COPPER CREEK PROJECT

DRAFT ENVIRONMENTAL IMPACT STATEMENT

SUPPORT DOCUMENT:

VEGETATION

submitted by

Anthony Basabe

for

Seattle City Light

October, 1980

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Section A - Vegetation Sampling Methods

The vegetation of the Copper Creek study area was qualitatively and quantitatively sampled to determine the occurrence and significance of plant associations, rare plants, and the availability of rare plant habitat.

QUANTITATIVE SAMPLING

Quantitative sampling was conducted at five forested sites where the vegetation was in a climax state, and where it was in primary succession (on rock outcrops and undisturbed riparian vegetation). With the exception of the riparian vegetation, all sites were sampled using a 15 x 25 meter plot described by Daubinmire (1968) and revised by Fonda (1975). The number of plots sampled at each site varied depending on the extent of vegetation being sampled in the study area. Plant species cover values were determined by using cover size classes described by Daubinmire (1968). Riparian vegetation was sampled in a similar fashion, but instead of using the Daubinmire rectangular plot, the riparian vegetation was sampled along a 50-meter transect by placing a 20 x 50 centimeter quadrant at one-meter intervals. The total numbers of sample plots per vegetation type are shown in the quantitative analysis (Tables 2 - 13).

VEGETATION MAPPING

The vegetation map (Figure 1) was derived initially by delineating broad vegetation types using a Bausch & Lomb zoom transfer scope. In this procedure 1:2,400 scale color aerial photographic imagery (taken in 1978) was transferred to a 1:400 base map. These broad vegetation types were further delineated by stereoscopic interpretation of 1:1,500 aerial photography and ground-truthed during the 1980 growing season. All vegetation mapping was based on the dominant overstory species.

ACREAGE DETERMINATION

Acreage determination for vegetation subunits was estimated by superimposing a transparent grid of known area over all units within the mapped area; each unit was assigned a number corresponding to the number of acres within it. All acreage within similar units was then totaled, both within the inundation zone of each of the three dam proposals and within the project area outside the Copper Creek 495-foot pool alternative. Loss of vegetation due to construction of

transmission lines and the relocated highway was estimated for each vegetation unit using a width figure of 200 feet for the former and 100 feet for the latter.

QUALITATIVE METHODS

All vegetation not considered climax was subjectively sampled and categorized into vegetation types and subtypes using characteristics shown in Table 1. The vegetation subtypes, characterized in the table on the basis of overstory dominant species or landform, were determined in the field by visual reconnaissance and reevaluated during the habitat evaluation process for wildlife utilization of vegetable associations.

RARE PLANT INVENTORIES

Inventories of threatened, endangered and rare plants in the Copper Creek study area were conducted bimonthly during the 1980 growing season from April to September.[a]

[a]Sixty percent of rare plant inventories were conducted at the time this analysis was prepared (July 8, 1980). Data from the remainder of the season will be included in the final environmental impact statement.

