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Faculty of Graduate Studies

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FINAL ORAL EXAMINATION
FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

of

ROBERT GORDON McMINN

B.A., University of British Columbia
M.S., State College of Washington

THURSDAY, APRIL 4th, 1957, at 2:00 P.M.

IN ROOM 33, BIOLOGY BUILDING

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External Examiner — DR. R. F. DAUBENMIRE,
Professor, State College of Washington

WATER RELATIONS IN THE DOUGLAS-FIR REGION ON VANCOUVER ISLAND

Abstract

In an evaluation of the role of water relations in forest distribution and growth in the Douglas-fir region on Vancouver Island, a section of the Nanaimo River Valley, lying from five to twelve miles inland from the east coast, was chosen as a suitable study area to exemplify conditions in the central mountains and on the eastern side of southern Vancouver Island. The study was conducted in mature stands typical of the principal forest associations found within the range of climates, topographies and soils represented in this area. The vegetation and soils of twenty-four quarter-acre plots were analysed in order to characterize stands and relate such characteristics to the influence of water relations. The soil moisture regimes and microclimates of each plot were defined by measuring soil moisture levels, precipitation beneath the tree canopy, evaporation rates, and soil and air temperatures. Variation in soil moisture contents was followed over a thirty-month period from July, 1951, to November, 1953, and precipitation and maximum/mimimum temperatures at various open stations were measured at monthly intervals from June, 1951, until December, 1956, in order to delineate climatic variations within the study area.

It was concluded that variation in soil moisture regimes was a most significant factor in the differentiation of sites. In moist, relatively nutritive soils *Pseudotsuga menziesii* so completely dominated *Tsuga heterophylla* that the latter species was restricted to the secondary canopy and formed only a small proportion of stand volume. In strongly leached soils the growth of both *Pseudotsuga* and *Tsuga* was impaired and even at maturity trees were smaller than in more nutritive soils. Where strongly leached soils were moist throughout the growing season, *Tsuga* could complete with *Pseudotsuga* on nearly equal terms and both species reached the upper tree canopy. In droughty, leached soils the growth of *Tsuga* was more impaired than the growth of *Pseudotsuga* and *Tsuga* formed small to negligible proportions of stand volume. *Thuja plicata* appeared in the upper tree canopy only in moist to very wet, relatively nutritive soils.

The dominant influence in the geographical location of the Douglas-fir region on Vancouver Island was its rainshadow climate. Within this region of low summer rainfall *Pseudotsuga* dominated other species on nearly all sites. In wetter climates, outside pronounced rainshadow areas, stands dominated by *Pseudotsuga* were confined to moist, relatively nutritive soils. Within any climatic area topographic position and concomitant climatic and edaphic influences largely differentiated sites. Site differentiation followed a definite catenary sequence, which regulated the sequence of forest associations on sidehills. Differences in local topography, aspect, soil depth and soil texture, however, sometimes caused variation from the typical arrangements.

PUBLICATIONS

The vegetation of a burn near Blaney Lake, British Columbia.
Ecology **32**:135-140. 1951.

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Canada Agriculture, Forest Biology Div., Bi-Monthly Progr. Rept. **11**:3. 1955.

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GRADUATE STUDIES

Field of Study: Botany

Taxonomy of Higher Plants .... T. M. C. Taylor

Forest Associations .... V. J. Krajina

Problems in Plant Ecology .... V. J. Krajina and R. W. Pillsbury

Problems in Plant Physiology .... D. J. Wort

Other Studies:

Colloid Chemistry .... M. Kirsch

Soil Genesis, Morphology and Classification .... C. A. Rowles

Advanced Physical and Chemical Properties of Soils .... C. A. Rowles

Advanced Silvics and Silviculture .... G. S. Allen

WATER RELATIONS IN THE DOUGLAS-FIR REGION
ON VANCOUVER ISLAND

by

ROBERT GORDON McMINN

A THESIS SUBMITTED IN PARTIAL FULFILMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

in the Department
of
BIOLOGY AND BOTANY

We accept this thesis as conforming
to the required standard

THE UNIVERSITY OF BRITISH COLUMBIA

April, 1957

ABSTRACT

In an evaluation of the role of water relations in forest distribution and growth in the Douglas-fir region on Vancouver Island, a section of the Nanaimo River Valley, lying from five to twelve miles inland from the east coast, was chosen as a suitable study area to exemplify conditions in the central mountains and on the eastern side of southern Vancouver Island. The study was conducted in mature stands typical of the principal forest associations found within the range of climates, topographies and soils represented in this area. The vegetation and soils of twenty-four, quarter-acre plots were analysed in order to characterize stands and relate such characteristics to the influence of water relations. The soil moisture regimes and microclimates of each plot were defined by measuring soil moisture levels, precipitation beneath the tree canopy, evaporation rates and soil and air temperatures. Variation in soil moisture contents was followed over a thirty-month period from July, 1951 to November, 1953, and precipitation and maximum/minimum temperatures at various open stations were measured at monthly intervals from June, 1951 until December, 1956 in order to delineate climatic variations within the study area.

It was concluded that variation in soil moisture regimes was a most significant factor in the differentiation of sites. In moist, relatively nutritive soils _Pseudotsuga menziesii_ so completely dominated _Tsuga heterophylla_ that the latter species was restricted to the secondary canopy and formed only a small proportion of stand volume. In strongly leached soils, the growth of _Pseudotsuga_ and _Tsuga_ was impaired, so that trees of both species were smaller than in more nutritive soils. Where strongly

leached soils were moist throughout the growing season, Tsuga could compete with Pseudotsuga on nearly equal terms and both species reached the upper tree canopy. In droughty, leached soils the growth of Tsuga was more impaired than the growth of Pseudotsuga, and Tsuga formed small to negligible proportions of stand volume. Thuja plicata appeared in the upper tree canopy only on moist to very wet, relatively nutritive sites.

The dominant influence in the geographical location of the Douglas-fir region on Vancouver Island appears to be its rainshadow climate. Within this region of low summer rainfall Pseudotsuga can dominate other species on nearly all sites. In wetter climates, outside pronounced rainshadow areas, stands dominated by Pseudotsuga are evidently confined to moist, relatively nutritive sites. Within the different climatic areas encountered, topographic position and concomitant climatic and edaphic influences would seem largely responsible for site differentiation. Such site differentiation followed a definite catenary sequence, which regulated the sequence of forest associations on hillsides. Differences in local topography, aspect, parent material, soil texture and soil depth, however, may cause variation from the typical arrangements.

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Department of **Biology and Botany**

The University of British Columbia,
Vancouver 8, Canada.

Date **4 April 1957**

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INTRODUCTION

It has long been recognized that water relations influence the distribution of natural vegetation. Schimper (1903) was one of the first to acknowledge water as a predominant factor. The classifications of Cajander (1926), Sukatchev (1928), Braun-Blanquet (1928), Weaver and Clements (1929), Wilde (1933), Krajina and Domin (1933), Dansereau (1946), Hills (1952) and many others have emphasized the importance of soil moisture in the distribution of forest types. The role of seasonal variation has also been recognized and a number of investigations have followed seasonal changes in forest stands. Hanson (1924) and Pearson (1931) have followed seasonal trends in various forests types of the southeastern United States and Weaver (1917) has studied others in the northwest. Haig et al. (1941) have shown how natural regeneration in white pine stands in Idaho was affected by seasonal occurrences of soil drought. McMinn (1952) has demonstrated differences in the time of onset of soil drought among different associations in the northern Rocky Mountains. Gaiser (1952) has reported seasonal differences in available moisture in some forest soils in Ohio, and Fraser (1954, 1956) has studied fluctuations in the water table of birch stands in Ontario. These and other studies have demonstrated that variations in plant distribution and growth are related to seasonal variation of available soil moisture.

During an investigation of the forest communities of coastal British Columbia, Krajina (1952) noted that water relations appeared to be one of the major factors controlling the distribution of Douglas-fir associations. The objective of the present study, initiated in 1951 at the suggestion of Dr. Krajina, has been to evaluate the role of water relations in forest distribution and growth in the Douglas-fir region of Vancouver Island.

STUDY AREA

The study was carried out in the Nanaimo River Valley, some eight miles south west of Nanaimo, British Columbia, on timberland within the Forest Management Licence of the Canadian Western Lumber Company (Fig. 1). The Nanaimo River is one of a series of easterly flowing streams (including the Cowichan, Chemainus, Englishman and Qualicum Rivers) which arise in the central height of land forming the backbone of Vancouver Island. Their drainage basins constitute one of the principal Douglas-fir logging areas in British Columbia. The portion of the valley in which the study area was located lies between five and twelve miles from the east coast (49°5'N and 125°25' to 05'W).

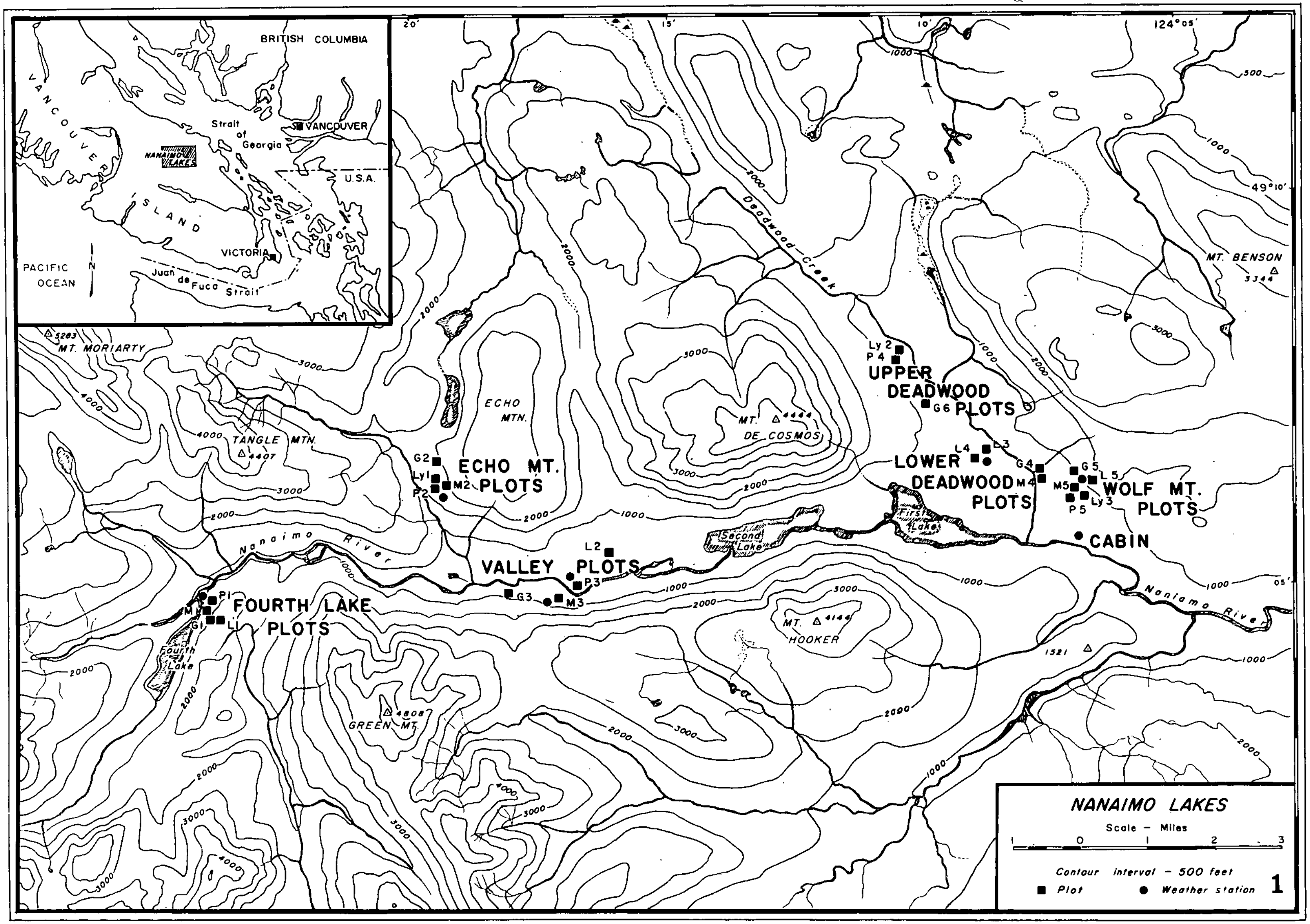
In the study area the valley floor drops gradually from 1000 feet above sea level at the western end to 600 feet in the eastern end. West of Second Lake the valley is less than half a mile wide, with the sides rising steeply more than 2000 feet. Many of the peaks are over 4000 feet high. The tributary creeks fall rapidly and their valleys are steep sided and narrow. To the east of First Lake the valley spreads out, and the sides of the land masses rise less steeply. The valley of Deadwood Creek (north fork of the Nanaimo River), in which some of the plots were located, is over one mile wide and the valley floor is relatively level. This condition is typical of the eastern coastal belt of Vancouver Island.

Mt. Hooker (4144 ft.) and Mt. de Cosmos (4444 ft.) mark the eastern end of the ridges which flank the narrow western portion of the valley. Cloud masses coming from the west, following the normal storm tracks, commonly descend after passing these peaks, resulting in the plots located to the east of them receiving a lower rainfall than the more westerly plots. The easterly plots were in a climatic zone corresponding to the lowland coastal belt of

PLATE I, Figure 1

PLATE I. Map of Study Area

Figure 1. Map of the Nanaimo Lakes showing the location of plots.



to follow page 3

eastern Vancouver Island, while the westerly plots were under conditions more typical of the higher land of the central land mass.

The vegetation of the region has been analysed by Krajina (1952) and classified into forest associations. Much of the study area was covered by stands in which Pseudotsuga menziesii (Mirbel) Franco (Douglas fir)[1] was predominant, although Thuja plicata D.Don (western redcedar) was dominant in one association and Tsuga heterophylla (Raf.) Sarg. (western hemlock) was codominant in another. Six associations were studied:

1. Pseudotsuga menziesii - Pinus contorta - Gaultheria shallon - Peltigera canina - Peltigera aphthosa association.
   (Pseudotsuga - Gaultheria - Peltigera or Douglas-fir - salal - lichen association) (Fig. 2).
2. Pseudotsuga menziesii - Gaultheria shallon association.
   (Pseudotsuga - Gaultheria or Douglas fir - salal association) (Fig. 3).
3. Pseudotsuga menziesii - Tsuga heterophylla - Hylocomium splendens - Eurhynchium oreganum association.
   (Pseudotsuga - Tsuga - Hylocomium - Eurhynchium or Douglas-fir - hemlock - moss association).
   This association occurredas a subassociation typicum, in which the ground cover was a luxuriant carpet of moss (Fig. 4) and a sub-association nudum where the ground was almost bare (Fig. 5).

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1 The species epithet menziesii has been used in the present study on the basis of a summary of the nomenclature of Douglas-fir made by Krajina (1956). Authorities for other specific names are given in the check list included in Appendix II.

PLATE II, Figures 2 - 7

PLATE II. Stands of various forest associations in the Nanaimo River Valley.

Figure 2. The *Pseudotsuga* - *Gaultheria* - *Peltigera* association (Plot L3). The meter stick is marked in decimeters.

Figure 3. The *Pseudotsuga* - *Gaultheria* association (Plot G6).

Figure 4. The *Pseudotsuga* - *Tsuga* - *Hylocomium* - *Eurhynchium* association (Plot M3). Subassociation typicum.

Figure 5. The *Pseudotsuga* - *Tsuga* - *Hylocomium* - *Eurhynchium* association (Plot M5). Subassociation nudum.

Figure 6. The *Pseudotsuga* - *Polystichum* association (Plot P1).

Figure 7. The *Thuja* - *Lysichitum* association (Plot Ly3).

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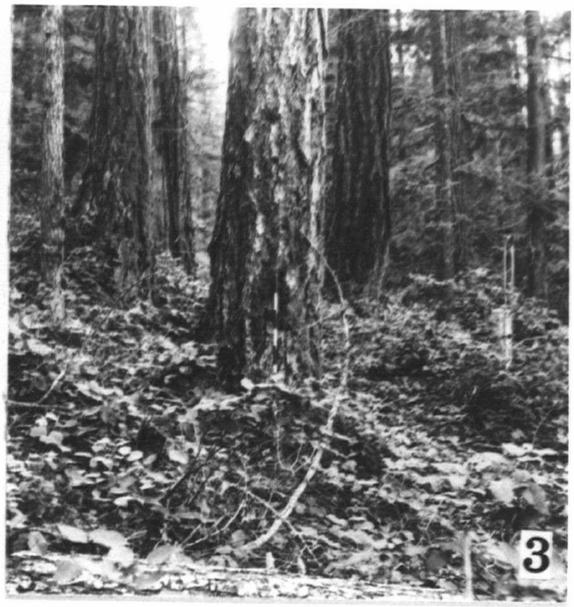

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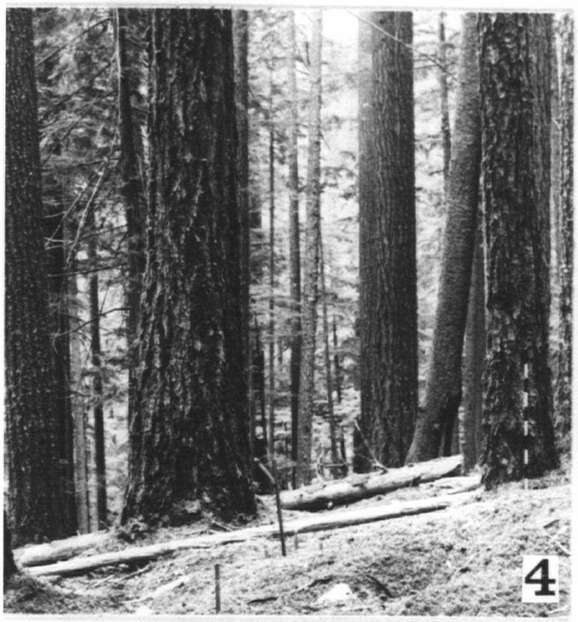

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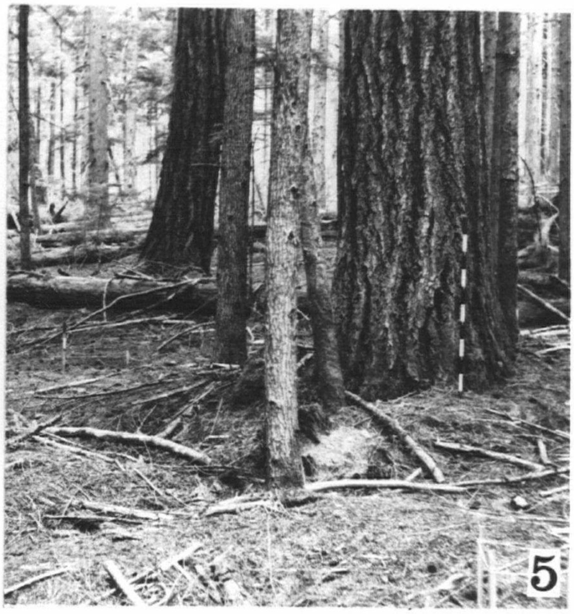

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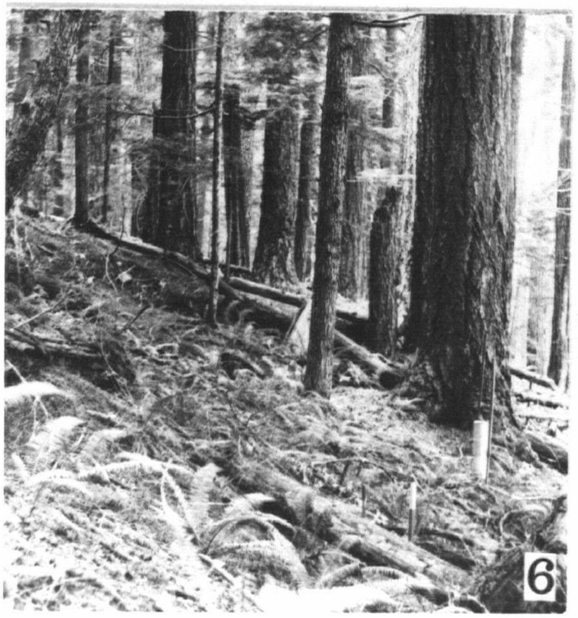

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PLATE III, Figures 8 - 13

PLATE III. Stands of various forest associations in the Nanaimo River Valley.

Figure 8. The _Pseudotsuga_ - _Tsuga_ - _Gaultheria_ association (Plot G1).

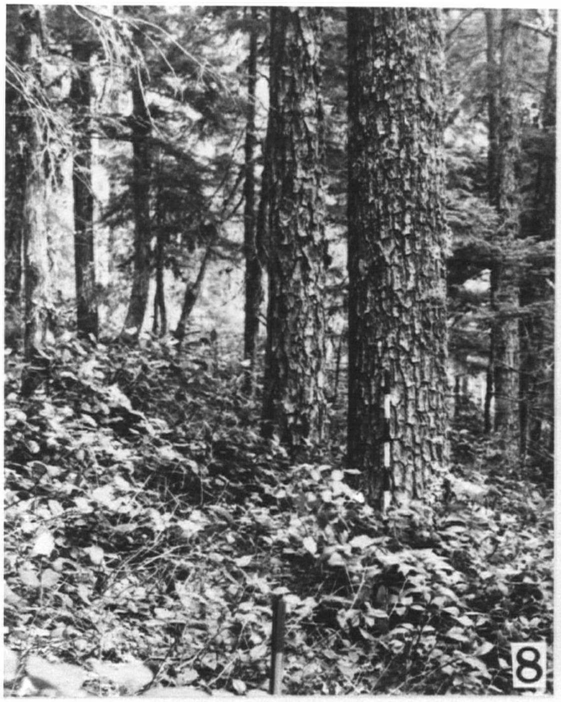
Figure 9. The _Pseudotsuga_ - _Tsuga_ - _Hylocomium_ - _Eurhynchium_ association (Plot M1), showing the large _Tsuga_ (by meter stick) of this stand at the western end of the study area.

Figure 10. The _Pseudotsuga_ - _Gaultheria_ association (Plot G6).

Figure 11. The _Pseudotsuga_ - _Polystichum_ association (Plot P4).

Figure 12. The _Pseudotsuga_ - _Gaultheria_ - _Peltigera_ association (Plot I5), showing the canopy of dominant and co-dominant trees.

Figure 13. The _Pseudotsuga_ - _Tsuga_ - _Hylocomium_ - _Eurhynchium_ association (Plot M5), showing small _Tsuga_ of the secondary canopy below the upper canopy formed by the dominant and codominant trees.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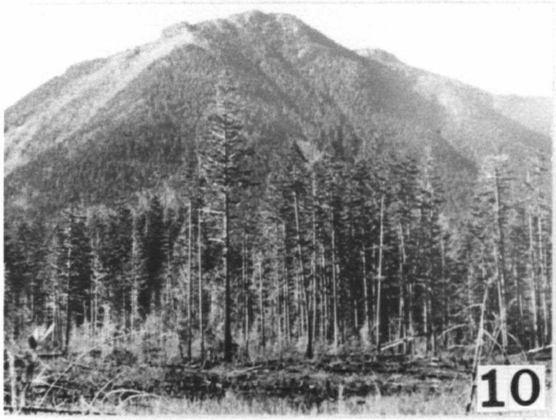
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13

4. *Pseudotsuga menziesii* - *Thuja plicata* - *Polystichum munitum* association. (*Pseudotsuga* - *Polystichum* or Douglas-fir - swordfern association) (Fig. 6).

