Listera convallarioides				
Mitella breweri	P			
Osmorhiza chilensis	P			
Pyrola asarifolia				
Pyrola chlorantha				
Pyrola secunda				
Pyrola uniflora			P	
Saxifraga ferruginea				
Senecio triangularis				
Smilacina stellata	P		P	
Streptopus amplexifolius				
Thalictrum occidentale				
Tiarella trifoliata	6	28	4	22
Trillium ovatum	P			
Urtica dioica	P			
Veratrum viride	2	2		
Veronica americana				
Viola glabella	P		P	
Viola orbiculata				
Xerophyllum tenax			P	
Total % Perennial Forbs	8	52	4	22
ANNUAL & BIENNIAL FORBS				
Verbascum thapsus				
Total % Annual & Biennial Forbs	0	0	0	0
CRYPTOGAMS				
Athyrium filix-femina	6	46	6	30
Dryopteris filix-mas				
Equisetum arvense			P	
Equisetum hyemale				
Gymnocarpium dryopteris		14	2	4
Lycopodium annotinum				
Moss		4	2	10
Pteridium aquilinum				
Thelypteris phegopteris				
Total % Cryptogams	6	64	10	44

TABLE 15A. (CONTINUED)

TRANSECT NUMBER	53		55	
	1st Hits	All Hits	1st Hits	All Hits
TOTAL % VEGETATION	100	230	92	152
Soil				
Litter			8	8
Rock				

P = SPECIES PRESENT BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 15A. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
TREES					
Abies grandis	3.6%	3.7%	4.2%	2.1%	70.0%
Abies lasiocarpa	P	0.0%	0.0%	0.0%	10.0%
Larix occidentalis	0.4%	0.4%	0.4%	0.2%	10.0%
Picea engelmannii	12.4%	12.6%	14.0%	7.2%	100.0%
Pinus monticola	0.2%	0.2%	0.2%	0.1%	20.0%
Populus trichocarpa	7.0%	7.2%	7.0%	3.6%	10.0%
Pseudotsuga menziesii	1.2%	1.2%	1.2%	0.6%	20.0%
Thuja plicata	18.8%	19.1%	21.0%	10.7%	50.0%
Tsuga heterophylla	20.4%	20.8%	25.4%	13.1%	90.0%
Total % Trees	64.0%	65.2%	73.4%	37.6%	
TALL SHRUBS					
Acer glabrum	10.2%	10.4%	12.2%	6.2%	30.0%
Alnus sinuata	5.2%	5.3%	6.0%	3.1%	50.0%
Sorbus scopulina	P	0.0%	0.0%	0.0%	10.0%
Sorbus sitchensis	P	0.0%	0.0%	0.0%	20.0%
Taxus brevifolia	0.0%	0.0%	1.4%	0.7%	30.0%
Total % Tall Shrubs	15.4%	15.7%	19.6%	10.0%	
LOW SHRUBS					
Amelanchier alnifolia	0.0%	0.0%	0.4%	0.2%	10.0%
Cornus stolonifera	0.2%	0.2%	1.4%	0.7%	20.0%
Lonicera involucrata	0.0%	0.0%	0.2%	0.1%	10.0%
Lonicera utahensis	0.0%	0.0%	0.2%	0.1%	10.0%
Menziesia ferruginea	P	0.0%	0.0%	0.0%	30.0%
Oplopanax horridum	0.6%	0.6%	3.8%	2.0%	50.0%
Pachistima myrsinites	P	0.0%	0.0%	0.0%	50.0%
Rhamnus alnifolia	0.0%	0.0%	0.6%	0.3%	20.0%
Ribes lacustre	0.0%	0.0%	0.2%	0.1%	60.0%
Rosa gymnocarpa	P	0.0%	0.0%	0.0%	30.0%
Rosa nutkana	P	0.0%	0.0%	0.0%	10.0%
Rubus idaeus	P	0.0%	0.0%	0.0%	10.0%
Sambucus racemosa	0.2%	0.2%	0.8%	0.4%	20.0%
Sheperdia canadensis	P	0.0%	0.0%	0.0%	10.0%
Symphoricarpos albus	0.6%	0.6%	2.6%	1.3%	40.0%
Vaccinium cespitosum	P	0.0%	0.0%	0.0%	10.0%
Vaccinium globulare	0.4%	0.4%	0.4%	0.2%	50.0%
Total % Low Shrubs	2.0%	2.0%	10.6%	5.4%	

TABLE 15A. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
SUBSHRUBS					
Chimaphila umbellata	P	0.0%	0.0%	0.0%	10.0%
Cornus canadensis	P	0.0%	0.0%	0.0%	20.0%
Linnaea borealis	P	0.0%	0.0%	0.0%	30.0%
Penstemon ellipticus	P	0.0%	0.0%	0.0%	10.0%
Rubus parviflorus	0.0%	0.0%	3.2%	1.6%	60.0%
Total % Subshrubs	0.0%	0.0%	3.2%	1.6%	
PERENNIAL GRAMINOIDS					
Bromus vulgaris	P	0.0%	0.0%	0.0%	70.0%
Calamagrostis canadensis	0.0%	0.0%	0.2%	0.1%	30.0%
Carex deweyana	P	0.0%	0.0%	0.0%	20.0%
Deschampsia elongata	0.2%	0.2%	0.2%	0.1%	10.0%
Elymus glaucus	P	0.0%	0.0%	0.0%	20.0%
Festuca subulata	0.2%	0.2%	0.4%	0.2%	20.0%
Glyceria grandis	0.6%	0.6%	4.0%	2.1%	40.0%
Scirpus maritimus	P	0.0%	0.0%	0.0%	10.0%
Total % Perennial Graminoids	1.0%	1.0%	4.8%	2.5%	
PERENNIAL FORBS					
Aconitum columbianum	0.4%	0.4%	1.4%	0.7%	30.0%
Actaea rubra	0.0%	0.0%	0.6%	0.3%	80.0%
Adenocaulon bicolor	0.2%	0.2%	0.6%	0.3%	40.0%
Angelica arguta	0.2%	0.2%	0.4%	0.2%	30.0%
Aralia nudicaulis	0.0%	0.0%	0.2%	0.1%	20.0%
Arnica cordifolia	0.2%	0.2%	3.4%	1.8%	60.0%
Asarum caudatum	0.0%	0.0%	1.0%	0.5%	20.0%
Cicuta douglasii	P	0.0%	0.0%	0.0%	10.0%
Circaea alpina	0.2%	0.2%	2.0%	1.0%	50.0%
Clintonia uniflora	0.2%	0.2%	2.4%	1.2%	90.0%
Coptis occidentalis	0.2%	0.2%	1.4%	0.7%	50.0%
Corallorhiza maculata	P	0.0%	0.0%	0.0%	20.0%
Disporum hookeri	0.0%	0.0%	2.2%	1.1%	70.0%
Epilobium angustifolium	P	0.0%	0.0%	0.0%	10.0%
Epilobium glaberrimum	0.0%	0.0%	0.2%	0.1%	20.0%
Fragaria vesca	P	0.0%	0.0%	0.0%	10.0%
Fragaria virginiana	P	0.0%	0.0%	0.0%	10.0%
Galium triflorum	0.0%	0.0%	0.8%	0.4%	60.0%
Geum macrophyllum	P	0.0%	0.0%	0.0%	10.0%
Goodyera oblongfolia	P	0.0%	0.0%	0.0%	10.0%
Habenaria dilatata	P	0.0%	0.0%	0.0%	30.0%

TABLE 15A. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Habenaria hyperborea	P	0.0%	0.0%	0.0%	10.0%
Habenaria obtusata	P	0.0%	0.0%	0.0%	10.0%
Ligusticum verticillatum	P	0.0%	0.0%	0.0%	20.0%
Listera convallarioides	P	0.0%	0.0%	0.0%	10.0%
Mitella breweri	P	0.0%	0.0%	0.0%	10.0%
Osmorhiza chilensis	0.0%	0.0%	0.6%	0.3%	80.0%
Pyrola asarifolia	0.0%	0.0%	0.2%	0.1%	30.0%
Pyrola chlorantha	0.0%	0.0%	0.2%	0.1%	10.0%
Pyrola secunda	P	0.0%	0.0%	0.0%	20.0%
Pyrola uniflora	0.0%	0.0%	0.2%	0.1%	30.0%
Saxifraga ferruginea	0.0%	0.0%	0.2%	0.1%	10.0%
Senecio triangularis	0.4%	0.5%	1.2%	0.6%	30.0%
Smilacina stellata	0.2%	0.2%	6.6%	3.5%	90.0%
Streptopus amplexifolius	0.2%	0.2%	1.0%	0.5%	60.0%
Thalictrum occidentale	0.0%	0.0%	0.8%	0.4%	50.0%
Tiarella trifoliata	1.0%	1.0%	7.6%	3.9%	80.0%
Trillium ovatum	P	0.0%	0.0%	0.0%	70.0%
Urtica dioica	P	0.0%	0.0%	0.0%	20.0%
Veratrum viride	0.2%	0.2%	0.4%	0.2%	40.0%
Veronica americana	0.0%	0.0%	0.2%	0.1%	20.0%
Viola glabella	0.0%	0.0%	1.8%	1.0%	100.0%
Viola orbiculata	0.0%	0.0%	0.2%	0.1%	30.0%
Xerophyllum tenax	P	0.0%	0.0%	0.0%	10.0%
Total % Perennial Forbs	3.6%	3.7%	37.8%	19.4%	
ANNUAL & BIENNIAL FORBS					
Verbascum thapsus	P	0.0%	0.0%	0.0%	10.0%
Total % Annual & Biennial Forbs	0.0%	0.0%	0.0%	0.0%	
CRYPTOGAMS					
Athyrium filix-femina	10.0%	10.2%	26.6%	13.6%	100.0%
Dryopteris filix-mas	0.2%	0.2%	0.2%	0.1%	10.0%
Equisetum arvense	0.0%	0.0%	2.2%	1.1%	50.0%
Equisetum hyemale	P	0.0%	0.0%	0.0%	10.0%
Gymnocarpium dryopteris	0.2%	0.2%	7.2%	3.7%	70.0%
Lycopodium annotinum	P	0.0%	0.0%	0.0%	10.0%
Moss	0.8%	0.8%	6.6%	3.4%	100.0%
Pteridium aquilinum	1.0%	1.0%	3.2%	1.6%	40.0%
Thelypteris phegopteris	P	0.0%	0.0%	0.0%	10.0%
Total % Cryptogams	12.2%	12.4%	46.0%	23.5%	

TABLE 15A. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
TOTAL % VEGETATION	98.2%	100.0%	195.4%	100.0%	
Soil	0.0%				
Litter	1.8%				
Rock	0.0%				

P = SPECIES PRESENT BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 16. WESTERN RED CEDAR/LADY FERN TREE DENSITY, REPRODUCTION, HEIGHT, DBH, AND AGE DATA SUMMARY - 1988 MONTANA PROJECT

DENSITY

	MEAN/ 125 SQ METERS	MEAN/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TREES				
Abies grandis	1.1	35.6	9.6%	
Abies lasiocarpa	0.3	9.7	2.6%	
Picea engelmannii	2.0	64.8	17.5%	
Pinus monticola	0.1	3.2	0.9%	
Populus trichocarpa	0.2	6.5	1.8%	
Pseudotsuga menziesii	0.1	3.2	0.9%	
Thuja plicata	4.4	142.5	38.6%	
Tsuga heterophylla	3.2	103.6	28.1%	
Total Trees	11.4	369.1	100.0%	8.0
TREES (DEAD)				
Picea engelmannii	0.2	6.5	50.0%	
Tsuga heterophylla	0.2	6.5	50.0%	
Total Trees (Dead)	0.4	13.0	100.0%	

REPRODUCTION

	MEAN SHRUBS/25 SQ M	MEAN SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
Abies grandis	0.3	48.6	1.8%	
Pseudotsuga menziesii	0.1	16.2	0.6%	
Thuja plicata	0.5	80.9	3.0%	
Tsuga heterophylla	15.6	2525.3	94.6%	
Total Tree Reproduction	16.5	2671.0	100.0%	36.8

TABLE 16. (Continued)

HEIGHT (FEET)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	8	90	33.2
Abies lasiocarpa	4	17	12.3
Picea engelmannii	7	97	32.1
Pinus monticola	21	21	21.0
Pseudotsuga menziesii	105	105	105.0
Thuja plicata	5	101	39.2
Tsuga heterophylla	5	95	25.8
Total Trees			33.3

DBH (INCHES)

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	0.8	25.2	6.8
Abies lasiocarpa	1.2	3.1	2.0
Picea engelmannii	1.2	30.3	6.9
Pinus monticola	5.1	5.1	5.1
Populus trichocarpa	33.1	35.0	34.1
Pseudotsuga menziesii	31.1	31.1	31.1
Thuja plicata	0.4	26.8	7.9
Tsuga heterophylla	0.4	46.5	5.9
Total Trees			7.5
TREES (DEAD)			
Picea engelmannii	3.1	4.7	3.9
Tsuga heterophylla	6.7	24.4	15.6

TABLE 16. (Continued)

AGE (YEARS)

TRANSECT NUMBER	NUMBER TREES CORED	MINIMUM	MAXIMUM	MEAN
Picea engelmannii	5	37	160+	105
Pseudotsuga menziesii	1	150+	150+	150+
Thuja plicata	1	170+	170+	170+
Total	7	37	170+	142

TABLE 16A. WESTERN RED CEDAR/LADY FERN TREE DENSITY, REPRODUCTION, HEIGHT, DBH, AND AGE DATA
MONTANA PROJECT

DENSITY

TRANSECT NUMBER	8	10	16	24	25	29	37	49	53	55
TREES										
Abies grandis	1	1	1	2		5				1
Abies lasiocarpa										3
Picea engelmannii	1	1	1	1	3	1	1	4	1	6
Pinus monticola					1					
Populus trichocarpa							2			
Pseudotsuga menziesii	1									
Thuja plicata			16	9	13		6			
Tsuga heterophylla	6	2	5	10	7				1	1
Total Trees	9	4	23	22	24	6	9	4	2	11
TREES (DEAD)										
Picea engelmannii										2
Tsuga heterophylla				1	1					
Total Trees (Dead)	0	0	0	1	1	0	0	0	0	2

	MEAN/ 125 SQ METERS	MEAN/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TREES				
Abies grandis	1.1	35.6	9.6%	
Abies lasiocarpa	0.3	9.7	2.6%	
Picea engelmannii	2.0	64.8	17.5%	
Pinus monticola	0.1	3.2	0.9%	
Populus trichocarpa	0.2	6.5	1.8%	
Pseudotsuga menziesii	0.1	3.2	0.9%	
Thuja plicata	4.4	142.5	38.6%	
Tsuga heterophylla	3.2	103.6	28.1%	
Total Trees	11.4	369.1	100.0%	8.0
TREES (DEAD)				
Picea engelmannii	0.2	6.5	50.0%	
Tsuga heterophylla	0.2	6.5	50.0%	
Total Trees (Dead)	0.4	13.0	100.0%	

TABLE 16A. (CONTINUED)

REPRODUCTION

TRANSECT NUMBER	8	10	16	24	25	29	37	49	53	55
Abies grandis	1	1								1
Pseudotsuga menziesii	1									
Thuja plicata			2	1	1		1			
Tsuga heterophylla		123			28		5			
Total Tree Reproduction	2	124	2	1	29	0	6	0	0	1

	MEAN SHRUBS/25 SQ M	MEAN SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
Abies grandis	0.3	48.6	1.8%	
Pseudotsuga menziesii	0.1	16.2	0.6%	
Thuja plicata	0.5	80.9	3.0%	
Tsuga heterophylla	15.6	2525.3	94.6%	
Total Tree Reproduction	16.5	2671.0	100.0%	36.8

TABLE 16A. (CONTINUED)

HEIGHT (FEET)

MEAN TREE HEIGHT TRANSECT NUMBER	8	10	16	24	25	29	37	49	53	55
	--	--	--	--	--	--	--	--	--	--
TREES										
Abies grandis	90.0	85.0	8.0	61.0		8.8				16.0
Abies lasiocarpa										10.7
Picea engelmannii	38.0	97.0	90.0	62.0	34.7	12.0		24.3	80.0	58.3
Pinus monticola					21.0					
Pseudotsuga menziesii	105.0									
Thuja plicata			41.6	46.9	41.8		15.7			
Tsuga heterophylla	24.3	43.0	21.0	28.6	7.8				95.0	39.0
Total Trees										

	MINIMUM	MAXIMUM	MEAN
	---	---	---
TREES			
Abies grandis	8	90	33.2
Abies lasiocarpa	4	17	12.3
Picea engelmannii	7	97	32.1
Pinus monticola	21	21	21.0
Pseudotsuga menziesii	105	105	105.0
Thuja plicata	5	101	39.2
Tsuga heterophylla	5	95	25.8
Total Trees			33.3

TABLE 16A. (CONTINUED)

DBH (INCHES)

MEAN dbh TRANSECT NUMBER	8	10	16	24	25	29	37	49	53	55
	--	--	--	--	--	--	--	--	--	--
TREES										
Abies grandis	18.1	25.2	1.2	11.0		1.1				2.4
Abies lasiocarpa										2.0
Picea engelmannii	8.3	24.4	8.7	9.8	7.0	2.0	30.3	4.6	22.0	10.4
Pinus monticola					5.1					
Populus trichocarpa							34.1			
Pseudotsuga menziesii	31.1									
Thuja plicata			7.2	10.7	9.1		2.8			
Tsuga heterophylla	5.0	14.8	3.1	4.5	2.2				46.5	8.7
Total Trees										
TREES (DEAD)										
Picea engelmannii										3.9
Tsuga heterophylla				2.0	6.7					

	MINIMUM	MAXIMUM	MEAN
TREES			
Abies grandis	0.8	25.2	6.8
Abies lasiocarpa	1.2	3.1	2.0
Picea engelmannii	1.2	30.3	6.9
Pinus monticola	5.1	5.1	5.1
Populus trichocarpa	33.1	35.0	34.1
Pseudotsuga menziesii	31.1	31.1	31.1
Thuja plicata	0.4	26.8	7.9
Tsuga heterophylla	0.4	46.5	5.9
Total Trees			7.5
TREES (DEAD)			
Picea engelmannii	3.1	4.7	3.9
Tsuga heterophylla	6.7	24.4	15.6

TABLE 16A. (CONTINUED)

AGE (YEARS)

TRANSECT NUMBER	8	10	16	24	25	29	37	NUMBER TREES CORED	MINIMUM	MAXIMUM	MEAN
Picea engelmannii		160+	70		150+	37	110+	5	37	160+	105
Pseudotsuga menziesii	150+							1	150+	150+	150+
Thuja plicata				170+				1	170+	170+	170+
Total								7	37	170+	142

* The age estimate for one or more trees in this category is too low, because the increment borer could estimate tree age only for trees of 32 inch diameter or less.