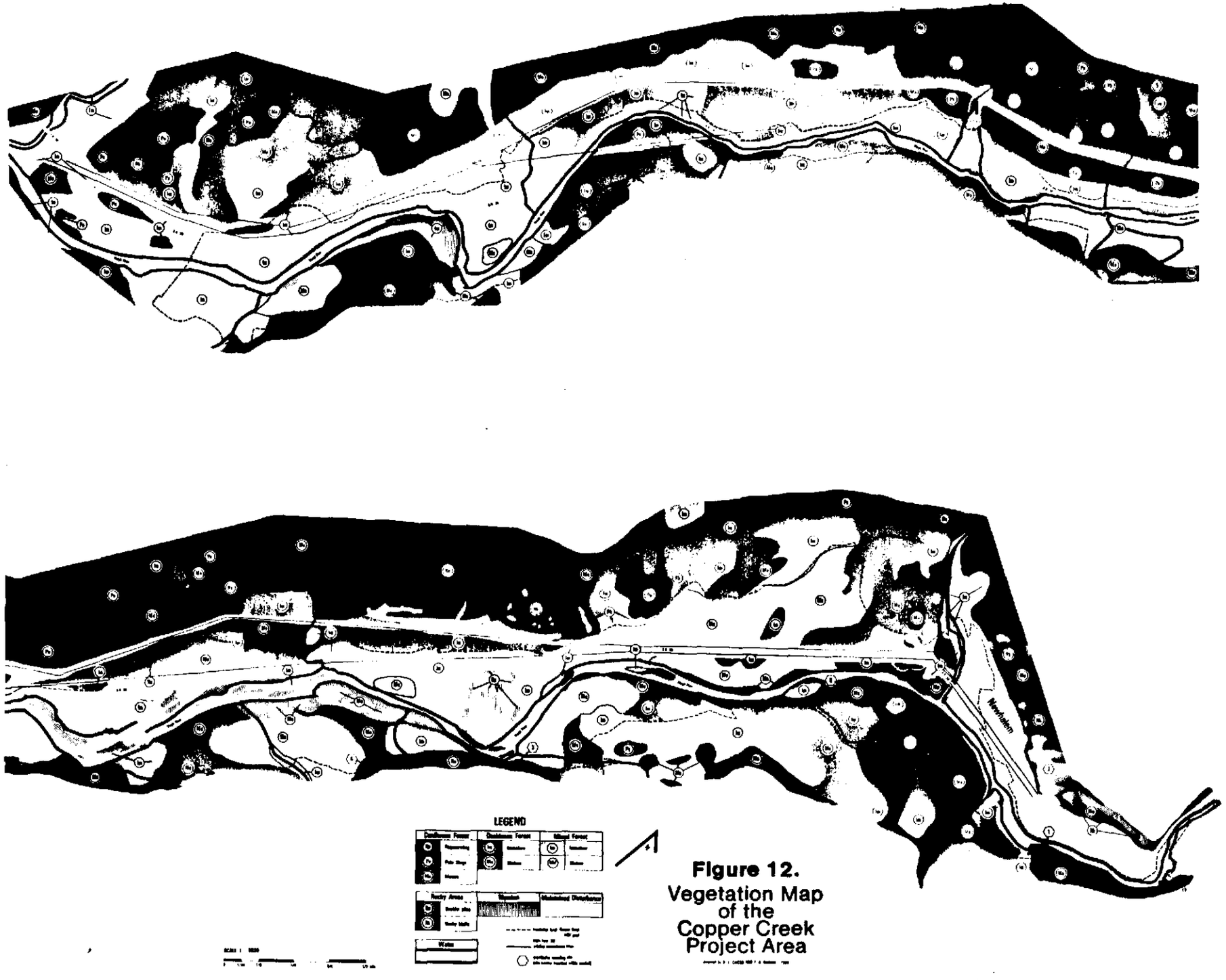

Figure 12.
Vegetation Map
of the
Copper Creek
Project Area

TABLE 1 Vegetation Classification Scheme

Vegetation Type[a] (Map Color Code)	Vegetation Subtype	Successional Status	Characteristics
CONIFEROUS FOREST			Greater than 60% conifer canopy dominance
	Regenerating	seral	Tree height less than 20 feet. Dense vegetative cover; lateral branches of individual trees in contact with those of adjacent trees. Little to no subcanopy development.
	Pole Stage	seral	Tree height twenty to forty feet. Canopy cover approaching 100% sparse subcanopy development bundant subcanopy development.
	Mature	seral	Tree height greater than forty feet. Canopy cover 60-100% due to canopy break up. Moderate to abundant subcanopy development (sometimes absent).
	Climax	climax	Naturally-occurring, self-sustaining community
DECIDUOUS FOREST			Greater than 60% deciduous canopy dominance.
	Immature	seral	Canopy height to approximately thirty feet. Sparse to abundant subcanopy development.
	Mature	seral	Canopy height greater than thirty feet. Sparse to abundant subcanopy development.