5. *Thuja plicata* - *Lysichitum americanum* association. (*Thuja* - *Lysichitum* or cedar - skunk cabbage association) (Fig. 7).

6. *Pseudotsuga menziesii* - *Tsuga heterophylla* - *Gaultheria shallon* association. (*Pseudotsuga* - *Tsuga* - *Gaultheria* or Douglas-fir - hemlock - salal association) (Fig. 8).

In an idealized catenary sequence (Fig. 15) the *Pseudotsuga* - *Gaultheria* - *Peltigera* association occurs on the ridge top, the *Pseudotsuga* - *Gaultheria* association on the upper slope, the *Pseudotsuga* - *Tsuga* - *Hylocomium* *Eurhynchium* association at midslope, the *Pseudotsuga* - *Polystichum* association on the lower slope and valley floor and the *Thuja* - *Lysichitum* association in swampy (but not stagnant) areas of the bottomland. Such a catenary sequence is typical of the Douglas-fir zone on the eastern side of Vancouver Island. This zone may be defined as the one in which *Pseudotsuga* associations predominate on essentially all sites. The upper altitudinal limit of the Douglas-fir zone at the eastern end of the study area was well over 2000 feet. In the western end, the Douglas-fir zone was depressed below 2000 feet, and western hemlock was codominant at higher altitudes.

The extent to which slopes were covered by the different members of this catenary sequence varied considerably. The range of *Pseudotsuga* - *Gaultheria* - *Peltigera* stands differed with aspect, spreading farther down south slopes than north slopes. The *Pseudotsuga* - *Gaultheria* association, representing the climatic climax of the region, covered the largest area. The Pseudotsuga - Tsuga - Hylocomium - Eurhynchium association was represented in some cases by only a short transition zone or was largely absent, particularly on southern aspects. The Pseudotsuga - Polystichum association was by no means universal even on well drained valley floors. Much of this land was variously occupied by Pseudotsuga - Gaultheria - Peltigera and Pseudotsuga - Gaultheria stands, reflecting different soil depths and textures. The Thuja - Lysichitum association was also found on gently sloping hillsides where streamlets spread out to form damp areas. A mosiac distribution was common in such areas, accompanying slight, but sufficient, soil profile differences. On steep slopes rock outcroppings also caused patchy distribution.

Other associations than those studied were also present. For example, Arctostaphylos uva-ursi occurred on treeless outcrops, Sphagnum spp. in stagnant swamps and a Thuja - Abies - Adiantum association on occasionally flooded alluvial benches. Tsuga heterophylla and Abies amabilis (Dougl.) Forbes stands occurred altitudinally above the typical sequence of Douglas-fir stands. The associations studied represented typical members of the catenary sequence in the Douglas-fir zone of Vancouver Island, and included some of the major commercial timber types of the Douglas-fir region.

Most of the soils of the Nanaimo River Valley have been developed from varying depths of glacial till and outwash. Near the ridge tops the overlay is thin, resulting in shallow profiles, often less than two feet down to the bed-rock. In many relatively level areas similar shallow profiles have been developed, with rooting depth restricted by ortstein layers. Elsewhere on slopes the depth of weathered material is greater and near the base of side-hills profiles over five feet deep were encountered. In these profiles root penetration was often terminated at deeper levels by dense soils with higher

PLATE IV, Figures 14 and 15

PLATE IV. Forest Association Catena in the Nanaimo River Valley

Figure 14. Forest association catena in the Valley area, showing the increase in tree heights from the upper to the lower slopes.

Figure 15. Diagram of the forest association catena, showing the relative position of the various members.


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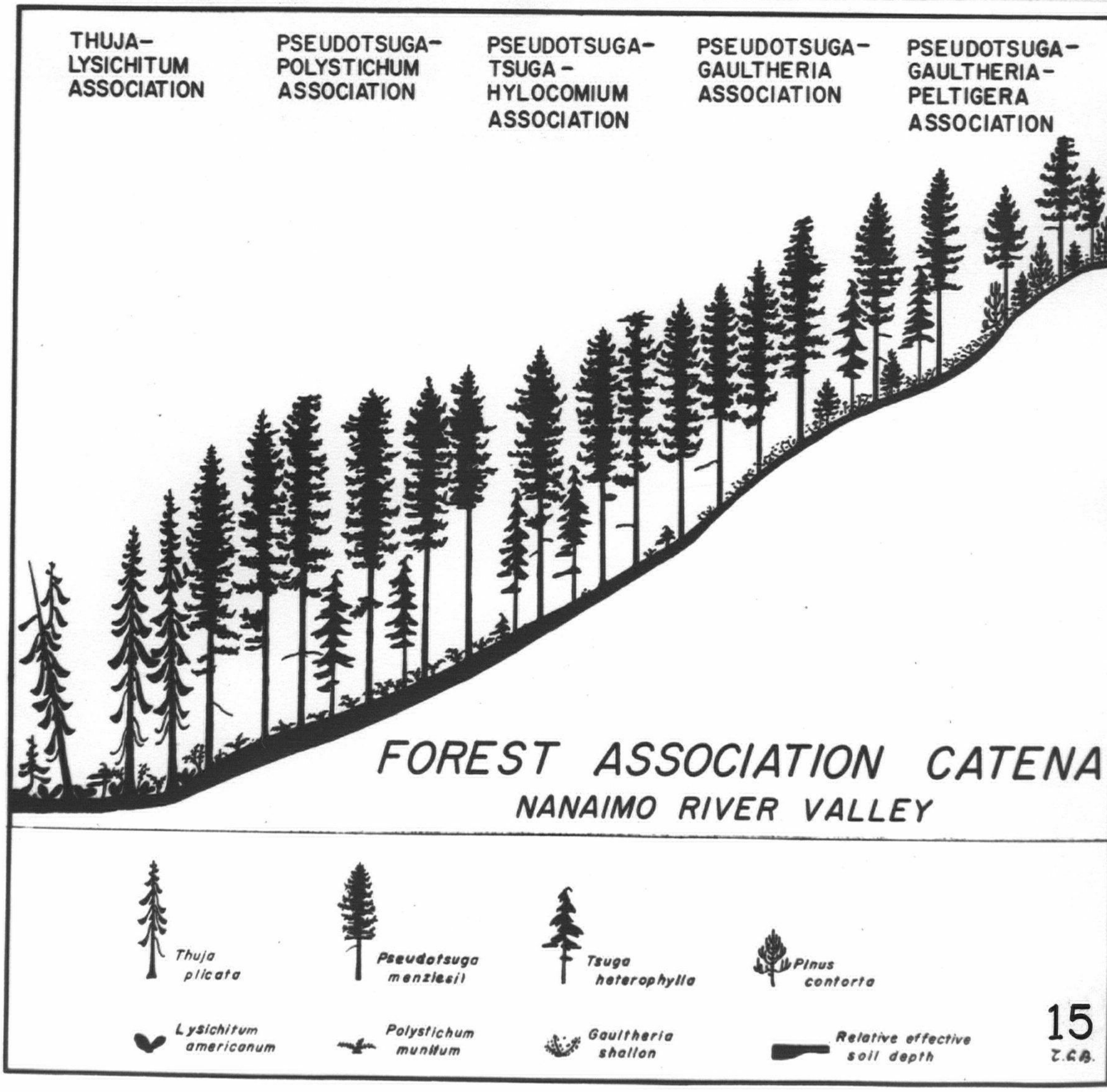

THUJA-
LYSICHITUM
ASSOCIATION
PSEUDOTSUGA-
POLYSTICHUM
ASSOCIATION
PSEUDOTSUGA-
TSUGA-
HYLOCOMIUM
ASSOCIATION
PSEUDOTSUGA-
GAULTHERIA
ASSOCIATION
PSEUDOTSUGA-
GAULTHERIA-
PELTIGERA
ASSOCIATION
FOREST ASSOCIATION CATENA
NANAIMO RIVER VALLEY
Thuja plicata
Pseudotsuga menziesii
Tsuga heterophylla
Pinus contorta
Lysichitum americanum
Polystichum munitum
Gaultheria shallon
Relative effective soil depth
15
T.C.B.

clay contents than those of the upper horizons. Recent alluvium provided the parent material in some parts of the wider valley floors. Soils developed from alluvium consisted of varying depths of stratified sand and gravel, often underlain or interspersed with beds of river cobbles. Most of the upland soils belonged to the Podzol and Brown Podzolic Great Soils Groups, with some Gleisolic and Hydromorphic soils occurring at the foot of slopes and on the valley floor.

METHODS

SELECTION OF PLOTS

Groups of stands, representing the mature condition of the associations, were selected at various locations along the valley (Fig. 1, Table 1). In this way advantage could be taken of the range of climatic conditions present to compare stands of the same association under different climatic conditions and to compare different associations under similar conditions. As stands were to be visited at frequent intervals accessibility was important and limited the study to areas serviced by logging roads. Some of the groups (Fourth Lake and Wolf Mountain) were in strict catenary sequence, but in other cases stands in this sequence were not accessible. At Echo Mountain and Valley, where a few stands did not follow the typical altitudinal series, and at Upper and Lower Deadwood, where all stands were essentially at the same altitude, other variables such as aspect, local topography and soil depths acted as compensating factors. The study was carried out on quarter-acre plots located in typical parts of the stands.

CLIMATE

Precipitation and maximum/minimum temperatures were recorded as a measure of the climates of the six localities in which the plots were grouped. Recording stations were maintained in open areas adjacent to the plots.

Inexpensive raingauges were constructed using 105 oz. cans as collecting funnels, soldered to 4 gal. cans as reservoirs (Fig. 16). The orifice area of such gauges was 184 sq. cm. The reservoirs had sufficient storage capacity for all water collected between measurements. Evaporation from the reservoirs was restricted by floating kerosene on the stored water. Measurements were made by pouring the water from the reservoirs into a plastic graduate, calibrated to read in centimeters of precipitation. The gauges were placed in small pits, with the orifices just above ground level. During the winter additional sleeves were inserted into the collecting funnels to prevent snow from drifting into the gauges. Unfortunately these sleeves probably resulted in some inaccuracies in precipitation measurement at the windier locations due to turbulence caused by the extra height of the orifice above the ground. A portable gasoline stove was used to melt the ice and snow which accumulated in the reservoirs during the winter months (Fig. 16).

Six's type thermometers were used to record maximum and minimum temperatures. The thermometers were enclosed in standard Stevenson screens during 1955 and 1956. Prior to these being available, the thermometers were housed in shelters made by opening out one side and louvering the top of 105 oz. cans (Fig. 16). Thermometer bulbs were located one meter above the ground. Although the minimum temperatures recorded by the thermometers in the cans were comparable to those in the screens, the maximum readings were often considerably higher for the same period. Therefore, the only maximum readings incorporated in the results were those recorded in the screens.

Monthly records were maintained from June, 1951 until December, 1956 to obtain average values for each station. Data for other stations on Vancouver

TABLE 1. LOCATIONS OF PLOTS ANALYSED IN THE STUDY OF WATER RELATIONS IN THE DOUGLAS FIR REGION

Plot	Locality	Lat.N ° '	Long.W ° '	Alt. ft.	Exposure	Slope °
PSEUDOTSUGA - GAULTHERIA - PELTIGERA ASSOCIATION						
L5	Wolf Mountain	49 06	124 07	1000	SSW	20
L4	Deadwood Creek (lower)	49 07	124 09	750	E	0-15
L3	Deadwood Creek (lower)	49 07	124 09	740	SE	2
L2	Valley	49 05	124 16	750	SSW	0-25
L1	Fourth Lake	49 05	124 24	1570	NW	0-5
PSEUDOTSUGA - GAULTHERIA ASSOCIATION						
G5	Wolf Mountain	49 06	124 07	880	SW	10
G4	Deadwood Creek (lower)	49 07	124 08	720	SW	12
G6	Deadwood Creek (upper)	49 08	124 10	810	E	5
G3	Valley	49 05	124 18	870	N	20
PSEUDOTSUGA - TSUGA - GAULTHERIA ASSOCIATION						
G1	Fourth Lake	49 05	124 24	1420	NW	20
G2	Echo Mountain	49 07	124 20	1700	WSW	20
PSEUDOTSUGA - TSUGA - HYLOCOMIUM - EURHYNCHIUM ASSOCIATION						
M5	Wolf Mountain	49 06	124 07	810	SSW	10
M2	Echo Mountain	49 06	124 20	1600	SW	20
M4	Deadwood Creek (lower)	49 07	124 08	700	SW	4
M3	Valley	49 05	124 17	850	NE	25
M1	Fourth Lake	49 05	124 24	1080	NW	25
PSEUDOTSUGA - POLYSTICHUM ASSOCIATION						
P4	Deadwood Creek (upper)	49 08	124 10	840	NE	2
P1	Fourth Lake	49 05	124 24	1050	NW	20
P2	Echo Mountain	49 06	124 20	1410	SW	10
P5	Wolf Mountain	49 06	124 07	760	SW	5
P3	Valley	49 05	124 17	640	-	0
THUJA - LYSICHITUM ASSOCIATION						
Ly3	Wolf Mountain	49 06	124 07	770	SW	3
Ly2	Deadwood Creek	49 08	124 10	830	NE	2
Ly1	Echo Mountain	49 06	124 20	1450	SW	10

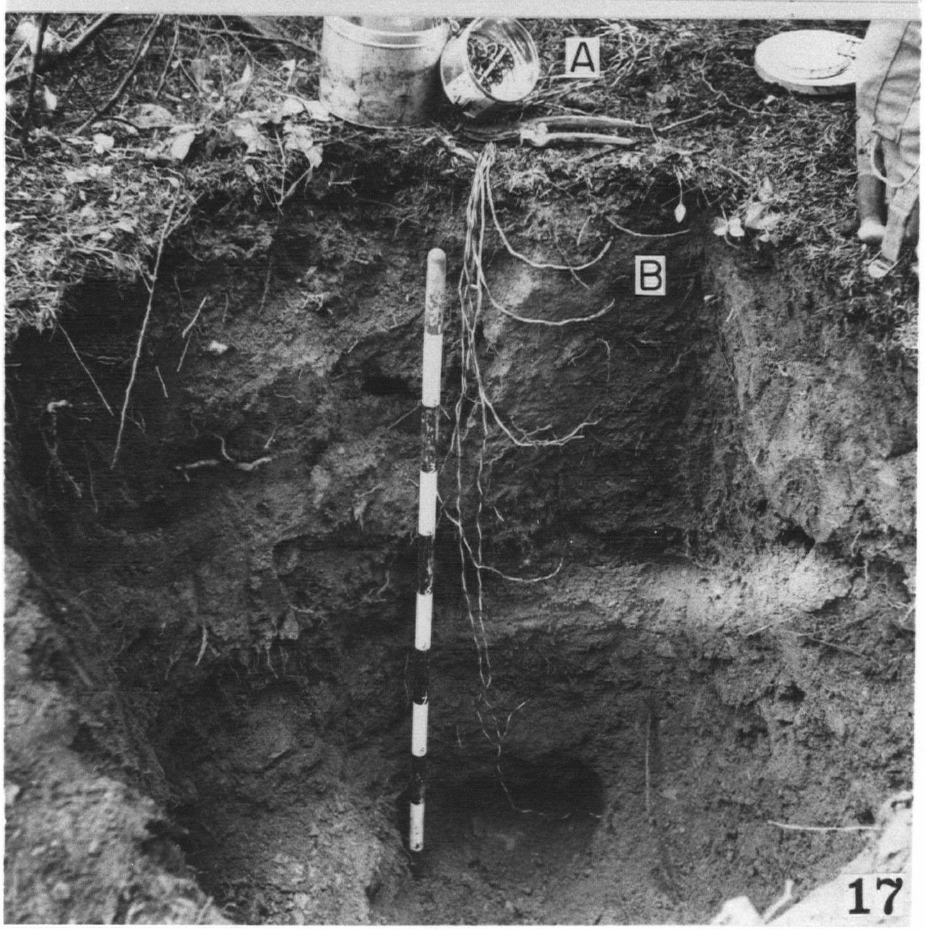
PLATE V, Figures 16 and 17

PLATE V Field equipment.

Figure 16. Equipment used in recording climatic data: A - raingauges, B - snow funnel, C - plastic graduate, D - Stevenson screen, E - Thermometer shelter made from can, F - location of thermometer to record soil surface temperatures.

Figure 17. Soil moisture unit installation: A - rotary selector switch, B - resistance units buried in side of pit.


D
E
A
F
C
B
16


A
B
17

Island and the adjacent mainland of British Columbia (Fig. 18) were obtained from the published records of the Meteorological Division of the Department of Transport (Canada), Department of Agriculture (Province of British Columbia), and from records taken by the British Columbia Forest Products Ltd., Nitinat Camp, B.C.

VEGETATION

The trees and subordinate plants were analyzed to show the vegetational characteristics of each plot. A total estimate analysis was made to record all the plants included in the tree, shrub, herb and moss layers and in the corticolous and lignicolous communities. The most common plants of the tree, shrub, herb, and moss layers were also evaluated by mensurational analyses, using the methods which most readily characterized them.

The following data were recorded for each plot at the time the analysis was made:

Date Analysed.
Altitude.
Exposure.
Slope.
Wind exposure (according to a scale of increasing exposure:
o, (+), +, +(+), ++, (!), !, !(!), !!).

The various vegetation layers were designated by the following letters:

A1 dominant and codominant tree canopy.
A2 intermediate and suppressed tree layer.

B1 tall shrub layer (bulk of foliage more than 1.5 m. high).
B2 low shrub layer.

C herb layer.
D moss, liverwort and lichen layer (with those growing on the ground differentiated from those on decaying wood and on the bark of trees within 2 m. of the ground line).

The abundance and percentage of cover of species in the various layers were estimated according to the eleven grade scale of Krajina and Domin (1933), in preference to the original six grade scale of Braun-Blanquet

(1928), as the former allowed greater accuracy of evaluation. The interpretations of the scale values are:

+ solitary, with small dominance.
1 seldom, with small dominance.
2 very scattered, with small dominance.
3 scattered, with small dominance.
4 often, with 1/20 dominance.
5 often, with 1/5 dominance.
6 any number, with 1/4 to 1/3 dominance.
7 any number, with 1/3 to 1/2 dominance.
8 any number, with 1/2 to 3/4 dominance.
9 any number, with dominance more than 3/4, but less than complete.
10 any number, with complete dominance.

These values were applied to each species in each layer in which it occurred. Values representing vitality were added to the total estimate value as an index, according to the following scale:

0 germinating, but not surviving, of ephemeral occurrence.
1 feeble, but able to survive.
2 strong, but not reaching maximum vigour.
3 well developed, with maximum vigour and development normally found in the species.

The tree layer was characterized by measurement of the height and age of representative trees of each species and the diameter at breast height of all trees larger than four inches. From these data the average height of dominants and codominants was calculated by averaging the height of the upper fifty-five percent of trees, heights having been obtained from a height/diameter curve constructed for each species on each plot. Site index for Douglas-fir was determined from the curves given by McArdle and Meyer (1949). Volumes per acre were derived from various volume tables used by the Research Division of the British Columbia Forest Service. The number of trees per acre, average diameter and basal area were also calculated.

The density of the shrub layer was determined by line interception (Canfield 1941). Ten lines, 50 feet long, approximately 6 feet apart, were run across each plot just above the level of the shrubs. The length of line covered by a vertical projection of the leaf surfaces was recorded and data summarised as percentage of interception. The average height of bushes crossed by the line was noted. Large leaved harbaceous plants, such as Lysichitum americanum and the larger ferns, were also measured by this method. In the case of ferns such as Polystichum munitum, the length of line covered by a circle described around the clump was recorded as the amount of interception. The line interception method involved some personal interpretation, particularly with higher bushes, because the line should always have been viewed directly from above to judge accurately the length intercepted. However, the additonal accuracy gained by the use of a plumb line did not appear to warrant the extra time involved.

The plants of the herb layer were evaluated by the frequency method (Raunkiaer 1943, Braun-Blanquet 1951). The size of the frequency frame (2 x 5 dm) was gauged so that a reasonable number of species fell within each frame. The frame was too small to describe accurately the frequency of occurrence of such large herbs as Polystichum munitum and Lysichitum americanum which were, therefore, also evaluated by line interception. Eighty to one hundred frames per plot were tallied. The frames were set 5 feet apart along the lines used for the line interception tallies. Results were expressed as the percentage of frames in which a species occurred.

The mosses and lichens growing on the ground were evaluated by the point frequency method (Levy and Madden 1933). A ten-point frame, one decimeter square constructed from 10-guage steel wire, was moved along the tape used for line interception at 5-foot intervals. The species in contact with each point was recorded at the eighty to one hundred spots on which the frame was set. Results were expressed as the percentage of ground covered by the various species encountered.

SOILS

Soil profile characteristics, the amount of stones and gravel, and the texture and organic content of the fine soil were studied as the principal soil properties determining water storage capacity.

The description of soil profiles was based on the terminology of the U.S. Department of Agriculture Soil Survey Manual (Handbook No.18, 1951), with the use of additional terms for organic layers and soils given by Hoover and Lunt (1952) and Wilde (1954). In addition to field descriptions, soil monoliths from eleven typical profiles were treated with vinylite resin (Smith and Moodie 1947) and preserved for laboratory examination.

The particle size classes used in this study were based on those of the International Scale (Soil Survey Manual 1951). These classes were:

more than 25 mm. -	stones and coarse gravel
25 - 5 mm. -	medium gravel
5 - 2 mm. -	fine gravel
2 - .02 mm. -	sand
.02 - .002 mm. -	silt
less than - .002 mm. -	clay

The proportions by volume of stones and coarse gravel, medium gravel, and the 5 mm. fraction were determined by analysing soil blocks of known size. The soil from blocks 20 cm. by 50 cm. by 20 cm. deep was separated by sieving and the volume of each fraction measured by displacement of water. Pore space was estimated by subtracting the volume of mineral soil (i.e. volume of water displaced) from the original volume of the block (20,000 ml.). Soil blocks were removed by two decimeter intervals down to the hardpan or to a depth of one meter which covered the normal root zone in most profiles. One series of determinations was made on each plot. Measurements were made at the end of the summer when soils were dry, facilitating field sieving and reducing error in pore space estimation resulting from an apparent increase in mineral soil volume attributable to soil moisture. Wet soils from certain profiles were allowed to air dry before sieving.

The proportions by weight of the fractions larger than 2 mm. were determined by sieving. A mechanical analysis of the 2 mm. fraction was made by the hydrometer method, according to the procedure prescribed by the American Society for Testing Materials (1944).

In the determination of the volume weight of the 25 mm. soil fraction, the volume occupied by a sample was found by pouring enough dry sand into a plastic bag to fill the hole left by excavating the sample. The volume of the sand was measured in a graduate and the weight of soil found on oven drying. Sample weight was divided by sample volume to obtain volume weight and the values for each decimeter depth interval were averaged for five pits on each plot.

Concretions were common in many soils. Samples of the medium and fine gravel fractions were heated in a mixture of concentrated sulphuric acid and potassium dichromate to reduce them to simple mineral particles. The residual material greater than 5 or 2 mm. (the lower limits of the medium and fine gravel fractions) was separated by sieving and the weight determined after oven drying. Results were expressed as the proportions of the gravel fractions which were actually composed of gravel particles and the proportions which were constituted of concretions of finer materials.