TABLE 17A. WESTERN RED CEDAR/LADY FERN SHRUB DENSITY DATA- 1988
MONTANA PROJECT

TRANSECT NUMBER	8	10	16	24	25	29	37	49	53	55
	--	--	--	--	--	--	--	--	--	--
TALL SHRUBS										
Acer glabrum		3						11	6	
Alnus sinuata		3				5	P			1
Sorbus scopulina		2								
Taxus brevifolia				3			3	P		
Total Tall Shrubs	0	8	0	3	0	5	3	11	6	1
LOW SHRUBS										
Amelanchier alnifolia							1			
Cornus stolonifera						3				
Menziesia ferruginea				1						5
Oplopanax horridum	6	4	2	17	11		1		10	
Pachistima myrsinites		1						7		
Rhamnus alnifolia							6			
Rosa gymnocarpa							2			
Rosa nutkana						2				
Salix scouleriana	1									
Sambucus racemosa		1						1		
Symphoricarops albus		10				5	51	P		
Vaccinium globulare		2	2	1	P					7
Vaccinium myrtillus					P					2
Total Low Shrubs	7	18	4	19	11	10	61	8	10	14
SUBSHRUBS										
Rubus parviflorus		1	2			P		28		
Total Subshrubs	0	1	2	0	0	0	0	28	0	0
TOTAL SHRUBS	7	27	6	22	11	15	64	47	16	15

TABLE 17A. (CONTINUED)

	MEAN SHRUBS/25 SQ M	MEAN SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TALL SHRUBS				
Acer glabrum	2.0	323.8	8.7%	
Alnus sinuata	0.9	145.7	3.9%	
Sorbus scopulina	0.2	32.4	0.9%	
Taxus brevifolia	0.6	97.1	2.6%	
Total Tall Shrubs	3.7	599.0	16.1%	
LOW SHRUBS				
Amelanchier alnifolia	0.1	16.2	0.4%	
Cornus stolonifera	0.3	48.5	1.3%	
Menziesia ferruginea	0.6	97.1	2.6%	
Oplopanax horridum	5.1	825.6	22.2%	
Pachistima myrsinites	0.8	129.5	3.4%	
Rhamnus alnifolia	0.6	97.1	2.6%	
Rosa gymnocarpa	0.2	32.4	0.9%	
Rosa nutkana	0.2	32.4	0.9%	
Salix scouleriana	0.1	16.2	0.4%	
Sambucus racemosa	0.2	32.4	0.9%	
Symphoricarops albus	6.6	1068.4	28.7%	
Vaccinium globulare	1.2	194.2	5.2%	
Vaccinium myrtillus	0.2	32.4	0.9%	
Total Low Shrubs	16.2	2622.4	70.4%	
SUBSHRUBS				
Rubus parviflorus	3.1	501.8	13.5%	
Total Subshrubs	3.1	501.8	13.5%	
TOTAL SHRUBS	23.0	3723.2	100.0%	17.7

TABLE 18A. POTENTIAL VEGETATION TYPE PRODUCTION DATA - 1988
MONTANA PROJECT

WESTERN RED CEDAR/LADY FERN

SAMPLE NUMBER	8A	8B	8C	8D	MEAN	10A	10B	10C	10D	MEAN	16A	16B	16C	16D	MEAN
Perennial Graminoids															
Annual Graminoids															
Perennial Forbs	2.3	1.2	2.0	0.0	1.4	93.8	26.1	8.7	28.7	39.3	15.0	4.5	10.5	4.7	8.7
Annual & Biennial Forbs															
Total Production	2.3	1.2	2.0	0.0	1.4	93.8	26.1	8.7	28.7	39.3	15.0	4.5	10.5	4.7	8.7

SAMPLE NUMBER	24A	24B	24C	24D	MEAN	25A	25B	25C	25D	MEAN	29A	29B	29C	29D	MEAN
Perennial Graminoids	0.1				0.03	1.5				0.4	1.5		5.5	15.9	5.7
Annual Graminoids															
Perennial Forbs	25.2	5.9	0.5	18.2	12.5	5.7	11.0	7.0	25.7	12.4	51.6	101.3	43.4	106.2	75.6
Annual & Biennial Forbs															
Total Production	25.3	5.9	0.5	18.2	12.5	7.2	11.0	7.0	25.7	12.7	53.1	101.3	48.9	122.1	81.4

SAMPLE NUMBER	37A	37B	37C	37D	MEAN	49A	49B	49C	49D	MEAN	53A	53B	53C	53D	MEAN
Perennial Graminoids		1.3	2.1	1.6	1.3								2.0		0.5
Annual Graminoids															
Perennial Forbs	52.6	63.9	4.4	59.6	45.1	0.0	4.9	0.0	0.0	1.2	28.5	48.3	20.3	49.3	36.6
Annual & Biennial Forbs															
Total Production	52.6	65.2	6.5	61.2	46.4	0.0	4.9	0.0	0.0	1.2	28.5	48.3	22.3	49.3	37.1

SAMPLE NUMBER	55A	55B	55C	55D	MEAN	GRAMS/ SQ M	KG/ HA	LBS/ ACRE	REL. PROD.	STD DEV
Perennial Graminoids		5.2		2.6	2.0	1.0	9.8	8.7	3.6%	
Annual Graminoids						0.0	0.0	0.0	0.0%	
Perennial Forbs	10.3	35.0	34.5	35.4	28.8	26.1	261.6	232.9	96.4%	
Annual & Biennial Forbs						0.0	0.0	0.0	0.0%	
Total Production	10.3	40.2	34.5	38.0	30.8	27.1	271.4	241.6	100.0%	20.5

TABLE 18A. (CONTINUED)

WESTERN RED CEDAR/DEVIL'S CLUB

SAMPLE NUMBER	1A	1B	1C	1D	MEAN	4A	4B	4C	4D	MEAN	GRAMS/ SQ M	KG/ HA	LBS/ ACRE	REL. PROD.	STD DEV
Perennial Graminoids	7.3				1.8						0.9	9.1	8.1	5.2%	
Annual Graminoids											0.0	0.0	0.0	0.0%	
Perennial Forbs	55.7	11.4	3.5	3.3	18.5	1.4	31.4	21.5	5.6	15.0	16.7	167.3	148.9	94.8%	
Annual & Biennial Forbs											0.0	0.0	0.0	0.0%	
Total Production	63.0	11.4	3.5	3.3	20.3	1.4	31.4	21.5	5.6	15.0	17.6	176.4	157.0	100.0%	19.7

TABLE 18A. (CONTINUED)

WESTERN HEMLOCK/OAK FERN

SAMPLE NUMBER	7A	7B	7C	7D	MEAN	50A	50B	50C	50D	MEAN	52A	52B	52C	52D	MEAN
Perennial Graminoids															
Annual Graminoids															
Perennial Forbs	10.2	7.5	0.8	1.5	5.0	8.1	0.5	12.3	0.5	5.4	1.0	0.1	0.0	0.0	0.3
Annual & Biennial Forbs															
Total Production	10.2	7.5	0.8	1.5	5.0	8.1	0.5	12.3	0.5	5.4	1.0	0.1	0.0	0.0	0.3

SAMPLE NUMBER	58A	58B	58C	58D	MEAN
Perennial Graminoids			4.7	0.1	1.2
Annual Graminoids					
Perennial Forbs	12.8	7.1	8.4	4.3	8.2
Annual & Biennial Forbs					
Total Production	12.8	7.1	13.1	4.4	9.4

WESTERN HEMLOCK/ OAK FERN PRODUCTION SUMMARY	GRAMS/ SQ M	KG/ HA	LBS/ ACRE	REL. PROD.	STD DEV
Perennial Graminoids	0.3	3.0	2.7	6.0%	
Annual Graminoids	0.0	0.0	0.0	0.0%	
Perennial Forbs	4.7	46.9	41.8	94.0%	
Annual & Biennial Forbs	0.0	0.0	0.0	0.0%	
Total Production	5.0	49.9	44.5	100.0%	4.9

TABLE 18A. (CONTINUED)

WESTERN HEMLOCK/QUEENCUP BEADLILY

SAMPLE NUMBER	9A	9B	9C	9D	MEAN	11A	11B	11C	11D	MEAN	15A	15B	15C	15D	MEAN
Perennial Graminoids											0.4	0.1			0.1
Annual Graminoids															
Perennial Forbs	1.0	4.7	0.1	0.3	1.5	3.6	30.0	0.7	46.7	20.3	9.2	15.2	15.8	7.4	11.9
Annual & Biennial Forbs															
Total Production	1.0	4.7	0.1	0.3	1.5	3.6	30.0	0.7	46.7	20.3	9.6	15.3	15.8	7.4	12.0

SAMPLE NUMBER	17A	17B	17C	17D	MEAN	18A	18B	18C	18D	MEAN	21A	21B	21C	21D	MEAN
Perennial Graminoids	0.1	3.2	0.1	1.7	1.3			0.9		0.2					
Annual Graminoids															
Perennial Forbs	12.2	164.7	11.1	16.4	51.1	36.7	10.3	2.3	42.2	22.9	0.5	1.2	2.9	0.5	1.3
Annual & Biennial Forbs															
Total Production	12.3	167.9	11.2	18.1	52.4	36.7	10.3	3.2	42.2	23.1	0.5	1.2	2.9	0.5	1.3

SAMPLE NUMBER	23A	23B	23C	23D	MEAN	28A	28B	28C	28D	MEAN	30A	30B	30C	30D	MEAN
Perennial Graminoids											8.3				2.1
Annual Graminoids															
Perennial Forbs	0.0	0.0	0.0	0.0	0.0	3.9	1.3	0.2	0.6	1.5	1.4	5.2	1.4	0.4	2.1
Annual & Biennial Forbs															
Total Production	0.0	0.0	0.0	0.0	0.0	3.9	1.3	0.2	0.6	1.5	9.7	5.2	1.4	0.4	4.2

TABLE 18A. (CONTINUED)

WESTERN HEMLOCK/QUEENCUP BEADLILY

SAMPLE NUMBER	36A	36B	36C	36D	MEAN	38A	38B	38C	38D	MEAN	39A	39B	39C	39D	MEAN
Perennial Graminoids								7.3	0.9	2.1					
Annual Graminoids															
Perennial Forbs	13.2	13.9	35.4	35.3	24.5	6.6	18.4	1.2	14.6	10.2	1.1	0.7	3.5	1.4	1.7
Annual & Biennial Forbs															
Total Production	13.2	13.9	35.4	35.3	24.5	6.6	18.4	8.5	15.5	12.3	1.1	0.7	3.5	1.4	1.7

SAMPLE NUMBER	40A	40B	40C	40D	MEAN	41A	41B	41C	41D	MEAN	42A	42B	42C	42D	MEAN
Perennial Graminoids											1.0	0.1			0.3
Annual Graminoids															
Perennial Forbs	29.0	18.8	12.9	1.8	15.6	0.1	1.0	0.1	0.0	0.3	20.0	6.8	45.7	6.9	19.9
Annual & Biennial Forbs															
Total Production	29.0	18.8	12.9	1.8	15.6	0.1	1.0	0.1	0.0	0.3	21.0	6.9	45.7	6.9	20.1

SAMPLE NUMBER	47A	47B	47C	47D	MEAN	51A	51B	51C	51D	MEAN
Perennial Graminoids		0.1			0.03					
Annual Graminoids										
Perennial Forbs	8.3	17.1	1.3	20.5	11.8	3.2	3.4	0.4	0.1	1.8
Annual & Biennial Forbs										
Total Production	8.3	17.2	1.3	20.5	11.8	3.2	3.4	0.4	0.1	1.8

PRODUCTION SUMMARY	GRAMS/ SQ M	KG/ HA	LBS/ ACRE	REL. PROD.	STD DEV
Perennial Graminoids	0.4	3.6	3.2	3.0%	
Annual Graminoids	0.0	0.0	0.0	0.0%	
Perennial Forbs	11.6	116.6	103.8	97.0%	
Annual & Biennial Forbs	0.0	0.0	0.0	0.0%	
Total Production	12.0	120.2	107.0	100.0%	24.3

TABLE 18A. (CONTINUED)

SUBALPINE FIR/QUEENCUP BEADLILY

SAMPLE NUMBER	54A	54B	54C	54D	MEAN	59A	59B	59C	59D	MEAN
Perennial Graminoids	1.0		3.5	3.3	2.0					
Annual Graminoids										
Perennial Forbs	17.7	37.3	31.1	10.0	24.0	1.1	0.5	25.4	25.3	13.1
Annual & Biennial Forbs										
Total Production	18.7	37.3	34.6	13.3	26.0	1.1	0.5	25.4	25.3	13.1

SUBALPINE FIR/QUEENCUP BEADLILY PRODUCTION SUMMARY	GRAMS/ SQ M	KG/ HA	LBS/ ACRE	REL. PROD.	STD DEV
Perennial Graminoids	1.0	9.8	8.7	5.0%	
Annual Graminoids	0.0	0.0	0.0	0.0%	
Perennial Forbs	18.5	185.5	165.1	95.0%	
Annual & Biennial Forbs	0.0	0.0	0.0	0.0%	
Total Production	19.5	195.3	173.8	100.0%	13.0

MOUNTAIN HEMLOCK/BEARGRASS

SAMPLE NUMBER	44A	44B	44C	44D	MEAN	45A	45B	45C	45D	MEAN	GRAMS/ SQ M	KG/ HA	LBS/ ACRE	REL. PROD.	STD DEV
Perennial Graminoids	1.7	6.2		1.6	2.4	5.9		1.5		1.9	2.1	21.1	18.8	7.2%	
Annual Graminoids											0.0	0.0	0.0	0.0%	
Perennial Forbs	1.6	0.1	0.5	3.5	1.4	11.9	18.4	90.9	90.2	52.9	27.1	271.4	241.6	92.9%	
Annual & Biennial Forbs											0.0	0.0	0.0	0.0%	
Total Production	3.3	6.3	0.5	5.1	3.8	17.8	18.4	92.4	90.2	54.7	29.2	292.0	260.0	100.2%	36.3

TABLE 18A. (CONTINUED)

HABITAT TYPE	LIFEFORM	GRAMS/ SQ M	KG/ HECTARE	LBS/ ACRE	RELATIVE PRODUCTION	STANDARD DEVIATION
WESTERN RED CEDAR/ LADY FERN	Perennial Graminoids	1.0	9.8	8.7	3.6%	
	Annual Graminoids	0.0	0.0	0.0	0.0%	
	Perennial Forbs	26.1	261.6	232.9	96.4%	
	Annual Forbs	0.0	0.0	0.0	0.0%	
	Total Production	27.1	271.4	241.6	100.0%	29.5
WESTERN RED CEDAR/ DEVIL'S CLUB	Perennial Graminoids	0.9	9.1	8.1	5.2%	
	Annual Graminoids	0.0	0.0	0.0	0.0%	
	Perennial Forbs	16.7	167.3	148.9	94.8%	
	Annual Forbs	0.0	0.0	0.0	0.0%	
	Total Production	17.6	176.4	157.0	100.0%	19.7
WESTERN HEMLOCK/ OAK FERN	Perennial Graminoids	0.3	3.0	2.7	6.0%	
	Annual Graminoids	0.0	0.0	0.0	0.0%	
	Perennial Forbs	4.7	46.9	41.8	94.0%	
	Annual Forbs	0.0	0.0	0.0	0.0%	
	Total Production	5.0	49.9	44.5	100.0%	4.9
WESTERN HEMLOCK/ QUEENCUP BEADLILY	Perennial Graminoids	0.4	3.6	3.2	3.0%	
	Annual Graminoids	0.0	0.0	0.0	0.0%	
	Perennial Forbs	11.6	116.6	103.8	97.0%	
	Annual Forbs	0.0	0.0	0.0	0.0%	
	Total Production	12.0	120.2	107.0	100.0%	24.3
SUBALPINE FIR/ QUEENCUP BEADLILY	Perennial Graminoids	1.0	9.8	8.7	5.0%	
	Annual Graminoids	0.0	0.0	0.0	0.0%	
	Perennial Forbs	18.5	185.5	165.1	95.0%	
	Annual Forbs	0.0	0.0	0.0	0.0%	
	Total Production	19.5	195.3	173.8	100.0%	13.0
MOUNTAIN HEMLOCK/ BEARGRASS	Perennial Graminoids	2.1	21.1	18.8	7.2%	
	Annual Graminoids	0.0	0.0	0.0	0.0%	
	Perennial Forbs	27.1	271.4	241.6	92.8%	
	Annual Forbs	0.0	0.0	0.0	0.0%	
	Total Production	29.2	292.5	260.4	100.0%	36.3

TABLE 19A. WESTERN RED CEDAR/DEVIL'S CLUB COVER DATA - 1988
MONTANA PROJECT

TRANSECT NUMBER	1		4	
	1st Hit	All Hits	1st Hit	All Hits
TREES				
Abies grandis	10	12	6	22
Picea engelmannii	12	12	10	10
Tsuga heterophylla			24	24
Total % Trees	22	24	40	56
TALL SHRUBS				
Acer glabrum		2	10	10
Alnus sinuata	6	6		
Sorbus sitchensis			P	
Taxus brevifolia	34	40		
Total % Tall Shrubs	40	48	10	10
LOW SHRUBS				
Menziesia ferruginea	6	6	P	
Oplopanax horridum	14	26	26	36
Ribes lacustre	P			2
Sambucus racemosa	P		P	
Symphoricarpos albus	P			
Vaccinium globulare		2	2	6
Total % Low Shrubs	20	34	28	44
SUBSHRUBS				
Rubus parviflorus	P		P	
Total % Subshrubs	0	0	0	0
PERENNIAL GRAMINOIDS				
Bromus vulgaris	P		P	
Festuca subulata	P			
Phleum pratense	P			
Total % Perennial Graminoids	0	0	0	0
PERENNIAL FORBS				
Actaea rubra	P		P	
Adenocaulon bicolor	P			
Arnica cordifolia	P			2
Clintonia uniflora		10		2
Coptis occidentalis			P	

TABLE 19A. (CONTINUED)

TRANSECT NUMBER	1		4	
	1st Hit	All Hits	1st Hit	All Hits
Disporum hookeri	P		P	
Galium triflorum	P		P	
Goodyera oblongfolia	P			
Hieracium cynoglossoides	P			
Osmorhiza chilensis	P		P	
Polemonium pulcherrimum			P	
Senecio triangularis	P			
Smilacina stellata		2		P
Streptopus amplexifolius				2
Thalictrum occidentale	4	6		
Tiarella trifoliata		4	4	12
Trillium ovatum	P		P	
Veratrum viride	P			
Viola glabella		4		
Viola orbiculata	P			
Total % Perennial Forbs	4	26	4	18
CRYPTOGAMS				
Athyrium filix-femina		4	6	6
Gymnocarpium dryopteris	2	8	6	28
Moss	4	6		4
Total % Cryptogams	6	18	12	38
TOTAL % VEGETATION	92	150	94	166
Soil				
Litter	8	8	6	6
Rock				

P = SPECIES PRESENT BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 19A. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
TREES					
Abies grandis	8.0%	8.6%	17.0%	10.7%	100.0%
Picea engelmannii	11.0%	11.8%	11.0%	7.0%	100.0%
Tsuga heterophylla	12.0%	12.9%	12.0%	7.6%	50.0%
Total % Trees	31.0%	33.3%	40.0%	25.3%	
TALL SHRUBS					
Acer glabrum	5.0%	5.4%	6.0%	3.8%	100.0%
Alnus sinuata	3.0%	3.2%	3.0%	1.9%	50.0%
Sorbus sitchensis	P	0.0%	0.0%	0.0%	50.0%
Taxus brevifolia	17.0%	18.3%	20.0%	12.7%	50.0%
Total % Tall Shrubs	25.0%	26.9%	29.0%	18.4%	
LOW SHRUBS					
Menziesia ferruginea	3.0%	3.2%	3.0%	1.9%	100.0%
Oplopanax horridum	20.0%	21.5%	31.0%	19.7%	100.0%
Ribes lacustre	0.0%	0.0%	1.0%	0.6%	100.0%
Sambucus racemosa	P	0.0%	0.0%	0.0%	100.0%
Symphoricarpos albus	P	0.0%	0.0%	0.0%	50.0%
Vaccinium globulare	1.0%	1.1%	4.0%	2.5%	100.0%
Total % Low Shrubs	24.0%	25.8%	39.0%	24.7%	
SUBSHRUBS					
Rubus parviflorus	P	0.0%	0.0%	0.0%	100.0%
Total % Subshrubs	0.0%	0.0%	0.0%	0.0%	
PERENNIAL GRAMINOIDS					
Bromus vulgaris	P	0.0%	0.0%	0.0%	100.0%
Festuca subulata	P	0.0%	0.0%	0.0%	50.0%
Phleum pratense	P	0.0%	0.0%	0.0%	50.0%
Total % Perennial Graminoids	0.0%	0.0%	0.0%	0.0%	
PERENNIAL FORBS					
Actaea rubra	P	0.0%	0.0%	0.0%	100.0%
Adenocaulon bicolor	P	0.0%	0.0%	0.0%	50.0%
Arnica cordifolia	0.0%	0.0%	1.0%	0.6%	100.0%
Clintonia uniflora	0.0%	0.0%	6.0%	3.8%	100.0%
Coptis occidentalis	P	0.0%	0.0%	0.0%	50.0%