Table 1, continued

Vegetation Type[a] (Map Color Code)	Vegetation Subtype	Successional Status	Characteristics
MIXED FOREST			Both deciduous and coniferous trees have greater than 40% canopy dominance.
	Immature	seral	Conifer trees less than forty feet in height. Deciduous trees less than thirty feet. Sparse to abundant subcanopy development.
	Mature	seral	Conifer tree height greater than forty feet. Deciduous tree height greater than thirty feet. Sparse to abundant subcanopy development.
RIPARIAN ZONE		climax	Confined to present seasonal fluctuation zone of Skagit River. Occasionally intergrades with immature deciduous.
ROCKY AREAS	Boulder piles	seral	Man-made deposits occurring at County Line Ponds.
	Rocky Bluffs	climax	Scattered trees and shrubs. Moderate to abundant herbaceous layer development.
AREAS OF MAINTAINED DISTURBANCE	transmission line clearing	seral	Dominated by grasses and forbs with moderate to abundant shrub layer. Tree invasion controlled by spraying or removal.

[a]Vegetation types were determined by the overstory canopy.

Section B - Vegetation Description

The following is a brief description of the existing vegetation in the Copper Creek study area.

CONIFEROUS FOREST

The 1,605 acres of coniferous forest in the study area occur predominantly on the valley walls on both sides of the Skagit River.

Regenerating Stage

A regenerating forest of 240 acres is generally restricted to the valley walls on both sides of the river and occurs in areas of recent logging and/or fire. Various deciduous tree species occur here but are never as dominant as evergreen (fir forest). These young conifer stands lack a middle story - a continuous cover of branches and foliage growing about midway between the ground and the treetops. There is also little understory development - foliage cover growing near the ground but over the plants forming the ground cover. Trailing blackberry, sword fern, and bracken fern, however, are found where tree density is relatively low. Douglas-fir is the dominant tree, although in some areas lodgepole pine is locally common.

Pole Stage

A pole stage of 339 acres occurs mostly on the valley walls on the north side of the river. It is usually dominated by Douglas-fir, and in some cases where abnormal soil and ground conditions prevail, lodgepole pine may be as dominant as fir. The shrub layer is sparse, and the herbaceous layer generally consists of mosses, lichens, Oregon grape, and salal. In a few local areas mosses form thick carpets in the understory. It is usually during this stage that the climax coniferous species (Western red cedar and Western hemlock) begin to appear as seedling.

Mature Forest

A mature forest of 1,002 acres occurs throughout the study area on the valley floor and on the valley walls. It is generally dominated by Douglas-fir, Western red cedar, and Western hemlock. On the valley walls these mature forests penetrate the study area on firm higher ground, where they are more extensive. Douglas-fir is the dominant tree in these peninsulas, most likely because of recurring fires and, to a lesser extent, logging. Vine maple is the dominant

middle story tree, and the herbaceous layer is commonly made up of sword fern, Oregon grape, twin flower, foam flower, fringe cup, Queen-cop lily. Mosses probably have the greatest cover and frequency in the understory.

Climax Forest

Four sites were found in the mature forest that resembled the climax vegetation described for the general area (Franklin and Dyrness, 1973). On the valley floor across from Newhalem, there is a four-acre cedar forest (Site 1, Tables 2-4) typical of natural vegetation found on river terraces for that area. Many of the trees are growing on nurse logs, and there is little evidence of human or fire disturbance. This entire site would be inundated by the 495-foot pool of the proposed Copper Creek dam. Mitigation is not warranted here because of the small size of the cedar forest and because it is better represented and more amply distributed in similar habitats adjacent to the study area. Directly across from the Newhalem ponds on the north-facing valley wall, a fir-cedar forest dips into the study area. The 495-foot pool would flood three acres of this ten-acre vegetation peninsula at Site 3 (Tables 7-8); however, this would not significantly reduce the total acreage of this forest type, since it is more amply distributed farther up the valley wall outside the study area.