Organic matter content was determined by the wet combustion method, as outlined in the Sampling Procedures and Methods of Analysis for Forest Soils (Forest Soils Committee of the Douglas-fir Region 1953).

Determinations of pH were made using sieved, air-dried soils, rewetted to a saturated paste (Richards 1954). Measurements were made with a Beckman N-2 glass electrode pH meter.

WEATHER AND MICROCLIMATE

Measurements of precipitation, evaporation and temperature were taken to evaluate the microclimate of plots and record seasonal variations.

The amount of precipitation reaching the ground within a plot was measured using four raingauges per plot. The gauges used on the plots were made from two 105-oz. cans soldered together, giving a total capacity of 35 cm. of rainfall. This amount proved inadequate during certain wet months, necessitating some interpolation of results. Seasonal variation was recorded by measurements at weekly intervals during the summer of 1951, twice monthly in the summer of 1952 and monthly during other periods of the study. Plot records were terminated in November 1953. Nine additional gauges were placed on four of the Wolf Mountain plots during part of the study. These gauges were used as a check on the adequacy of four gauges for measurement of the precipitation penetrating the canopy. Average rainfall reaching the gauges within the plots was subtracted from total rainfall measured at adjacent open stations outside stands to obtain the amounts intercepted. Results were expressed as the percentage of total rainfall which failed to reach the ground. Water reaching the ground by running down tree trunks was not measured because none was present during the summer which appeared to be the only season in which interception played a prominent part in influencing soil moisture contents.

Porous porcelain atmometers (Livingston 1935) were used to measure evaporation at three open stations and within the subordinate vegetation of each plot. Measurements were made at 5 cm. and 100 cm. above the ground. A mercury valve, held in place by lambs wool plugs was incorporated with each atmometer to prevent entrance of rainwater (Daubenmire 1947). On the Fourth Lake and Wolf Mountain plots black bulb atmometers were placed alongside the 5-cm. white bulbs to compare the radiant energy reaching ground level on the different plots. Readings of evaporation were taken at weekly intervals June through September 1951 and twice monthly May through September 1952. The atmometers were standardised in the customary manner (Daubenmire 1947), correction coefficients being obtained by comparison with standard bulbs supplied by Mrs. Burton E. Livingston.

Air temperatures on the Wolf Mountain and Fourth Lake plots were measured with Six's type maximum/minimum thermometers placed one meter above the ground. Monthly records were taken June through October 1953.

Soil surface temperatures on each plot and at adjacent open stations were also measured with Six's type thermometers. The thermometers were buried with the tops of the bulbs approximately one-half of one centimeter beneath the soil surface. This placed them within the litter layer in most cases. Readings were taken weekly June through September 1951, twice monthly May through September 1952 and monthly during other periods of the study. Plot records were terminated in November 1953, although measurements at the open stations were continued until November 1955.

Soil temperatures were measured whenever soil moisture was sampled. During the direct sampling soil temperatures were measured by inserting a thermometer into the side of the pits at various depths (5, 15, 30, 60, 80 and 100 cm.). The thermometer was enclosed in a pointed armoured case for protection. Thermistors were incorporated with the fibreglas soil moisture units used for soil moisture determination (Colman and Hendrix 1949). Readings were interpreted from the calibration curves constructed for each thermistor. Soil temperatures were taken semi-monthly June through December 1951 and monthly from May 1952 until November 1953.

SOIL MOISTURE

Soil moistures were determined both by direct and indirect sampling methods.

Samples for direct measurement were obtained by digging pits because the soils of most plots were stony and samplers could not be used. Sampling was by decimeter intervals down to the hardpan or to a depth of one meter. Pits were refilled on completion of sampling, with the exception of one pit on each plot which was left open to observe fluctuations in the level of any water table that might be present. Moisture contents were determined by oven drying the 5 mm. fraction of these samples at 105^{o}C, and results were expressed as a percentage of dry weight. During part of the study a 4 mm. wire mesh screen was used for sieving the field samples. The effect of this variation in sieve size on moisture values was unimportant.

Fiberglas electrical resistance units were selected for indirect measurements because they were supplied with thermistors enabling temperature measurements to be made at the same time as moisture readings (Colman and Hendrix 1949). The meter used with these units was also more convenient to operate than those used with other types of units. It has been shown that electrical resistance units are sensitive over a wide range of soil moistures (Kelley et al 1946), and that the fiberglas units have as good a range of sensitivity and accuracy of response as other types of units (Palplant and Lull 1953). Since this study was conducted in leached soils, no complication through the effects of salt concentration in the soil solution was anticipated. The units were inserted into the side of pits at depths of approximately 5, 15, 30, 50, 80 and 120 cm. where profiles were deep enough, or down to the hardpan in shallower soils. The leads from the units were connected to a rotary selector switch enabling rapid measurement of moisture and temperature values (Fig. 17). One bank of units was placed on each plot.

Although it has been recommended that units be calibrated in undisturbed soils (Hendrix and Colman 1951), the 5 mm. soil fraction was used in this study because of the difficulty of obtaining undisturbed samples in the gravelly soils encountered and because the major emphasis was on variation in available moisture.

Wilting percentage is more closely related to texture and organic content than to structure. Sieved samples also had greater uniformity because variation in the coarse gravel content of unsieved samples disproportionately influenced their dry weight and therefore moisture percentage.

Several methods of calibration were tested. It was found that although calibration took longer, there was a more even distribution of moisture in closed containers than in screen boxes, such as those used by Kelley (1944). The units were calibrated in small cans (1 x 1 x 2 in.), filled with soil from the locations where the units had been buried. Drying was carried out at 100°F. Following an equilibration period at 60°F., the cans were weighed and the corresponding resistances measured. A drying cycle of six readings from saturation to below wilting percentage occupied about two weeks, with an average of five drying cycles per unit being needed for good calibration. Percentage moisture was calculated on the basis of the oven dry weight of soil, determined at the end of the calibration period. Calibration curves were plotted for each unit.

The original units used during the field study were accidentally destroyed before moisture calibration had been undertaken. Calibration was done on new units, using the soil in which the originals had been embedded in the field. Ten units from this new lot were tested to find the variability that might be expected among units. Calibration curves for each of these units were determined in the same sample soil. Although variation was appreciable (4 to 10 percent) at the higher moisture percentages, variation near wilting percentage was less than one percent. Variation among the higher values was probably largely attributable to the effects of structure and packing, noted by Hendrix and Colman (1951). It was therefore assumed that the calibration curves obtained using the substitute units could be applied to the field readings. Field readings were corrected for temperature before the corresponding moisture percentages were interpreted.

The 15-atmosphere percentage was used as an indirect measurement of wilting percentage (Richards and Weaver 1943). Direct measurements using sunflowers (Briggs and Shantz 1912, Daubenmire 1947) were not made because in many of the soils sampled sunflower root growth was too poor to obtain satisfactory results. The procedure was also considered too lengthy for the number of samples involved. The 1/3-atmosphere percentage was determined as a measure of field capacity (Richards and Weaver 1944). Although no laboratory procedure using sieved soils can be entirely accurate because field capacity is largely dependent on soils structure, the 1/3-atmosphere percentage appeared to be a convenient value to indicate when soils were nearing saturation. Values obtained by this method usually corresponded to field moisture contents after soils had drained to field capacity following heavy rainfall.

Wilting percentages (15-atmosphere percentages) and field capacities (1/3-atmosphere percentages) were determined with a pressure membrane apparatus. The procedures followed were similar to those outlined by Richards (1954), except that extractions were made on the 5 mm. soil fraction using a Visking membrane at both pressures. Extractions at the higher pressure (220 p.s.i.) were made for 24 hours, by which time water was no longer expressed. Organic layers required 48 hours or longer. Samples extracted at the lower pressure (5 p.s.i.) also required 48 hours before equilibrium was reached. A standard sample of known soil moisture constants was included with each batch of samples. With variations of less than 2 percent in the standard value, a correction factor was applied to the values for the samples. Where the variation was greater a new extraction was made.

Wilting percentages were determined from subsamples of all the samples dug for direct measurement and all the soils surrounding resistance units. Field capacity was determined for very wet samples. Available moisture was calculated by subtracting wilting percentage from field moisture and the presence of gravitational water was noted in those samples which were above field capacity. The depth of available water in the profile was calculated by multiphying soil depth (excluding the amount occupied by stones and coarse gravel) by the volume weight of the 25 mm. fraction and the percentage of available moisture. It was assumed that the water held by the gravel of the 5-25 mm. fraction was negligible.

Seasonal variations in available moisture were followed for a thirty-month period. Each plot was sampled nine times by direct measurement between June 1951 and September 1952. Readings of the resistance units were made from October 1952 until November 1953.

RESULTS

CLIMATE

Precipitation.

Mean annual precipitation for the period 1952 to 1956 decreased from west to east in the study area, the Fourth Lake station receiving 107 inches, the Valley station 77 inches and the Deadwood Creek station 54 inches (Table 2). This trend paralleled that shown by other stations on Vancouver Island in comparable locations. During the same period an average of 121 inches was recorded at Nitinat Camp in the central mountains, 88 inches at Cowichan Lake further east and 43 inches at Duncan near the east coast (Fig. 18). Annual precipitation in the western part of the central mountain range was similar to that received on the west coast (e.g. Pachena Point 125 in.). The pattern of decreasing rainfall from west to east occurred because the prevailing rainbearing winds were westerly and the central mountains caused a rainshadow on their leeward side. This rainshadow effect became intensified towards the east coast of the Island and was continued onto the adjacent mainland of British Columbia.

Total rainfall during the summer months (June, July, August) of 1951 to 1956 averaged 5.9 inches at Fourth Lake, 4.7 inches at the Valley station and 3.2 inches at Deadwood Creek, again showing an intensification of the rainshadow effect towards the eastern end of the study area. The same trend may be noted from the averages for Nitinat Camp, Cowichan Lake and Duncan (Table 2). However, in summer the rainshadow area was displaced further to the west, with Nitinat Camp receiving little more than half the rainfall measured at Pachena Point (Table 2.). This displacement occurred because during periods of light rainfall clouds coming from the west dropped most of their moisture on the western coastal belt, leaving only a small proportion to fall farther east. In high rainfall periods a larger amount of moisture still remained after the clouds had passed the coastal belt and the western part of the central mountains received as much precipitation as the west coast. Thus, although annual rainfall at the western end of the study area was comparable to the wet climate of the west coast outside the rainshadow area, during the growing season even the westerly plots were within the rainshadow area.

A comparison of the precipitation recorded at the station on the valley floor and another 250 feet higher up an adjacent sidehill in the Valley area showed that rainfall increased with altitude. The mean annual precipitation was 78 inches on the valley floor compared with 85 inches at the upper station. In summer the average was 4.7 inches at the lower station and 5.0 inches at the upper station. Records from another pair of stations on Echo Mountain also showed the same trend (Appendix IV). The importance of local rainshadows in modifying such trends was, however, shown by the records for the Valley and Echo Mountain stations. Although the latter was 750 feet higher it received much the same summer rainfall (4.7 inches at Valley, 4.8 inches at Echo Mountain) and the difference in rainfall over the entire year was only ten inches. The

TABLE 2. THE CLIMATE OF THE NANAIMO RIVER VALLEY COMPARED WITH OTHER STATIONS ON VANCOUVER ISLAND

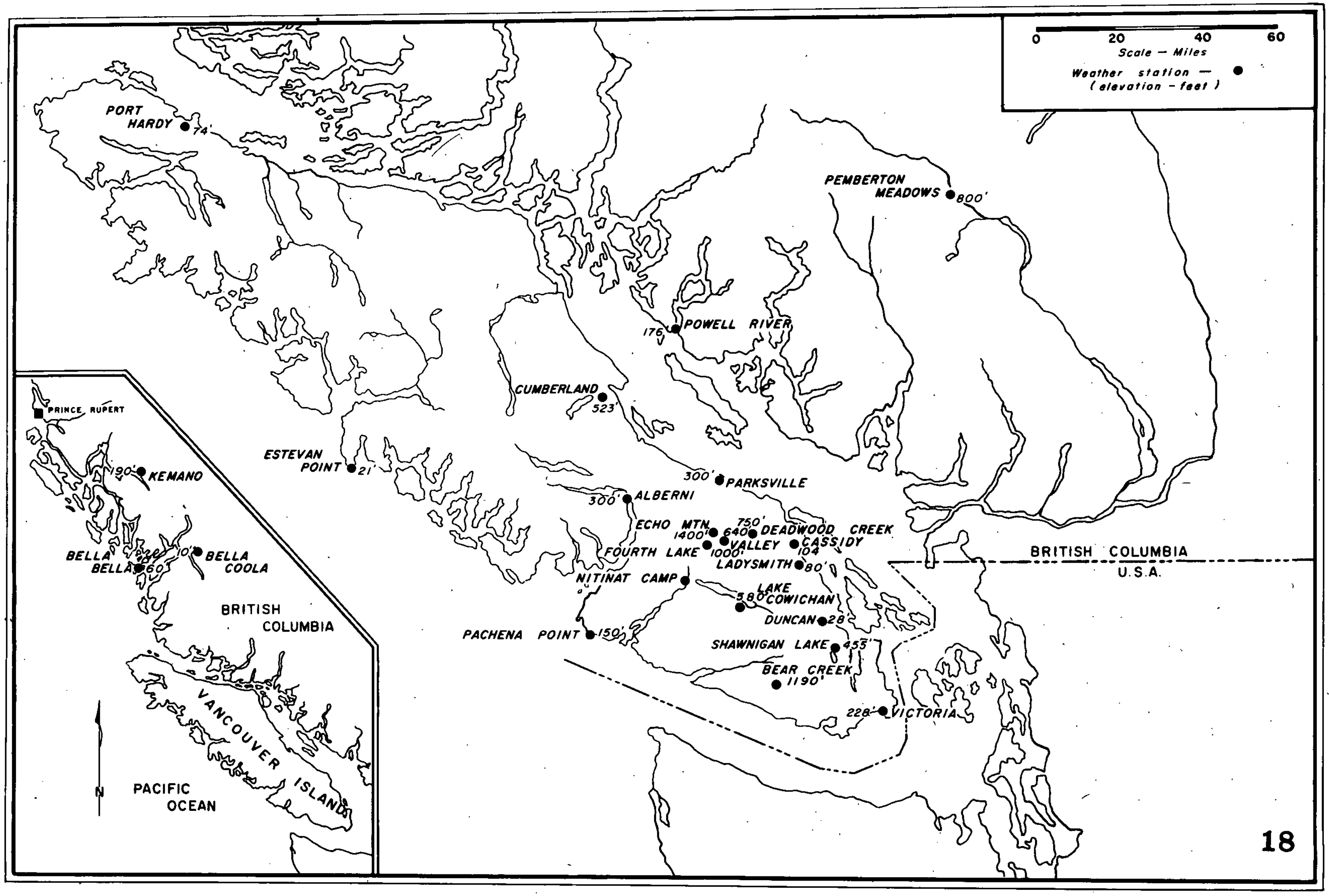
STATION	LOCATION: Latitude N. ° '	LOCATION: Longitude W. ° '	LOCATION: Altitude (feet)	PRECIPITATION (inches): Annual (mean 1952-1956)	PRECIPITATION (inches): Summer (mean 1951-1956)	TEMPERATURE (°F) SUMMER[2]: Monthly maximum (mean 1955-1956)	TEMPERATURE (°F) SUMMER[2]: Monthly range (mean 1955-1956)	TEMPERATURE (°F) WINTER[3]: Monthly minimum (mean 1952-1956)	TEMPERATURE (°F) WINTER[3]: Monthly range (mean 1952-1956)	Frost free period (days)	Months with monthly min. more than 32°F.	POTENTIAL EVAPOTRANSPIRATION[1]: Annual T-E[4]	Summer T-E	Summer T-E (%)	Surplus (inches)	Deficiency (inches)
NANAIMO RIVER																
Deadwood Creek	49 07	124 09	750	54	3.2	87	49	15	36	-	3½	-	-	-	41[5]	11
Valley	49 05	124 17	650	77	4.7	88	49	16	36	-	4¼	-	-	-	50[6]	10
Echo Mountain	49 06	124 20	1400	88	4.8	84	40	18	28	-	5	-	-	-	72[7]	10
Fourth Lake	49 05	124 24	1000	107	5.9	88	48	15	34	-	3¾	-	-	-	87[8]	8
EAST COAST																
Victoria[9]	48 31	123 25	730	35	3.0	83	38	25	25	274	7	26	13	50	17	16
Duncan	48 47	123 43	28	43	3.2	93	48	20	33	156	4¾	26	14	54	25	13
Cassidy	49 04	123 54	104	40	3.2	85	44	18	32	182[10]	4¼	23	12	52	30	11
Cumberland	49 39	125 01	523	58	4.5	88	48	20	35	154	4¼	25	13	52	42	9
CENTRAL MOUNTAINS																
Cowichan Lake	48 49	124 08	580	88	5.2	85	44	18	30	174	3¾	24	12	50	52	9
Nitinat Camp	48 55	124 29	560	121	6.0	-	-	-	-	-	-	-	-	-	97[11]	7
WEST COAST																
Pachena Point	48 43	125 06	150	125	10.4	70	28	24	26	196	5½	24	10	42	89	1
Estevan Point	49 23	126 32	21	121	10.9	68	26	25	24	227	7	24	11	44	87	1

[1] After Thornthwaite (1948).
[2] Summer - June, July, August.
[3] Winter - December, January, February.
[4] T-E - Thermal efficiency.
[5] Surplus and deficiency calculated using potential evapotranspiration for Cassidy.
[6] Surplus and deficiency calculated using potential evapotranspiration for Alberni.
[7] Surplus and deficiency calculated using potential evapotranspiration for Cumberland.
[8] Surplus and deficiency calculated using potential evapotranspiration for Cowichan Lake.
[9] Dominion Astrophysical Observatory (Little Saanich Mountain).
[10] Ladysmith.
[11] Surplus and deficiency calculated using potential evapotranspiration for Cowichan Lake.

PLATE VI, Figure 18

PLATE VI. Location of weather stations.

Figure 18. Location of weather stations on Vancouver Island and the coastal mainland of British Columbia



to follow page 27

Echo Mountain station was located on the leeward side of Tangle Mountain (Fig. 1).

Within the rainshadow area, precipitation decreased from north to south as well as from west to east (Table 2). At the Valley station, which was some eight miles from the east coast, summer rainfall was much the same as at Cumberland only three miles inland, but thirty minutes latitude (35 miles) farther north. However, this trend from north to south was less predictable than the west to east trend. Parksville, for example, averaged a lower annual rainfall than Cassidy to the south and for the period 1952 to 1956 Duncan received less rainfall than Cassidy to the north, even though the average rainfall at Cassidy is greater than at Duncan. Topographic features which cause local rainshadows and variations in the distribution of weather systems bring about deviations from the general trends.

TEMPERATURE

High maxima in summer, low minima in winter and a wide range of temperatures during both seasons were recorded at all the stations in the study area. The values recorded were comparable to those measured at other stations of the eastern coastal belt and central mountains of Vancouver Island (Table 2). Such temperature regimes are characteristic of the "continental" climate of inland areas and coastal belts where offshore winds are prevalent. By contrast, the stations of the west coast had lower summer maxima, higher winter minima and smaller ranges, characteristic of "maritime" climates where the moderating influence of the sea is carried inland by frequent onshore winds (Sanderson 1948). Temperatures at Victoria, at the southern end of the eastern coastal belt, are also moderated because of the prevalence of onshore winds (Chapman 1952). Summer temperatures on the east coast and in the central mountains were, therefore, fairly warm compared with those on the west coast, the difference in mean temperatures being 4 to 8°F. (Appendix I). This difference is even more pronounced when mean maximum temperatures were compared (13° - 15°F.).

Summer maxima recorded at the Echo Mountain station were lower than those measured at other stations in the study area. Winter minima were also higher and the range of temperatures smaller. The lower maximum temperatures were presumably partly attributable to the greater altitude of this station. However, the higher minima and smaller range would indicate that the station was also situated in the thermal belt. Extreme temperatures, particularly minimum temperatures, are moderated in the thermal belt because accumulations of cold air occur less readily at midslope than on the valley floor (Daubenmire 1947). In the Valley area the smaller mean monthly range of temperatures at the sidehill station, compared with those recorded on the valley floor, clearly demonstrated this feature. In summer the monthly range was 43°F. on the sidehill and 47°F. on the valley floor, whereas in winter it was 28°F. on the sidehill and 35°F. on the valley floor. However, minor variations also occurred between stations at the same altitude. Minima at the Cabin station were consistently one or two degrees lower than at the Deadwood Creek station less than one mile away across relatively level terrain (Appendix I). Local differences in air drainage were probably responsible for such variations.

The best measure of the length of growing season for native vegetation is the calendar of phenological events. From the data recorded on such occurrences as the appearance and increase in size of new <u>Polystichum</u> fronds and the yellowing and fall of <u>Achlys</u> leaves in the autumn, it was apparent that the growing season in the study area extended from early May until mid October. It was also noted that similar events in spring on the Fourth Lake plots were a week to two weeks later than at the eastern end of the valley. Variation in response of individual species and ecotypes would, of course, result in difference in the lengths of their growing periods.

The length of the frost-free period is another commonly used measure of the length of the growing season. The length of this period may serve to illustrate various trends found on Vancouver Island, even though it has more direct significance for cultivated tropical plants growing beyond their natural range than it does for vegetation native to temperate regions. The stations with a maritime climate, such as Pachena Point and Victoria, have a much longer frost free period than those of the east coast and central mountains with their continental climate (Connor 1949). On the east coast the more northerly stations have a shorter frost-free period than do stations farther south. The stations in the central mountains may also have a short frost-free period. Duncan, however, illustrates how local conditions may cause deviation from these trends. The Duncan station, being located in a frost-pocket area, has an average frost-free season of 156 days, barely longer than the 154 days recorded at Cumberland, fifty-five minutes latitude (60 miles) farther north and 500 feet higher in elevation. The frost-free period at Cowichan Lake of 175 days is probably longer than many inland points because of the proximity of the recording station to the Lake.

Since daily temperature records were not taken at the stations in the study area it was not possible to compare lengths of frost-free periods. A comparison of the average number of months with monthly minimum temperatures greater than 32°F. shows that the stations on the valley floor averaged 3 1/2 to 4 1/2, whereas the Echo Mountain station, in the thermal belt, averaged 5 months. During the same period other stations in the central mountains and on the east coast averaged 3 3/4 to 4 3/4 months. The stations of the west coast and Victoria average 5 1/2 to 7 months, indicative of their maritime climates.

Another indication of the relative climates of the various stations in the Nanaimo River Valley was the depth and duration of the snow pack. Cold temperatures and precipitation controlled snow depth, while warm temperatures affected its duration. For the period 1952 to 1956 the average maximum depth of the snow pack at Fourth Lake was 38 inches, at the Valley station it was 19 inches and 8 inches at Deadwood Creek. In the winters of 1951/52 and 1953/54, snow remained at Fourth Lake and Echo Mountain into April, by which time the ground was only partially covered in the Valley area and was clear at Deadwood Creek. In 1956 even at the end of March the snow pack was still at its maximum of from 5 to 6 feet at Fourth Lake and from 3 to 4 feet on Echo Mountain, but it was only 6 inches deep at the Valley station, and the Deadwood Creek area was largely free from snow.