TABLE 19A. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Disporum hookeri	P	0.0%	0.0%	0.0%	100.0%
Galium triflorum	P	0.0%	0.0%	0.0%	100.0%
Goodyera oblongfolia	P	0.0%	0.0%	0.0%	50.0%
Hieracium cynoglossoides	P	0.0%	0.0%	0.0%	50.0%
Osmorhiza chilensis	P	0.0%	0.0%	0.0%	100.0%
Polemonium pulcherrimum	P	0.0%	0.0%	0.0%	50.0%
Senecio triangularis	P	0.0%	0.0%	0.0%	50.0%
Smilacina stellata	0.0%	0.0%	1.0%	0.6%	100.0%
Streptopus amplexifolius	0.0%	0.0%	1.0%	0.6%	50.0%
Thalictrum occidentale	2.0%	2.1%	3.0%	1.9%	50.0%
Tiarella trifoliata	2.0%	2.2%	8.0%	5.1%	100.0%
Trillium ovatum	P	0.0%	0.0%	0.0%	100.0%
Veratrum viride	P	0.0%	0.0%	0.0%	50.0%
Viola glabella	0.0%	0.0%	2.0%	1.3%	50.0%
Viola orbiculata	P	0.0%	0.0%	0.0%	50.0%
Total % Perennial Forbs	4.0%	4.3%	22.0%	13.9%	
CRYPTOGAMS					
Athyrium filix-femina	3.0%	3.2%	5.0%	3.2%	100.0%
Gymnocarpium dryopteris	4.0%	4.3%	18.0%	11.3%	100.0%
Moss	2.0%	2.2%	5.0%	3.2%	100.0%
Total % Cryptogams	9.0%	9.7%	28.0%	17.7%	
TOTAL % VEGETATION	93.0%	100.0%	158.0%	100.0%	
Soil	0.0%				
Litter	7.0%				
Rock	0.0%				

P = SPECIES PRESENT BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 20A. WESTERN RED CEDAR/DEVIL'S CLUB TREE DENSITY, REPRODUCTION, HEIGHT, DBH, AND AGE DATA - 1988
MONTANA PROJECT

DENSITY

TRANSECT NUMBER	1	4	MEAN NO. TREES/ 125 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TREES						
Abies grandis	1	4	2.5	80.9	45.4%	
Picea engelmannii	3	1	2.0	64.8	36.4%	
Tsuga heterophylla	1	1	1.0	32.4	18.2%	
Total Trees	5	6	5.5	178.1	100.0%	0.5

REPRODUCTION

TRANSECT NUMBER	1	4	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
Abies grandis	2	1	1.5	242.8	100.0%	
Total Tree Reproduction	2	1	1.5	242.8	100.0%	0.5

HEIGHT (FEET)

MEAN TREE HEIGHT TRANSECT NUMBER	1	4	RANGE IN HEIGHT (FEET) (MIN)	RANGE IN HEIGHT (FEET) (MAX)	ABSOLUTE MEAN HEIGHT IN FEET
TREES					
Abies grandis	3.0	18.8	3	35	15.6
Picea engelmannii	40.3	99.0	7	99	55.0
Tsuga heterophylla	16.0	46.0	16	46	31.0
Total Trees					32.7

TABLE 20A. (CONTINUED)

DBH (INCHES)

MEAN DBH			RANGE IN DBH (INCHES) (MIN)	RANGE IN DBH (INCHES) (MAX)	ABSOLUTE MEAN DBH IN INCHES
TRANSECT NUMBER	1	4			
TREES					
Abies grandis	0.4	3.0	0.4	5.5	2.4
Picea engelmannii	7.1	28.0	1.2	28.0	12.3
Tsuga heterophylla	4.3	11.4	4.3	11.4	7.9
Total Trees					7.0

AGE (YEARS)

TRANSECT NUMBER	1	4	NUMBER TREES CORED	MINIMUM	MAXIMUM	MEAN AGE
Picea engelmannii	88	170	2	88	170	129

* The age estimate for one or more trees in this category is too low, because the increment borer could estimate tree age only for trees of 32 inch diameter or less.

TABLE 21A. WESTERN RED CEDAR/DEVIL'S CLUB SHRUB DENSITY DATA - 1988 MONTANA PROJECT

TRANSECT NUMBER	1	4	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TALL SHRUBS						
Acer glabrum	1	1	1.0	161.9	2.9%	
Taxus brevifolia	5		2.5	404.7	7.1%	
Total Tall Shrubs	6	1	3.5	566.6	10.0%	
LOW SHRUBS						
Menziesia ferruginea	1	1	1.0	161.9	2.9%	
Oplopanax horridum	9	6	7.5	1214.1	21.5%	
Ribes lacustre	4	1	2.5	404.7	7.1%	
Vaccinium globulare		39	19.5	3156.6	55.7%	
Vaccinium scoparium	1		0.5	80.9	1.4%	
Total Low Shrubs	15	47	31.0	5018.2	88.6%	
SUBSHRUBS						
Rubus parviflorus		1	0.5	80.9	1.4%	
Total Subshrubs	0	1	0.5	80.9	1.4%	
TOTAL SHRUBS	21	49	35.0	5665.7	100.0%	14.0

TABLE 22A. WESTERN HEMLOCK/OAK FERN COVER DATA -1988
MONTANA PROJECT

TRANSECT NUMBER	7		50		52		58	
	1st Hit	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
TREES								
Abies grandis			P				22	24
Abies lasiocarpa							14	14
Picea engelmannii			P				14	22
Pinus monticola					P			
Thuja plicata			P					
Tsuga heterophylla	88	88	100	100	94	94	12	14
Total % Trees	88	88	100	100	94	94	62	74
TALL SHRUBS								
Acer glabrum								10
Taxus brevifolia	P				P		10	14
Total % Tall Shrubs	0	0	0	0	0	0	10	24
LOW SHRUBS								
Menziesia ferruginea							2	2
Oplopanax horridum	P			8				
Ribes lacustre							P	
Ribes viscosissimum							P	
Sambucus racemosa								4
Vaccinium globulare		2	P			6	P	
Total % Low Shrubs	0	2	0	8	0	6	2	6
SUBSHRUBS								
Rubus parviflorus							4	6
Rubus pedatus						8		
Total % Subshrubs	0	0	0	0	0	8	4	6
PERENNIAL GRAMINOIDS								
Calamagrostis canadensis							P	
Elymus glaucus							2	4
Luzula parviflora				2				
Total % Perennial Graminoids	0	0	0	2	0	0	2	4
PERENNIAL FORBS								
Arnica cordifolia	P							P
Clintonia uniflora		2	P		P			6
Disporum hookeri			P					2

TABLE 22A. (CONTINUED)

TRANSECT NUMBER	7		50		52		58	
	1st Hit	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
Galium boreale							2	2
Mitella breweri								2
Pyrola secunda		4	P				P	
Pyrola uniflora							P	
Smilacina stellata		P	P					
Streptopus amplexifolius		P						
Thalictrum occidentale							P	
Tiarella trifoliata	2	12		4				8
Trillium ovatum			P					
Viola glabella								2
Viola orbiculata		P						
Total % Perennial Forbs	2	18	0	4	0	0	2	22
CRYPTOGAMS								
Athyrium filix-femina				2				2
Gymnocarpium dryopteris	4	36		18		6	8	32
Moss		32		8		14	4	32
Total % Cryptogams	4	68	0	28	0	20	12	66
TOTAL % VEGETATION	94	176	100	142	94	128	94	202
Soil								
Litter	6	6			6	6	6	6
Rock								

TABLE 22A. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
TREES					
Abies grandis	5.5%	5.8%	6.0%	3.7%	50.0%
Abies lasiocarpa	3.5%	3.7%	3.5%	2.2%	25.0%
Picea engelmannii	3.5%	3.7%	5.5%	3.4%	50.0%
Pinus monticola	P	0.0%	0.0%	0.0%	25.0%
Thuja plicata	P	0.0%	0.0%	0.0%	25.0%
Tsuga heterophylla	73.5%	77.0%	74.0%	45.7%	100.0%
Total % Trees	86.0%	90.2%	89.0%	55.0%	
TALL SHRUBS					
Acer glabrum	0.0%	0.0%	2.5%	1.5%	25.0%
Taxus brevifolia	2.5%	2.6%	3.5%	2.2%	75.0%
Total % Tall Shrubs	2.5%	2.6%	6.0%	3.7%	
LOW SHRUBS					
Menziesia ferruginea	0.5%	0.5%	0.5%	0.3%	25.0%
Oplopanax horridum	0.0%	0.0%	2.0%	1.2%	50.0%
Ribes lacustre	P	0.0%	0.0%	0.0%	25.0%
Ribes viscosissimum	P	0.0%	0.0%	0.0%	25.0%
Sambucus racemosa	0.0%	0.0%	1.0%	0.6%	25.0%
Vaccinium globulare	0.0%	0.0%	2.0%	1.2%	100.0%
Total % Low Shrubs	0.5%	0.5%	5.5%	3.3%	
SUBSHRUBS					
Rubus parviflorus	1.0%	1.0%	1.5%	1.0%	25.0%
Rubus pedatus	0.0%	0.0%	2.0%	1.2%	25.0%
Total % Subshrubs	1.0%	1.0%	3.5%	2.2%	
PERENNIAL GRAMINOIDS					
Calamagrostis canadensis	P	0.0%	0.0%	0.0%	25.0%
Elymus glaucus	0.5%	0.5%	1.0%	0.6%	25.0%
Luzula parviflora	0.0%	0.0%	0.5%	0.3%	25.0%
Total % Perennial Graminoids	0.5%	0.5%	1.5%	0.9%	
PERENNIAL FORBS					
Arnica cordifolia	P	0.0%	0.0%	0.0%	50.0%
Clintonia uniflora	0.0%	0.0%	2.0%	1.3%	100.0%
Disporum hookeri	0.0%	0.0%	0.5%	0.3%	50.0%

TABLE 22A. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Galium boreale	0.5%	0.5%	0.5%	0.3%	25.0%
Mitella breweri	0.0%	0.0%	0.5%	0.3%	25.0%
Pyrola secunda	0.0%	0.0%	1.0%	0.6%	75.0%
Pyrola uniflora	P	0.0%	0.0%	0.0%	25.0%
Smilacina stellata	P	0.0%	0.0%	0.0%	50.0%
Streptopus amplexifolius	P	0.0%	0.0%	0.0%	25.0%
Thalictrum occidentale	P	0.0%	0.0%	0.0%	25.0%
Tiarella trifoliata	0.5%	0.5%	6.0%	3.7%	75.0%
Trillium ovatum	P	0.0%	0.0%	0.0%	25.0%
Viola glabella	0.0%	0.0%	0.5%	0.3%	25.0%
Viola orbiculata	P	0.0%	0.0%	0.0%	25.0%
Total % Perennial Forbs	1.0%	1.0%	11.0%	6.8%	
CRYPTOGAMS					
Athyrium filix-femina	0.0%	0.0%	1.0%	0.6%	50.0%
Gymnocarpium dryopteris	3.0%	3.2%	23.0%	14.2%	100.0%
Moss	1.0%	1.0%	21.5%	13.3%	100.0%
Total % Cryptogams	4.0%	4.2%	45.5%	28.1%	
TOTAL % VEGETATION	95.5%	100.0%	162.0%	100.0%	
Soil	0.0%				
Litter	4.5%				
Rock	0.0%				

P = SPECIES PRESENT BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 23A. WESTERN HEMLOCK/OAK FERN TREE DENSITY, REPRODUCTION, HEIGHT, DBH, AND AGE DATA -1988
MONTANA PROJECT

DENSITY

TRANSECT NUMBER	7	50	52	58
	--	--	--	--
TREES				
Abies grandis				2
Abies lasiocarpa				3
Picea engelmannii				6
Pseudotsuga menziesii				
Tsuga heterophylla	6	27	21	2
Total Trees	6	27	21	13
TREES (DEAD)				
Picea engelmannii				2
Total Trees (Dead)	0	0	0	2

	MEAN NO. TREES/ 125 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TREES				
Abies grandis	0.5	16.2	3.0%	
Abies lasiocarpa	0.8	24.3	4.5%	
Picea engelmannii	1.5	48.6	8.9%	
Tsuga heterophylla	14.0	453.2	83.6%	
Total Trees	16.8	542.3	100.0%	7.9
TREES (DEAD)				
Picea engelmannii	0.5	16.2	100.0%	
Total Trees (Dead)	0.5	16.2	100.0%	0.9

TABLE 23A. (CONTINUED)

REPRODUCTION

TRANSECT NUMBER	7	50	52	58
Tsuga heterophylla	4	6	44	
Total Tree Reproduction	4	6	44	0

	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
Tsuga heterophylla	13.5	2185.4	100.0%	
Total Tree Reproduction	13.5	2185.4	100.0%	17.7

HEIGHT (FEET)

TRANSECT NUMBER	7	50	52	58
TREES				
Abies grandis				60.0
Abies lasiocarpa				54.0
Picea engelmannii				23.8
Pseudotsuga menziesii				
Tsuga heterophylla	45.7	29.6	12.1	60.0
Total Trees				
TREES (DEAD)				
Picea engelmannii				27.5
Total Dead Trees				

TABLE 23A. (CONTINUED)

HEIGHT (FEET)

	RANGE IN HEIGHT (FEET) (MIN)	RANGE IN HEIGHT (FEET) (MAX)	ABSOLUTE MEAN HEIGHT IN FEET
TREES			
Abies grandis	30	90	60.0
Abies lasiocarpa	32	76	19.7
Picea engelmannii	15	32	8.7
Tsuga heterophylla	5	100	12.4
Total Trees			28.0
TREES (DEAD)			
Picea engelmannii	13	42	27.5
Total Dead Trees			27.5

DBH (INCHES)

MEAN DIAMETER AT BREAST HEIGHT (dbh) IN INCHES				
TRANSECT NUMBER	7	50	52	58
	--	--	--	--
TREES				
Abies grandis				12.4
Abies lasiocarpa				7.7
Picea engelmannii				3.4
Tsuga heterophylla	10.4	6.1	1.5	7.7
Total Trees				
TREES (DEAD)				
Picea engelmannii				3.9

	RANGE IN DBH (INCHES) (MIN)	RANGE IN DBH (INCHES) (MAX)	ABSOLUTE MEAN DBH IN INCHES
TREES			
Abies grandis	3.5	21.3	12.4
Abies lasiocarpa	2.8	12.2	7.7
Picea engelmannii	1.6	4.7	3.4
Tsuga heterophylla	0.4	25.2	4.9
Total Trees			5.1
TREES (DEAD)			
Picea engelmannii	1.2	6.7	3.9
Total Dead Trees			3.9

TABLE 23A. (CONTINUED)

AGE (YEARS)

TRANSECT NUMBER	7	NUMBER TREES CORED	MINIMUM	MAXIMUM	MEAN AGE
Tsuga heterophylla	104	1	104	104	104

TABLE 24A. WESTERN HEMLOCK/OAK FERN SHRUB DENSITY DATA -1988
MONTANA PROJECT

TRANSECT NUMBER	7	50	52	58
	--	--	--	--
TALL SHRUBS				
Taxus brevifolia				1
Total Tall Shrubs	0	0	0	1
LOW SHRUBS				
Menziesia ferruginea				1
Oplopanax horridum	2	18		
Ribes lacustre				4
Ribes viscosissimum				1
Sambucus racemosa				3
Vaccinium globulare	1	P	53	19
Total Low Shrubs	3	18	53	28
SUBSHRUBS				
Rubus parviflorus				7
Total Subshrubs	0	0	0	7
TOTAL SHRUBS	3	18	53	36

	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TALL SHRUBS				
Taxus brevifolia	0.3	40.5	0.9%	
Total Tall Shrubs	0.3	40.5	0.9%	
LOW SHRUBS				
Menziesia ferruginea	0.3	40.5	0.9%	
Oplopanax horridum	5.0	809.4	18.2%	
Ribes lacustre	1.0	161.9	3.6%	
Ribes viscosissimum	0.3	40.5	0.9%	
Sambucus racemosa	0.7	121.4	2.7%	
Vaccinium globulare	18.2	2954.2	66.4%	
Total Low Shrubs	25.5	4127.9	92.7%	
SUBSHRUBS				
Rubus parviflorus	1.7	283.3	6.4%	
Total Subshrubs	1.7	283.3	6.4%	
TOTAL SHRUBS	27.5	4451.7	100.0%	18.8

TABLE 25A. WESTERN HEMLOCK/QUEENCUP BEADLILY COVER DATA -1988
MONTANA PROJECT

TRANSECT NUMBER	9		11		15		17	
	1st Hit	All Hits	1st Hit	All Hits	1st Hits	All Hits	1st Hits	All Hits
TREES								
Abies grandis	58	62	50	58	8	10	10	12
Larix occidentalis	4	4	2	2	18	18	4	4
Picea engelmannii	P				12	14		
Pinus contorta			2	2				
Pinus monticola		4					14	14
Pseudotsuga menziesii	8	14	22	22	50	60	10	10
Thuja plicata					P		16	20
Tsuga heterophylla			8	10	P		P	
Total % Trees	70	84	84	94	88	102	54	60
TREES - DEAD								
Abies grandis								
Pinus contorta								
Total % Trees - Dead	0	0	0	0	0	0	0	0
TALL SHRUBS								
Acer glabrum	6	6		2		6		
Sorbus sitchensis								
Taxus brevifolia	P		P					
Total % Tall Shrubs	6	6	0	2	0	6	0	0
LOW SHRUBS								
Amelanchier alnifolia					P		P	
Cornus stolonifera					P			
Holodiscus discolor								
Lonicera ciliosa								
Lonicera utahensis			P		P			
Menziesia ferruginea					P			
Oplopanax horridum								
Pachistima myrsinites		4	P			8	P	
Ribes lacustre					P			
Rosa gymnocarpa			P		P			
Salix scouleriana								
Sheperdia canadensis								
Spiraea betulifolia		2				2	2	2
Symphoricarpos albus							P	
Vaccinium globulare	4	4	P		P		P	
Vaccinium myrtillus								10

TABLE 25A. (CONTINUED)

TRANSECT NUMBER	9		11		15		17	
	1st Hit	All Hits	1st Hit	All Hits	1st Hits	All Hits	1st Hits	All Hits
Total % Low Shrubs	4	10	0	0	0	10	2	12
SUBSHRUBS								
Arctostaphylos uva-ursi								
Berberis repens								
Chimaphila umbellata	P			4			P	
Cornus canadensis								
Linnaea borealis				2		2	2	6
Rubus parviflorus	P					8		
Total % Subshrubs	0	0	0	6	0	10	2	6
PERENNIAL GRAMINOIDS								
Bromus vulgaris						2		
Calamagrostis rubescens							2	4
Carex concinnoides							P	
Carex rossii								
Festuca occidentalis							P	
Muhlenbergia asperifolia								
Total % Perennial Graminoids	0	0	0	0	0	2	2	4
PERENNIAL FORBS								
Actaea rubra						4		
Adenocaulon bicolor			P		P			
Angelica arguta					P			
Aralia nudicaulis								
Arnica cordifolia	P					14	12	24
Cirsium flodmanii								
Clematis columbiana					2	4		
Clintonia uniflora		2	4	6	2	10	P	
Coptis occidentalis							2	10
Corallorhiza maculata					P			
Disporum hookeri	P				P			
Fragaria virginiana							2	2
Galium triflorum			P		P			
Goodyera oblongfolia	P		P				P	
Heeracium albiflorum	P				P		P	
Listera convallarioides								
Osmorhiza chilensis					P			
Pedicularis bracteosa								
Pyrola asarifolia			P				2	2
Pyrola chlorantha			P					

TABLE 25A. (CONTINUED)

TRANSECT NUMBER	9		11		15		17	
	1st Hit	All Hits	1st Hit	All Hits	1st Hits	All Hits	1st Hits	All Hits
Pyrola minor								
Pyrola secunda		2	P		P			
Smèlacina stellata			P		2	14		
Thalictrum occidentale	P		P			2		
Tiarella trifoliata		2	P		2	18		
Trillium ovatum			P		P		P	
Veratrum viride								
Viola glabella					P			
Viola orbiculata		2	4	4		2	2	4
Xerophyllum tenax		6	P				10	12
Total % Perennial Forbs	0	14	8	10	8	68	30	54
ANNUAL & BIENNIAL FORBS								
Melampyrum lineare							P	
Verbascum thapsus					P			
Total % Annual & Biennial Forbs	0	0	0	0	0	0	0	0
CRYPTOGAMS								
Athyrium filix-femina					P		P	
Gymnocarpium dryopteris								
Moss	2	4		8		2		
Pteridium aquilinum					P			
Total % Cryptogams	2	4	0	8	0	2	0	0
TOTAL % VEGETATION	82	118	92	120	96	200	90	136
Soil								
Litter	18	18	8	8	2	2	10	10
Rock					2	2		

P = SPECIES PRESENT BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 25A. (CONTINUED)