Just west of Site 3 lies a 10-acre cedar-hemlock forest (Site 4, Tables 9-10) which wuld be inundated by the 495-foot pool level of the Copper Creek Dam. Again, this forest type is more amply distributed in areas adjacent to the project site and would probably not constitute a significant loss. Fire climax forests have not been described for the general area, but if there were such a climax type, the area on the south-facing valley wall near Thornton Creek (Site 5, Tables 11-12) might qualify. Its significance isn't known. Site 5 could be affected by power transmission construction; this impact could be mitigated by placing the proposed power lines outside this area.

DECIDUOUS FOREST

The 1,275 acres of deciduous forest in the study area occur predominantly on the valley floor. These forests are in secondary succession mainly because of logging and, to a lesser extent, fires.

Immature Stage

There are 390 acres of immature stage of deciduous forest in the study area. The most extensive areas of this vegetation

type lie around the Newhalem and County Line ponds. The dominant tree here is black cottonwood, although red alder, birch, and big leaf maple are important. These immature stands are usually dense, but open stands are not uncommon. Salmon berry, thimbleberry, red huckleberry and bracken fern are conspicuous shrubs; and sword fern, salal, lady fern, fringe cup, wall lettuce and mosses are common constituents of the sometimes extensive understory.

Mature

Mature deciduous forest totalling 385 acres occurs throughout the valley floor largely as a consequence of past logging and fires. Cottonwoods and/or maples dominate the tree canopy, although sometimes alder and birch trees are the most conspicuous. Vine maple and regenerating conifers dominate the middle story, with occasional Pacific dogwoods. The understory is much the same as the immature deciduous forest, but not as extensive, and regenerating conifers are present.

MIXED FOREST

There are 1,039 acres of mixed forest in the study area which have a similar distribution to the deciduous forest but vary somewhat in that the mixed forest extends locally up the valley walls. This forest type is the most variable and has attributes of all the forest types previously discussed. Probably the most significant feature of this mixed forest is that it is closer than the deciduous forest to becoming the climax forest typical of that area. There are 754 acres of immature and 285 acres of mature mixed forest in the study area.

RIPARIAN VEGETATION

For this report, the riparian zone was strictly defined to be that area which is contained within the present fluctuation zone of the Skagit River and is thus subject to regular flooding. Not included in this definition were the stands of immature or mature deciduous forest along the Skagit River and its tributaries or on islands within the river. Therefore, the riparian zone as defined in this report is considerably smaller than the areas usually considered within that category - that is, vegetation which is influenced by the cooler and moister air adjacent to a river or other body of water. Existing conditions indicate that riparian vegetation within the study area was at one time more extensive than now. This change appears to be a result of reduced seasonal water level fluctuation due to operation of the upstream hydroelectric projects. Before the existing

dams, the riparian zone was probably more than twice what it is today. The old riparian areas are reverting to coniferous forests, as evidenced by conspicuous conifer regeneration in the understory.

The dominant trees are black cottonwoods, Scouler's willow, and red alder. These trees seldom attain the size realized by the same species in the other habitats. There are several grassy and herbaceous species here which do not occur anywhere else in the study area. Riparian vegetation as defined here was considered important because it is undisturbed; quantitative descriptions are shown in Table 13.

VEGETATION ON ROCKY BLUFFS

There are 70 acres of rock outcrops within the study area (Site 2, Tables 5-6). The vegetation is mostly herbaceous with an occasional shrub or tree. Mosses, lichens, little club mosses and grasses are the most conspicuous, and wild strawberries are locally common. Some of the bluffs have pristine vegetation, such as the bluffs above Newhalem to the north (quantitatively described in Tables 5 and 6).

MAINTAINTED DISTURBANCE

There are 811 acres in the project area which are maintainted in their present condition by continual human activity. This category includes the community of Newhalem, the area around Gorge Powerhouse, State Highway 20, and the existing transmission line corridors. The only significant vegetated areas are the transmission line corridors, characterized by shrubby vegetation. Species include bracken fern, graminoids, Oregon grape, thimbleberry, and a large number of weedy species. Invading tree species are controlled either by spraying or by removal.