From the available data it may be seen that the study area was influenced by a continental type of climate with relatively warm summers. There was an increase in length of the growing season from west to east paralleling the increase from the central mountains to the east coast and from north to south.

WATER BALANCE

Average annual thermal efficiencies, calculated according to the potential evapotranspiration formula proposed by Thornthwaite (Thornthwaite and Mather 1955) were similar for various stations on Vancouver Island (Table 2). It may be noted, however, that average summer thermal efficiencies were greater at the east coast and central mountain stations than at the west coast stations. The summer percentages were therefore greater at the stations with a continental climate (50 percent or more) than at the stations of the west coast with a maritime climate (42 to 44 percent).

Using Thornthwaite's concept that water balances (surpluses and deficiencies) may be determined by subtracting potential evapotranspiration from precipitation, it can be seen that the potential surpluses and deficiencies at various stations on Vancouver Island were chiefly dependent on rainfall distribution because most stations had rather similar potential evapotranspirations (thermal efficiencies). As potential evapotranspirations at the stations of the east coast and central mountains were much alike, it may be assumed that the values for the stations in the Nanaimo River Valley would not differ greatly from those of other stations with similar climates, where mean deaily temperatures have been recorded. Such values were therefore used to determine water balances in the study area. The largest potential surpluses and the smallest potential deficiencies occurred at Fourth Lake (Table 2 and Appendix I). Potential surpluses decreased and potential deficiencies increased further east. These trends paralleled those from west to east and north to south present among other stations on Vancouver Island. The increased deficiencies in the rainshadow areas were also partly attributable to their increased summer potential evapotranspirations.

VEGETATION

Pseudotsuga menziesii - Pinus contorta - Gaultheria shallon - Peltigera canina - Peltigera aphthosa association

Pseudotsuga menziesii was the main component of the tree layers, with other species forming a negligible proportion of the stands studied (Tables 3 and 8). Even at maturity, however, the average height of the dominant and co-dominant Pseudotsuga was little more than 100 ft. and average diameter at breast height only 18 inches. Despite the fairly large number of stems per acre, the small stature of the trees resulted in small basal areas and volumes per acre. In the Fourth Lake plot (L1) volume per acre was further decreased by the presence of openings caused by rock outcrops. The Valley plot (L2), situated on a small ridge at the side of the valley floor, had a somewhat higher site index than normal for the association, and this was reflected in the larger basal area and volume per acre. Pinus contorta was occasionally present in the lower tree layer (e.g. Plot L3) of mature stands, but it was more commonly present as clumps or scattered individuals a few inches in diameter and from twenty to forty feet high. Tsuga heterophylla was uncommon in the tree layer, occurring mostly in groups with individuals up to 40 ft. high. Pinus monticola, though infrequent, occurred more often in this association than in others.

Low, scattered Gaultheria shallon was the predominant plant of the shrub layer. Local concentrations of Tsuga heterophylla, four or five feet high, were present on some plots, particularly at the western end of the valley. Pseudotsuga menziesii was also present in the shrub layer on the Wolf Mountain plot (L5). Arctostaphyllos columbiana was a characteristic, though infrequent, shrub, occurring mostly in the more open parts of stands.

The most common species of the herb layer were Linnaea borealis, Chimaphila umbellata, Goodyera oblongifolia, Mahonia nervosa and Arctostaphyllos uva-ursi. Boschniakia hookeri was also a constant component. Pseudotsuga seedlings were scattered throughout, with seedlings of other species being rare.

The most common species among the mosses of the moss-lichen layer were Hylocomium splendens and Eurhynchium oreganum, with Camptothecium megaptilum, Calliergonella schreberi, Polytrichum spp. and Rhacomitrium spp., mosses characteristic of the association, forming extensive patches in some plots. Lichens, such as Cladonia spp., Peltigera spp. and Stereocaulon spp. were also common on the ground. Other lichens, particularly Alectoria spp. Usnea plicata, Sphaerophorus globosus, Cetraria spp. and Lobaria oregana, on the bark of trees, were a very conspicuous feature of the association.

Pseudotsuga menziesii - Gaultheria shallon association

Pseudotsuga menziesii was again the predominant species of the tree layer, with the dominants and codominants averaging from 147 to 175 ft.

TABLE 3: TOTAL ESTIMATE ANALYSIS OF THE PSEUDOTSUGA MENZIESII - PINUS CONTORTA - GAULTHERIA SHALLON - PELTIGERA CANINA - PELTIGERA APHTHOSA ASSOCIATION PLOTS

		PLOT L5	PLOT L4	PLOT L3	PLOT L2	PLOT L1
Date analysed		10 June'52	5 June'52	11 July'51	19 June'52	2 Aug'53
Altitude (ft.)		1000	750	740	750	1570
Exposure		SSW	E	SE	SSW	NW
Slope		20°	0 - 15°	2°	0 - 25°	0 - 5°
Wind exposure		++	+	+	+(+)	!
Cover	A1	60% } 65%	50% } 55%	40% } 50%	40% } 50%	50% } 60%
	A2	10%	10%	10%	10%	20%
	B1	1% } 40%	10% } 55%	30% } 60%	2% } 45%	2% } 45%
	B2	40%	50%	50%	50%	45%
	C	30%	35%	35%	35%	25%
	D	30%	30%	60%	50%	25%

	PLOT L5	L4	L3	L2	L1
A1					
Pseudotsuga menziesii	8^2	7^2	7^1	7^2	7^2
A2					
Pseudotsuga menziesii	5^1	5^1	4^1	3^1	5^2
Pinus contorta	-	$+^1$	5^1	-	-
Pinus monticola	-	-	-	4^1	-
Tsuga heterophylla	-	-	-	3^1	-
B1					
Tsuga heterophylla	1^1	$+^1$	4^1	2^1	3^1
Pseudotsuga menziesii	1^1	1^1	2^1	2^1	-
Pinus contorta	2^1	3^1	3^1	-	-
Pinus monticola	-	2^+	-	2^1	-
B2					
Gaultheria shallon	7^1	7^1	7^2	7^2	6^1
Pinus contorta	-	$+^+$	$+^1$	-	$+^1$
Arctostaphylos columbiana	-	$+^2$	$+^1$	-	-
Pseudotsuga menziesii	1^1	3^+	2^1	-	$+^1$
Salix sitchensis	-	-	-	-	$+^1$
Tsuga heterophylla	-	$+^1$	2^1	$+^1$	1^2
Pinus monticola	-	2^1	3^1	$+^1$	$+^1$
Vaccinium parvifolium	-	4^1	1^2	-	$+^1$
Thuja plicata	$+^+$	-	$+^1$	-	$+^1$
Rosa gymnocarpa	-	$+^1$	$+^2$	-	-
Vaccinium membranaceum	-	-	-	-	$+^1$
Abies grandis	$+^+$	$+^0$	$+^+$	-	-
C					
Gaultheria shallon	6^2	5^2	4^2	5^1	6^2
Linnaea borealis	3^1	2^1	2^2	2^1	2^1
Arctostaphylos uva-ursi	-	2^1	3^2	-	2^1
Allotropa virgata	$+^2$	$+^2$	1^2	$+^3$	1^3
Hieracium albiflorum	2^2	2^2	$+^2$	$+^3$	1^2
Boschniakia hookeri	2^2	3^2	3^3	3^2	$+^2$
Goodyera oblongifolia	3^2	3^2	2^2	1^3	1^2
Chimaphila umbellata	3^1	3^1	3^2	2^1	$+^2$
Vaccinium parvifolium	-	1^2	1^2	-	$+^2$
Festuca occidentalis	-	$+^2$	1^2	1^1	$+^1$
Mahonia nervosa	3^2	4^2	3^2	4^1	$+^2$
Mahonia aquifolium	2^1	$+^1$	1^1	-	-
Viola orbiculata	-	1^2	$+^1$	-	-
Pyrola picta var. dentata	$+^1$	-	$+^2$	-	-
Apocynum androsaemifolium	$+^1$	-	-	-	-
Pseudotsuga menziesii	-	3^1	2^1	$+^1$	$+^1$
Rubus vitifolius	$+^1$	-	$+^1$	1^2	$+^1$
Monotropa latisquama	$+^2$	1^2	$+^2$	-	1^2
Chimaphila menziesii	-	$+^1$	-	-	1^2
Symphoricarpos mollis	$+^1$	-	-	$+^1$	-
Achlys triphylla	$+^1$	$+^1$	-	3^1	-
Pteridium aquilinum	2^1	2^2	2^2	1^2	-
Trientalis latifolia	$+^1$	2^1	$+^2$	1^1	-
Thuja plicata	-	-	$+^1$	$+^1$	-
Pinus monticola	-	2^1	1^1	1^1	-
Polystichum munitum	$+^+$	-	-	$+^1$	$+^+$
Tsuga heterophylla	-	-	1^1	-	-
Vaccinium membranaceum	-	-	-	-	2^1
Pinus contorta	-	-	1^1	-	-
Rosa gymnocarpa	3^2	-	$+^1$	-	-
Vaccinium alaskaense	-	-	1^1	-	-
Listera cordata	-	-	3^2	-	-
Epilobium paniculatum	-	-	$+^1$	-	-
Festuca subulata	-	-	$+^1$	-	-
Taxus brevifolia	-	-	$+^1$	-	-
Campanula scouleri	2^2	1^1	$+^2$	-	-
Lilium columbianum	-	-	$+^2$	-	-
Pyrola bracteata	-	-	$+^2$	-	-
Calypso bulbosa	$+^2$	-	-	-	-
Polypodium vulgare	$+^+$	-	-	-	-
Pyrola picta var. crenata	-	1^2	-	-	-
Malus diversifolia	$+^1$	$+^1$	-	-	-
Vaccinium ovalifolium	-	-	-	-	$+^1$

	PLOT L5	L4	L3	L2	L1
D (on ground)					
Hylocomium splendens	3^2	4^2	4^3	4^2	5^2
Eurhynchium oreganum	4^2	4^2	4^2	4^2	2^2
Camptothecium megaptilum	3^2	3^3	3^2	3^2	3^2
Dicranum scoparium	2^2	3^2	3^2	3^2	2^2
Peltigera aphthosa	2^2	3^3	2^2	2^2	2^3
Peltigera canina	2^2	2^2	2^2	2^2	2^2
Peltigera polydactyla	-	$+^1$	-	-	1^2
Polytrichum juniperinum	-	3^2	3^2	2^1	3^2
•Polytrichum piliferum	-	$+^2$	-	-	$+^1$
Calliergonella schreberi	$+^1$	1^2	3^3	2^3	2^3
Aulacomnium androgynum	1^2	3^2	2^2	1^1	-
•Rhacomitrium canescens	2^2	1^2	1^2	$+^2$	2^3
•Rhacomitrium heterostichum	2^2	2^2	1^2	1^2	1^2
Rhacomitrium lanuginosum	$+^2$	-	-	2^2	-
Cladonia gracilis	-	2^2	2^2	$+^2$	1^2
Cladonia sylvatica	-	-	$+^2$	$+^2$	4^3
Cladonia furcata	1^2	3^2	1^2	$+^2$	-
Cladonia rangiferina	-	-	-	-	3^3
Cladonia fimbriata	-	$+^1$	-	-	1^2
Cladonia bellidiflora	-	-	$+^1$	-	1^2
•Cladonia pyxidata	-	2^2	$+^1$	-	$+^2$
Cladonia verticillata	-	-	$+^2$	-	$+^3$
Cladonia uncialis	-	-	-	-	$+^3$
Cladonia squamosa	-	-	$+^2$	-	-
Cladonia degenerans	-	$+^2$	-	-	-
Stereocaulon paschale	-	$+^2$	1^2	-	4^2
Stereocaulon tomentosum	-	2^2	-	-	-
Dicranum fuscescens	-	2^2	1^2	1^2	1^2
Pilophoron cereolus	$+^2$	$+^3$	1^2	$+^2$	-
Pilophoron Hallii	-	-	-	-	1^2
Bryum pallens	-	$+^2$	$+^2$	1^2	-
Pseudotsuga menziesii	1^+	2^+	$+^+$	$+^+$	2^+
Rhytidiopsis robusta	-	$+^1$	-	-	$+^1$
Rhytidiadelphus triquetrus	2^2	$+^2$	1^2	1^2	-
Rhytidiadelphus loreus	-	-	$+^2$	$+^2$	$+^2$
•Bartramia pomiformis	$+^2$	-	-	1^2	-
•Pseudisothecium stoloniferum	-	1^2	-	2^2	-
Dicranum strictum	-	-	-	$+^1$	-
Dicranum bonjeanii	-	-	$+^2$	-	-
Dicranoweisia cirrhata	-	-	$+^2$	-	-
•Mnium spinulosum	-	-	-	$+^1$	-
Tsuga heterophylla	-	-	$+^1$	-	-
D (on decaying wood)					
Dicranum fuscescens	1^2	$+^3$	1^3	3^3	1^1
Hypnum circinale	-	-	-	3^2	-
Aulacomnium androgynum	$+^2$	$+^2$	$+^3$	2^3	-
Cladonia pyxidata	-	$+^2$	-	-	-
Eurhynchium oreganum	$+^2$	$+^2$	1^3	3^2	2^1
Hylocomium splendens	-	-	$+^2$	3^3	$+^1$
Peltigera aphthosa	$+^2$	$+^2$	-	2^2	$+^1$
Cladonia gracilis	$+^2$	$+^3$	$+^2$	2^2	1^1
Cladonia bellidiflora	1^2	-	-	1^2	$+^1$
Cladonia fimbriata	$+^2$	$+^3$	-	$+^2$	-
Cladonia macilenta	-	-	-	$+^2$	-
Cladonia squamosa	-	-	$+^2$	-	-
Cladonia verticillata	-	$+^2$	-	-	-
Cladonia subsquamosa	$+^1$	-	-	-	-
Cladonia furcata	$+^1$	-	-	-	-
Peltigera canina	-	$+^2$	$+^2$	$+^2$	$+^1$
Dicranum strictum	$+^2$	$+^3$	$+^2$	1^2	$+^1$
Pseudisothecium stoloniferum	1^1	-	-	1^1	-
Scapania bolanderi	-	$+^1$	-	$+^1$	-
Rhytidiadelphus loreus	-	-	-	1^2	-
Rhytidiadelphus triquetrus	-	-	-	1^2	-
Antitrichia curtipendula	-	-	-	1^2	-
Calliergonella schreberi	-	-	$+^2$	-	$+^1$
Polytrichum juniperinum	$+^2$	$+^1$	-	-	-
Cephalozia leucantha	-	-	-	$+^1$	-
Cephalozia media	-	-	-	$+^1$	-
Dicranum scoparium	-	$+^2$	-	-	-
Dicranoweisia cirrhata	$+^2$	-	-	-	-
Plagiothecium denticulatum	-	-	-	$+^1$	-
Lophocolea heterophylla	-	-	-	$+^1$	-
Blepharostoma trichophyllum	-	-	-	$+^1$	-
Ochrolechia tartarea	$+^1$	-	-	-	-
Protococcus viridis	-	-	-	$+^1$	-

	PLOT L5	L4	L3	L2	L1
D (on trees)					
On PSEUDOTSUGA MENZIESII					
Alectoria sarmentosa	3^3	4^3	3^3	1^1	5^3
Sphaerophorus globosus	2^2	1^3	1^3	3^2	3^2
Parmelia physodes	2^2	1^2	2^2	2^2	1^2
Cetraria lacunosa	2^2	3^3	2^2	2^2	-
Cetraria glauca	-	-	3^3	-	3^3
Cetraria scutata	1^2	1^3	1^2	-	-
Nephromopsis ciliaris	2^2	2^3	-	2^2	-
Hypnum circinale	1^1	$+^2$	1^1	2^2	2^2
Cladonia macilenta	-	3^3	2^3	2^1	-
Alectoria oregana	-	-	1^2	-	2^3
Alectora jubata	$+^2$	$+^2$	-	-	2^2
Ochrolechia upsaliensis	-	1^3	1^2	-	-
Lobaria oregana	-	-	$+^1$	$+^1$	-
Usnea plicata	-	$+^2$	1^2	-	-
Letharia vulpina	$+^1$	-	$+^1$	-	-
-Dicranum fuscescens	2^2	1^2	1^2	2^2	2^1
Dicranum strictum	-	$+^2$	1^2	2^2	-
Cladonia furcata	-	-	-	$+^1$	-
Mycoblastus sanguinarius	-	3^3	-	-	1^3
Mycoblastus alpinus	-	-	-	-	1^2
Ochrolechia tartarea	$+^1$	-	-	-	1^2
Aulacomnium androgynum	1^1	-	1^2	1^2	-
Dicranoweisia cirrhata	-	-	$+^2$	$+^1$	-
-Eurhynchium oreganum	1^1	-	-	1^1	-
Pertusaria ambigens	-	$+^2$	1^2	-	-
Graphis sp.	-	-	-	$+^1$	-
on PINUS CONTORTA					
Parmelia physodes	1^2	$+^2$	1^2	-	-
-Cetraria glauca	1^2	$+^3$	1^2	-	-
Cetraria lacunosa	$+^2$	$+^3$	$+^2$	-	-
Alectoria sarmentosa	$+^2$	$+^3$	$+^2$	-	-
-Alectoria jubata	$+^2$	-	$+^2$	-	-
Alectoria oregana	-	$+^2$	-	-	-
-Hypnum circinale	-	$+^2$	$+^2$	-	-
Usnea plicata	-	-	$+^2$	-	-
Cladonia macilenta	-	$+^2$	-	-	-
Pertusaria ambigens	-	$+^2$	3^2	-	-
-Mycoblastus sanguinarius	-	$+^3$	$+^2$	-	-
-Cetraria scutata	-	$+^2$	-	-	-
-Eurhynchium oreganum	-	-	$+^1$	-	-
-Dicranum strictum	-	$+^2$	-	-	-
Cronartium harknessii	$+^2$	-	2^2	-	-
on TSUGA HETEROPHYLLA					
Parmelia physodes	-	-	-	2^2	-
Lobaria oregana	-	-	-	2^2	-
Cetraria glauca	-	-	-	2^1	-
-Eurhynchium oreganum	-	-	-	1^1	-
Hylocomium splendens	-	-	-	1^1	-
Pseudisothecium stoloniferum	-	-	-	1^1	-
Frullania nisquallensis	-	-	-	$+^1$	-
Ptilidium californicum	-	-	-	$+^1$	-
Porella navicularis	-	-	-	$+^1$	-
on PINUS MONTICOLA					
Cetraria lacunosa	-	-	-	2^2	-
-Cetraria glauca	-	-	-	2^2	$+^2$
Cetraria scutata	-	-	-	$+^1$	-
Nephromopsis ciliaris	-	-	-	2^1	-
*Lobaria oregana	-	-	-	2^2	3^3
Hypnum circinale	-	-	-	2^2	-
Parmelia physodes	-	-	-	2^2	$+^2$
Sphaerophorus globosus	-	-	-	1^1	$+^3$
Cladonia macilenta	-	-	-	1^1	1^2
Alectoria jubata	-	-	-	-	$+^2$
Alectoria oregana	-	-	-	-	$+^2$
-Dicranum fuscescens	-	-	-	2^2	$+^1$
Eurhynchium oreganum	-	-	-	1^1	$+^1$
Alectoria sarmentosa	-	-	-	$+^1$	1^2
Pertusaria multipuncta	-	-	-	-	$+^1$
-Frullania nisquallensis	-	-	-	-	$+^2$

The main numeral in each column is the total estimate value for each species, based on a scale from + to 10.
The index represents the vitality, on a scale from 0 to 3.

Interpretation of symbols:

• Largely on exposed rock and stones.
* Largely on dead branches
- Largely at the bases of trees

TABLE 4: TOTAL ESTIMATE ANALYSIS OF THE PSEUDOTSUGA MENZIESII - GAULTHERIA SHALLON AND THE PSEUDOTSUGA MENZIESII - TSUGA HETEROPHYLLA - GAULTHERIA SHALLON ASSOCIATION PLOTS

	PSEUDOTSUGA - GAULTHERIA ASSOCIATION				PSEUDOTSUGA - TSUGA - GAULTHERIA ASS'N.	
	PLOT G5	PLOT G4	PLOT G6	PLOT G3	PLOT G1	PLOT G2
Date analysed	11 Aug'52	13 Aug'52	6 June'52	18 Aug'52	2 Aug'53	12 July'51
Altitude (ft.)	880	720	810	870	1420	1700
Exposure	SW	SW	E	N	NW	WSW
Slope	10°	12°	5°	20°	20°	20°
Wind exposure	+	+	+	+	+	++
Cover: A1	50%	50%	60%	60%	60%	60%
A2	30% } 65%	20% } 65%	40% } 75%	20% } 70%	30% } 75%	45% } 75%
B1	2%	5%	5%	5%	10%	15%
B2	70% } 70%	65% } 65%	75% } 75%	65% } 65%	65% } 70%	60% } 75%
C	20%	20%	10%	35%	10%	10%
D	25%	20%	35%	30%	35%	45%

	PSEUDOTSUGA - GAULTHERIA ASSOCIATION PLOT G5	G4	G6	G3	PSEUDOTSUGA - TSUGA - GAULTHERIA ASS'N. PLOT G1	G2
A1						
Pseudotsuga menziesii	7^2	7^2	8^2	8^2	6^2	6^2
Tsuga heterophylla	-	-	-	-	6^2	6^2
A2						
Pseudotsuga menziesii	6^2	5^2	5^1	5^2	5^2	6^2
Tsuga heterophylla	-	-	3^2	-	5^2	6^2
Thuja plicata	-	-	1^2	-	4^2	3^2
Pinus monticola	-	-	$+^2$	-	$+^0$	2^2
Chamaecyparis nootkatensis	-	-	-	-	-	1^2
B1						
Tsuga heterophylla	3^2	3^3	4^2	4^2	3^2	4^2
Thuja plicata	1^1	$+^1$	3^2	3^2	2^1	1^1
Pseudotsuga menziesii	-	$+^1$	$+^1$	2^2	2^1	1^1
Pinus monticola	-	+	-	-	1^0	1^1
Chamaecyparis nootkatensis	-	-	-	-	1^1	1^1
Holodiscus discolor	-	-	-	1^2	-	-
Abies grandis	-	$+^1$	-	-	-	-
Abies amabilis	-	-	-	-	-	$+^1$
Pinus contorta	-	$+^2$	-	-	-	-
B2						
Gaultheria shallon	5^3	4^2	9^3	8^2	5^2	8^2
Vaccinium parvifolium	-	$+^2$	$+^2$	-	-	2^2
Thuja plicata	$+^1$	$+^1$	$+^1$	1^1	2^1	$+^1$
Tsuga heterophylla	2^1	1^1	2^1	-	2^1	2^1
Rosa gymnocarpa	1^2	1^2	1^2	1^1	-	-
Pseudotsuga menziesii	$+^1$	$+^1$	-	-	-	1^1
Abies grandis	$+^+$	$+^1$	-	-	-	-
Chamaecyparis nootkatensis	-	-	-	-	-	3^1
Pinus monticola	-	$+^+$	-	-	-	$+^1$
Vaccinium membranaceum	-	-	-	-	-	2^2
Vaccinium ovalifolium	-	-	-	-	-	1^1
Abies amabilis	-	-	-	-	-	1^1
Holodiscus discolor	-	-	-	1^1	-	-
C						
Gaultheria shallon	7^2	7^2	6^2	5^2	6^2	6^2
Mahonia nervosa	3^2	3^2	3^2	2^1	3^1	1^1
Linnaea borealis	3^2	2^1	3^2	3^2	3^3	2^2
Vaccinium parvifolium	$+^1$	$+^1$	1^2	1^1	3^1	3^2
Chimaphila umbellata	2^2	3^2	3^2	-	3^2	2^2
Boschniakia hookeri	1^2	$+^1$	$+^1$	-	1^1	$+^1$
Goodyera oblongifolia	1^1	-	2^2	-	2^2	2^2
Allotropa virgata	-	-	-	-	-	$+^3$
Achlys triphylla	3^2	3^2	1^1	2^2	-	-
Rubus vitifolius	3^2	2^1	$+^1$	2^1	-	-
Polystichum munitum	$+^1$	$+^1$	$+^+$	4^1	1^+	-
Pteridium aquilinum	2^1	1^1	1^1	1^1	-	$+^1$
Rosa gymnocarpa	3^2	3^1	-	2^1	-	-
Chimaphila menziesii	1^1	$+^1$	1^1	-	-	$+^2$
Symphoricarpos mollis	3^1	1^1	1^1	-	-	-
Tsuga heterophylla	-	-	1^1	-	-	1^1
Vaccinium ovalifolium	-	-	-	-	-	1^1
Vaccinium membranaceum	-	-	-	-	1^1	-
Pyrola picta	$+^+$	$+^1$	-	-	-	-
Pyrola bracteata	$+^+$	$+^1$	-	-	-	-
Holodiscus discolor	-	-	$+^1$	-	-	$+^1$
Gaultheria ovatifolia	-	-	-	-	-	1^1
Lonicera sp.	-	-	-	1^1	-	-
Festuca occidentalis	-	1^2	-	-	-	-
Adenocaulon bicolor	$+^1$	-	-	-	-	-
Viola orbiculata	$+^1$	-	-	-	-	-
Corallorhiza maculata	$+^1$	-	-	-	-	-
Vaccinium alaskaense	-	-	-	-	1	-