TRANSECT NUMBER	18		21		23		28	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
TREES								
Abies grandis	40	42	P					
Larix occidentalis	4	4			20	20	P	
Picea engelmannii			8	8			18	18
Pinus contorta	6	6						
Pinus monticola	4	4	10	10	10	10		
Pseudotsuga menziesii	10	10	2	2	24	30		
Thuja plicata		2	36	52	4	12	24	26
Tsuga heterophylla	4	6	34	44	36	68	58	60
Total % Trees	68	74	90	116	94	140	100	104
TREES - DEAD								
Abies grandis								
Pinus contorta								
Total % Trees - Dead	0	0	0	0	0	0	0	0
TALL SHRUBS								
Acer glabrum								
Sorbus sitchensis								
Taxus brevifolia					P			
Total % Tall Shrubs	0	0	0	0	0	0	0	0
LOW SHRUBS								
Amelanchier alnifolia	P						P	
Cornus stolonifera								
Holodiscus discolor		2						
Lonicera ciliosa								
Lonicera utahensis		2	P				P	
Menziesia ferruginea								
Oplopanax horridum								
Pachistima myrsinites	P		P		P		P	
Ribes lacustre								
Rosa gymnocarpa	P						P	
Salix scouleriana								
Sheperdia canadensis		2						
Spiraea betulifolia	P						P	
Symphoricarpos albus								
Vaccinium globulare	P		P					
Vaccinium myrtillus	P		P					

TABLE 25A. (CONTINUED)

TRANSECT NUMBER	18		21		23		28	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
Total % Low Shrubs	0	6	0	0	0	0	0	0
SUBSHRUBS								
Arctostaphylos uva-ursi								
Berberis repens	P				P			
Chimaphila umbellata	2	2						
Cornus canadensis								4
Linnaea borealis		14	P		P		P	
Rubus parviflorus								
Total % Subshrubs	2	16	0	0	0	0	0	4
PERENNIAL GRAMINOIDS								
Bromus vulgaris								
Calamagrostis rubescens	2	4						
Carex concinnoides		2						
Carex rossii			P					
Festuca occidentalis	P							
Muhlenbergia asperifolia								
Total % Perennial Graminoids	2	6	0	0	0	0	0	0
PERENNIAL FORBS								
Actaea rubra								
Adenocaulon bicolor								
Angelica arguta								
Aralia nudicaulis								
Arnica cordifolia			P					
Cirsium flodmanii								
Clematis columbiana								
Clintonia uniflora		4	P		P		P	
Coptis occidentalis	4	16		2	P			2
Corallorhiza maculata								
Disporum hookeri								
Fragaria virginiana	P							
Galium triflorum								
Goodyera oblongfolia			P		P			
Hieracium albiflorum	P		P					
Listera convallarioides	P				P			
Osmorhiza chilensis	P							
Pedicularis bracteosa			P					
Pyrola asarifolia	P		P		P		P	
Pyrola chlorantha	P							

TABLE 25A. (CONTINUED)

TRANSECT NUMBER	18		21		23		28	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
Pyrola minor								
Pyrola secunda			P		P		P	
Smèlacina stellata		2					P	
Thalictrum occidentale								
Tiarella trifoliata					P		P	
Trillium ovatum								
Veratrum viride								
Viola glabella		4	P				P	
Viola orbiculata	P		P		P			
Xerophyllum tenax	14	30		2				
Total % Perennial Forbs	18	56	0	4	0	0	0	2
ANNUAL & BIENNIAL FORBS								
Melampyrum lineare								
Verbascum thapsus								
Total % Annual & Biennial Forbs	0	0	0	0	0	0	0	0
CRYPTOGAMS								
Athyrium filix-femina							P	
Gymnocarpium dryopteris							P	
Moss		2	2	6				
Pteridium aquilinum	4	10	P		P			
Total % Cryptogams	4	12	2	6	0	0	0	0
TOTAL % VEGETATION	94	170	92	126	94	140	100	110
Soil								
Litter	6	6	8	8	6	6		
Rock								

P = SPECIES PRESENT BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 25A. (CONTINUED)

TRANSECT NUMBER	30		36		38		39	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
TREES								
Abies grandis	30	32	12	24	40	44	4	12
Larix occidentalis	2	2	38	38	P		28	28
Picea engelmannii	10	14	12	16				
Pinus contorta					12	12	28	30
Pinus monticola	10	10	P		2	2		
Pseudotsuga menziesii	4	4	P					
Thuja plicata	14	18	P		P		18	44
Tsuga heterophylla	18	24	28	32		4	4	12
Total % Trees	88	104	90	110	54	62	82	126
TREES - DEAD								
Abies grandis								
Pinus contorta					26	26		
Total % Trees - Dead	0	0	0	0	26	26	0	0
TALL SHRUBS								
Acer glabrum								
Sorbus sitchensis								
Taxus brevifolia								
Total % Tall Shrubs	0	0	0	0	0	0	0	0
LOW SHRUBS								
Amelanchier alnifolia				2				
Cornus stolonifera								
Holodiscus discolor								
Lonicera ciliosa								
Lonicera utahensis		2			P			
Menziesia ferruginea								
Oplopanax horridum								
Pachistima myrsinites	P				P			2
Ribes lacustre								
Rosa gymnocarpa	P		2	10	P		P	
Salix scouleriana					P			
Sheperdia canadensis					P			
Spiraea betulifolia	P			2		4	P	
Symphoricarpos albus								
Vaccinium globulare				2	P		P	
Vaccinium myrtillus		4	P					2

TABLE 25A. (CONTINUED)

TRANSECT NUMBER	30		36		38		39	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
Total % Low Shrubs	0	6	2	16	0	4	0	4
SUBSHRUBS								
Arctostaphylos uva-ursi							P	
Berberis repens	P				P		P	
Chimaphila umbellata		6	P		4	8	2	6
Cornus canadensis	P		P					
Linnaea borealis		4	P		2	26	4	16
Rubus parviflorus								
Total % Subshrubs	0	10	0	0	6	34	6	22
PERENNIAL GRAMINOIDS								
Bromus vulgaris				2				
Calamagrostis rubescens	P		P		P		P	
Carex concinnoides								
Carex rossii	P							
Festuca occidentalis								
Muhlenbergia asperifolia				2				
Total % Perennial Graminoids	0	0	0	4	0	0	0	0
PERENNIAL FORBS								
Actaea rubra								
Adenocaulon bicolor	P		P					
Angelica arguta								
Aralia nudicaulis	P							
Arnica cordifolia			2	18				
Cirsium flodmanii	P							
Clematis columbiana								
Clintonia uniflora		2		10	P			
Coptis occidentalis		10	4	20		4		4
Corallorhiza maculata								
Disporum hookeri								
Fragaria virginiana								
Galium triflorum	P							
Goodyera oblongfolia	P				P		P	
Hëeracium albiflorum	P				P			
Listera convallarioides			P					
Osmorhiza chilensis			P					
Pedicularis bracteosa								
Pyrola asarifolia							P	
Pyrola chlorantha								

TABLE 25A. (CONTINUED)

TRANSECT NUMBER	30		36		38		39	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
Pyrola minor	P							
Pyrola secunda					P		P	
Smèlacina stellata			P					
Thalictrum occidentale				2				
Tiarella trifoliata			P					
Trillium ovatum	P			2				
Veratrum viride								
Viola glabella	P		P					
Viola orbiculata	P		2	2	P			2
Xerophyllum tenax			P			10		10
Total % Perennial Forbs	0	12	8	54	0	14	0	16
ANNUAL & BIENNIAL FORBS								
Melampyrum lineare					4	4	P	
Verbascum thapsus								
Total % Annual & Biennial Forbs	0	0	0	0	4	4	0	0
CRYPTOGAMS								
Athyrium filix-femina								
Gymnocarpium dryopteris								
Moss		2					4	20
Pteridium aquilinum					4	12		
Total % Cryptogams	0	2	0	0	4	12	4	20
TOTAL % VEGETATION	88	134	100	184	94	156	92	188
Soil								
Litter	12	12			6	6	8	8
Rock								

P = SPECIES PRESENT BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 25A. (CONTINUED)

TRANSECT NUMBER	40		41		42		47	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
TREES								
Abies grandis	66	76	50	60	28	30	6	8
Larix occidentalis	14	14	8	8				
Picea engelmannii							16	18
Pinus contorta			18	18	4	4		
Pinus monticola					4	4		
Pseudotsuga menziesii	P		12	12	2	2		
Thuja plicata	P		8	54	8	12	20	22
Tsuga heterophylla	2	2		14	6	8	46	48
Total % Trees	82	92	96	166	52	60	88	96
TREES - DEAD								
Abies grandis	2	2						
Pinus contorta					22	22		
Total % Trees - Dead	2	2	0	0	22	22	0	0
TALL SHRUBS								
Acer glabrum								8
Sorbus sitchensis							2	2
Taxus brevifolia	2	14					P	
Total % Tall Shrubs	2	14	0	0	0	0	2	10
LOW SHRUBS								
Amelanchier alnifolia					P		P	
Cornus stolonifera								
Holodiscus discolor								
Lonicera ciliosa					P			
Lonicera utahensis	P		P		P		P	
Menziesia ferruginea							P	
Oplopanax horridum								4
Pachistima myrsinites			P		P			2
Ribes lacustre								
Rosa gymnocarpa	P				P			
Salix scouleriana							2	2
Sheperdia canadensis								
Spiraea betulifolia						2		2
Symphoricarpos albus								
Vaccinium globulare	P							
Vaccinium myrtillus						2		

TABLE 25A. (CONTINUED)

TRANSECT NUMBER	40		41		42		47	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
Total % Low Shrubs	0	0	0	0	0	4	2	10
SUBSHRUBS								
Arctostaphylos uva-ursi								
Berberis repens	P							
Chimaphila umbellata		2			2	6	P	
Cornus canadensis								
Linnaea borealis		10	P		6	16		
Rubus parviflorus							4	4
Total % Subshrubs	0	12	0	0	8	22	4	4
PERENNIAL GRAMINOIDS								
Bromus vulgaris								
Calamagrostis rubescens	P					4		
Carex concinnoides								
Carex rossii								
Festuca occidentalis								
Muhlenbergia asperifolia								
Total % Perennial Graminoids	0	0	0	0	0	4	0	0
PERENNIAL FORBS								
Actaea rubra							P	
Adenocaulon bicolor								2
Angelica arguta								
Aralia nudicaulis								
Arnica cordifolia		4					P	
Cirsium flodmanii								
Clematis columbiana								
Clintonia uniflora	P		P		P			4
Coptis occidentalis		4		6	4	12		
Corallorhiza maculata								
Disporum hookeri							P	
Fragaria virginiana								
Galium triflorum								
Goodyera oblongfolia	P		P		P		P	
Hèeracium albiflorum	P				P			
Listera convallarioides					P			
Osmorhiza chilensis							P	
Pedicularis bracteosa								
Pyrola asarifolia	P		P		2	2	P	
Pyrola chlorantha							P	

TABLE 25A. (CONTINUED)

TRANSECT NUMBER	40		41		42		47	
	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits	1st Hits	All Hits
Pyrola minor								
Pyrola secunda			P				P	
Smèlacina stellata	P		P					8
Thalictrum occidentale							P	
Tiarella trifoliata		2						4
Trillium ovatum			P				P	
Veratrum viride							P	
Viola glabella	P		P				P	
Viola orbiculata	P		P		P		P	
Xerophyllum tenax		4			10	30	P	
Total % Perennial Forbs	0	14	0	6	16	44	0	18
ANNUAL & BIENNIAL FORBS								
Melampyrum lineare								
Verbascum thapsus								
Total % Annual & Biennial Forbs	0	0	0	0	0	0	0	0
CRYPTOGAMS								
Athyrium filix-femina								2
Gymnocarpium dryopteris							P	
Moss						2	2	8
Pteridium aquilinum	P					2	P	
Total % Cryptogams	0	0	0	0	0	4	2	10
TOTAL % VEGETATION	86	134	96	172	98	160	98	148
Soil								
Litter	14	14	4	4	2	2	2	2
Rock								

P = SPECIES PRESENT BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 25A. (CONTINUED)

TRANSECT NUMBER	51	
	1st Hits	All Hits
TREES		
Abies grandis	76	80
Larix occidentalis	P	
Picea engelmannii		
Pinus contorta		
Pinus monticola	2	2
Pseudotsuga menziesii	12	12
Thuja plicata	6	10
Tsuga heterophylla		
Total % Trees	96	104
TREES - DEAD		
Abies grandis		
Pinus contorta		
Total % Trees - Dead	0	0
TALL SHRUBS		
Acer glabrum	P	
Sorbus sitchensis		
Taxus brevifolia		
Total % Tall Shrubs	0	0
LOW SHRUBS		
Amelanchier alnifolia		
Cornus stolonifera		
Holodiscus discolor		
Lonicera ciliosa		
Lonicera utahensis	P	
Menziesia ferruginea		
Oplopanax horridum		
Pachistima myrsinites	P	
Ribes lacustre		
Rosa gymnocarpa	P	
Salix scouleriana		
Sheperdia canadensis		
Spiraea betulifolia		
Symphoricarpos albus		
Vaccinium globulare		
Vaccinium myrtillus		

TABLE 25A. (CONTINUED)

TRANSECT NUMBER	51	
	1st Hits	All Hits
Total % Low Shrubs	0	0
SUBSHRUBS		
Arctostaphylos uva-ursi		
Berberis repens		
Chimaphila umbellata	P	
Cornus canadensis		
Linnaea borealis		
Rubus parviflorus		
Total % Subshrubs	0	0
PERENNIAL GRAMINOIDS		
Bromus vulgaris	P	
Calamagrostis rubescens		
Carex concinnoides		
Carex rossii		
Festuca occidentalis		
Muhlenbergia asperifolia		
Total % Perennial Graminoids	0	0
PERENNIAL FORBS		
Actaea rubra		
Adenocaulon bicolor		2
Angelica arguta		
Aralia nudicaulis		
Arnica cordifolia		
Cirsium flodmanii		
Clematis columbiana		
Clintonia uniflora	2	2
Coptis occidentalis		
Corallorhiza maculata		
Disporum hookeri	P	
Fragaria virginiana		
Galium triflorum	P	
Goodyera oblongfolia	P	
Hèeracium albiflorum		
Listera convallarioides		
Osmorhiza chilensis	P	
Pedicularis bracteosa		
Pyrola asarifolia		
Pyrola chlorantha		

TABLE 25A. (CONTINUED)

TRANSECT NUMBER	51	
	1st Hits	All Hits
Pyrola minor		
Pyrola secunda	P	
Smèlacina stellata	P	
Thalictrum occidentale	P	
Tiarella trifoliata		4
Trillium ovatum		
Veratrum viride		
Viola glabella		
Viola orbiculata	P	
Xerophyllum tenax		
Total % Perennial Forbs	2	8
ANNUAL & BIENNIAL FORBS		
Melampyrum lineare		
Verbascum thapsus		
Total % Annual & Biennial Forbs	0	0
CRYPTOGAMS		
Athyrium filix-femina		
Gymnocarpium dryopteris		
Moss		2
Pteridium aquilinum		
Total % Cryptogams	0	2
TOTAL % VEGETATION	98	114
Soil		
Litter	2	2
Rock		

P = SPECIES PRESENT BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 25A. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
TREES					
Abies grandis	28.1%	30.1%	31.9%	22.9%	88.2%
Larix occidentalis	8.4%	8.9%	8.4%	6.0%	82.4%
Picea engelmannii	4.5%	4.8%	4.1%	3.0%	41.2%
Pinus contorta	4.1%	4.4%	4.2%	3.0%	35.3%
Pinus monticola	3.3%	3.5%	3.5%	2.5%	58.8%
Pseudotsuga menziesii	9.2%	9.8%	10.5%	7.5%	76.5%
Thuja plicata	9.1%	9.7%	14.7%	10.6%	88.2%
Tsuga heterophylla	14.4%	15.4%	16.7%	12.1%	88.2%
Total % Trees	79.1%	86.6%	94.0%	67.6%	
TREES - DEAD					
Abies grandis	0.1%	0.1%	0.1%	0.1%	5.9%
Pinus contorta	2.8%	3.0%	2.8%	2.0%	11.8%
Total % Trees - Dead	2.9%	3.1%	2.9%	2.1%	
TALL SHRUBS					
Acer glabrum	0.4%	0.4%	0.8%	0.6%	29.4%
Sorbus sitchensis	0.1%	0.1%	0.0%	0.0%	5.9%
Taxus brevifolia	0.1%	0.1%	0.8%	0.6%	23.5%
Total % Tall Shrubs	0.6%	0.6%	1.6%	1.2%	
LOW SHRUBS					
Amelanchier alnifolia	0.0%	0.0%	0.1%	0.1%	41.2%
Cornus stolonifera	P	0.0%	0.0%	0.0%	5.9%
Holodiscus discolor	0.0%	0.0%	0.1%	0.1%	5.9%
Lonicera ciliosa	P	0.0%	0.0%	0.0%	5.9%
Lonicera utahensis	0.0%	0.0%	0.2%	0.2%	70.6%
Menziesia ferruginea	P	0.0%	0.0%	0.0%	11.8%
Oplopanax horridum	P	0.0%	0.0%	0.0%	5.9%
Pachistima myrsinites	0.0%	0.0%	0.8%	0.6%	88.2%
Ribes lacustre	P	0.0%	0.0%	0.0%	5.9%
Rosa gymnocarpa	0.1%	0.1%	0.6%	0.4%	64.7%
Salix scouleriana	0.1%	0.1%	0.0%	0.0%	11.8%
Sheperdia canadensis	0.0%	0.0%	0.1%	0.1%	11.8%
Spiraea betulifolia	0.1%	0.1%	0.8%	0.6%	64.7%
Symphoricarpos albus	P	0.0%	0.0%	0.0%	5.9%
Vaccinium globulare	0.2%	0.3%	0.4%	0.2%	58.8%
Vaccinium myrtillus	0.0%	0.0%	1.1%	0.8%	41.2%
Total % Low Shrubs	0.5%	0.6%	4.2%	3.1%	

TABLE 25A. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
SUBSHRUBS					
Arctostaphylos uva-ursi	P	0.0%	0.0%	0.0%	5.9%
Berberis repens	P	0.0%	0.0%	0.0%	35.3%
Chimaphila umbellata	0.6%	0.6%	2.0%	1.4%	70.6%
Cornus canadensis	0.0%	0.0%	0.2%	0.2%	17.6%
Linnaea borealis	0.8%	0.9%	5.6%	4.1%	82.4%
Rubus parviflorus	0.2%	0.3%	0.5%	0.3%	17.6%
Total % Subshrubs	1.6%	1.8%	8.3%	6.0%	
PERENNIAL GRAMINOIDS					
Bromus vulgaris	0.0%	0.0%	0.2%	0.2%	17.6%
Calamagrostis rubescens	0.2%	0.3%	0.7%	0.5%	47.1%
Carex concinnoides	0.0%	0.0%	0.1%	0.1%	11.8%
Carex rossii	P	0.0%	0.0%	0.0%	11.8%
Festuca occidentalis	P	0.0%	0.0%	0.0%	11.8%
Muhlenbergia asperifolia	0.0%	0.0%	0.1%	0.1%	5.9%
Total % Perennial Graminoids	0.2%	0.3%	1.1%	0.9%	
PERENNIAL FORBS					
Actaea rubra	0.0%	0.0%	0.3%	0.2%	11.8%
Adenocaulon bicolor	0.0%	0.0%	0.1%	0.1%	35.3%
Angelica arguta	P	0.0%	0.0%	0.0%	5.9%
Aralia nudicaulis	P	0.0%	0.0%	0.0%	5.9%
Arnica cordifolia	0.8%	0.9%	3.5%	2.5%	41.2%
Cirsium flodmanii	P	0.0%	0.0%	0.0%	5.9%
Clematis columbiana	0.1%	0.1%	0.2%	0.2%	5.9%
Clintonia uniflora	0.5%	0.5%	2.1%	1.5%	94.1%
Coptis occidentalis	0.8%	0.9%	5.3%	3.8%	70.6%
Corallorhiza maculata	P	0.0%	0.0%	0.0%	5.9%
Disporum hookeri	P	0.0%	0.0%	0.0%	23.5%
Fragaria virginiana	0.1%	0.1%	0.1%	0.1%	11.8%
Galium triflorum	P	0.0%	0.0%	0.0%	23.5%
Goodyera oblongfolia	P	0.0%	0.0%	0.0%	76.5%
Hëeracium albiflorum	P	0.0%	0.0%	0.0%	52.9%
Listera convallarioides	P	0.0%	0.0%	0.0%	23.5%
Osmorhiza chilensis	P	0.0%	0.0%	0.0%	29.4%
Pedicularis bracteosa	P	0.0%	0.0%	0.0%	5.9%
Pyrola asarifolia	0.2%	0.3%	0.2%	0.2%	64.7%
Pyrola chlorantha	P	0.0%	0.0%	0.0%	17.6%
Pyrola minor	P	0.0%	0.0%	0.0%	5.9%
Pyrola secunda	0.0%	0.0%	0.1%	0.1%	58.8%