TABLE 2. Tree composition of cedar forest (site 1,4 plots)

SPECIES	Basal area of trees measured at breast height in m^2/hectare	Density trees/ hectare	Size class distribution of tree diameter at breast height (dbh) for all areas sampled 5-10 cm.	10-25 cm.	25-75 cm.	75-125 cm.	125-175 cm.	175-200 cm.	300+ cm.
Thuja plicata	257.7	202.7	2	1	3	8	8	2	1
Tsuga heterophylla	11.2	88.9	4	1	3	1	0	0	0
Taxus brevifolia	.29	53.3	5	1	0	0	0	0	0
Pseudostuga menziesii	18.3	18.32	0	1	0	2	0	0	0
Cornus canadensis	.11	26.67	3	0	0	0	0	0	0
Acer macrophylla	.11	17.8	0	1	1	0	0	0	0
Alnus rubra	.48	17.8	0	2	0	0	0	0	0

TABLE 3. Mean composition of shrub layer in cedar forest (site 1)

SPECIES	% cover	% frequency
Acer circinatum	64.9	16
Tsuga heterophylla	.83	12
Cornus canadensis	.63	5
Pseudotsuga menziesii	.63	3

TABLE 4. Mean composition of herbaceous layer in cedar forest (site 1)

SPECIES	mean % cover	mean % frequency
Berberis nervosa	18.5	53
Clintonia uniflora	9.8	38
Smilacina stellata	10.4	18
Osmorhiza purpurea	3.6	25
Polystichum munitum	9.1	17
Anemone lyalli	.96	22
Tellima grandiflorum	.92	20
Acer circinatum seedlings	1.25	10
Gymnocarpium dryopteris	1.2	7
Viola glabella	.71	12
Pyrola picta	.83	8
Trillum ovatum	.92	5
Adencaulon bicolor	.8	7
Galium sp	.42	8
Symphory-carpos albus	.63	2
Trientalis latifolia	.29	8
Goodyera oblongifolia	.33	5
Geum macrophyllum	.13	5
Pseudostuga menziessi seedlings	.04	2
Mosses	23.3	80
Lichens	1.4	46
Litter	55.8	47

TABLE 5. Overstory composition of grassy bluffs (site 2, 1 plot)

SPECIES	Basal area of trees measured at breast height in m^2/hectare	Density trees/ hectare	Size class distribution of tree diameter at breast height (dbh)
Pinos contorta	.1289	80.0	(Only three trees) 1 at 36.8 dbh 1 at 12.2 dbh 1 at 11.7 dbh

TABLE 6. Mean composition of understory in grassy bluffs (site 1)

	% cover	% frequency
Shrubs layer		
Pinus contorta	10.6	13
Amelanchier alnifolia	4.8	13
Prunus virginiana	1.9	13
Herbaceous layer		
Agropyron sp	13.7	75
Fragaria virginiana	13.6	55
Selaginella wallacei	22.5	15
Rosa nutkana	7.9	30
Achillea millefolium	6.3	35
Zigadenus venenosus	8.1	20
Holodiscus discolor	6.3	30
Luzula compestris	5.7	20
Arctostaphyllus uva-ursi	4.3	25
Cryptograma crispa	4.1	20
Castilleja hispida	2	10
Sorbus sitchensis	1.9	5
Amelanchier alnifolia	1.9	5
Saxifraga ferruginea var. *macounii*	.75	5
Polypodium glycyrrhiza	.125	5
Pachystima myrsinites	.125	5
Mosses	47.7	75
Lichens	19.3	50
Bare rock	30	45

TABLE 7. Tree composition of fir-cedar forest (site 3, 1 plot)

SPECIES	Basal area of trees measured at breast height in m^2 hectare	Density trees/ hectare	Size class distribution of tree diameter at breast height (dbh) 5-10 cm.	10-25 cm.	25-50 cm.	50-75 cm.	75-100 cm.	100-150 cm.
Pseudostuga menziesii	143.2	133.4				1		4
Thuja plicata	24.9	320	1	7	3		1	
Tsuga heterophylla	4.6	53.3			2			