	PSEUDOTSUGA - GAULTHERIA ASSOCIATION PLOT G5	G4	G6	G3	PSEUDOTSUGA - TSUGA - GAULTHERIA ASS'N. PLOT G1	G2
C (continued)						
Trientalis latifolia	$+^1$	-	-	-	-	-
Hypochaeris radicata	-	$+^1$	-	-	-	-
Chamaecyparis nootkatensis	-	-	-	-	-	$+^1$
Pinus monticola	-	-	-	-	-	$+^1$
Trillium ovatum	$+^+$	-	-	-	-	-
Listera cordata	-	-	$+^1$	-	-	-
Polypodium vulgare	-	-	$+^1$	-	-	-
D (on ground)						
Hylocomium splendens	4^2	5^2	5^2	5^2	5^2	6^3
Eurhynchium oreganum	6^3	3^2	5^2	4^2	4^2	3^2
Rhytidiadelphus loreus	-	-	-	4^2	5^2	5^2
Rhytidiadelphus triquetrus	-	1^1	-	1^1	-	-
Rhytidiopsis robusta	-	-	-	-	2^2	3^2
Camptothecium megaptilum	-	-	-	-	$+^1$	$+^1$
oDicranum scoparium	2^2	-	-	$+^1$	$+^1$	$+^1$
oDicranum fuscescens	-	-	-	$+^1$	$+^1$	$+^1$
oPolytrichum juniperinum	-	-	-	$+^1$	$+^1$	-
oPeltigera aphthosa	-	-	-	-	-	$+^1$
Hypnum circinale	2^2	-	-	$+^1$	-	$+^2$
Plagiothecium denticulatum	-	-	-	$+^1$	1^1	-
Rhacomitrium heterostichum	-	$+^1$	-	-	-	$+^1$
Mnium punctatum	$+^+$	-	-	-	-	-
oMnium menziesii	-	-	-	$+^1$	-	-
Claopodium crispifolium	-	-	-	$+^+$	-	-
oPseudisothecium stoloniferum	$+^1$	-	-	-	1^1	-
oPilophoron hallii	-	-	-	-	-	$+^1$
Pseudotsuga menziesii	1^0	1^0	1^+	$+^0$	2^+	$+^+$
Tsuga heterophylla	$+^0$	$+^0$	2^0	$+^0$	1^0	2^0
Thuja plicata	-	-	1^0	1^0	$+^0$	$+^0$
D (on decaying wood)						
Hylocomium splendens	2^2	2^1	4^3	3^2	2^1	2^2
Eurhynchium oreganum	4^2	3^2	3^2	4^2	2^2	$+^+$
Scapania bolanderi	-	$+^1$	1^2	1^1	1^2	1^2
Dicranum fuscescens	-	1^2	1^2	-	1^1	$+^2$
Dicranum scoparium	2^1	1^1	-	$+^1$	-	-
Hypnum circinale	2^2	2^2	2^2	-	1^2	$+^2$
Mnium punctatum	$+^1$	-	$+^1$	-	-	-
Cephalozia media	-	-	1^2	-	-	-
Cladonia macilenta	-	-	-	-	-	$+^1$
Rhytidiadelphus loreus	-	-	$+^2$	1^2	1^2	-
Pseudisothecium stoloniferum	$+^1$	1^1	-	-	-	-
Plagiothecium undulatum	-	-	-	$+^1$	-	$+^1$
Rhytidiopsis robusta	-	-	-	-	-	$+^2$
Icmadophila ericetorum	-	-	-	-	-	$+^1$
Ptilidium pulcherrimum	-	-	-	-	-	$+^2$
Scapania umbrosa	-	-	$+^2$	-	-	-
Lepidozia reptans	-	-	$+^2$	-	-	-
Aulacomnium androgynum	-	$+^1$	-	-	-	-
Calypogeia trichomanis	-	-	$+^1$	-	-	-
Tsuga heterophylla	$+^0$	$+^0$	1^0	-	$+^0$	$+^0$
Pseudotsuga menziesii	-	-	$+^0$	-	$+^0$	-
Thuja plicata	-	-	$+^0$	-	-	-
D (on tree bark) on PSEUDOTSUGA MENZIESII						
Dicranum fuscescens	1^2	3^3	2^2	3^2	$+^1$	$+^2$
Sphaerophorus globosus	$+^+$	1^1	1^2	1^1	-	1^2
Hypnum circinale	2^1	2^2	3^2	4^3	-	$+^2$
Cladonia macilenta	3^2	2^1	4^2	$+^1$	$+^1$	$+^2$
Cetraria lacunosa	3^2	2^1	1^2	-	-	+
Cetraria scutata	1^1	-	-	-	-	-
Nephromopsis ciliaris	3^2	2^1	2^2	-	-	$+^1$
Parmelia physodes	$+^1$	-	1^2	-	1^1	1^2
Ochrolechia pallescens	$+^1$	1^1	$+^1$	-	-	$+^2$

	PSEUDOTSUGA - GAULTHERIA ASSOCIATION PLOT G5	G4	G6	G3	PSEUDOTSUGA - TSUGA - GAULTHERIA ASS'N. PLOT G1	G2
D (continued)						
Scapania bolanderi	-	-	$+^1$	2^1	-	-
Ptilidium pulcherrimum	-	-	-	-	-	$+^2$
Aulacomnium androgynum	$+^1$	$+^2$	-	-	-	-
-Eurhynchium oreganum	1^1	2^1	2^1	2^1	-	-
-Pseudisothecium stoloniferum	$+^1$	-	-	-	1^1	-
Alectoria sarmentosa	1^+	$+^1$	-	-	$+^1$	$+^1$
Alectoria jubata	$+^1$	$+^+$	-	-	-	-
Dicranum strictum	1^2	2^2	-	-	-	-
Dicranum scoparium	$+^1$	-	-	$+^1$	-	-
Rhytidiadelphus loreus	-	-	-	$+^1$	$+^1$	-
Mycoblastus sanguinarius	-	-	-	-	-	$+^2$
Cladonia subsquamosa	-	$+^1$	-	-	-	-
Cladonia bellidiflora	$+^1$	-	-	-	-	-
Pertusaria ambigens	-	-	-	-	-	$+^1$
Graphis scripta	-	-	-	-	$+^1$	-
on PINUS MONTICOLA						
Hypnum circinale	-	-	$+^2$	-	$+^2$	$+^2$
Parmelia physodes	-	-	$+^2$	-	$+^2$	$+^2$
Dicranum fuscescens	-	-	-	-	$+^1$	$+^1$
Sphaerophorus globosus	-	-	$+^2$	-	-	$+^2$
Cetraria lacunosa	-	-	$+^1$	-	-	$+^1$
Nephromopsis ciliaris	-	-	$+^2$	-	-	$+^1$
Cladonia macilenta	-	-	$+^2$	-	-	-
Ochrolechia pallescens	-	-	-	-	-	$+^2$
Ptilidium pulcherrimum	-	-	-	-	-	$+^1$
Lobaria oregana	-	-	$+^1$	-	$+^2$	$+^2$
Pertusaria ambigens	-	-	-	-	-	$+^2$
Rhytidiadelphus loreus	-	-	-	-	-	$+^+$
Hylocomium splendens	-	-	-	-	-	$+^+$
-Eurhynchium oreganum	-	-	$+^1$	-	-	-
on TSUGA HETEROPHYLLA						
Hypnum circinale	1^1	1^1	4^2	1^2	-	1^2
Cladonia macilenta	-	-	2^2	-	1^2	1^2
Cetraria lacunosa	-	-	1^2	-	-	2^3
Nephromopsis ciliaris	-	-	1^2	-	-	2^2
Pertusaria ambigens	-	-	2^2	-	-	2^2
Scapania bolanderi	-	-	$+^1$	$+^1$	-	-
Parmelia physodes	-	-	-	-	-	2^2
Dicranum fuscescens	-	-	-	$+^1$	$+^1$	-
Sphaerophorus globosus	-	-	2^2	$+^1$	-	-
Ochrolechia pallescens	-	-	-	-	-	1^3
Thelotrema lepadinum	-	-	2^2	-	-	-
-Eurhynchium oreganum	1^1	1^1	3^1	$+^1$	-	-
-Pseudisothecium stoloniferum	-	-	-	-	$+^1$	-
-Hylocomium splendens	-	-	1^1	$+^1$	-	-
Lobaria oregana	-	-	1^2	-	1^1	2^2
Mycoblastus sanguinarius	-	-	1^2	-	-	2^3
Rhytidiadelphus loreus	-	-	-	$+^1$	-	$+^1$
Alectoria sarmentosa	-	-	-	-	-	$+^+$
on THUJA PLICATA						
Cladonia macilenta	-	2^1	$+^2$	-	$+^+$	-
Lobaria oregana	-	-	$+^1$	-	-	$+^2$
-Hypnum circinale	-	-	1^3	1^1	-	$+^2$
Dicranum fuscescens	-	-	-	$+^1$	-	$+^1$
Sphaerophorus globosus	-	-	1^2	-	-	$+^2$
Parmelia physodes	-	-	-	-	-	$+^2$
Ochrolechia pallescens	-	-	-	-	-	$+^1$
Scapania bolanderi	-	-	-	$+^1$	-	-
Thelotrema lepadinum	-	-	$+^2$	-	-	-
Eurhynchium oreganum	-	1^1	$+^1$	$+^1$	-	-
Pseudisothecium stoloniferum	-	-	$+^1$	-	1^1	-
Rhytidiadelphus loreus	-	-	-	$+^1$	1^1	$+^1$
Hylocomium splendens	-	-	$+^+$	-	-	$+^0$
Alectoria sarmentosa	-	-	-	-	-	$+^1$
Mycoblastus sanguinarius	-	-	-	-	-	$+^2$

The main numeral in each column is the total estimate value for each species, based on a scale from + to 10.
The index represents the vitality, on a scale from 0 to 3.

Interpretation of symbols:

o Largely on exposed rock and stones.
- Largely at the bases of trees.

TABLE 5: TOTAL ESTIMATE ANALYSIS OF THE <u>PSEUDOTSUGA MENZIESII</u> - <u>TSUGA HETEROPHYLLA</u> - <u>HYLOCOMIUM SPLENDENS</u> - <u>EURHYNCHIUM OREGANUM</u>

ASSOCIATION PLOTS

		PLOT M5	PLOT M2	PLOT M4	PLOT M3	PLOT M1
Date analysed		10 June'52	19 June'52	5 June'52	11 July'51	2 Aug'53
Altitude (ft.)		810	1600	700	850	1080
Exposure		SSW	SW	SW	NE	NW
Slope		10°	20°	4°	25°	25°
Wind exposure		+	+(+)	(+)	+	+
Cover:	A1	60% } 80%	75% } 80%	60% } 85%	60% } 75%	60% } 85%
	A2	10%	5%	20%	15%	20%
	A3	40%	5%	50%	20%	30%
	B1	20% } 20%	5% } 5%	40% } 45%	5% } 5%	5% } 7%
	B2	+	+	5%	+	2%
	C	5%	5%	5%	5%	5%
	D	10%	5%	60%	70%	35%

	PLOT				
	M5	M2	M4	M3	M1
A1					
Pseudotsuga menziesii	8^{3}	8^{3}	8^{2}	8^{2}	6^{2}
Tsuga heterophylla	-	-	-	-	6^{3}
Pinus monticola	-	-	-	$+^{1}$	-
A2					
Pseudotsuga menziesii	5^{2}	-	4^{2}	4^{2}	4^{2}
Tsuga heterophylla	-	1^{2}	3^{2}	3^{2}	5^{2}
Thuja plicata	-	1^{2}	$+^{2}$	$+^{2}$	$+^{2}$
A3					
Tsuga heterophylla	6^{2}	4^{2}	7^{2}	5^{2}	3^{2}
Thuja plicata	-	$+^{2}$	$+^{2}$	$+^{2}$	3^{3}
Pseudotsuga menziesii	1	-	-	$+^{1}$	$+^{1}$
Abies grandis	$+^{2}$	-	-	-	-
B1					
Tsuga heterophylla	5^{1}	1^{1}	6^{1}	2^{1}	2^{1}
Thuja plicata	-	1^{1}	-	-	1^{1}
Abies grandis	$+^{1}$	-	-	-	-
B2					
Tsuga heterophylla	$+^{1}$	$+^{1}$	3^{1}	1^{1}	1^{1}
Thuja plicata	-	$+^{1}$	-	-	1^{1}
Gaultheria shallon	-	-	3^{1}	1^{1}	2^{1}
Mahonia nervosa	-	-	1^{1}	-	2^{1}
Vaccinium parvifolium	-	-	-	$+^{1}$	-
Rubus spectabilis	-	-	-	$+^{2}$	-
Abies grandis	$+^{1}$	-	-	-	-
C					
Chimaphila menziesii	$+^{2}$	3^{3}	3^{3}	2^{3}	2^{2}
Mahonia nervosa	1^{2}	$+^{1}$	2^{1}	$+^{1}$	3^{2}
Linnaea borealis	+	-	$+^{2}$	$+^{2}$	4^{2}
Viola orbiculata	1^{2}	3^{2}	1^{2}	-	2^{1}
Pyrola picta	$+^{2}$	$+^{3}$	2^{2}	$+^{2}$	-
Pyrola bracteata	-	-	-	-	$+^{2}$
Monotropa uniflora	$+^{2}$	-	$+^{2}$	1^{3}	$+^{2}$
Monotropa latisquama	-	1^{2}	-	$+^{2}$	-
Listera cordata	$+^{3}$	1^{1}	-	-	-
Corallorhiza maculata	1^{2}	-	-	$+^{2}$	-
^Vaccinium parvifolium	1^{1}	1^{1}	$+^{1}$	1^{1}	3^{2}
Chimaphila umbellata	$+^{1}$	$+^{1}$	1^{1}	1^{1}	3^{2}
Achlys triphylla	1^{1}	$+^{1}$	1^{1}	$+^{1}$	2^{1}
Goodyera oblongifolia	$+^{1}$	$+^{1}$	$+^{2}$	1^{2}	1^{1}
^Gaultheria shallon	$+^{1}$	-	$+^{1}$	$+^{1}$	3^{1}
Polystichum munitum	1^{1}	1^{1}	$+^{1}$	$+^{1}$	-
Trillium ovatum	$+^{1}$	$+^{1}$	$+^{1}$	-	$+^{1}$
Trientalis latifolia	$+^{2}$	1^{1}	$+^{1}$	-	-
Tiarella trifoliata	$+^{1}$	$+^{1}$	-	$+^{2}$	-
Tiarella laciniata	1^{1}	-	-	-	-
Allotropa virgata	-	-	$+^{2}$	$+^{3}$	$+^{2}$
Acer macrophyllum	$+^{1}$	$+^{1}$	-	$+^{1}$	-
Rubus vitifolius	$+^{1}$	-	$+^{2}$	-	-

	PLOT				
	M5	M2	M4	M3	M1
C (continued)					
Pteridium aquilinum	$+^{1}$	-	$+^{1}$	-	-
Rosa gymnocarpa	$+^{1}$	-	$+^{1}$	-	-
Claytonia sibirica	$+^{2}$	-	-	-	-
Galium triflorum	$+^{1}$	-	-	-	-
Dicentra formosa	$+^{1}$	-	-	-	-
Bromus vulgaris	$+^{1}$	-	-	-	-
Blechnum spicant	$+^{1}$	-	-	-	-
Symphoricarpos albus	-	-	$+^{1}$	-	-
Vaccinium alaskaense	-	-	-	-	1^{1}
Melica smithii	1^{2}	-	-	-	-
Carex leptopoda	1^{2}	-	-	-	-
Pseudotsuga menziesii	$+^{1}$	-	$+^{1}$	-	-
^Tsuga heterophylla	1^{1}	$+^{1}$	-	-	-
Thuja plicata	$+^{1}$	-	-	-	-
Abies grandis	1^{1}	-	-	$+^{1}$	-
Pinus monticola	-	-	-	$+^{0}$	-
D (on ground)					
Hylocomium splendens	4^{2}	1^{2}	7^{3}	7^{3}	5^{2}
Eurhynchium oreganum	4^{2}	4^{1}	5^{2}	5^{3}	5^{2}
Rhytidiadelphus loreus	$+^{2}$	1^{1}	$+^{2}$	5^{3}	1^{1}
Rhytidiadelphus triquetrus	$+^{2}$	-	$+^{2}$	-	-
Rhytidiopsis robusta	-	$+^{2}$	-	-	1^{1}
Mnium spinulosum	3^{3}	1^{2}	-	-	-
Plagiothecium elegans	-	$+^{1}$	-	-	$+^{1}$
Camptothecium megaptilum	$+^{1}$	-	-	$+^{2}$	$+^{1}$
•Pseudisothecium stoloniferum	3^{2}	-	-	1^{3}	1^{2}
Polyporus schweinitzii	2^{2}	1^{3}	-	1^{3}	-
Amanita sp.	1^{2}	-	$+^{2}$	-	-
Sparassis radicata	$+^{2}$	1^{2}	$+^{2}$	-	-
Dicranum fuscescens	2^{2}	$+^{1}$	$+^{1}$	-	-
Atrichum undulatum	$+^{1}$	-	-	-	-
Plagiochila asplenioides	-	-	$+^{2}$	-	-
•Claopodium crispifolium	-	1^{2}	-	-	-
Heterocladium procumbens	-	$+^{1}$	-	-	-
Pseudotsuga menziesii	1^{+}	$+^{0}$	1^{0}	1^{+}	1^{+}
Tsuga heterophylla	1^{0}	1^{0}	1^{0}	2^{0}	1^{0}
Thuja plicata	$+^{0}$	$+^{0}$	-	1^{0}	2^{0}
Abies grandis	2^{+}	-	-	$+^{1}$	-
Alnus rubra	-	-	-	$+^{1}$	-
D (on decayed wood)					
Hypnum circinale	4^{3}	4^{3}	4^{3}	4^{3}	3^{3}
Cephalozia media	2^{2}	2^{1}	2^{2}	1^{2}	2^{2}
Scapania bolanderi	2^{1}	1^{1}	2^{1}	1^{3}	-
Dicranum fuscescens	2^{2}	1^{2}	2^{3}	1^{3}	1^{2}
Lepidozia reptans	1^{1}	1^{2}	1^{2}	-	-
Lophocolea heterophylla	1^{2}	-	1^{2}	-	-
Mnium punctatum	-	-	$+^{1}$	-	-
Rhytidiadelphus loreus	$+^{2}$	-	$+^{1}$	$+^{3}$	$+^{2}$
Eurhynchium oreganum	1^{2}	-	2^{1}	$+^{2}$	$+^{2}$
Hylocomium splendens	1^{2}	-	2^{2}	1^{3}	1^{2}
•Ptilidium pulcherrimum	$+^{2}$	-	-	$+^{1}$	-
Riccardia latifrons	$+^{1}$	-	$+^{1}$	-	-
Calipogeia trichomanis	-	1^{2}	-	-	-

	PLOT				
	M5	M2	M4	M3	M1
D (on decayed wood; cont.)					
=Cladonia macilenta	-	-	-	$+^{2}$	-
Frullania nisquallensis	-	-	-	$+^{1}$	-
Pseudisothecium stoloniferum	-	-	$+^{1}$	-	-
Cephalozia leucantha	-	-	$+^{2}$	-	-
Icmadophila ericetorum	$+^{3}$	-	-	-	-
=Antitrichia curtipendula	$+^{1}$	-	-	-	-
Mnium spinulosum	$+^{2}$	-	-	-	-
Tsuga heterophylla	1^{1}	1^{1}	2^{1}	$+^{0}$	1^{1}
Pseudotsuga menziesii	$+^{0}$	-	-	-	-
Protococcus viridis	1^{3}	-	-	-	-
D (on trees)					
on PSEUDOTSUGA MENZIESII					
-Hypnum circinale	5^{3}	2^{3}	4^{3}	3^{3}	2^{3}
Dicranum fuscescens	1^{3}	2^{2}	2^{2}	3^{3}	2^{2}
-Scapania bolanderi	$+^{1}$	$+^{1}$	-	1^{2}	-
Frullania nisquallensis	-	-	-	-	1^{1}
Cladonia macilenta	4^{1}	3^{2}	3^{1}	2^{3}	-
*Pseudisothecium stoloniferum	2^{2}	-	-	$+^{2}$	1^{2}
-Eurhynchium oreganum	-	$+^{1}$	$+^{1}$	-	-
Parmelia physodes	$+^{1}$	-	-	-	-
Cetraria glauca	$+^{1}$	-	-	1^{3}	-
Sphaerophorus globosus	-	-	1^{1}	-	-
Protococcus viridis	1^{3}	-	-	-	-
on TSUGA HETEROPHYLLA					
-Hypnum circinale	2^{3}	3^{3}	3^{3}	1^{3}	2^{3}
Dicranum fuscescens	-	1^{2}	1^{2}	1^{2}	1^{2}
Scapania bolanderi	-	-	-	$+^{2}$	-
*Frullania nisquallensis	1^{1}	-	1^{2}	1^{2}	-
Cladonia macilenta	$+^{1}$	1^{1}	1^{1}	$+^{2}$	1^{1}
*Pseudisothecium stoloniferum	5^{2}	-	2^{1}	1^{2}	1^{2}
-Eurhynchium oreganum	-	-	1^{1}	-	-
Parmelia physodes	-	$+^{1}$	-	$+^{1}$	-
Sphaerophorus globosus	-	-	$+^{1}$	$+^{2}$	$+^{1}$
Mycoblastus sanguinarius	$+^{2}$	$+^{2}$	-	1^{2}	-
Pertusaria ambigens	-	-	$+^{1}$	1^{3}	-
Hylocomium splendens	-	-	$+^{1}$	-	-
Lophocolea heterophylla	$+^{1}$	-	-	-	-
Thelotrema lepadinum	-	-	1^{2}	-	-
Ptilidium pulcherrimum	-	-	-	$+^{2}$	-
on THUJA PLICATA					
-Hypnum circinale	$+^{2}$	3^{3}	1^{3}	$+^{2}$	-
-Dicranum fuscescens	$+^{1}$	1^{2}	$+^{1}$	$+^{2}$	1^{1}
Frullania nisquallensis	-	-	1^{1}	-	-
Cladonia macilenta	$+^{1}$	3^{2}	$+^{1}$	$+^{2}$	$+^{1}$
*Pseudisothecium stoloniferum	$+^{2}$	-	$+^{1}$	$+^{2}$	$+^{1}$
-Eurhynchium oreganum	-	$+^{1}$	$+^{1}$	$+^{1}$	-
Parmelia physodes	-	$+^{1}$	-	-	-
Sphaerophorus globosus	-	-	$+^{1}$	$+^{2}$	$+^{1}$
Mycoblastus sanguinarius	-	-	$+^{2}$	-	-
-Hylocomium splendens	-	-	$+^{1}$	$+^{1}$	-
Ptilidium pulcherrimum	-	$+^{2}$	-	-	-
Antitrichia curtipendula	-	-	-	$+^{2}$	-

The main numeral in each column is the total estimate value for each species, based on a scale from + to 10.
The index represents the vitality, on a scale from 0 to 3.