TABLE 25A. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Smilacina stellata	0.1%	0.1%	1.0%	0.6%	52.9%
Thalictrum occidentale	0.0%	0.0%	0.2%	0.2%	35.3%
Tiarella trifoliata	0.1%	0.1%	1.5%	1.1%	52.9%
Trillium ovatum	0.0%	0.0%	0.1%	0.1%	41.2%
Veratrum viride	P	0.0%	0.0%	0.0%	5.9%
Viola glabella	0.0%	0.0%	0.2%	0.2%	52.9%
Viola orbiculata	0.5%	0.5%	1.0%	0.6%	94.1%
Xerophyllum tenax	2.0%	2.1%	6.1%	4.4%	64.7%
Total % Perennial Forbs	5.2%	5.6%	22.0%	15.9%	
ANNUAL & BIENNIAL FORBS					
Melampyrum lineare	0.2%	0.3%	0.2%	0.2%	17.6%
Verbascum thapsus	P	0.0%	0.0%	0.0%	5.9%
Total % Annual & Biennial Forbs	0.2%	0.3%	0.2%	0.2%	
CRYPTOGAMS					
Athyrium filix-femina	P	0.0%	0.0%	0.0%	23.5%
Gymnocarpium dryopteris	P	0.0%	0.0%	0.0%	11.8%
Moss	0.6%	0.6%	2.8%	2.0%	58.8%
Pteridium aquilinum	0.5%	0.5%	1.4%	1.0%	47.1%
Total % Cryptogams	1.1%	1.1%	4.2%	3.0%	
TOTAL % VEGETATION	93.5%	100.0%	138.5%	100.0%	
Soil	0.0%				
Litter	6.4%				
Rock	0.1%				

P = SPECIES PRESENT BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 26A. WESTERN HEMLOCK/QUEENCUP BEADLILY TREE DENSITY, REPRODUCTION, HEIGHT, DBH, AND AGE DATA -1988 MONTANA PROJECT

DENSITY

TRANSECT NUMBER	9	11	15	17	18	21	23	28	30	36	38	39	40	41	42	47	51
TREES																	
Abies grandis	10	14	1	14	9	2			4	5	5	5	16	31	13	2	7
Larix occidentalis	4	1	8	1	1		7		2	4		6	1	2			
Picea engelmannii	1		2			1		5	2	3						3	
Pinus contorta		1			1						16	17		8	5		
Pinus monticola	1			11	6	1	3		1		5	1		1	7		
Pseudotsuga menziesii	4	2	13	4	5	1	4			1		1		2	1		2
Thuja plicata				7	1	6	2	4	2		1	35		22	3	3	
Tsuga heterophylla				2	2	6	15	7	7	1	1	3		4	2	8	1
Total Trees	20	18	24	39	25	17	31	16	18	14	28	68	17	70	31	16	10
TREES (DEAD)																	
Abies grandis				1		1			2	1			1	2	4		1
Larix occidentalis				1			4		2								
Picea engelmannii						2		4	1								
Pinus contorta				3	2						17	5		4	13		
Pinus monticola				3	1		11				1						1
Pseudotsuga menziesii							1										
Tsuga heterophylla							2								1		
Total Trees (Dead)	0	0	0	8	3	3	18	4	5	1	18	5	1	6	18	0	2

TABLE 26A. (CONTINUED)

DENSITY

	MEAN NO. TREES/ 125 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TREES				
Abies grandis	8.1	262.2	29.9%	
Larix occidentalis	2.2	71.2	8.0%	
Picea engelmannii	1.0	32.4	3.7%	
Pinus contorta	2.8	90.7	10.4%	
Pinus monticola	2.2	71.2	8.0%	
Pseudotsuga menziesii	2.3	74.5	8.6%	
Thuja plicata	5.1	165.1	18.6%	
Tsuga heterophylla	3.5	113.3	12.8%	
Total Trees	27.2	880.6	100.0%	7.5
TREES (DEAD)				
Abies grandis	0.8	25.9	14.1%	
Larix occidentalis	0.4	13.0	7.6%	
Picea engelmannii	0.4	13.0	7.6%	
Pinus contorta	2.5	80.9	47.8%	
Pinus monticola	1.0	32.3	18.5%	
Pseudotsuga menziesii	0.1	3.2	1.1%	
Tsuga heterophylla	0.2	6.5	3.3%	
Total Trees (Dead)	5.4	174.8	100.0%	6.3

TABLE 26A. (CONTINUED)

REPRODUCTION

TRANSECT NUMBER	9	11	15	17	18	21	23	28	30	36	38	39	40	41	42	47	51
Abies grandis			7	22	5				6	1	6	9	2		4	3	
Pseudotsuga menziesii					2												
Thuja plicata						1			2			22		11	2	2	
Tsuga heterophylla		2	3	13	3	P			161	17	3	3	3			1	3
Total Tree Reproduction	0	2	10	35	10	1	0	0	169	18	9	34	5	11	6	6	3

	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
Abies grandis	3.8	615.1	20.4%	
Pseudotsuga menziesii	0.1	16.2	0.6%	
Thuja plicata	2.4	388.5	12.5%	
Tsuga heterophylla	12.5	2023.5	66.5%	
Total Tree Reproduction	18.8	3043.3	100.0%	5.6

TABLE 26A. (CONTINUED)

HEIGHT (FEET)

TRANSECT NUMBER	9	11	15	17	18	21	23	28	30	36	38	39	40	41	42	47	51
TREES																	
Abies grandis	40	37	51	14	29	24			66	44	20	17	27	33	23	17	67
Larix occidentalis	55	50	76	87	72		75			113		73	102				
Picea engelmannii	10		45			88		57	39	70						32	
Pinus contorta		70			30						54	38		60	45		
Pinus monticola	32			14	13	78	73		114		19	8		20	20		
Pseudotsuga menziesii	48	100	55	18	18	87	67			68		6		50	9		88
Thuja plicata				14	6	58	63	45	46	70	8	10		14	23	31	
Tsuga heterophylla				12	10	27	40	62	24		6	18		23	18	41	7
TREES (DEAD)																	
Abies grandis						38											
Larix occidentalis									96								
Picea engelmannii						31											
Pinus contorta															16		
Pinus moniticola				12													99

TABLE 26A. (CONTINUED)

HEIGHT (FEET)

MEAN TREE HEIGHT IN FEET	RANGE IN HEIGHT (FEET) (MIN)	RANGE IN HEIGHT (FEET) (MAX)	ABSOLUTE MEAN HEIGHT IN FEET
TREES			
Abies grandis	14	67	31.7
Larix occidentalis	50	113	74.2
Picea engelmannii	10	88	50.2
Pinus contorta	30	70	48.4
Pinus monticola	8	114	25.3
Pseudotsuga menziesii	6	100	49.4
Thuja plicata	6	70	19.3
Tsuga heterophylla	6	62	33.8
Total Trees			36.5
TREES (DEAD)			
Abies grandis	38	38	38.0
Larix occidentalis	96	96	96.0
Picea engelmannii	21	40	30.5
Pinus contorta	16	16	16.0
Pinus moniticola	12	99	55.5
Total Dead Trees			52.3

TABLE 26A. (CONTINUED)

DBH (INCHES)

MEAN DIAMETER AT BREAST HEIGHT (DBH) IN INCHES

TRANSECT NUMBER	9	11	15	17	18	21	23	28	30	36	38	39	40	41	42	47	51
TREES																	
Abies grandis	7.5	6.1	7.5	1.7	4.0	4.5			8.9	6.9	4.7	2.5	4.7	4.2	3.5	3.7	12.0
Larix occidentalis	7.7	5.9	10.5	15.4	9.4		8.1			19.6		6.9	16.5	6.9			
Picea engelmannii	1.6		6.7			14.2		5.8	6.5	13.3						5.4	
Pinus contorta		16.1			3.1						6.3	4.7		6.5	4.5		
Pinus monticola	3.1			1.8	1.5	12.2	8.8		18.9		2.5	0.8		2.0	3.0		
Pseudotsuga menziesii	8.4	25.2	8.3	2.5	2.3	16.5	8.9			9.8		0.4		5.9	0.8		20.1
Thuja plicata				2.0	0.4	12.2	13.6	5.9	5.3		1.2	1.2		1.7	3.7	5.5	
Tsuga heterophylla				1.2	0.8	5.7	4.9	8.5	3.2	14.2	0.4	2.1		3.0	3.7	7.6	1.2
Total Trees																	
TREES (DEAD)																	
Abies grandis				2.8		7.9			3.3	8.3			13.8	2.4	2.9		2.4
Larix occidentalis				10.2			2.2		12.2								
Picea engelmannii						7.3		1.7	2.4								
Pinus contorta				9.3	8.7						5.8	3.7		3.3	6.1		
Pinus moniticola				2.4	0.4		3.3				1.2						26.4
Pseudotsuga menziesii							7.9										
Tsuga heterophylla							3.1								3.5		
Total Dead Trees																	

TABLE 26A. (CONTINUED)

DBH (INCHES)

MEAN DIAMETER	RANGE IN DBH (INCHES) (MIN)	RANGE IN DBH (INCHES) (MAX)	ABSOLUTE MEAN DBH IN INCHES
TREES			
Abies grandis	0.8	22.4	5.0
Larix occidentalis	3.1	26.8	11.3
Picea engelmannii	1.2	15.0	7.5
Pinus contorta	2.8	16.1	5.7
Pinus monticola	0.4	18.9	3.5
Pseudotsuga menziesii	0.4	29.1	8.2
Thuja plicata	0.4	22.4	3.0
Tsuga heterophylla	0.4	26.8	5.0
Total Trees			5.3
TREES (DEAD)			
Abies grandis	1.6	13.8	4.5
Larix occidentalis	1.6	12.2	6.2
Picea engelmannii	1.2	11.0	3.4
Pinus contorta	1.6	9.8	5.8
Pinus moniticola	0.4	26.4	4.2
Pseudotsuga menziesii	7.9	7.9	7.9
Tsuga heterophylla	2.8	3.5	3.3
Total Dead Trees			12.9

TABLE 26A. (CONTINUED)

AGE (YEARS)

TRANSECT NUMBER	9	11	15	17	18	21	23	28	30	36	38	39	40	41	42
Abies grandis	76				82									80	89
Larix occidentalis										240			218		
Pinus contorta											89	92			
Pinus monticola				68		130	85								
Pseudotsuga menziesii		208	110						198						
Tsuga heterophylla								60							

	NUMBER TREES CORED	MINIMUM	MAXIMUM	MEAN AGE
Abies grandis	4	76	82	109
Larix occidentalis	2	218	240	229
Pinus contorta	2	89	92	91
Pinus monticola	3	68	130	94
Pseudotsuga menziesii	3	110	208	172
Tsuga heterophylla	1	60	60	60
Total	15	60	240	126

* The age estimate for one or more trees in this category is too low, because the increment borer could estimate tree age only for trees of 32 inch diameter or less.

TABLE 27A. WESTERN HEMLOCK/QUEENCUP BEADLILY SHRUB DENSITY DATA -1988
MONTANA PROJECT

TRANSECT NUMBER	9	11	15	17	18	21	23	28	30	36	38	39	40	41	42	47	51
TALL SHRUBS																	
Acer glabrum	8	2	18													2	2
Taxus brevifolia													5			P	
Total Tall Shrubs	8	2	18	0	0	0	0	0	0	0	0	0	5	0	0	2	2
LOW SHRUBS																	
Amelanchier alnifolia	1		1	2	12			2		13					1	P	
Holodiscus discolor					3												
Lonicera utahensis	1	2	6		9	P						P	P	1			
Oplopanax horridum																2	
Pachistima myrsinites	30	27	36	12	24				3		1	44			4	16	6
Rosa gymnocarpa		14	2		8				4	54	33	11	2		2		2
Rosa nutkana	1									1							
Salix scouleriana				2							1						
Shepheria canadensis					4						P						
Spiraea betulifolia	6	1		5	7			1	7	9	59	9	1		6		
Symphoricarops albus			3														
Vaccinium globulare	28	24	3		12	6				13	7	P	6				2
Vaccinium myrtillus				36		27			14	3		16					
Total Low Shrubs	67	68	51	57	79	33	0	3	28	93	101	80	9	1	13	18	10
SUBSHRUBS																	
Berberis repens									3		36	2					
Rubus parviflorus			12													4	
Total Subshrubs	0	0	12	0	0	0	0	0	3	0	36	2	0	0	0	4	0
TOTAL SHRUBS	75	70	81	57	79	33	0	3	31	93	137	82	14	1	13	24	12

TABLE 27A. (CONTINUED)

	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TALL SHRUBS				
Acer glabrum	1.9	307.5	4.0%	
Taxus brevifolia	0.3	48.6	0.6%	
Total Tall Shrubs	2.2	356.1	4.6%	
LOW SHRUBS				
Amelanchier alnifolia	1.9	307.5	4.0%	
Holodiscus discolor	0.2	32.4	0.4%	
Lonicera utahensis	1.1	178.1	2.4%	
Oplopanax horridum	0.1	16.2	0.2%	
Pachistima myrsinites	12.0	1942.5	25.2%	
Rosa gymnocarpa	7.8	1262.6	16.4%	
Rosa nutkana	0.1	16.2	0.2%	
Salix scouleriana	0.2	32.4	0.4%	
Shepheria canadensis	0.2	32.4	0.5%	
Spiraea betulifolia	6.5	1052.2	13.8%	
Symphoricarops albus	0.2	32.4	0.4%	
Vaccinium globulare	5.9	955.1	12.5%	
Vaccinium myrtillus	5.6	906.5	11.9%	
Total Low Shrubs	41.8	6766.5	88.3%	
SUBSHRUBS				
Berberis repens	2.4	388.5	5.1%	
Rubus parviflorus	1.0	161.9	2.0%	
Total Subshrubs	3.4	550.4	7.1%	
TOTAL SHRUBS	47.4	7673.0	100.0%	6.2

TABLE 28A. SUBALPINE FIR/QUEENCUP BEADLILY COVER DATA -1988
MONTANA PROJECT

TRANSECT NUMBER	54		59	
	1st Hits	All Hits	1st Hits	All Hits
TREES				
Abies grandis	4	4	8	8
Abies lasiocarpa	70	70	40	40
Larix occidentalis			14	14
Picea engelmannii	P		10	12
Pinus contorta			10	10
Pseudotsuga menziesii			2	4
Tsuga heterophylla	P			
Total % Trees	74	74	84	88
TALL SHRUBS				
Acer glabrum	4	10	P	
Sorbus scopulina	P		P	
Taxus brevifolia		2		2
Total % Tall Shrubs	4	12	0	2
LOW SHRUBS				
Lonicera utahensis	P		P	
Menziesia ferruginea	P			
Pachistima myrsinites				4
Ribes lacustre		2		
Rosa gymnocarpa			P	
Rosa nutkana			P	
Rubus idaeus	P			
Spiraea betulifolia	P		P	
Vaccinium globulare		6	4	26
Vaccinium myrtillus	P			
Total % Low Shrubs	0	8	4	30
SUBSHRUBS				
Chimaphila umbellata			P	
Rubus parviflorus	P			
Total % Subshrubs	0	0	0	0
PERENNIAL GRAMINOIDS				
Calamagrostis inexpansa	P			
Festuca subulata	P			
Luzula hitchcockii	P			
Total % Perennial Graminoids	0	0	0	0

TABLE 28A. (CONTINUED)

TRANSECT NUMBER	54		59	
	1st Hits	All Hits	1st Hits	All Hits
PERENNIAL FORBS				
Arnica cordifolia				8
Clintonia uniflora	2	20		6
Disporum hookeri			P	
Galium triflorum	2	2		
Goodyera oblongfolia	P		2	2
Pyrola secunda				4
Smilacina stellata	2	2	P	
Thalictrum occidentale	P			
Tiarella trifoliata	2	10		8
Viola orbiculata				2
Xerophyllum tenax		2	P	
Total % Perennial Forbs	8	36	2	30
CRYPTOGAMS				
Athyrium filix-femina	4	4		
Dryopteris filix-mas	P			
Moss	8	24	2	2
Polystichum andersonii	P			
Pteridium aquilinum			2	8
Total % Cryptogams	12	28	4	10
TOTAL % VEGETATION	98	158	94	160
Soil				
Litter	2	2	6	6
Rock				

P = SPECIES PRESENT, BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 28A. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
TREES					
Abies grandis	6.0%	6.3%	6.0%	3.8%	100.0%
Abies lasiocarpa	55.0%	57.3%	55.0%	34.6%	100.0%
Larix occidentalis	7.0%	7.3%	7.0%	4.4%	50.0%
Picea engelmannii	5.0%	5.2%	6.0%	3.8%	100.0%
Pinus contorta	5.0%	5.2%	5.0%	3.1%	50.0%
Pseudotsuga menziesii	1.0%	1.0%	2.0%	1.3%	50.0%
Tsuga heterophylla	P	0.0%	0.0%	0.0%	50.0%
Total % Trees	79.0%	82.3%	81.0%	51.0%	
TALL SHRUBS					
Acer glabrum	2.0%	2.1%	5.0%	3.1%	100.0%
Sorbus scopulina	P	0.0%	0.0%	0.0%	100.0%
Taxus brevifolia	0.0%	0.0%	2.0%	1.3%	100.0%
Total % Tall Shrubs	2.0%	2.1%	7.0%	4.4%	
LOW SHRUBS					
Lonicera utahensis	P	0.0%	0.0%	0.0%	100.0%
Menziesia ferruginea	P	0.0%	0.0%	0.0%	50.0%
Pachistima myrsinites	0.0%	0.0%	2.0%	1.2%	50.0%
Ribes lacustre	0.0%	0.0%	1.0%	0.6%	50.0%
Rosa gymnocarpa	P	0.0%	0.0%	0.0%	50.0%
Rosa nutkana	P	0.0%	0.0%	0.0%	50.0%
Rubus idaeus	P	0.0%	0.0%	0.0%	50.0%
Spiraea betulifolia	P	0.0%	0.0%	0.0%	100.0%
Vaccinium globulare	2.0%	2.1%	16.0%	10.1%	100.0%
Vaccinium myrtillus	P	0.0%	0.0%	0.0%	50.0%
Total % Low Shrubs	2.0%	2.1%	19.0%	11.9%	
SUBSHRUBS					
Chimaphila umbellata	P	0.0%	0.0%	0.0%	50.0%
Rubus parviflorus	P	0.0%	0.0%	0.0%	50.0%
Total % Subshrubs	0.0%	0.0%	0.0%	0.0%	
PERENNIAL GRAMINOIDS					
Calamagrostis inexpansa	P	0.0%	0.0%	0.0%	50.0%
Festuca subulata	P	0.0%	0.0%	0.0%	50.0%
Luzula hitchcockii	P	0.0%	0.0%	0.0%	50.0%
Total % Perennial Graminoids	0.0%	0.0%	0.0%	0.0%	

TABLE 28A. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
PERENNIAL FORBS					
Arnica cordifolia	0.0%	0.0%	4.0%	2.5%	50.0%
Clintonia uniflora	1.0%	1.0%	13.0%	8.2%	100.0%
Disporum hookeri	P	0.0%	0.0%	0.0%	50.0%
Galium triflorum	1.0%	1.0%	1.0%	0.6%	50.0%
Goodyera oblongfolia	1.0%	1.0%	1.0%	0.6%	100.0%
Pyrola secunda	0.0%	0.0%	2.0%	1.3%	50.0%
Smilacina stellata	1.0%	1.0%	1.0%	0.6%	100.0%
Thalictrum occidentale	P	0.0%	0.0%	0.0%	50.0%
Tiarella trifoliata	1.0%	1.0%	9.0%	5.7%	100.0%
Viola orbiculata	0.0%	0.0%	1.0%	0.6%	50.0%
Xerophyllum tenax	0.0%	0.0%	1.0%	0.6%	100.0%
Total % Perennial Forbs	5.0%	5.2%	33.0%	20.7%	
CRYPTOGAMS					
Athyrium filix-femina	2.0%	2.1%	2.0%	1.3%	50.0%
Dryopteris filix-mas	P	0.0%	0.0%	0.0%	50.0%
Moss	5.0%	5.2%	13.0%	8.2%	100.0%
Polystichum andersonii	P	0.0%	0.0%	0.0%	50.0%
Pteridium aquilinum	1.0%	1.0%	4.0%	2.5%	50.0%
Total % Cryptogams	8.0%	8.3%	19.0%	12.0%	
TOTAL % VEGETATION	96.0%	100.0%	159.0%	100.0%	
Soil	0.0%				
Litter	4.0%				
Rock	0.0%				