TABLE 8. Mean composition of understory in fir-cedar forest (site 3)

	% cover	% frequency
Shrubs layer		
Acer circinatum	26.0	38
Vaccinium parvifolium	39.4	25
Thuja plicata	7.8	13
Herbaceous layer		
Linnea borealis	3.7	25
Gaultheria shallon	4.3	5
Polystichum munitum	2.0	10
Polypodium glycyrrhiza	1.2	20
Polystichum lonchitis x munitum	1.9	5
Chimophylla umbellat	0.8	5
Berperis nervosa	0.4	15
Acer circinatum	0.1	5
Trientalis latifolia	0.1	5
Mosses	79	95
Lichens	1.3	25
Bare rock or ground	2.8	15

TABLE 9. Tree composition of cedar-hemlock forest (site 4, 2 plots)

SPECIES	Basal area of trees measured at breast height in m^2/hectare	Density trees/ hectare	Size class distribution of tree diameter at breast height (dbh) 5-10 cm.	10-25 cm.	25-50 cm.	50-100 cm.	100-150 cm.	150-200 cm.
Thuja plicata	342.60	186.7	1	1	0	0	0	5
Tsuga heterophylla	41.30	560.1	4	11	4	0	1	0
Acer macrophyllum	4.84	80.0	0	2	1	0	0	0
Cornus canadensis	0.09	26.7	1	0	0	0	0	0

TABLE 10. Mean composition of understory in Cedar-hemlock forest (site 4)

	% cover	% frequency
Shrubs layer		
Oplopanax horridum	0.75	5
Cornus canadensis	0.75	5
Herbaceous layer		
Polystichum munitum	0.125	5
Tellimia grandiflorum	0.125	5
Smilacina stellata	0.125	5
Trientalis latifolia	0.125	5
Polystichum munitum	0.125	5
Acer circinatum	0.125	5
Mosses	20.6	95
Lichens	0.75	30
Litter	80	95

TABLE 11. Tree composition of hemlock forest (site 5, 3 plots)

SPECIES	Basal area of trees measured at breast height in m^2/hectare	Density trees/ hectare	Size class distribution of tree diameter at breast height (dbh) 5-10 cm.	10-25 cm.	25-50 cm.	50-100 cm.	100-150 cm.
Tsuga heterophylla	43.0	417.8	1	21	18	7	0
Thuja plicata	16.7	124.5	1	7	4	0	1
Pseudostuga menziesii	15.9	71.1	0	0	3	5	0

TABLE 12. Mean composition of understory in hemlock forest (site 4)

	% cover	% frequency
Shrub layer		
Tsuga heterophylla	.86	3.6
Herbaceous layer		
Gaultheria shallon	32.6	67
Vaccinium parviflorum	7.4	30
Linnea borealis	1.4	15
Tsuga heterophylla	.67	10
Chimophylla umbellata	.125	5
Gymnocarpium dryoptera	.25	1.7
Goodyera oblongifolia	.25	1.7
Mosses	64	100
Lichens	4	76.7
Litter	37.4	90

TABLE 13. Mean composition of riparian vegetation (4 transects)

SPECIES	% Cover	% Frequency
Shrub layer		
Alnus rubra	12.6	36
Populus trichocarpa	8.9	48
Herbaceous layer		
Epilobium latifolium	18	14
Epilobium minutum	3.2	56
Montia parvifolia	1.3	14
Douglas-fir seedlings	.85	24
Agrostics sp	.65	6
Graminiae sp	.5	6
Rubus parvifolium	.75	2
Lactuca muralis	.75	2
Vine maple seedling	.4	6
Osmorhiza purpurea	.35	4
Galium	.35	4
Agrostis alba	.3	2
Anaphalis margaritaceae	.3	2
Epilobium angustifolium	.3	2
Rubus ursinus	.1	4
Graminiae sp (only vegetative parts present)	.05	2
Mosses	5.3	92
Bare gravel and sand	76	96