Interpretation of symbols:

• Largely on exposed rock and stones.
^ Largely on decaying wood.
* Largely on dead branches.
- Largely at the bases of the trees.
= Surviving on fallen trunks and branches.

TABLE 6: TOTAL ESTIMATE ANALYSIS OF THE *PSEUDOTSUGA MENZIESII* - *THUJA PLICATA* - *POLYSTICHUM MUNITUM* ASSOCIATION PLOTS

	PLOT P4	PLOT P1	PLOT P2	PLOT P5	PLOT P3
Date analysed	22 June'52	2 Aug'53	21 June'52	20 June'52	20 June'52
Altitude (ft.)	840	1050	1410	760	640
Exposure	NE	NW	SW	SW	-
Slope	2°	20°	10°	5°	0°
Wind exposure	+	+	+	+	(+)
Cover A1	75%	70%	60%	70%	70%
A2	5% } 80%	20% } 75%	5% } 65%	10% } 75%	5% } 75%
A3	20%	10%	10%	10%	5%
B1	15% } 20%	10% } 10%	15% } 20%	10% } 15%	15% } 20%
B2	5%	2%	5%	5%	10%
C	65%	50%	70%	60%	70%
D	20%	12%	7%	15%	15%

PLOT	P4	P1	P2	P5	P3
A1					
Pseudotsuga menziesii	8^{3}	8^{3}	8^{3}	8^{3}	8^{3}
A2					
Pseudotsuga menziesii	1^{2}	$+^{2}$	-	1^{2}	-
Tsuga heterophylla	1^{2}	5^{3}	3^{2}	3^{2}	1^{2}
Thuja plicata	$+^{2}$	$+^{3}$	$+^{3}$	1^{3}	-
Abies grandis	-	-	-	1^{2}	-
A3					
Tsuga heterophylla	3^{2}	3^{2}	2^{2}	3^{2}	1^{2}
Thuja plicata	$+^{2}$	$+^{2}$	$+^{2}$	$+^{2}$	$+^{2}$
Abies grandis	-	-	-	-	$+^{2}$
Acer macrophyllum	-	-	-	-	$+^{3}$
B1					
Tsuga heterophylla	$+^{1}$	2^{1}	3^{1}	$+^{1}$	$+^{1}$
Pseudotsuga menziesii	-	$+^{+}$	-	-	-
B2					
Tsuga heterophylla	2^{1}	3^{1}	3^{1}	3^{1}	2^{1}
Thuja plicata	-	1^{1}	1^{1}	1^{1}	-
Rosa gymnocarpa	-	-	$+^{1}$	$+^{2}$	1^{2}
Rubus spectabilis	-	-	$+^{1}$	-	$+^{1}$
Vaccinium parvifolium	-	-	1^{1}	-	$+^{1}$
Abies grandis	-	-	-	-	$+^{+}$
C					
Polystichum munitum	7^{3}	6^{2}	5^{3}	6^{2}	5^{1}
Tiarella trifoliata	2^{2}	2^{2}	4^{3}	3^{2}	6^{3}
Achlys triphylla	3^{2}	4^{2}	5^{2}	2^{2}	6^{3}
Galium triflorum	3^{2}	1^{2}	3^{2}	2^{2}	2^{3}
Trillium ovatum	1^{1}	2^{1}	2^{2}	1^{1}	2^{2}
Tiarella laciniata	1^{1}	-	4^{2}	2^{2}	3^{2}
Athyrium filix-femina	-	-	2^{1}	1^{1}	1^{1}
Adenocaulon bicolor	$+^{1}$	-	2^{2}	$+^{1}$	3^{2}
Dryopteris linnaeana	4^{2}	-	$+^{+}$	$+^{1}$	1^{2}
Claytonia sibirica	1^{1}	$+^{1}$	1^{1}	2^{2}	-
Streptopus amplexifolius	1^{2}	-	$+^{1}$	1^{2}	$+^{1}$
Festuca subulata	-	-	-	1^{2}	1^{2}
Melica subulata	1^{2}	-	1^{2}	-	-
Carex hendersonii	-	-	$+^{2}$	1^{2}	$+^{2}$
Carex leptopoda	-	-	-	1^{2}	2^{2}
Blechnum spicant	-	-	3^{2}	5^{2}	-
Sambucus pubens	-	-	$+^{1}$	$+^{1}$	-
Dicentra formosa	-	-	-	$+^{1}$	-
Mahonia nervosa	-	2^{2}	2^{2}	3^{2}	3^{2}
Linnaea borealis	-	3^{2}	3^{2}	1^{2}	1^{2}
Viola orbiculata	1^{1}	1^{1}	3^{2}	$+^{1}$	-
Trientalis latifolia	-	1^{1}	2^{2}	1^{2}	2^{2}
Luzula parviflora	$+^{1}$	-	1^{2}	$+^{3}$	$+^{1}$
Chimaphila menziesii	-	2^{1}	1^{1}	-	$+^{1}$
^Chimaphila umbellata	-	$+^{1}$	1^{1}	$+^{1}$	-
Rubus vitifolius	-	$+^{1}$	$+^{1}$	$+^{1}$	$+^{1}$
Rubus nivalis	-	-	1^{2}	-	-
Disporum oreganum	$+^{1}$	-	$+^{1}$	-	1^{1}
Vaccinium parvifolium	-	$+^{1}$	1^{1}	1^{1}	-
Vaccinium alaskaense	-	1^{1}	$+^{1}$	-	1^{1}
Rosa gymnocarpa	-	-	-	$+^{2}$	$+^{2}$
^Goodyera oblongifolia	-	$+^{1}$	$+^{1}$	$+^{1}$	-
Adiantum pedatum	$+^{1}$	-	$+^{1}$	-	1^{1}
Veratrum eschscholtzii	$+^{1}$	-	$+^{1}$	$+^{1}$	$+^{1}$
Circaea pacifica	-	-	$+^{2}$	$+^{2}$	1^{2}
Circaea alpina	-	-	-	1^{2}	-
^Gaultheria shallon	-	1^{1}	2^{1}	2^{1}	-
Viola glabella	-	1^{1}	$+^{1}$	-	1^{2}
Bromus vulgaris	$+^{1}$	-	-	4^{2}	2^{2}
C (continued)					
Campanula scouleri	-	-	-	-	1^{2}
Pteridium aquilinum	-	1^{1}	-	$+^{1}$	-
Monotropa uniflora	1^{1}	-	-	1^{1}	-
Listera caurina	$+^{1}$	-	-	$+^{2}$	$+^{1}$
Smilacina stellata	-	-	$+^{1}$	$+^{3}$	$+^{2}$
Maianthemum dilatatum	-	-	$+^{+}$	-	$+^{+}$
Osmorhiza chilensis	-	-	-	-	$+^{2}$
Rubus spectabilis	-	-	$+^{1}$	-	$+^{1}$
Ranunculus bongardii	-	-	$+^{1}$	$+^{2}$	1^{2}
Galium aparine	-	-	-	1^{2}	$+^{1}$
Mitella ovalis	-	-	$+^{1}$	1^{2}	-
Lysichitum americanum	-	-	1^{1}	1^{1}	-
Stachys ciliata	-	-	$+^{1}$	$+^{1}$	-
Glyceria nervosa	-	-	-	$+^{2}$	-
Stellaria crispa	-	-	-	1^{2}	-
Rubus leucodermis	-	$+^{1}$	-	-	-
^Hieracium albiflorum	-	-	-	$+^{1}$	-
Pseudotsuga menziesii	-	-	$+^{1}$	-	-
Tsuga heterophylla	-	1^{1}	1^{1}	-	1^{1}
Thuja plicata	-	-	1^{1}	1^{1}	$+^{+}$
Abies grandis	-	-	-	1^{1}	1^{+}
D (on ground)					
Eurhynchium oreganum	2^{2}	5^{2}	2^{2}	3^{2}	5^{2}
Mnium insigne	4^{2}	$+^{1}$	$+^{1}$	4^{3}	4^{2}
Mnium menziesii	-	$+^{1}$	$+^{1}$	4^{3}	-
Hylocomium splendens	5^{2}	1^{2}	1^{2}	3^{2}	2^{2}
Rhytidiadelphus loreus	-	1^{2}	2^{2}	-	$+^{2}$
Rhytidiopsis robusta	-	1^{2}	1^{2}	-	-
Mnium punctatum	-	-	$+^{1}$	2^{2}	-
Conocephalum conicum	-	-	$+^{1}$	2^{3}	-
Eurhynchium stokesii	-	-	$+^{1}$	3^{2}	-
Plagiochila asplenioides	-	-	-	1^{2}	-
Plagiothecium undulatum	-	1^{2}	-	-	-
+Atrichum undulatum	-	-	-	$+^{2}$	-
Rhytidiadelphus triquetrus	-	-	-	-	1^{2}
Polyporus schweinitzii	-	$+^{2}$	$+^{2}$	2^{2}	$+^{2}$
Pseudotsuga menziesii	2^{+}	1^{+}	1^{0}	2^{0}	2^{+}
Tsuga heterophylla	2^{0}	2^{0}	2^{0}	2^{0}	
Thuja plicata	2^{0}	2^{0}	2^{+}	1^{0}	2^{0}
Abies grandis	-	-	-	2^{+}	2^{+}
Acer macrophyllum	$+^{+}$	-	-	-	$+^{+}$
D (on decaying wood)					
Lepidozia reptans	1^{2}	1^{2}	2^{1}	2^{3}	1^{2}
Mnium punctatum	$+^{1}$	$+^{1}$	1^{2}	2^{1}	1^{2}
Mnium spinulosum	$+^{2}$	$+^{1}$	$+^{2}$	$+^{3}$	$+^{2}$
Plagiothecium denticulatum	1^{1}	-	$+^{1}$	$+^{1}$	-
Isoadophila ericetorum	-	$+^{2}$	-	$+^{2}$	-
Riccardia latifrons	1^{2}	-	-	1^{3}	-
Calypogeia trichomanis	-	-	-	1^{2}	-
Eurhynchium oreganum	3^{2}	-	2^{2}	3^{3}	2^{2}
Hylocomium splendens	2^{2}	-	3^{2}	4^{3}	3^{2}
Rhytidiadelphus loreus	1^{2}	$+^{1}$	1^{1}	2^{3}	$+^{1}$
Pseudisothecium stoloniferum	2^{1}	1^{1}	1^{1}	$+^{1}$	2^{1}
Cephalozia media	1^{2}	-	2^{2}	4^{3}	2^{2}
Cephalozia leucantha	-	$+^{1}$	$+^{2}$	$+^{2}$	$+^{2}$
Scapania bolanderi	$+^{1}$	$+^{1}$	1^{2}	1^{2}	1^{2}
Dicranum fuscescens	2^{2}	1^{1}	1^{2}	2^{2}	1^{2}
Hypnum circinale	1^{2}	1^{2}	-	3^{2}	1^{2}
Dicranum scoparium	-	-	$+^{2}$	1^{2}	$+^{2}$
Rhytidiadelphus triquetrus	-	-	-	$+^{2}$	$+^{1}$
Fomes applanatus	-	-	-	1^{2}	1^{2}
D (continued)					
Rhytidiopsis robusta	-	$+^{1}$	$+^{1}$	-	-
Ptilidium pulcherrimum	-	-	-	$+^{2}$	-
Plagiothecium undulatum	-	-	-	$+^{2}$	-
Antitrichia curtipendula	-	-	-	-	$+^{0}$
Cladonia macilenta	-	$+^{+}$	-	1^{+}	-
Lophocolea heterophylla	-	-	-	1^{2}	-
Pleurococcus viridis	-	-	-	2^{2}	-
Tsuga heterophylla	-	2^{1}	3^{1}	$+^{1}$	$+^{1}$
Thuja plicata	-	-	1^{1}	-	-
Pseudotsuga menziesii	-	-	-	$+^{0}$	$+^{0}$
Abies grandis	-	-	-	$+^{+}$	$+^{1}$
D (on tree bark)					
on PSEUDOTSUGA MENZIESII					
Pseudisothecium stoloniferum	$+^{1}$	-	-	$+^{1}$	-
Hypnum circinale	2^{2}	3^{2}	-	4^{2}	4^{3}
Dicranum fuscescens	1^{2}	3^{3}	2^{2}	3^{2}	3^{3}
Scapania bolanderi	-	3^{2}	2^{2}	2^{2}	2^{2}
Hylocomium splendens	1^{1}	-	2^{2}	-	1^{1}
Cladonia macilenta	-	3^{2}	2^{1}	6^{1}	3^{2}
Parmelia physodes	1^{1}	$+^{1}$	-	-	$+^{1}$
Pleurococcus viridis	-	-	2^{1}	1^{2}	2^{2}
Plagiothecium elegans	-	$+^{1}$	$+^{2}$	-	$+^{2}$
Sphaerophorus globosus	-	$+^{1}$	-	-	$+^{1}$
on TSUGA HETEROPHYLLA					
Pseudisothecium stoloniferum	2^{2}	2^{2}	3^{2}	3^{2}	4^{2}
Porella navicularis	1^{2}	1^{2}	2^{2}	-	2^{2}
Neckera douglasii	-	1^{2}	1^{2}	-	1^{2}
Frullania nisquallensis	2^{2}	1^{2}	-	1^{2}	2^{2}
Radula complanata	-	1^{1}	-	-	1^{2}
Hypnum circinale	-	1^{2}	1^{2}	4^{2}	$+^{1}$
Dicranum fuscescens	1^{1}	1^{1}	2^{2}	1^{1}	$+^{1}$
Eurhynchium oreganum	1^{1}	-	-	1^{1}	1^{1}
Cladonia macilenta	1^{1}	1^{1}	-	2^{1}	-
Thelotrema lepadinum	-	-	-	1^{3}	-
Parmelia physodes	-	-	-	$+^{+}$	-
Sphaerophorus globosus	-	$+^{1}$	-	-	-
Ptilidium pulcherrimum	-	-	-	-	1^{2}
Rhytidiadelphus loreus	-	-	$+^{+}$	-	$+^{1}$
Pleurococcus viridis	-	$+^{1}$	-	1^{3}	-
on THUJA PLICATA					
Pseudisothecium stoloniferum	$+^{1}$	1^{2}	$+^{1}$	1^{2}	$+^{3}$
Porella navicularis	$+^{1}$	$+^{1}$	-	-	$+^{3}$
Neckera douglasii	-	-	-	-	$+^{2}$
Frullania nisqualensis	1^{1}	-	-	-	$+^{2}$
Radula complanata	-	-	-	-	$+^{2}$
Radula bolanderi	-	-	-	-	$+^{2}$
Hypnum circinale	-	1^{2}	1^{1}	$+^{2}$	-
Scapania bolanderi	-	-	$+^{1}$	-	$+^{1}$
Dicranum fuscescens	-	2^{2}	$+^{1}$	-	-
Cladonia macilenta	$+^{1}$	1^{1}	$+^{1}$	$+^{1}$	$+^{1}$
-Eurhynchium oreganum	-	-	1^{1}	$+^{2}$	-
Sphaerophorus globosus	-	1^{2}	-	-	-
Ptilidium pulcherrimum	-	-	-	-	$+^{2}$
Lobaria oregona	-	-	-	-	$+^{2}$
Lobaria pulmonaria	-	-	-	-	$+^{2}$
Lobaria anthrapsis	-	-	-	-	$+^{2}$
on ABIES GRANDIS					
Pseudisothecium stoloniferum	-	-	-	3^{2}	4^{2}
Porella navicularis	-	-	-	-	$+^{1}$
Neckera douglasii	-	-	-	-	$+^{1}$
Dicranum fuscescens	-	-	-	$+^{2}$	$+^{1}$
Eurhynchium oreganum	-	-	-	1^{2}	$+^{1}$
Cladonia macilenta	-	-	-	$+^{2}$	$+^{2}$
Plagiothecium denticulatum	-	-	-	-	$+^{1}$
Plagiothecium elegans	-	-	-	-	$+^{1}$
Hypnum circinale	-	-	-	1^{2}	-
Scapania bolanderi	-	-	-	-	$+^{1}$

The main numeral in each column is the total estimate value for each species, based on a scale from + to 10. The index represents the vitality, on a scale from 0 to 3.

Interpretation of symbols:
+ On mineral soil of windthrows.
^ Largely on decaying wood.
- Largely at the bases of the trees.

TABLE 7: TOTAL ESTIMATE ANALYSIS OF THE THUJA PLICATA - LYSICHITUM AMERICANUM ASSOCIATION PLOTS

	PLOT Ly3	PLOT Ly2	PLOT Ly1
Date analysed	10 June'52	21 June '52	19 June '52
Altitude (ft.)	770	830	1450
Exposure	SW	NE	SW
Slope	3^o	2^o	10^o
Wind Exposure	(+)	(+)	(+)
Cover A1	50%	40%	40%
A2	15% } 65%	10% } 50%	10% } 50%
A3	10%	5%	10%
B1	10% } 10%	15% } 15%	20% } 20%
B2	3%	5%	10%
C	70%	85%	80%
D	60%	50%	60%

	PLOT Ly3	PLOT Ly2	PLOT Ly1
A1			
Thuja plicata	7^3	7^3	7^3
Pseudotsuga menziesii	2^2	1^2	1^2
Tsuga heterophylla	-	-	$+^2$
Pinus monticola	-	-	$+^2$
Abies grandis	$+^2$	-	-
A2			
Thuja plicata	1^2	2^2	3^2
Tsuga heterophylla	1^1	1^1	$+^1$
A3			
Thuja plicata	1^1	1^1	2^1
Tsuga heterophylla	2^1	1^1	1^1
B1			
Oplopanax horridus	-	3^2	-
xTsuga heterophylla	4^1	4^1	4^1
xThuja plicata	2^1	$+^1$	1^1
xRubus spectabilis	-	3^2	-
B2			
xTsuga heterophylla	3^1	3^1	3^1
xGaultheria shallon	3^2	1^2	1^2
xRubus spectabilis	$+^2$	2^2	1^2
xRubus leucodermis	-	-	1^2
xThuja plicata	2^1	-	-
xVaccinium parvifolium	1^2	1^2	1^2
xVaccinium alaskaensis	-	-	$+^+$
Spiraea douglasii	-	-	$+^+$
C			
Lysichitum americanum	8^2	7^2	8^3
Veratrum eschscholtzii	1^1	2^2	2^2
Circaea pacifica	$+^2$	1^2	$+^2$
Mitella ovalis	1^2	4^2	-
Oenanthe sarmentosa	2^2	3^2	-
Cardamine angulata	1^3	2^2	-
Veronica americana	-	-	2^3
Stachys ciliata	2^2	-	-
Maianthemum dilatatum	-	1^2	-
Mimulus moschatus	$+^2$	-	-
Tiarella trifoliata	3^2	4^2	4^2
Claytonia sibirica	4^2	2^2	3^2
Galium triflorum	2^2	3^2	3^2
Tiarella laciniata	3^2	2^2	2^2
Athyrium filix-femina	1^2	3^2	2^1
Carex leptopoda	1^2	$+^2$	2^2
Luzula parviflora	$+^2$	$+^1$	$+^2$
Dryopteris linnaeana	$+^1$	1^2	-
Galium boreale	-	2^2	-
Epilobium adenocaulon	-	2^2	-
Adiantum pedatum	-	1^1	1^+
Listera convallarioides	-	-	2^3
Viola glabella	-	-	2^2
Streptopus amplexifolius	2^2	1^1	2^2
C (continued)			
Equisetum arvense	1^2	$+^1$	$+^2$
Glyceria striata	$+^2$	-	-
Viola orbiculata	-	2^2	$+^2$
xBlechnum spicant	3^2	2^2	4^2
xAchlys triphylla	1^1	2^1	4^1
xTrillium ovatum	$+^2$	1^2	$+^1$
xVaccinium parvifolium	2^2	2^2	-
xGaultheria shallon	1^1	$+^1$	-
xRubus spectabilis	-	$+^1$	$+^1$
xGoodyera oblongifolia	$+^+$	-	2^+
xPolystichum munitum	1^2	-	1^2
xMahonia nervosa	$+^2$	-	$+^+$
xAdenocaulon bicolor	-	-	$+^2$
xRubus nivalis	-	-	$+^+$
xListera cordata	-	-	$+^+$
xThuja plicata	-	-	$+^+$
xRubus vitifolius	$+^2$	-	-
xPteridium aquilinum	$+^1$	-	-
D (on ground)			
Mnium punctatum	6^3	5^3	7^2
Eurhynchium stokesii	5^3	5^3	4^3
Brachythecium washingtonianum	4^3	4^3	5^3
Conocephalum conicum	3^3	2^1	3^3
Mnium menziesii	4^2	4^2	1^2
Pellia columbiana	1^2	3^2	2^2
Mnium insigne	1^2	3^2	$+^1$
Riccardia latifrons	1^2	-	-
Plagiochila asplenioides	$+^2$	-	-
Chiloscyphus rivularis	$+^2$	-	-
Pogonatum alpinum	$+^1$	-	-
Atrichum undulatum	-	-	$+^1$
xHylocomium splendens	3^2	2^2	1^1
xEurhynchium oreganum	4^2	$+^1$	-
xPseudisothecium stoloniferum	1^2	$+^1$	-
xPlagiothecium denticulatum	$+^2$	1^2	-
xPlagiothecium undulatum	-	1^2	-
xTsuga heterophylla	$+^+$	1^+	1^+
xPseudotsuga menziesii	$+^0$	-	$+^+$
xAbies grandis	$+^0$	$+^0$	-
xThuja plicata	2^1	2^1	2^+
D (on decaying wood)			
Cephalozia media	3^2	2^2	2^3
Calypogeia trichomanis	2^3	$+^2$	$+^2$
Mnium punctatum	2^2	1^2	2^2
Scapania bolanderi	3^3	1^2	2^3
Hylocomium splendens	4^3	2^2	1^2
Eurhynchium oreganum	3^2	2^1	1^2
Dicranum fuscescens	$+^2$	1^1	2^2
Lepidozia reptans	2^2	1^2	1^3
Rhytidiadelphus loreus	1^2	1^2	1^2
Mnium spinulosum	$+^2$	$+^1$	$+^2$
Plagiothecium denticulatum	$+^2$	$+^1$	$+^2$
Hypnum circinale	-	2^2	4^3
D (continued)			
Cladonia macilenta	-	$+^1$	$+^1$
Mnium menziesii	$+^2$	$+^+$	-
Peltigera canina	$+^2$	-	$+^3$
Hookeria lucens	$+^2$	-	-
Scapania umbrosa	-	-	$+^2$
Rhytidiopsis robusta	-	-	$+^1$
▪Pseudisothecium stoloniferum	3^2	2^2	4^3
▪Neckera douglasii	$+^1$	$+^1$	$+^2$
▪Porella navicularis	$+^1$	-	$+^2$
▪Lobaria oregona	-	-	$+^+$
▪Sphaerophorus globosus	-	-	$+^+$
▪Antitrichia curtipendula	-	-	$+^2$
▪Frullania nisquallensis	$+^2$	-	-
Thuja plicata	1^+	1^+	2^+
Tsuga heterophylla	1^+	1^+	2^+
Pseudotsuga menziesii	-	-	$+^0$
D (on tree bark)			
on THUJA PLICATA			
Hypnum circinale	1^1	2^2	3^2
Dicranum fuscesens	$+^2$	2^2	2^2
Cladonia macilenta	1^1	1^1	3^2
▪Pseudisothecium stoloniferum	2^2	1^2	$+^1$
Scapania bolanderi	1^2	$+^1$	$+^1$
Frullania nisquallensis	-	$+^1$	$+^2$
Parmelia physodes	-	$+^1$	$+^1$
Cetraria lacunosa	-	-	$+^1$
Sphaerophorus globosus	-	-	$+^1$
Ochrolechia palescens	-	-	$+^1$
Mycoblastus sanguinarius	-	-	$+^2$
Rhytidiadelphus loreus	-	-	$+^1$
Radula bolanderi	-	-	$+^1$
Neckera douglasii	$+^2$	-	-
on TSUGA HETEROPHYLLA			
Hypnum circinale	2^2	2^2	1^2
▪Pseudisothecium stoloniferum	4^2	2^2	1^2
Scapania bolanderi	$+^1$	$+^1$	$+^2$
Frullania nisquallensis	1^2	1^2	1^2
Dicranum fuscescens	-	1^1	1^2
Radula bolanderi	$+^2$	-	1^2
Cladonia macilenta	1^1	$+^2$	-
-Hylocomium splendens	$+^1$	$+^1$	-
-Eurhynchium oreganum	1^1	$+^1$	-
Cetraria lacunosa	-	-	$+^1$
Sphaerophorus globosus	-	-	$+^1$
Mycoblastus sanguinarius	-	-	$+^2$
Porella navicularis	1^2	-	-
Antitrichia curtipendula	$+^2$	-	-
on PSEUDOTSUGA MENZIESII			
Hypnum circinale	$+^3$	$+^3$	$+^3$
Dicranum fuscescens	$+^3$	$+^3$	$+^3$
Cladonia macilenta	$+^2$	$+^1$	$+^2$
Scapania bolanderi	-	-	$+^2$
Dicranum strictum	$+^1$	$+^1$	-
Pleurococcus viridis	1^2	-	-

The main numeral in each column is the total estimate value for each species, based on a scale from + to 10.
The index represents the vitality, on a scale from 0 to 3.