P = SPECIES PRESENT, BUT NOT ENCOUNTERED QUANTITATIVELY

TABLE 29A. SUBALPINE FIR/QUEENCUP BEADLILY TREE DENSITY, REPRODUCTION, HEIGHT, AND DBH DATA -1988
MONTANA PROJECT

DENSITY

TRANSECT NUMBER	54	59	MEAN NO. TREES/ 125 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
	--	--				
TREES						
Abies grandis	3	1	2.0	64.7	15.4%	
Abies lasiocarpa	13	2	7.5	242.8	57.7%	
Larix occidentalis		2	1.0	32.4	7.7%	
Picea engelmannii		3	1.5	48.6	11.6%	
Pinus contorta		1	0.5	16.2	3.8%	
Tsuga heterophylla	1		0.5	16.2	3.8%	
Total Trees	17	9	13.0	420.9	100.0%	4.0
TREES (DEAD)						
Abies lasiocarpa	2	1	0.1	48.6	100.0%	
Total Trees (Dead)	2	1	0.1	48.6	100.0%	0.5

REPRODUCTION

TRANSECT NUMBER	54	59	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
	--	--				
Abies grandis		5	2.5	404.7	100.0%	
Total Tree Reproduction	0	5	2.5	404.7	100.0%	2.5

TABLE 29A. (CONTINUED)

HEIGHT (FEET)

MEAN TREE HEIGHT TRANSECT NUMBER	54 --	59 --	RANGE IN HEIGHT (FEET) (MIN)	RANGE IN HEIGHT (FEET) (MAX)	ABSOLUTE MEAN HEIGHT IN FEET
TREES					
Abies grandis	21.7	41.0	8	41	26.5
Abies lasiocarpa	35.0	82.0	5	94	41.3
Larix occidentalis		90.0	90	90	90.0
Picea engelmannii		36.0	20	48	36.0
Pinus contorta		81.0	81	81	81.0
Tsuga heterophylla	10.0		10	10	10.0
Total Trees					42.5

DBH (INCHES)

MEAN DIAMETER AT BREAST HEIGHT (dbh) IN INCHES TRANSECT NUMBER	54 --	59 --	RANGE IN DBH (INCHES) (MIN)	RANGE IN DBH (INCHES) (MAX)	ABSOLUTE MEAN DBH IN INCHES
TREES					
Abies grandis	5.0	5.5	1.2	7.5	5.1
Abies lasiocarpa	8.9	15.9	0.4	28.3	9.8
Larix occidentalis		14.8	14.6	15.0	14.8
Picea engelmannii		5.2	2.0	7.1	5.2
Pinus contorta		10.6	10.6	10.6	10.6
Tsuga heterophylla	2.0		2.0	2.0	2.0
Total Trees					8.7
TREES (DEAD)					
Abies lasiocarpa	7.3	3.5	3.5	10.2	6.0
Total Dead Trees					

TABLE 30A. SUBALPINE FIR/QUEENCUP BEADLILY SHRUB DENSITY DATA
MONTANA PROJECT

TRANSECT NUMBER	54	59
	--	--
TALL SHRUBS		
Sorbus scopulina		3
Total Tall Shrubs	0	3
LOW SHRUBS		
Lonicera utahensis	10	
Pachistima myrsinites		41
Rosa nutkana		3
Rubus idaeus	1	
Vaccinium globulare	67	74
Vaccinium myrtillus	9	
Total Low Shrubs	87	118
SUBSHRUBS		
Rubus parviflorus	5	3
Total Subshrubs	5	3
TOTAL SHRUBS	92	124

	MEAN NUMBER SHRUBS/25 SQ M	MEAN NUMBER SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TALL SHRUBS				
Sorbus scopulina	1.5	242.8	1.4%	
Total Tall Shrubs	1.5	242.8	1.4%	
LOW SHRUBS				
Lonicera utahensis	5.0	809.4	4.6%	
Pachistima myrsinites	20.5	3318.5	19.0%	
Rosa nutkana	1.5	242.8	1.4%	
Rubus idaeus	0.5	80.9	0.4%	
Vaccinium globulare	70.5	11412.4	65.3%	
Vaccinium myrtillus	4.5	728.5	4.2%	
Total Low Shrubs	102.5	16592.5	94.9%	
SUBSHRUBS				
Rubus parviflorus	4.0	647.5	3.7%	
Total Subshrubs	4.0	647.5	3.7%	
TOTAL SHRUBS	108.0	17482.8	100.0%	16.0

TABLE 31A. MOUNTAIN HEMLOCK/BEARGRASS COVER DATA -1988
MONTANA PROJECT

TRANSECT NUMBER	44		45	
	1st Hit	All Hits	1st Hit	All Hits
TREES				
Abies grandis		2		
Abies lasiocarpa	10	10	4	4
Pinus monticola	P		P	
Pseudotsuga menziesii	6	6	18	18
Tsuga mertensiana	P		8	8
Total % Trees	16	18	30	30
TALL SHRUBS				
Acer glabrum	P		P	
Prunus emarginata			P	
Sorbus scopulina	P			4
Sorbus sitchensis			P	
Total % Tall Shrubs	0	0	0	4
LOW SHRUBS				
Amelanchier alnifolia			2	8
Lonicera utahensis	4	4		
Menziesia ferruginea			2	2
Pachistima myrsinites	14	20	12	16
Ribes lacustre	P			
Rubus idaeus	P			
Salix scouleriana	P		P	
Spiraea betulifolia	P			
Spiraea douglasii	P			
Vaccinium globulare	10	20		4
Vaccinium myrtillus	14	14	P	
Total % Low Shrubs	42	58	16	30
SUBSHRUBS				
Penstemon ellipticus	8	8		
Total % Subshrubs	8	8	0	0
PERENNIAL GRAMINOIDS				
Agrostis alba	P			
Calamagrostis rubescens	P			
Carex geyeri	4	8	P	
Carex spp.	2	2		
Elymus glaucus	P			
Festuca viridula			P	
Juncus parryi	P			

TABLE 31A. (CONTINUED)

TRANSECT NUMBER	44		45	
	1st Hit	All Hits	1st Hit	All Hits
Total % Perennnial Graminoids	6	10	0	0
PERENNIAL FORBS				
Achillea millefolium	P			
Epilobium angustifolium	P		P	
Penstemon lyallii	P			
Thalictrum occidentale	P			
Xerophyllum tenax	8	20	30	44
Total % Perennial Forbs	8	20	30	44
CRYPTOGAMS				
Cheilanthes gracillima	P			
Cryptogramma crispa	P		2	2
Moss			2	2
Total % Cryptogams	0	0	4	4
TOTAL % VEGETATION	80	114	80	112
Soil				
Litter	6	6	4	4
Rock	14	14	16	16

TABLE 31A. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
TREES					
Abies grandis	0.0%	0.0%	1.0%	0.9%	50.0%
Abies lasiocarpa	7.0%	8.8%	7.0%	6.2%	100.0%
Pinus monticola	P	0.0%	0.0%	0.0%	100.0%
Pseudotsuga menziesii	12.0%	15.0%	12.0%	10.6%	100.0%
Tsuga mertensiana	4.0%	5.0%	4.0%	3.5%	100.0%
Total % Trees	23.0%	28.8%	24.0%	21.2%	
TALL SHRUBS					
Acer glabrum	P	0.0%	0.0%	0.0%	100.0%
Prunus emarginata	P	0.0%	0.0%	0.0%	50.0%
Sorbus scopulina	0.0%	0.0%	2.0%	1.8%	100.0%
Sorbus sitchensis	P	0.0%	0.0%	0.0%	50.0%
Total % Tall Shrubs	0.0%	0.0%	2.0%	1.8%	
LOW SHRUBS					
Amelanchier alnifolia	1.0%	1.3%	4.0%	3.5%	50.0%
Lonicera utahensis	2.0%	2.5%	2.0%	1.8%	50.0%
Menziesia ferruginea	1.0%	1.3%	1.0%	0.9%	50.0%
Pachistima myrsinites	13.0%	16.1%	18.0%	15.9%	100.0%
Ribes lacustre	P	0.0%	0.0%	0.0%	50.0%
Rubus idaeus	P	0.0%	0.0%	0.0%	50.0%
Salix scouleriana	P	0.0%	0.0%	0.0%	100.0%
Spiraea betulifolia	P	0.0%	0.0%	0.0%	50.0%
Spiraea douglasii	P	0.0%	0.0%	0.0%	50.0%
Vaccinium globulare	5.0%	6.3%	12.0%	10.6%	100.0%
Vaccinium myrtillus	7.0%	8.8%	7.0%	6.2%	100.0%
Total % Low Shrubs	29.0%	36.3%	44.0%	38.9%	
SUBSHRUBS					
Penstemon ellipticus	4.0%	5.0%	4.0%	3.5%	50.0%
Total % Subshrubs	4.0%	5.0%	4.0%	3.5%	
PERENNIAL GRAMINOIDS					
Agrostis alba	P	0.0%	0.0%	0.0%	50.0%
Calamagrostis rubescens	P	0.0%	0.0%	0.0%	50.0%
Carex geyeri	2.0%	2.5%	4.0%	3.5%	100.0%
Carex spp.	1.0%	1.3%	1.0%	0.9%	50.0%
Elymus glaucus	P	0.0%	0.0%	0.0%	50.0%
Festuca viridula	P	0.0%	0.0%	0.0%	50.0%
Juncus parryi	P	0.0%	0.0%	0.0%	50.0%

TABLE 31A. (CONTINUED)

	MEAN % ABSOLUTE COVER 1ST HITS	MEAN % RELATIVE COVER 1ST HITS	MEAN % ABSOLUTE COVER ALL HITS	MEAN % RELATIVE COVER ALL HITS	FREQUENCY
Total % Perennnial Graminoids	3.0%	3.8%	5.0%	4.4%	
PERENNIAL FORBS					
Achillea millefolium	P	0.0%	0.0%	0.0%	50.0%
Epilobium angustifolium	P	0.0%	0.0%	0.0%	100.0%
Penstemon lyallii	P	0.0%	0.0%	0.0%	50.0%
Thalictrum occidentale	P	0.0%	0.0%	0.0%	50.0%
Xerophyllum tenax	19.0%	23.8%	32.0%	28.3%	100.0%
Total % Perennial Forbs	19.0%	23.8%	32.0%	28.3%	
CRYPTOGAMS					
Cheilanthes gracillima	P	0.0%	0.0%	0.0%	50.0%
Cryptogramma crispa	1.0%	1.1%	1.0%	0.9%	100.0%
Moss	1.0%	1.2%	1.0%	1.0%	50.0%
Total % Cryptogams	2.0%	2.3%	2.0%	1.9%	
TOTAL % VEGETATION	80.0%	100.0%	113.0%	100.0%	
Soil	0.0%				
Litter	5.0%				
Rock	15.0%				

TABLE 32A. MOUNTAIN HEMLOCK/BEARGRASS TREE DENSITY, REPRODUCTION, HEIGHT, DBH, AND AGE DATA -1988
MONTANA PROJECT

DENSITY

TRANSECT NUMBER	44	45	MEAN NO. TREES/ 125 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TREES (>1.3 M DBH)						
Abies lasiocarpa	1	1	1.0	32.4	16.7%	
Pinus monticola	1		0.5	16.2	8.3%	
Pseudotsuga menziesii	2	6	4.0	129.5	66.7%	
Tsuga mertensiana		1	0.5	16.2	8.3%	
Total Trees	4	8	6.0	194.3	100.0%	2.0

REPRODUCTION

TRANSECT NUMBER	44	45	MEAN NO. TREES/ 25 SQ METERS	MEAN NUMBER TREES/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
Abies lasiocarpa		1	0.5	80.9	25.0%	
Pseudotsuga menziesii	1	2	1.5	242.9	75.0%	
Total Tree Reproduction	1	3	2.0	323.8	100.0%	1.0

HEIGHT (FEET)

MEAN TREE HEIGHT IN FEET TRANSECT NUMBER	44	45	RANGE IN HEIGHT (FT) (MIN)	RANGE IN HEIGHT (FT) (MAX)	ABSOLUTE MEAN HEIGHT IN FEET
TREES					
Abies lasiocarpa	21.0	28.0	21	28	24.5
Pinus monticola	10.0		10	10	10.0
Pseudotsuga menziesii	17.0	11.8	8	18	13.1
Tsuga mertensiana		35.0	35	35	35.0
Total Trees					16.6

TABLE 32A. (CONTINUED)

DBH (INCHES)

MEAN DBH IN INCHES TRANSECT NUMBER	44	45	RANGE IN DBH (INCHES) (MIN)	RANGE IN DBH (INCHES) (MAX)	ABSOLUTE MEAN DBH IN INCHES
	--	--			
TREES					
Abies lasiocarpa	4.3	6.3	4.3	6.3	5.3
Pinus monticola	2.4		2.4	2.4	2.4
Pseudotsuga menziesii	3.9	2.8	2.0	4.3	3.1
Tsuga mertensiana		12.6	12.6	12.6	12.6
Total Trees					4.2

AGE (YEARS)

TRANSECT NUMBER	44	45	NUMBER TREES CORED	MINIMUM	MAXIMUM	MEAN
	--	--	---	---	---	---
Abies lasiocarpa	45		1	45	45	45
Tsuga mertensiana		55	1	55	55	55
Total			2	45	55	50

TABLE 33A. MOUNTAIN HEMLOCK/BEARGRASS SHRUB DENSITY DATA -1988
MONTANA PROJECT

TRANSECT NUMBER	44 --	45 --	MEAN SHRUBS/25 SQ M	MEAN SHRUBS/ACRE	RELATIVE DENSITY	STANDARD DEVIATION
TALL SHRUBS						
Acer glabrum		2	1.0	161.9	1.1%	
Sorbus scopulina		2	1.0	161.9	1.1%	
Total Tall Shrubs	0	4	2.0	323.8	2.2%	
LOW SHRUBS						
Amelanchier anlifolia		1	0.5	80.9	0.6%	
Lonicera utahensis	6	3	4.5	728.5	5.0%	
Pachistima myrsinites	30	28	29.0	4694.5	32.4%	
Ribes lacustre	1		0.5	80.9	0.6%	
Rubus idaeus	4		2.0	323.8	2.2%	
Spiraea betulifolia	3	1	2.0	323.8	2.2%	
Vaccinium globulare	49	31	40.0	6475.0	44.7%	
Vaccinium myrtillus	16	2	9.0	1456.9	10.1%	
Total Low Shrubs	109	66	87.5	14164.3	97.8%	
TOTAL SHRUBS	109	70	89.5	14488.1	100.0%	19.5

TABLE 34A. FORMULAS USED TO CALCULATE TREE VOLUME
MONTANA PROJECT

10 - 20" DBH

Abies grandis	$\text{Volume} = 1.293 \left(\frac{DBH^2 \times Height}{100}\right) - 34.127$
Abies lasiocarpa	$\text{Volume} = 1.011 \left(\frac{DBH^2 \times Height}{100}\right) - 11.403$
Larix occidentalis	$\text{Volume} = 0.997 \left(\frac{DBH^2 \times Height}{100}\right) - 29.790$
Picea engelmannii	$\text{Volume} = 1.149 \left(\frac{DBH^2 \times Height}{100}\right) - 11.851$
Pinus contorta	$\text{Volume} = 1.208 \left(\frac{DBH^2 \times Height}{100}\right) - 8.085$
Pinus monticola	$\text{Volume} = 1.189 \left(\frac{DBH^2 \times Height}{100}\right) - 26.729$
Populus tremuloides	$\text{Volume} = 1.197 \left(\frac{DBH^2 \times Height}{100}\right) - 18.544$
Populus trichocarpa	$\text{Volume} = 1.046 \left(\frac{DBH^2 \times Height}{100}\right) - 15.966$
Pseudotsuga menziesii	$\text{Volume} = 1.003 \left(\frac{DBH^2 \times Height}{100}\right) - 25.332$
Thuja plicata	$\text{Volume} = 0.878 \left(\frac{DBH^2 \times Height}{100}\right) - 10.742$
Tsuga heterophylla	$\text{Volume} = 1.203 \left(\frac{DBH^2 \times Height}{100}\right) - 37.314$

Region 1 Volume Tables for ADP Cruise Computations
Reference FSH 2431.23
Scribner Board Foot Volume

TABLE 34A. (CONTINUED)

>21" DBH

Abies grandis	$\text{Volume} = 1.218 \left(\frac{DBH^2 \times Height}{100}\right) + 10.603$
Abies lasiocarpa	$\text{Volume} = 0.694 \left(\frac{DBH^2 \times Height}{100}\right) + 124.425$
Larix occidentalis	$\text{Volume} = 0.841 \left(\frac{DBH^2 \times Height}{100}\right) + 85.150$
Picea engelmannii	$\text{Volume} = 1.158 \left(\frac{DBH^2 \times Height}{100}\right) + 1.620$
Pinus contorta	$\text{Volume} = 1.103 \left(\frac{DBH^2 \times Height}{100}\right) + 14.111$
Pinus monticola	$\text{Volume} = 1.181 \left(\frac{DBH^2 \times Height}{100}\right) - 32.516$
Populus tremuloides	$\text{Volume} = 1.216 \left(\frac{DBH^2 \times Height}{100}\right) - 21.309$
Populus trichocarpa	$\text{Volume} = 1.140 \left(\frac{DBH^2 \times Height}{100}\right) - 46.735$
Pseudotsuga menziesii	$\text{Volume} = 1.011 \left(\frac{DBH^2 \times Height}{100}\right) - 9.522$
Thuja plicata	$\text{Volume} = 0.799 \left(\frac{DBH^2 \times Height}{100}\right) - 4.064$
Tsuga heterophylla	$\text{Volume} = 1.306 \left(\frac{DBH^2 \times Height}{100}\right) - 50.680$

Region 1 Volume Tables for ADP Cruise Computations
Reference FSH 2431.23
Scribner Board Foot Volume

BASELINE VEGETATION STUDY

Montana Project

LINCOLN & SANDERS COUNTIES, MONTANA

APPENDIX B. MAPS

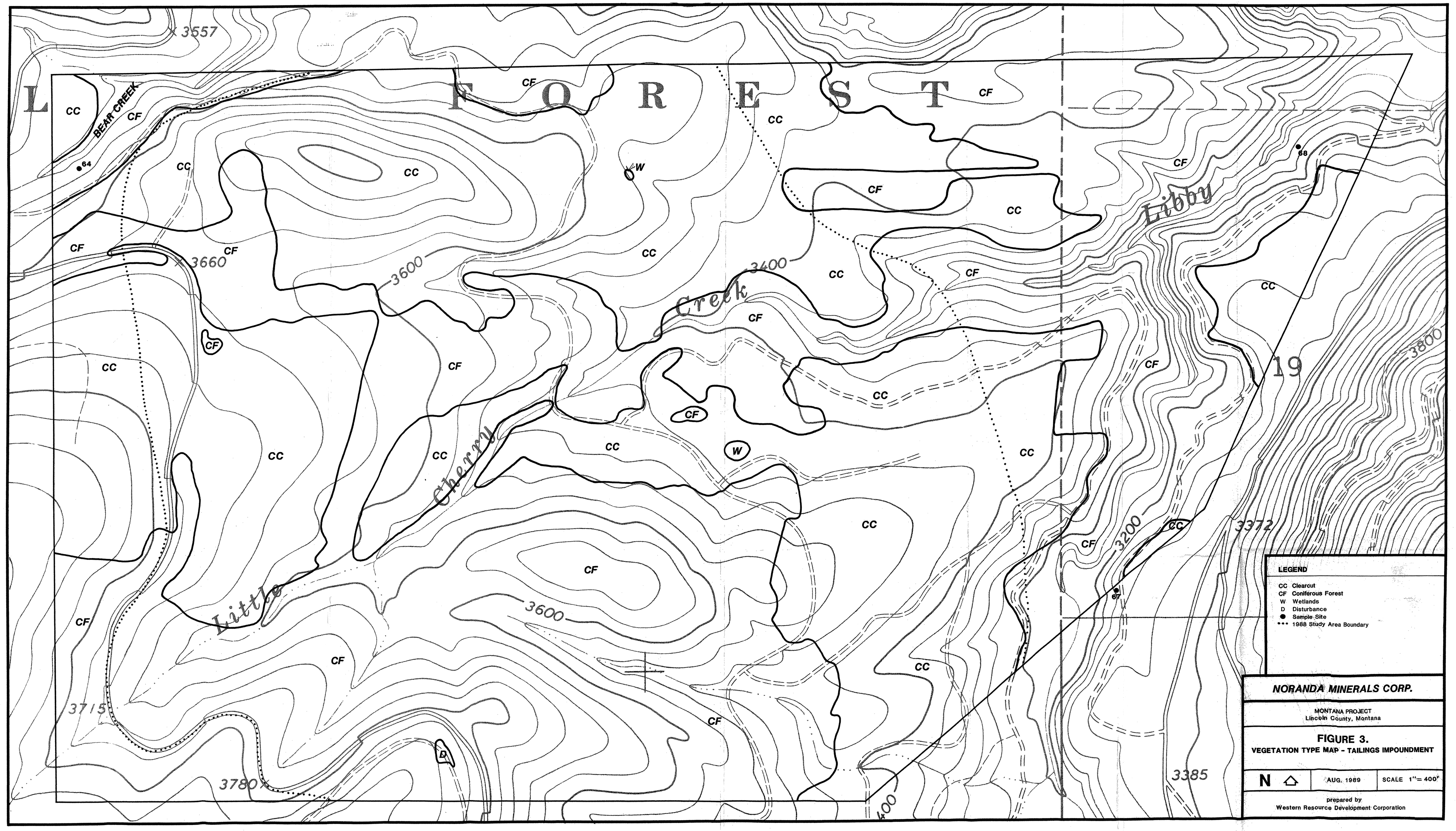
prepared for

Noranda Minerals Corp.
65 N. Edison Way Suite 4 P.O. Box 7176 Reno, Nevada 89501

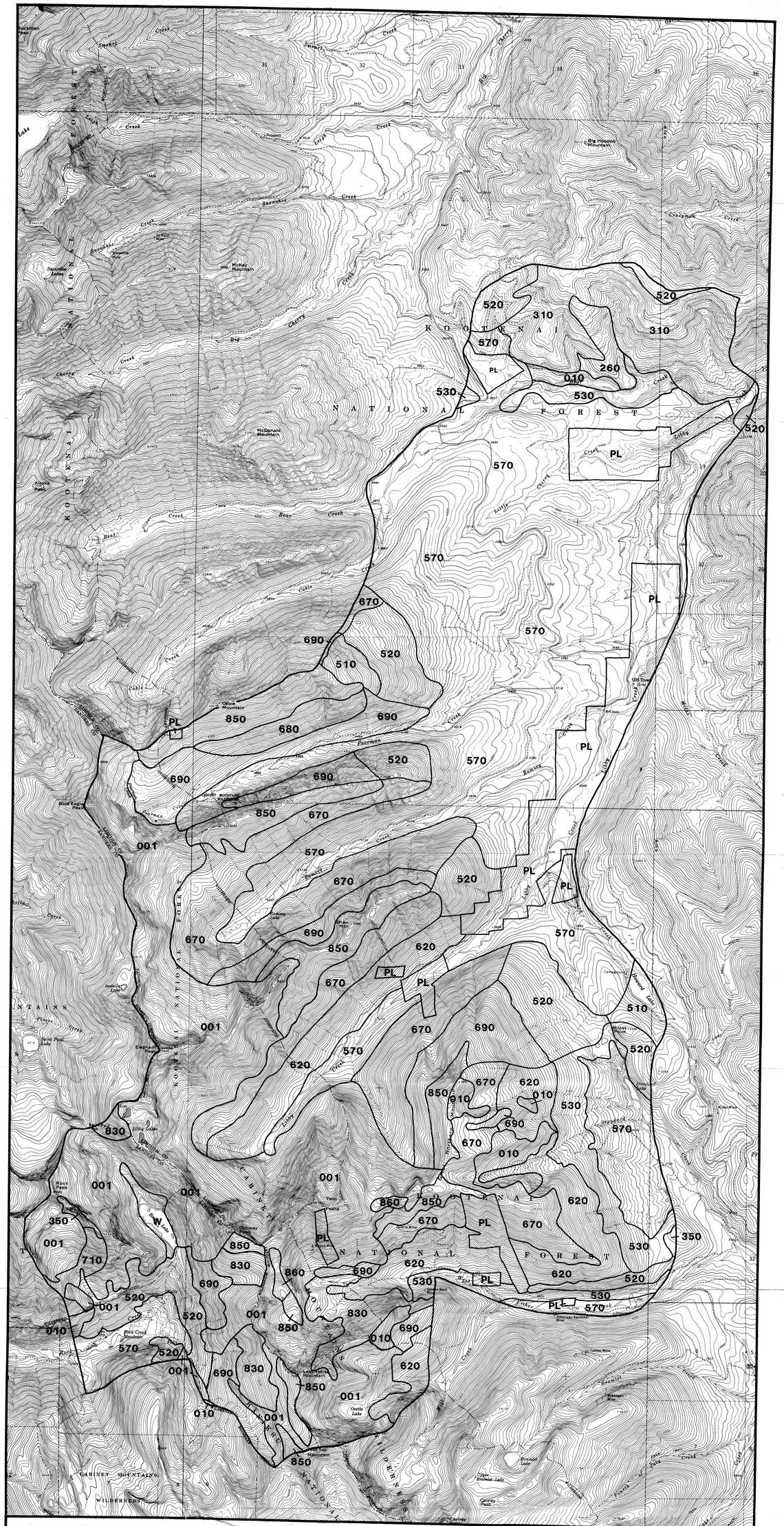
prepared by

Western Resource Development Corporation
711 Walnut St. P.O. Box 467 Boulder, Colorado 80306

February 1989



L F O R E S T
BEAR CREEK
Little Cherry Creek
Libby
19
3557
3660
3600
3400
3200
3800
3372
3385
3715
3780
CC
CF
W
D
64
67
68
LEGEND
CC Clearcut
CF Coniferous Forest
W Wetlands
D Disturbance
Sample Site
1988 Study Area Boundary
NORANDA MINERALS CORP.
MONTANA PROJECT
Lincoln County, Montana
FIGURE 3.
VEGETATION TYPE MAP - TAILINGS IMPOUNDMENT
N
AUG. 1989
SCALE 1"= 400'
prepared by
Western Resource Development Corporation



FOREST HABITAT TYPES

DOUGLAS FIR CLIMAX SERIES

260 DOUGLAS FIR/NINEBARK
310 DOUGLAS FIR /BLUEBUNCH WHEATGRASS
350 DOUGLAS FIR/DWARF HUCKLEBERRY

GRAND FIR CLIMAX SERIES

510 GRAND FIR/BEARGRASS
520 GRAND FIR/QUEENCUP BEADLILY

SUBALPINE FIR CLIMAX SERIES

620 SUBALPINE FIR/QUEENCUP BEADLILY
670 SUBALPINE FIR/MENZIESIA
680 MOUNTAIN HEMLOCK/MENZIESIA
690 SUBALPINE FIR/BEARGRASS
710 MOUNTAIN HEMLOCK/BEARGRASS
830 SUBALPINE FIR/SMOOTH WOODRUSH
850 WHITEBARK PINE/SUBALPINE FIR
860 ALPINE LARCH/SUBALPINE FIR

WESTERN RED CEDAR CLIMAX SERIES

530 WESTERN RED CEDAR/QUEENCUP BEADLILY

WESTERN HEMLOCK CLIMAX SERIES

570 WESTERN HEMLOCK/QUEENCUP BEADLILY

OTHER MAP UNITS

PL UNMAPPED PRIVATE LAND
010 SCREE
001 ROCK
W WATER

SOURCE: U.S. FOREST SERVICE,
KOOTENAI NATIONAL FOREST. 1984.
LAND INVENTORY SYSTEM.

NORANDA MINERALS CORP.

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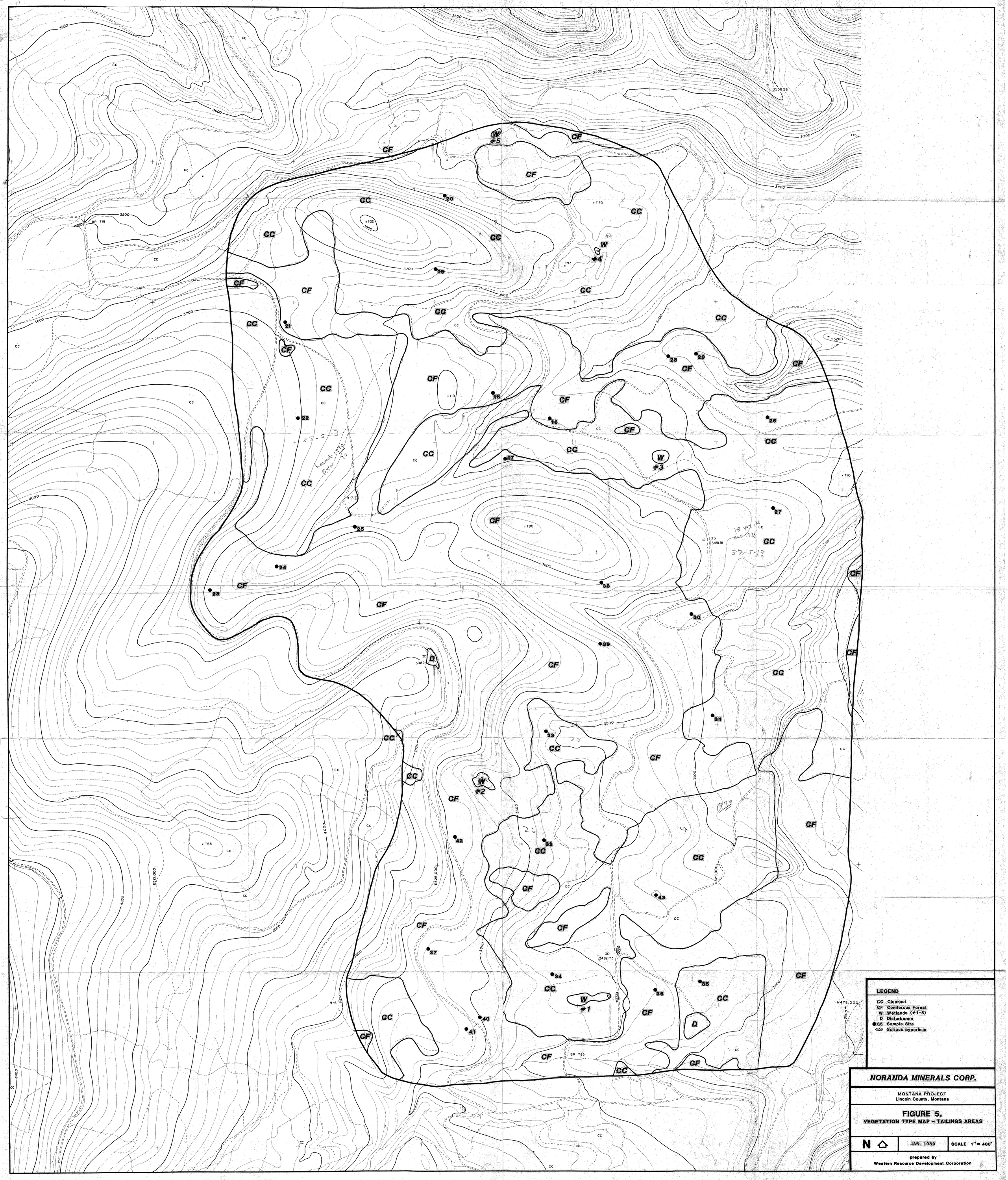
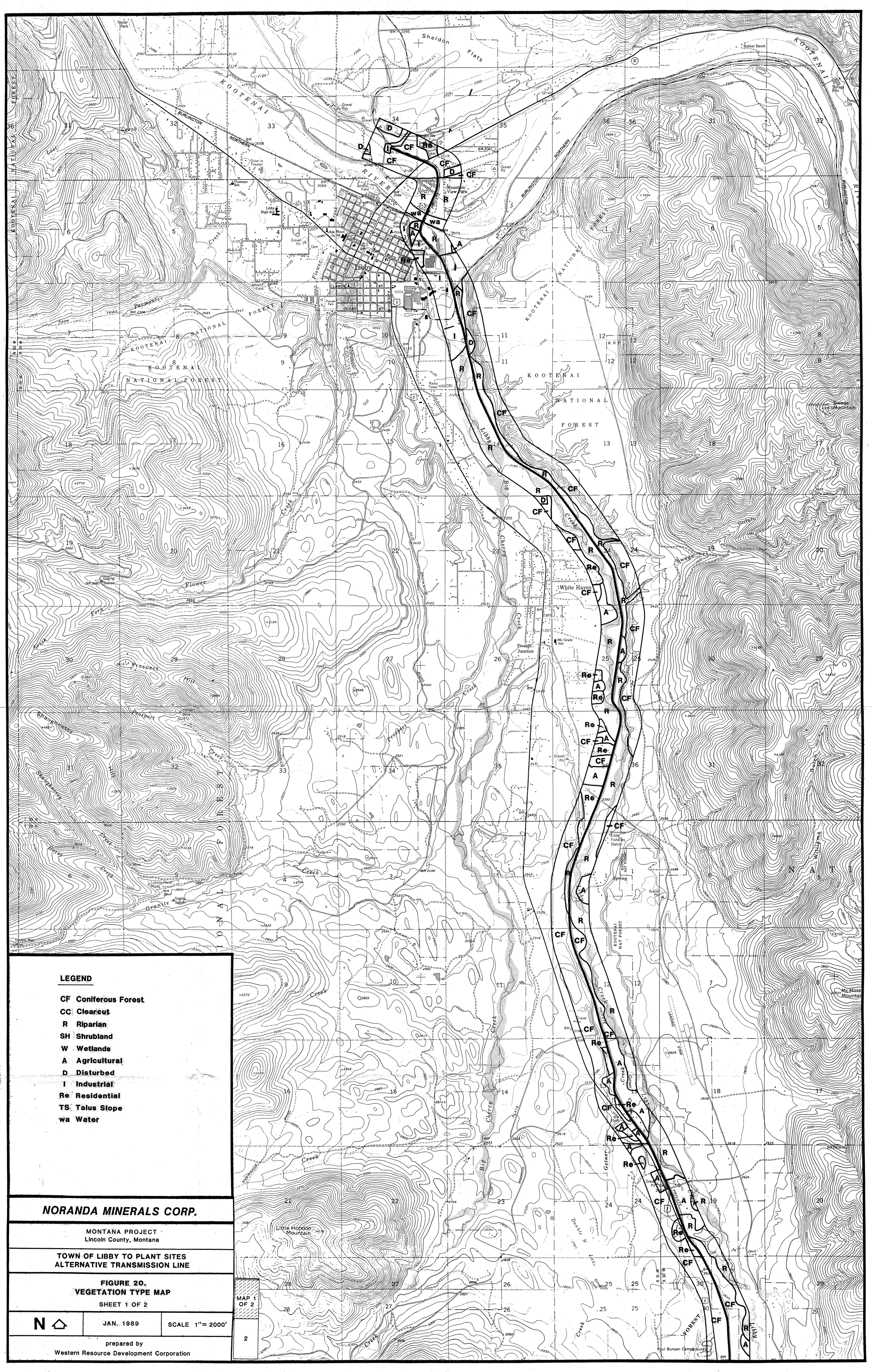
Lincoln & Sanders Counties, Montana

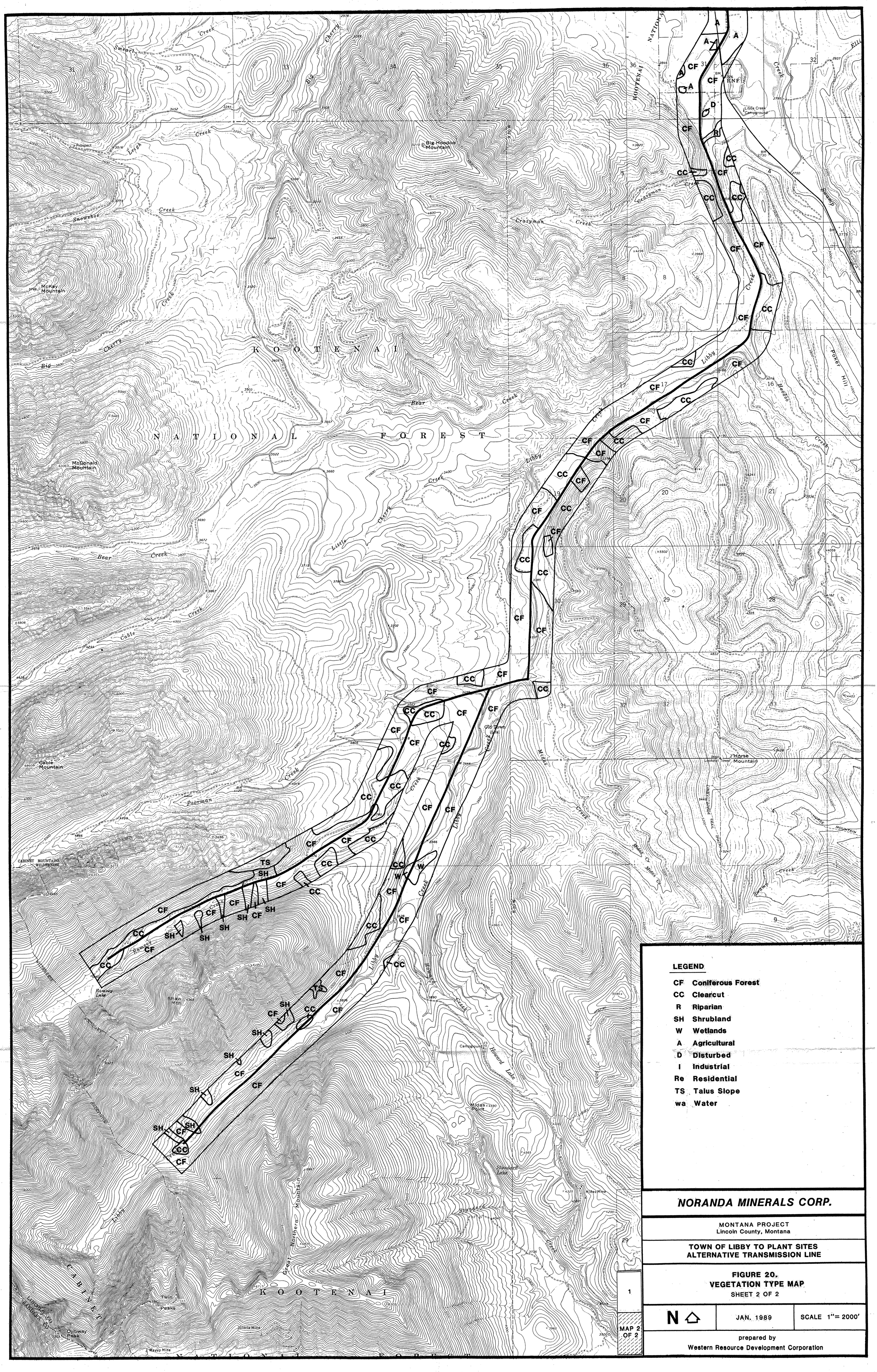
FIGURE 4.
HABITAT TYPE MAP - EXTENSIVE STUDY AREA

N ⌂ | JAN. 1989 | SCALE 1"= 2000'

prepared by
Western Resource Development Corporation


LEGEND
CC Clearcut
CF Coniferous Forest
W Wetlands (#1-5)
D Disturbance
35 Sample Site
Scirpus cyperinus
NORANDA MINERALS CORP.
MONTANA PROJECT
Lincoln County, Montana
FIGURE 5.
VEGETATION TYPE MAP - TAILINGS AREAS
N
JAN. 1989
SCALE 1" = 400'
prepared by
Western Resource Development Corporation


LEGEND
CF Coniferous Forest
CC Clearcut
R Riparian
SH Shrubland
W Wetlands
A Agricultural
D Disturbed
I Industrial
Re Residential
TS Talus Slope
wa Water
NORANDA MINERALS CORP.
MONTANA PROJECT
Lincoln County, Montana
TOWN OF LIBBY TO PLANT SITES
ALTERNATIVE TRANSMISSION LINE
FIGURE 20.
VEGETATION TYPE MAP
SHEET 1 OF 2
N
JAN. 1989
SCALE 1"= 2000'
prepared by
Western Resource Development Corporation
MAP 1 OF 2
2
Libby
Sheldon Flats
White Haven
Pioneer Junction
Mountain View Park
Libby High Sch
Drive in Theater
Trailer Park
Bakker Ranch
Swede Mountain
Little Hoodoo Mountain
Paul Bunyan Campground
Libby Fisheries Station
Kootenai River
Flower Creek
Libby Creek
Swede Gulch
Cherry Creek
Prospect Creek
Shaughnessy Creek
Granite Creek
Williams Gulch
Kootenai National Forest
Burlington Northern



LEGEND

CF	Coniferous Forest
CC	Clearcut
R	Riparian
SH	Shrubland
W	Wetlands
A	Agricultural
D	Disturbed
I	Industrial
Re	Residential
TS	Talus Slope
wa	Water

NORANDA MINERALS CORP.