Interpretation of Symbols:
\+ On mineral soil of windthrows.
▪ Largely on dead branches.
\- Largely at the bases of the trees.
▪ Surviving on fallen trunks and branches.
x Largely on hummocks and banks at the edge of the swamp.

TABLE 8: MENSURATION ANALYSIS OF THE *PSEUDOTSUGA MENZIESII* - *PINUS CONTORTA* - *GAULTHERIA SHALLON* - *PELTIGERA CANINA* - *PELTIGERA APHTHOSA* ASSOCIATION PLOTS

	PLOT L5	PLOT L4	PLOT L3	PLOT L2	PLOT L1
Location	Wolf Mt.	Deadwood	Deadwood	Valley	Fourth Lk.
Date analysed (1952)	11 Aug.	14 Aug.	14 Aug.	17 July	18 July
Stand age (yrs.)	210	250	260	250	250
Site index (for *Pseudotsuga*)	90	80	80	90	70
TREE LAYER[1]					
Pseudotsuga menziesii					
Av.ht., dom. & codom. (ft.)	106	95	99	116	87
Trees per acre	140	108	160	152	92
Average diameter (in.)	17	18	16	19	19
Basal area (sq.ft./acre)	250	210	260	360	185
Volume (cu.ft./acre)	9,280	6,860	9,140	13,730	5,600
Pinus contorta					
Av.ht., dom. & codom. (ft.)	-	67	-	-	-
Trees per acre	-	4	-	-	-
Average diameter (in.)	-	8	-	-	-
Basal area (sq.ft./acre)	-	1	-	-	-
Volume (cu.ft./acre)	-	40	-	-	-
Tsuga heterophylla					
Av.ht., dom. & codom. (ft.)	-	-	-	60	-
Trees per acre	-	-	-	8	-
Average diameter (in.)	-	-	-	10	-
Basal area (sq.ft./acre)	-	-	-	4	-
Volume (cu.ft./acre)	-	-	-	110	-
Pinus monticola					
Av.ht., dom. & codom. (ft.)	-	-	-	61	-
Trees per acre	-	-	-	20	-
Average diameter (in.)	-	-	-	9	-
Basal area (sq.ft./acre)	-	-	-	8	-
Volume (cu.ft./acre)	-	-	-	200	-
SHRUB LAYER (Line intercept)					
Gaultheria shallon	25	35	33	38	24
Tsuga heterophylla	-	1	+	3	6
Mahonia nervosa	2	1	3	1	-
Pseudotsuga menziesii	1	1	1	-	-
Pinus monticola	-	3	1	-	-
Arctostaphylos uva-ursi	-	-	1	-	1
Arctostaphylos columbiana	-	+	-	-	-
Thuja plicata	-	-	-	-	1
Vaccinium membranaceum	-	-	-	-	+
Abies grandis	-	+	-	-	-
Pinus contorta	-	+	-	-	-

	PLOT L5	PLOT L4	LOT L3	PLOT L2	PLOT L1
HERB LAYER (Frequency)					
Gaultheria shallon	88	97	92	84	74
Linnaea borealis	13	4	40	26	21
Chimaphila umbellata	29	35	40	10	9
Goodyera oblongifolia	11	17	4	2	1
Boschniakia hookeri	3	3	7	5	1
Mahonia nervosa	11	5	20	21	-
Pseudotsuga menziesii	9	19	9	-	1
Arctostaphylos uva-ursi	-	-	14	-	4
Festuca occidentalis	6	-	-	2	5
Vaccinium parvifolium	-	3	4	-	-
Pyrola picta	-	1	2	-	-
Allotropa virgata	-	2	1	-	-
Hieracium albiflorum	1	1	-	-	-
Apocynum androsaemifolium	-	4	-	-	-
Chimaphila menziesii	-	2	-	-	-
Mahonia aquifolium	1	-	-	-	-
Viola orbiculata	-	1	-	-	-
Pteridium aquilinum	1	1	7	1	-
Trientalis latifolia	13	3	-	1	-
Achlys triphylla	4	-	-	6	-
Malus diversifolia	1	1	-	-	-
Pinus monticola	-	1	1	-	-
Vaccinium membranaceum	-	-	-	-	30
Rosa gymnocarpa	11	-	-	-	-
Symphoricarpos	7	-	-	-	-
Campanula scouleri	6	-	-	-	-
Pyrola bracteata	-	-	1	-	-
Vaccinium ovalifolium	-	-	-	-	1
Tsuga heterophylla	-	1	-	-	-
Rubus vitifolius	1	-	-	-	-
Bromus vulgaris	1	-	-	-	-
MOSS - LICHEN LAYER (Point frequency)					
Eurhynchium oreganum	19	15	23	22	2
Hylocomium splendens	1	3	23	17	9
Rhytidiadelphus triquetrus	2	-	2	+	+
Rhytidiadelphus loreus	-	-	+	+	+
Dicranum scoparium	+	5	2	4	2
Camptothecium megaptilum	2	1	1	3	1
Peltigera canina	1	1	1	1	1
Peltigera aphthosa	-	1	1	+	1
Calliergonella schreberi	-	+	9	3	8
Dicranum fuscescens	1	+	+	1	-
Polytrichum juniperinum	-	1	+	+	+
Cladonia sylvatica	-	-	-	-	3
Cladonia gracilis	-	-	+	-	+
Cladonia squamosa	-	-	+	-	+
Cladonia furcata	-	+	-	-	+
Cladonia bellidiflora	-	-	-	-	1
Cladonia macilenta	-	-	+	-	-
Cladonia fimbriata	+	-	-	-	-
Rhacomitrium lanuginosum	-	+	+	-	-
Rhacomitrium canescens	-	+	-	-	+
Rhacomitrium heterostichum	-	-	+	-	-
Aulacomnium androgynum	-	+	-	+	-
Bryum pallens	-	+	-	+	-
Stereocaulon tomentosum	-	-	+	-	-
Stereocaulon paschale	-	-	-	-	+

[1] Measurements made on all trees above a minimum diameter (at breast height) of 4 inches

TABLE 9: MENSURATION ANALYSIS OF THE *PSEUDOTSUGA MENZIESII* - *GAULTHERIA SHALLON* AND THE *PSEUDOTSUGA MENZIESII* - *TSUGA HETEROPHYLLA* - *GAULTHERIA SHALLON* ASSOCIATION PLOTS

	PSEUDOTSUGA - *GAULTHERIA* ASSOCIATION				*PSEUDOTSUGA* - *TSUGA* - *GAULTHERIA* ASSOC'N.	
	PLOT G5	PLOT G4	PLOT G6	PLOT G3	PLOT G1	PLOT G2
Location	Wolf Mt.	Deadwood	Deadwood	Valley	Fourth Lk.	Echo Mt.
Date analysed (1952)	11 Aug.	13 Aug.	8 Aug.	16 Aug.	19 July	21 July
Stand age (yrs.)	210	280	290	230	240	260
Site index (for *Pseudotsuga*)	130	140	120	140	90	60
TREE LAYER[1]						
Pseudotsuga menziesii						
Av.ht., dom. & codom. (ft.)	147	175	148	169	110	77
Trees per acre	100	108	104	64	172	104
Average diameter (in.)	22	27	26	28	17	14
Basal area (sq.ft./acre)	300	470	410	280	300	130
Volume (cu.ft./acre)	13,800	24,120	19,180	14,490	11,250	3,550
Tsuga heterophylla						
Av.ht., dom. & codom. (ft.)	73	57	66	88	71	70
Trees per acre	12	8	40	16	32	120
Average diameter (in.)	10	6	10	11	10	12
Basal area (sq.ft./acre)	9	2	24	12	17	120
Volume (cu.ft./acre)	300	43	690	410	520	3,140
Thuja plicata						
Av.ht., dom. & codom. (ft.)	-	52	74	60	74	64
Trees per acre	-	4	28	12	36	24
Average diameter (in.)	-	9	10	11	14	9
Basal area (cu.ft./acre)	-	2	16	7	44	12
Volume (cu.ft./acre)	-	38	470	170	1,300	340
Pinus monticola						
Av.ht., dom. & codom. (ft.)	-	-	134	-	-	-
Trees per acre	-	-	4	-	-	-
Average diameter (in.)	-	-	20	-	-	-
Basal area (sq.ft./acre)	-	-	9	-	-	-
Volume (cu.ft./acre)	-	-	400	-	-	-
SHRUB LAYER (Line intercept)						
Gaultheria shallon	59	41	64	31	50	36
Mahonia nervosa	4	1	-	+	-	-
Polystichum munitum	-	-	-	5	-	-

	PSEUDOTSUGA - *GAULTHERIA* ASSOCIATION				*PSEUDOTSUGA* - *TSUGA* - *GAULTHERIA* ASSOC'N.	
	PLOT G5	PLOT G4	PLOT G6	PLOT G3	PLOT G1	PLOT G2
HERB LAYER (Frequency)						
Gaultheria shallon	89	78	83	71	76	76
Linnaea borealis	11	1	9	10	50	5
Mahonia nervosa	47	10	14	7	15	-
Chimaphila umbellata	16	10	1	-	9	6
Vaccinium parvifolium	-	-	1	-	12	26
Boschniaka hookeri	6	1	1	-	-	1
Goodyera oblongifolia	-	-	-	-	6	5
Achlys triphylla	56	31	14	29	2	-
Rubus vitifolius	11	6	1	6	-	-
Rosa gymnocarpa	1	4	-	1	-	-
Chimaphila menziesii	2	1	1	-	1	-
Symphoricarpos mollis	4	1	-	-	-	-
Pteridium aquilinum	2	-	-	1	-	-
Polystichum munitum	-	-	-	10	-	-
Vaccinium membranaceum	-	-	-	-	-	5
Vaccinium ovalifolium	-	-	-	-	-	2
Gaultheria ovatifolia	-	-	-	-	-	2
Tsuga heterophylla	-	-	-	-	-	1
Pyrola bracteata	-	1	-	-	-	-
Hypochaeris radicata	-	1	-	-	-	-
Adenocaulon bicolor	1	-	-	-	-	-
Viola orbiculata	1	-	-	-	-	-
Corallorhiza maculata	1	-	-	-	-	-
Trientalis latifolia	1	-	-	-	-	-
MOSS - LICHEN LAYER (Point frequency)						
Hylocomium splendens	1	15	15	16	16	23
Eurhynchium oreganum	22	+	13	10	4	+
Rhytidiadelphus loreus	-	-	-	2	5	5
Camptothecium megaptilum	+	-	-	-	1	1
Rhytidiopsis robusta	-	-	-	-	1	12
Plagiothecium undulatum	-	-	-	+	+	-
Dicranum scoparium	-	-	-	+	-	+
Pseudisothecium stoloniferum	+	-	-	-	-	-
Pseudotsuga menziesii	-	-	-	-	+	-

[1] Measurements made on all trees above a minimum diameter (at breast height) of 4 inches.

TABLE 10: MENSURATION ANALYSIS OF THE *PSEUDOTSUGA MENZIESII* - *TSUGA HETEROPHYLLA* - *HYLOCOMIUM SPLENDENS* - *EURHYNCHIUM OREGANUM* ASSOCIATION PLOTS

	PLOT M5	PLOT M2	PLOT M4	PLOT M3	PLOT M1
Location	Wolf Mt.	Echo Mt.	Deadwood	Valley	Fourth Lk.
Date analysed (1952)	1 Aug.	21 July	13 Aug.	16 Aug.	17 July
Stand age (yrs.)	210	260	290	290	260
Site index (for *Pseudotsuga*)	170	170	130	130	120
TREE LAYER[1]					
Pseudotsuga menziesii					
Av.ht., dom. & codom. (ft.)	199	209	158	157	144
Trees per acre	80	72	96	84	68
Average diameter (in.)	33	37	26	23	22
Basal area (sq.ft./acre)	500	550	380	270	210
Volume (cu.ft./acre)	28,540	31,950	17,960	13,230	9,410
Tsuga heterophylla					
Av.ht., dom. & codom. (ft.)	65	87	85	86	136
Trees per acre	96	52	176	88	64
Average diameter (in.)	7	10	9	10	18
Basal area (sq.ft./acre)	26	28	92	50	140
Volume (cu.ft./acre)	770	990	3,770	1,900	7,420
Thuja plicata					
Av.ht., dom. & codom. (ft.)	-	107	101	78	85
Trees per acre	-	16	12	12	56
Average diameter (in.)	-	14	13	13	14
Basal area (sq.ft./acre)	-	20	13	11	68
Volume (cu.ft./acre)	-	830	540	360	2,380
Pinus monticola					
Av.ht., dom. & codom. (ft.)	-	-	-	160	-
Trees per acre	-	-	-	8	-
Average diameter (in.)	-	-	-	24	-
Basal area (sq.ft./acre)	-	-	-	26	-
Volume (cu.ft./acre)	-	-	-	1,290	-
Abies grandis					
Av.ht., dom. & codom. (ft.)	77	-	-	-	-
Trees per acre	12	-	-	-	-
Average diameter (in.)	8	-	-	-	-
Basal area (sq.ft./acre)	4	-	-	-	-
Volume (cu.ft./acre)	140	-	-	-	-

	PLOT M5	PLOT M2	PLOT M4	PLOT M3	PLOT M1
SHRUB LAYER (Line intercept)					
Polystichum munitum	+	+	3	-	+
Gaultheria shallon	-	-	5	+	3
Mahonia nervosa	-	-	1	-	2
Tsuga heterophylla	-	-	1	-	+
HERB LAYER (Frequency)					
Chimaphila menziesii	-	12	7	2	2
Mahonia nervosa	1	1	11	-	9
Linnaea borealis	-	-	2	11	49
Viola orticulata	1	6	1	-	1
Pyrola picta	-	1	1	-	1
Achlys triphylla	-	3	3	3	4
Gaultheria shallon	-	-	13	1	19
Goodyera oblongifolia	2	1	1	-	-
Vaccinium parvifolium	-	-	-	1	21
Chimaphila umbellata	-	-	-	2	12
Trientalis latifolia	-	-	-	2	-
Festuca subulata	2	-	-	-	-
Pseudotsuga menziesii	-	-	-	-	2
Tiarella trifoliata	-	-	-	-	1
Carex leptopoda	1	-	-	-	-
Polystichum munitum	-	1	-	-	-
Tsuga heterophylla	-	-	-	-	1
Taxus brevifolia	-	-	-	-	1
Sparassis radicata	-	1	-	-	-
MOSS - LICHEN LAYER (Point frequency)					
Eurhynchium oreganum	3	2	10	18	17
Hylocomium splendens	2	-	44	35	8
Rhytidiadelphus loreus	-	-	-	8	2
Rhytidiadelphus triquetrus	-	-	-	1	-
Rhytidiopsis robusta	-	-	-	-	2
Plagiothecium elegans	-	+	-	-	-
Pseudisothecium stoloniferum	1	+	-	1	-
Camptothecium megaptilum	-	-	-	+	2
Dicranum fuscescens	-	+	+	-	-
Pseudotsuga menziesii	-	-	-	-	-
Heterocladium procurrens	-	+	-	-	-
Tsuga heterophylla	+	-	-	-	-
Thuja plicata	-	+	-	-	-

[1] Measurements made on all trees above a minimum diameter (breast height) of 4 inches

TABLE 11: MENSURATION ANALYSIS OF THE PSEUDOTSUGA MENZIESII - THUJA PLICATA - POLYSTICHUM MUNITUM ASSOCIATION PLOTS

	PLOT P4	PLOT P1	PLOT P2	PLOT P5	PLOT P3
Location	Deadwood	Fourth Lk.	Echo Mt.	Wolf Mt.	Valley
Date analysed (1952)	8 Aug.	18 Aug.	20 Aug.	6 Aug.	17 Aug.
Stand age (yrs.)	280	260	260	210	250
Site index (for Pseudotsuga)	200	160	200	180	200
TREE LAYER[1]					
Pseudotsuga menziesii					
Av.ht., dom. & codom. (ft.)	248	199	244	218	233
Trees per acre	44	40	52	56	64
Average diameter (in.)	48	36	42	39	37
Basal area (sq.ft./acre)	570	280	440	490	500
Volume (cu.ft./acre)	38,180	16,840	33,560	29,200	32,060
Thuja plicata					
Av.ht., dom. & codom. (ft.)	140	137	178	148	50
Trees per acre	12	12	12	12	4
Average diameter (in.)	34	31	25	29	7
Basal area (sq.ft./acre)	78	77	50	56	1
Volume (cu.ft./acre)	2,710	3,410	2,830	2,660	24
Tsuga heterophylla					
Av.ht., dom. & codom. (ft.)	76	106	83	111	96
Trees per acre	52	76	28	44	24
Average diameter (in.)	10	13	10	11	11
Basal area (sq.ft./acre)	31	94	15	35	16
Volume (cu.ft./acre)	1,280	4,460	550	1,630	620
Abies grandis					
Av.ht., dom. & codom. (ft.)	-	-	-	118	77
Trees per acre	-	-	-	28	8
Average diameter (in.)	-	-	-	13	9
Basal area (sq.ft./acre)	-	-	-	35	4
Volume (cu.ft./acre)	-	-	-	1,740	62
SHRUB LAYER (Line intercept)					
Polystichum munitum	33	40	21	20	18
Tsuga heterophylla	-	1	4	-	2
Mahonia nervosa	-	+	-	1	1
Thuja plicata	-	+	1	+	-
Athyrium filix-femina	1	-	+	-	-
Blechnum spicant	-	-	1	-	-
Lysichitum americanum	-	-	-	+	-
Pteridium aquilinum	-	-	-	+	-
Pseudotsuga menziesii	-	-	+	-	-
Gaultheria shallon	-	+	-	-	-

	PLOT P4	PLOT P1	PLOT P2	PLOT P5	PLOT P3
HERB LAYER (Frequency)					
Polystichum munitum	29	41	8	20	10
Tiarella trifoliata	22	12	58	30	91
Achlys triphylla	24	25	48	13	65
Tiarella laciniata	1	-	39	8	30
Trillium ovatum	-	1	1	1	5
Athyrium filix-femina	2	-	2	4	-
Melica subulata	-	-	1	3	1
Adenocaulon bicolor	-	-	5	-	37
Dryopteris linnaeana	27	-	-	-	1
Blechnum spicant	-	-	4	10	-
Viola orbiculata	-	1	25	-	-
Galium triflorum	8	-	17	-	-
Carex hendersonii	1	-	-	-	9
Claytonia sibirica	-	-	-	4	-
Disporum oreganum	-	-	-	-	2
Streptopus amplexifolius	-	-	-	1	-
Mahonia nervosa	-	4	9	17	19
Linnaea borealis	-	34	54	-	-
Vaccinium parvifolium	-	4	2	-	1
Luzula parviflora	1	-	-	1	4
Trientalis latifolia	-	-	10	-	2
Bromus vulgaris	-	-	-	-	17
Campanula scouleri	-	1	-	-	6
Abies grandis	-	-	-	1	2
Monotropa uniflora	1	-	-	1	-
Rubus vitifolius	-	1	-	-	1
Rosa gymnocarpa	-	-	-	-	4
Chimaphila umbellata	-	-	4	-	-
Chimaphila menziesii	-	1	-	-	-
Pteridium aquilinum	-	-	-	3	-
Vaccinium alaskaense	-	-	2	-	-
Thuja plicata	-	-	2	-	-
Viola glabella	-	-	-	-	1
Listera cordata	-	-	-	1	-
Tsuga heterophylla	-	1	-	-	-
Pseudotsuga menziesii	-	-	1	-	-

	PLOT P4	PLOT P1	PLOT P2	PLOT P5	PLOT P3
MOSS - LICHEN LAYER (Point frequency)					
Eurhychium oreganum	2	9	3	8	9
Hylocomium splendens	10	+	+	2	1
Rhytidiadelphus loreus	-	+	1	-	+
Mnium insigne	4	-	-	1	3
Mnium menziesii	-	-	+	1	-
Rhytidiopsis robusta	-	+	+	-	-
Plagiothecium undulatum	-	+	-	-	-
Plagiochila asplenioides	-	-	-	+	-
Pseudisothecium stoloniferum	-	-	-	-	+
Pseudotsuga menziesii	-	-	-	-	-
Abies grandis	-	+	-	-	+

[1]Measurements made on all trees above a minimum diameter (at breast height) of 4 inches.