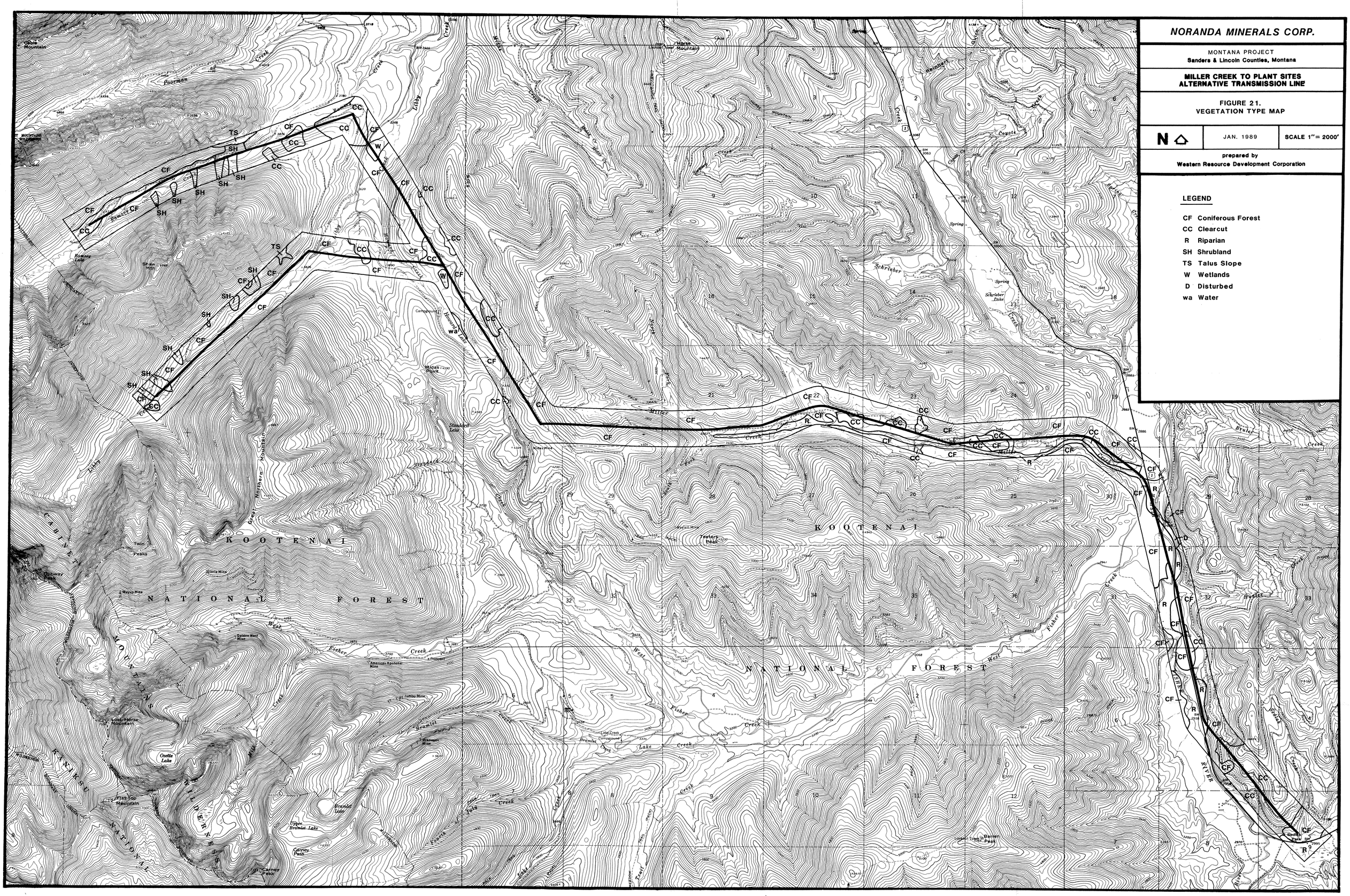
MONTANA PROJECT
Lincoln County, Montana

TOWN OF LIBBY TO PLANT SITES ALTERNATIVE TRANSMISSION LINE

FIGURE 20.
VEGETATION TYPE MAP
SHEET 2 OF 2

N	JAN. 1989	SCALE 1"= 2000'

prepared by
Western Resource Development Corporation



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Sanders & Lincoln Counties, Montana

MILLER CREEK TO PLANT SITES ALTERNATIVE TRANSMISSION LINE

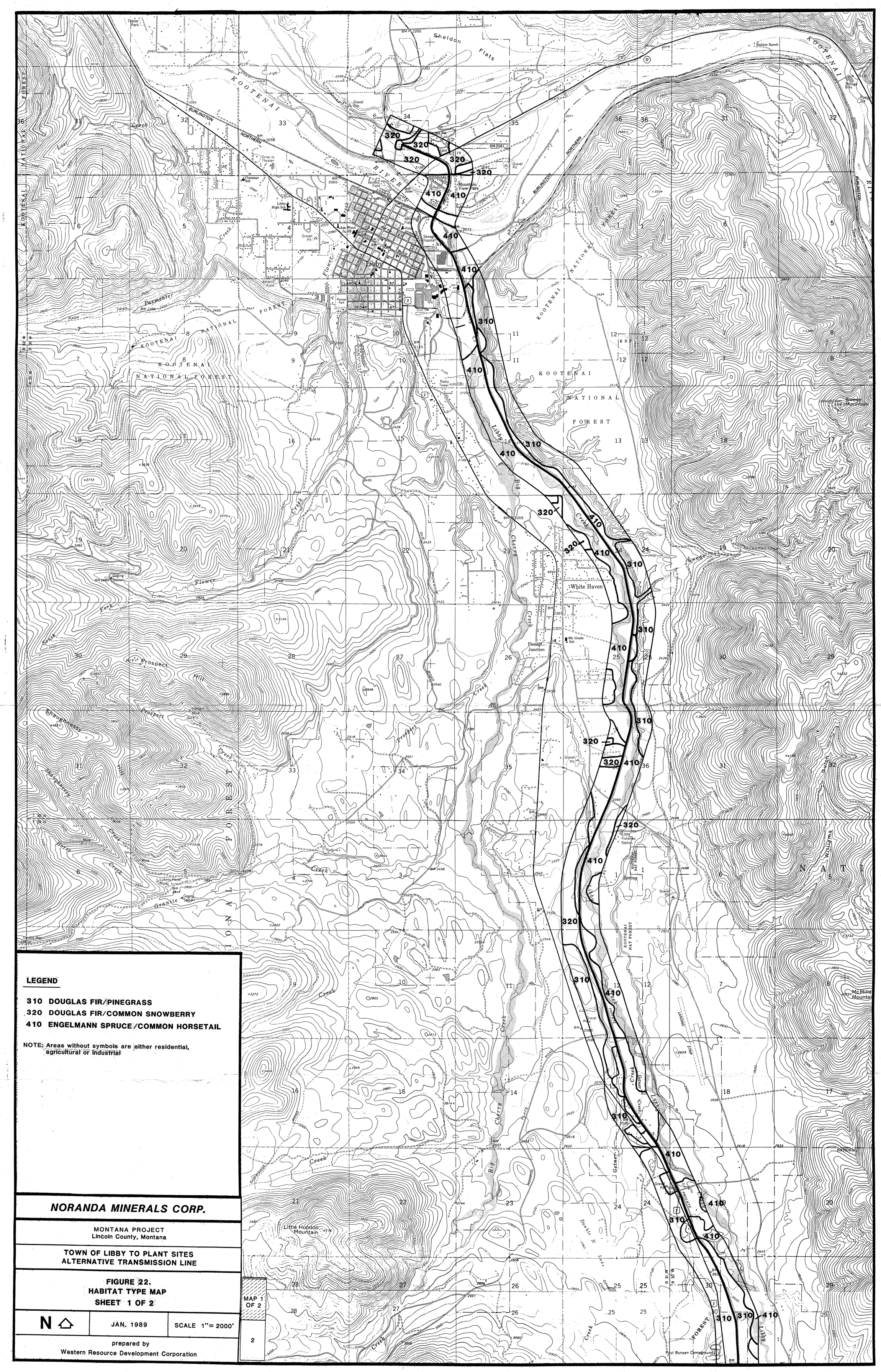
FIGURE 21.
VEGETATION TYPE MAP

N | JAN. 1989 | SCALE 1" = 2000'

prepared by
Western Resource Development Corporation

LEGEND

- CF Coniferous Forest
- CC Clearcut
- R Riparian
- SH Shrubland
- TS Talus Slope
- W Wetlands
- D Disturbed
- wa Water



LEGEND

310 DOUGLAS FIR/PINEGRASS

320 DOUGLAS FIR/COMMON SNOWBERRY

410 ENGELMANN SPRUCE/COMMON HORSETAIL

NOTE: Areas without symbols are either residential, agricultural or industrial

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MONTANA PROJECT
Lincoln County, Montana

TOWN OF LIBBY TO PLANT SITES
ALTERNATIVE TRANSMISSION LINE

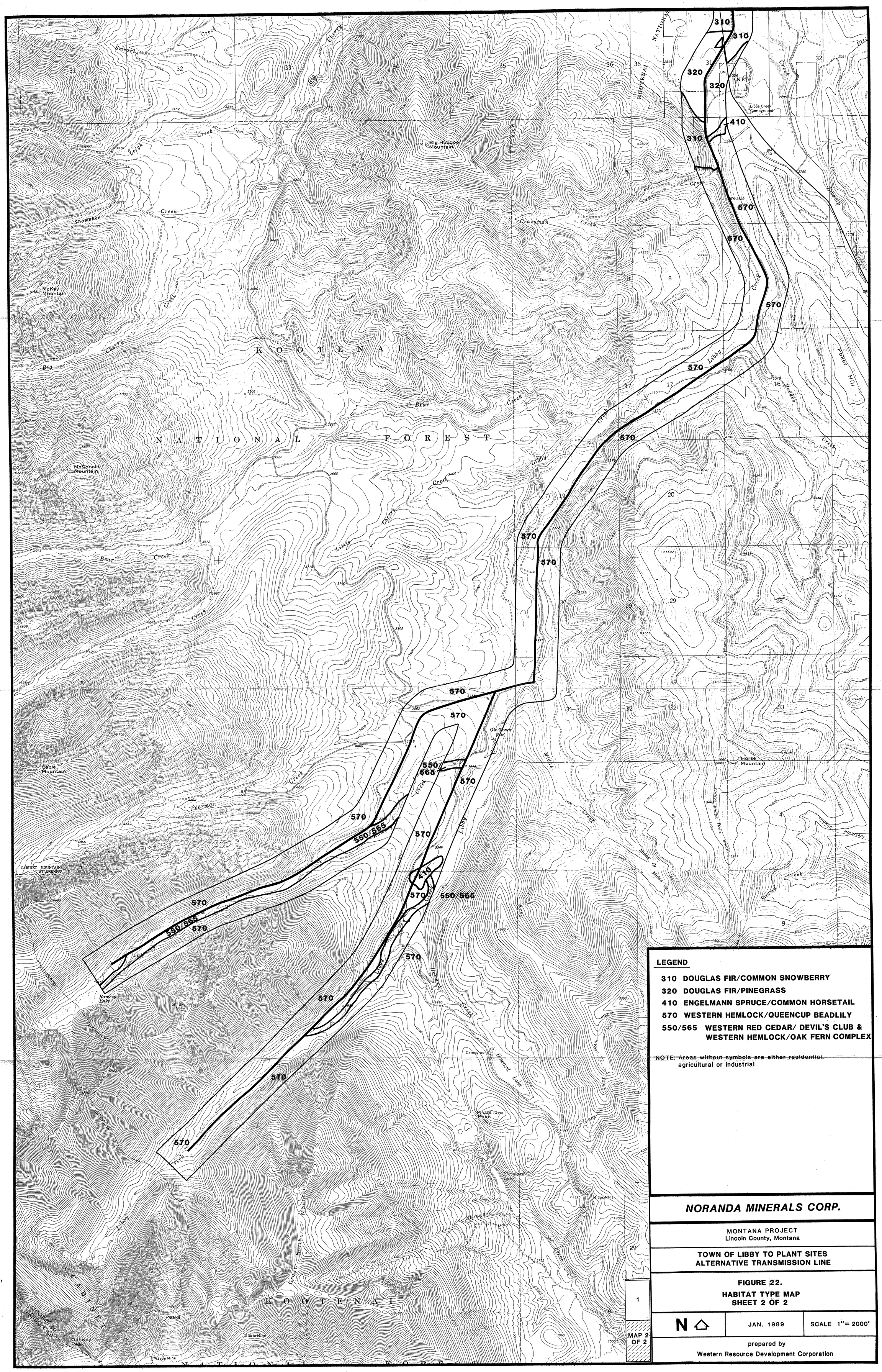
FIGURE 22.
HABITAT TYPE MAP
SHEET 1 OF 2

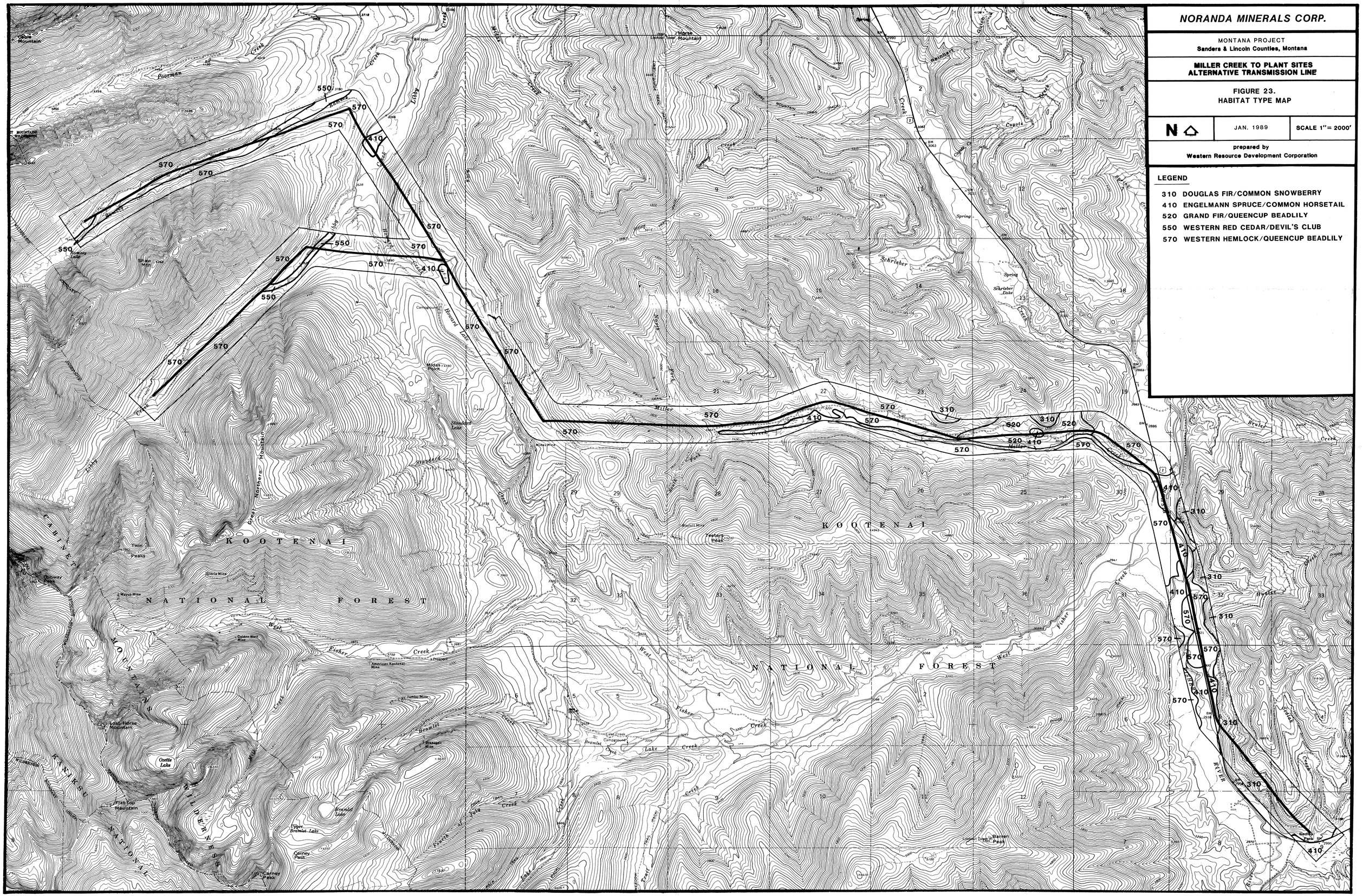
N	JAN. 1989	SCALE 1"= 2000'

prepared by
Western Resource Development Corporation

MAP 1 OF 2

2


LEGEND
310 DOUGLAS FIR/COMMON SNOWBERRY
320 DOUGLAS FIR/PINEGRASS
410 ENGELMANN SPRUCE/COMMON HORSETAIL
570 WESTERN HEMLOCK/QUEENCUP BEADLILY
550/565 WESTERN RED CEDAR/ DEVIL'S CLUB & WESTERN HEMLOCK/OAK FERN COMPLEX
NOTE: Areas without symbols are either residential, agricultural or industrial
NORANDA MINERALS CORP.
MONTANA PROJECT
Lincoln County, Montana
TOWN OF LIBBY TO PLANT SITES
ALTERNATIVE TRANSMISSION LINE
FIGURE 22.
HABITAT TYPE MAP
SHEET 2 OF 2
N
JAN. 1989
SCALE 1"= 2000'
prepared by
Western Resource Development Corporation
MAP 2 OF 2
KOOTENAI NATIONAL FOREST
CABINET MOUNTAINS WILDERNESS
Big Hoodoo Mountain
McKay Mountain
McDonald Mountain
Cable Mountain
Horse Mountain
Poker Hill
Libby Creek Campground
Old Town (Site)
Midas Point
Midas Mine
Standard Lake
Howard Lake
Ramsey Lake
Shaw Mtn
Twin Peaks
Oilbway Peak
Gloria Mine
Wayup Mine
Great Northern Mountain
Smearl Creek
Cherry Creek
Big Cherry Creek
Leigh Creek
Snowshoe Creek
Crazyman Creek
Bear Creek
Little Cherry Creek
Cable Creek
Poorman Creek
Libby Creek
Hoodoo Creek
Swamp Creek
Midas Creek
Howard Creek
Standard Creek
Prospect
Lookout Tower
Lookout Tower Trail
Horse Mountain Trail
Divide Trail
Lincoln Co
Stevens Co
310
320
410
570
550/565



NORANDA MINERALS CORP.

MONTANA PROJECT
Sanders & Lincoln Counties, Montana

MILLER CREEK TO PLANT SITES ALTERNATIVE TRANSMISSION LINE

FIGURE 23.
HABITAT TYPE MAP

N	JAN. 1989	SCALE 1" = 2000'

prepared by
Western Resource Development Corporation

LEGEND

- 310 DOUGLAS FIR/COMMON SNOWBERRY
- 410 ENGELMANN SPRUCE/COMMON HORSETAIL
- 520 GRAND FIR/QUEENCUP BEADLILY
- 550 WESTERN RED CEDAR/DEVIL'S CLUB
- 570 WESTERN HEMLOCK/QUEENCUP BEADLILY