TABLE 12: MENSURATION ANALYSIS OF THE THUJA PLICATA - LYSICHITUM AMERICANUM ASSOCIATION PLOTS

	PLOT Ly3	PLOT Ly2	PLOT Ly1
Location	Wolf Mt.	Deadwood	Echo Mt.
Date analysed (1952)	14 Aug.	8 Aug.	20 July
Stand age (yrs.)	210	280	260
Site index (for Pseudotsuga)	150	190	170
TREE LAYER[1]			
Thuja plicata			
Av.ht., dom. & codom. (ft.)	125	196	177
Trees per acre	88	68	60
Average diameter (in.)	38	30	25
Basal area (sq.ft./acre)	797	366	220
Volume (cu.ft./acre)	41,960	22,030	12,400
Pseudotsuga menziesii[2]			
Av.ht., dom. & codom. (ft.)	183	230	206
Trees per acre	8	16	16
Average diameter (in.)	40	46	36
Basal area (sq.ft./acre)	72	190	120
Volume (cu.ft./acre)	3,680	11,680	6,700
Tsuga heterophylla			
Av.ht., dom.& codom. (ft.)	71	132	186
Trees per acre	60	48	12
Average diameter (in.)	11	14	26
Basal area (sq.ft./acre)	48	83	56
Volume (cu.ft./acre)	1,364	4,320	3,610

	PLOT Ly3 A	PLOT Ly3 B	PLOT Ly2 A	PLOT Ly2 B	PLOT Ly1 A	PLOT Ly1 B
SHRUB LAYER (Line intercept)	A	B	A	B	A	B
Lysichitum americanum	49	10	46	-	73	11
Oplopanax horridus	-	-	54	-	-	-
Athyrium filix-femina	-	-	8	-	-	-
Rubus spectabilis	-	-	+	-	-	-
Blechnum spicant	3	9	5	16	+	32
Polystichum munitum	-	1	1	3	-	-
Adiantum pedatum	-	-	-	-	1	10
Gaultheria shallon	2	12	-	-	-	-
Thuja plicata	-	+	-	-	-	-
HERB LAYER (Frequency)						
Lysichitum americanum	76	12	42	-	54	7
Claytonia sibirica	22	-	2	-	11	-
Galium triflorum	13	-	12	5	28	7
HERB LAYER (continued)						
Mitella ovalis	3	-	25	-	-	-
Viola orbiculata	-	-	3	-	35	-
Viola glabella	-	-	-	-	28	7
Listera cordata	-	-	-	-	16	-
Athyrium filix-femina	-	-	11	-	-	-
Stachys ciliata	3	-	-	-	-	-
Oenanthe sarmentosa	-	-	3	-	-	-
Dryopteris linnaeana	-	-	3	-	-	-
Epilobium adenocaulon	-	-	3	-	-	-
Carex leptopoda	-	-	-	-	3	-
Thuja plicata	-	-	-	-	3	-
Polystichum munitum	-	-	-	-	3	-
Cardamine angulata	-	-	2	-	-	-
Galium boreale	-	-	2	-	-	-
Maianthemum dilatatum	-	-	2	-	-	-
Circaea pacifica	-	-	-	-	1	-
Veratrum eschscholtzii	-	2	-	5	16	7
Tiarella trifoliata	3	12	40	-	11	36
Tiarella laciniata	3	5	9	-	3	14
Streptopus amplexifolius	-	7	2	-	5	-
Achlys triphylla	-	2	-	5	-	57
Blechnum spicant	5	14	2	5	5	50
Vaccinium parvifolium	-	5	-	5	-	-
Gaultheria shallon	8	40	-	-	-	-
Adenocaulon bicolor	-	-	-	-	5	14
Rubus vitifolius	3	5	-	-	-	-
Goodyera oblongifolia	-	-	-	-	-	7
Luzula parviflora	-	-	-	-	3	7
MOSS - LICHEN LAYER (Point frequency)						
Mnium punctatum	36	1	19	+	50	-
Eurhynchium stokesii	16	+	12	-	11	1
Brachythecium washingtonianum	14	1	2	-	7	-
Conocephalum conicum	1	-	+	-	3	-
Pellia columbiana	1	-	3	-	1	-
Mnium menziesii	3	-	1	-	-	-
Mnium insigne	+	-	2	-	-	-
Hookeria lucens	1	-	-	-	-	-
Plagiochila asplenioides	+	-	-	-	-	-
Chiloscyphus rivularis	+	-	-	-	-	-
Thuja plicata	+	+	-	-	+	-
Plagiothecium denticulatum	+	+	+	-	-	-
Eurhynchium oreganum	2	10	-	-	-	-
Hylocomium splendens	-	5	+	2	-	-
Pseudisothecium stoloniferum	-	1	-	-	-	-
Plagiothecium undulatum	-	-	-	1	-	-

[1] Measurements made on all trees above a minimum diameter (breast height) of 4 inches

[2] Pseudotuga occurs on the margins only.

[A] Occurrence in the swamp

[B] Occurrence on the banks and hummocks.

(Tables 4 and 9). The site index for Pseudotsuga of 120 to 140 was considerably higher than the index for the Pseudotsuga - Gaultheria - Peltigera stands (70 to 90). Basal areas and volume were also greater, even though there were fewer trees per acre. Tsuga heterophylla was constantly present in the lower tree layer, but it made up little of the volume of the plots studied. Thuja plicata was present in most plots, but again sizes and volumes were small.

The Gaultheria shallon of the stands of this association was considerably taller (one meter or more) and much denser than that in the previous association. Other shrubs were uncommon.

Herb layers were characterized by poor species representation and low cover value. The most common plants of the herb layer of the Pseudotsuga - Gaultheria - Peltigera association were also the most common ones of this association, but their frequency was lower. This lower frequency was largely attributable to the greater density of Gaultheria. The presence of Polystichum munitum in the Valley plot (G3) and Achlys triphylla in the Wolf Mountain plot (G5) both being species which occurred more characteristically in the Pseudotsuga - Polystichum association, was reflected in the higher average tree heights and site indices on these plots.

Lichens were largely absent from the ground layer, occurring mostly on stones or rock outcrops when present. Lichens on the bark of trees were less common, whereas mosses were somewhat more common than in the Pseudotsuga - Gaultheria - Peltigera association. Hylocomium splendens and Eurhynchium oreganum were the prominent mosses of the moss-lichen layer and they covered the ground to the almost complete exclusion of other species. Tree seedlings rarely survived the first growing season.

Pseudotsuga menziesii - Tsuga heterophylla - Gaultheria shallon association

In stands of this association Tsuga heterophylla was frequently as common in the upper tree layer as Pseudotsuga (Tables 4 and 9), with the average height of both trees being rather low (e.g. Plot G2, 70 ft. for Tsuga and 77 ft. for Pseudotsuga). The Fourth Lake plot (G1) represented an intermediate situation, being at a lower elevation than the Echo Mountain plot. Site index for Pseudotsuga and volumes per acre were low on both plots, although in the Fourth Lake plot the frequency of Tsuga was less than average for the association, resulting in a higher volume for Pseudotsuga.

The presence of Chamaecyparis nootkatensis and Abies amabilis in the tree and shrub layers of the Echo Mountain plot showed its affinity with the altitudinal zone above that of the Pseudotsuga forests. The Gaultheria shallon of these stands was shorter and less dense than in the Pseudotsuga - Gaultheria plots. Vaccinium membranaceum was another species of the shrub layer which was characteristic of higher altitudes, as was the Gaultheria ovatifolia of the herb layer. Most of the other plants of the herb layer were common to both associations.

In the moss-lichen layer, apart from Hylocomium splendens, which was the predominant moss, Eurhynchium oreganum, Rhytidiadelphus loreus, and Rhytidiopsis robusta were common, with the latter species being another characteristic of higher altitudes. Tree seedlings had poor vitality.

Both mosses and lichens were present on the bark of trees, with Dicranum fuscescens and Sphaerophorus globosus being common on the boles, and particularly on the Echo Mountain plot, Lobaria oregana being conspicuous on both living and dead branches.

Pseudotsuga menziesii - Tsuga heterophylla - Hylocomium splendens - Eurhynchium oreganum association

The average height of Pseudotsuga menziesii (Tables 5 and 10) in the subassociation nudum plots (199 ft. to 209 ft.) was considerably greater than in the typicum plots (144 ft. to 158 ft.). Basal areas and volumes per acre were likewise much greater. In most plots Tsuga heterophylla formed a secondary canopy with average heights from 70 to 130 ft. lower than the dominant and codominant Pseudotsuga (Fig. 13). Although the number of Tsuga was similar or greater, their volume formed only a small part of the stand. However, in the Fourth Lake plot (M1) (Fig. 9) the height, diameter and volume of Tsuga was nearly comparable with that of Pseudotsuga, indicating the affinity of this stand with those of the west coast, where Tsuga may be predominant. The number and volume of Thuja plicata was mostly small, even though in the Fourth Lake plot it was more frequent and constituted 12 percent of the volume of the stand.

The subordinate vegetation of this association was characterized by an almost complete absence of conspicuous shrubs and herbs. Such plants as Chimaphila menziesii, Pyrola picta, Monotropa uniflora, M. latisquamea, Listera cordata, Viola orbiculata and Corallorhiza maculata, characteristic species of the association, were present, but their cover value was small. Stunted Gaultheria shallon, Polystichum munitum and Achlys triphylla, characteristic of other associations, occurred locally and presumably reflected minor variations in edaphic factors. Occasional small Tsuga heterophylla and Taxus brevifolia were also present in some plots.

In the subassociation nudum plots the forest floor was essentially bare. Hylocomium splendens and Eurhynchium oreganum formed an almost complete green, mossy carpet in stands of the subassociation typicum, with Rhytidiadelphus loreus also being common in the Valley plot (M3). On decaying wood, such characteristic species as Hypnum circinale, Cephalozia media and Scapania bolanderi were present. Conspicuous epiphytic lichens were absent from the lower bole of trees, but bryophytes such as Hypnum circinale, Dicranum *fuscescens* and *Scapania bolanderi* were quite common.

Pseudotsuga menziesii - *Thuja plicata* - *Polystichum munitum* association

Pseudotsuga menziesii attained its maximum height and diameter in stands of this association. In three of the plots studied site index was over 200 (Tables 6 and 11). Tree heights and site index of the Fourth Lake plot (P1) were lower than average because the plot was situated toward the upper margin of the stand. The setting on the lower slope, below the plot, which had been logged prior to this study, had larger stump diameters and a higher site index (Krajina and Spilsbury 1950: Plot 64). Although the number of *Thuja plicata* was not great, *Thuja* was the tallest species of the secondary canopy, with average diameters being fairly large. *Tsuga heterophylla* was more numerous and formed a secondary canopy below the level of most of the *Thuja*. The average diameter of *Tsuga*, however, was small resulting in small basal areas and volumes, although in the Fourth Lake plot the species was somewhat more numerous than in other plots. The Wolf Mountain plot (P5) was the only plot with any appreciable volume of *Abies grandis*.

Shrubby plants had little cover value in the shrub layer. The clumps of *Polystichum munitum* were commonly 80 cm. high and dominated the subordinate vegetation. Other ferns, such as *Blechnum spicant* (Plot P5), *Dryopteris linnaeana* (Plot P4) and *Athyrium filix-femina* (Plot P2) were common on some plots. *Achlys triphylla* was one of the most conspicuous herbs of this association, with the Valley plot (P3) representing a subtype in which *Achlys* was more common even than *Polystichum*. Typical development of the mature stage of this association included numerous herbaceous plants, with *Tiarella trifoliata*, *T. laciniata*, *Trillium ovatum*, *Adenocaulon bicolor*, *Galium triflorum*, *Claytonia sibirica* and *Dryopteris linnaeana* being some of the characteristic species which were present on the plots studied.

Minum insigne and M. menziesii, among the mosses characteristic of the association, were present on the ground. On decaying wood such typical bryophytes as Lepidozia reptans, Mnium punctatum, M. spinulosum and Plagiothecium denticulatum were recorded. The characteristic epiphytic species, including Pseudisothecium stoloniferum, Porella navicularis, Neckera douglasii, and Frullania nisquallensis, were most abundant on Thuja, Abies grandis and Acer macrophyllum.

Thuja plicata - Lysichitum americanum association

The trees in stands of this association occurred on the banks and hummocks which bordered the swampy areas. Thuja plicata was the dominant species of the tree layer. Average diameter ranged from 25 to 38 inches and average height from 125 to 196 ft. (Tables 7 and 12). Pseudotsuga menziesii was restricted to the drier marginal areas, but individual trees reached good heights and diameters. In the lower altitude plots (Ly2, Ly3) Tsuga heterophylla was present only in the secondary canopy, but on Echo Mountain (Plot Ly1) there were a few tall trees with large diameters. Where a considerable proportion of the plot consisted of swampy areas stocking was fairly low, although this was partially compensated by the large volume of individual trees.

Gaultheria shallon was quite abundant in the litter and decayed wood of the banks. Other plants which were largely restricted to the banks included Blechnum spicant, Adiantum pedatum, Achlys triphylla, Tiarella spp., Hylocomium splendens and Eurhynchium oreganum, with Cephalozia media, Calypogeia trichomanis, Mnium punctatum and Scapania bolanderi occurring on decaying wood.

The species more characteristic of the association were found most frequently in the swampy areas. The most conspicuous of these was Lysichitum americanum, which dominated the swamps during the growing season. Other characteristic herbaceous plants growing between and beneath the large Lystichitum leaves included Veratrum eschscholtzii, Circaea pacifica, Mitella ovalis and Oenanthe sarmentosa, with Claytonia sibirica, Galium triflorum, Tiarella trifoliata and other herbs, which also occurred in the Pseudotsuga - Polystichum association, being quite frequent. The surface of the muck in the swampy areas was densely covered by bryophytes, the most common of which were Mnium punctatum, Eurhynchium stokesii, Brachythecium Washingtonianum and Conocephalum conicum. Corticolous plants on the boles of trees were similar to those in the Pseudotsuga - Polystichum association stands.

SOILS

Pseudotsuga - Gaultheria - Peltigera association

The plots of this association were located on sidehills (Plots L1 and L5) on a low ridge (Plot L2) and on nearly level ground (Plots L3 and L4). Soil profiles were mostly shallow, with rooting being restricted by a hardpan or bedrock at 50 to 70 cm. (Table 13, Fig. 19 A and C). Effective soil volume was further reduced by the presence of stones and clinker-like concretions. Soil moisture was largely provided by precipitation because the topographic location of the stands limited addition by ground water movement.

Most profiles had a shallow litter layer (A_0), since conditions for accumulation were not favourable in these open stands. The leached layer (A_2) was commonly less than 2 cm. deep and was sometimes barely discernable. The shallow litter layer and droughty nature of the soil presumably moderated the intensity of leaching and profile differentiation. In some areas (e.g. on Plot L3) the upper 20 cm. of the profile consisted of a rubble of angular cobbles. Here the A_2 horizon was usually deeper than average, as were the F

PLATE VII, Figure 19

PLATE VII. Soil Profiles.

Figure 19. Typical soil profiles from various associations in the Nanaimo River Valley; the scale is marked in decimeters.

A. The Pseudotsuga - Gaultheria - Peltigera association (Plot L1, Fourth Lake).

B. The Pseudotsuga - Tsuga - Gaultheria association (Plot G1, Echo Mountain).

C. The Pseudotsuga - Gaultheria - Peltigera association (Plot L3, Deadwood Creek).

D. The Pseudotsuga - Gaultheria association (Plot G6, Deadwood Creek).

E. The Pseudotsuga - Tsuga - Hylocomium - Eurhynchium association (Plot M5, Wolf Mountain).

F. The Pseudotsuga - Polystichum association (Plot P1, Fourth Lake.)

G. The Pseudotsuga - Polystichum association (Plot P3, Valley).

H. The Pseudotsuga - Polystichum association (Plot P2, Echo Mountain).

I. The Pseudotsuga - Polystichum association (Plot P5, Wolf Mountain).

J. The Thuja - Lysichitum association (Plot Ly3, Wolf Mountain).

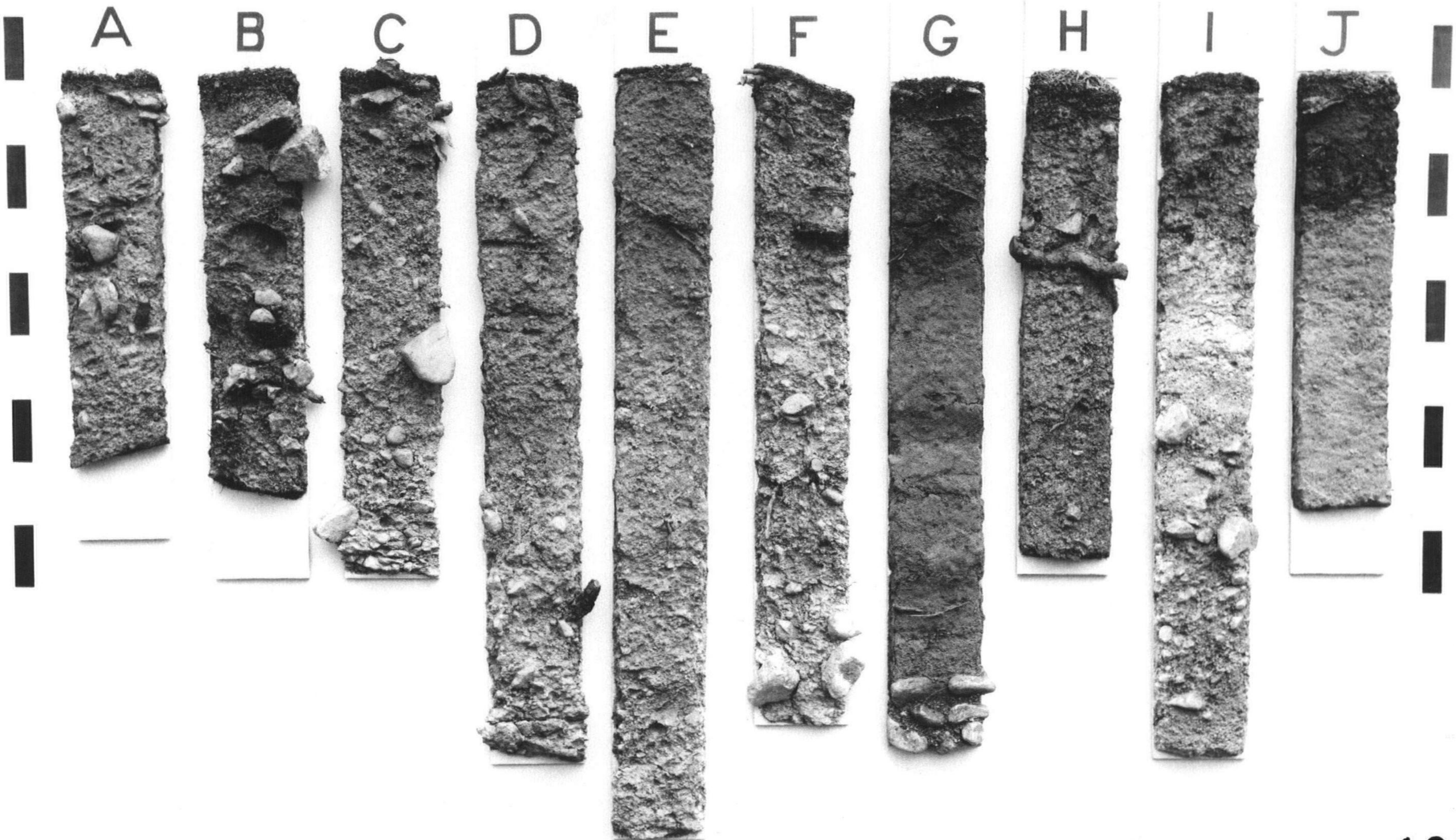


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TABLE 13: DESCRIPTION, pH, AND ORGANIC AND CLAY CONTENTS OF TYPICAL SOIL PROFILES FROM THE PSEUDOTSUGA - GAULTHERIA - PELTIGERA ASSOCIATION PLOTS

Horizon	Depth (cm.)	Description	pH	Organic content (%)	Clay content (%)
PLOT L5 (Wolf Mt.)					
Ao F	2-1	Very dark brown (10YR 2/2) partially decomposed litter	-	-	-
H	1-0	Black (10YR 2/1) granular to felty mor; roots common	-	-	-
A2	0-1	Gray (5Y 6/1) sandy loam, often poorly defined; weak fine subangular blocky structure; very friable	-	-	-
B	1-10	Light yellowish brown (10YR 6/4) gravelly sandy loam, with scattered angular cobbles; weak fine subangular blocky structure; very friable; numerous shotty concretions, with yellowish red (5YR 5/8) coatings; light, dappled, strong brown (7.5YR 5/8) coatings on cobbles and gravel; roots common	6.0	4.3	6
B	10-20	Pale olive (5Y 6/3) gravelly sandy loam, with angular cobbles; weak fine subangular blocky structure; very friable; shotty concretions; occasional pale olive (5Y 6/3) clinker-like concretions, with yellowish red (5YR 5/8) staining; dappled, strong brown (7.5YR 5/8) coatings on cobbles and gravel; scattered yellow (2.5Y 7/6) and blue (5.0B 7/2) speckling; roots common	5.9	3.4	8
B	20-45	Pale yellow (5Y 7/3) gravelly sandy loam, with angular cobbles; weak fine subangular blocky structure; very friable; shotty concretions; light olive gray (5Y 6/2) clinker-like concretions becoming more common; dappled, strong brown (7.5YR 5/8) coatings on cobbles and gravel; roots moderately common	6.0	2.0	11
B	45-70	Light olive gray (5Y 6/2) gravelly sandy loam, with numerous angular cobbles; weak fine subangular blocky structure; very friable; shotty concretions; numerous clinker-like concretions; dappled, yellowish red (5YR 5/8) coatings on gravel and shot; roots sparse, although fine roots common above the ortstein layer	6.1	2.0	11
Ortstein	70-	Olive gray (5Y 5/2) gravelly sandy loam; irregular thick platy structure; cemented; reddish yellow (5YR 6/8) staining, particularly in the upper part; roots absent	6.2	1.4	8
PLOT L4 (Lower Deadwood)					
Ao F	3-2	Very dark brown (10YR 2/2) partially decomposed litter	5.5	-	-
H	2-0	Black (10YR 2/1) granular to felty mor; roots common	5.8	-	-
A2	0-2	Gray (5Y 6/1) sandy loam, somewhat discontinuous, but up to 3 cm. thick among surface cobbles; weak fine subangular blocky structure; very friable	5.6	7.6	7
B	2-10	Yellowish brown (10YR 5/4) gravelly sandy loam, with scattered angular cobbles; weak fine subangular blocky structure; very friable; shotty concretions, with yellowish red (5YR 5/8) coatings; light, dappled, strong brown (7.5YR 5/8) coatings on cobbles and gravel; roots common	5.7	3.0	7
B	10-20	Light yellowish brown (10YR 6/4) gravelly sandy loam, with scattered angular cobbles, weak fine subangular blocky structure; very friable; shotty concretions; dappled, strong brown (7.5YR 5/8) coatings on cobbles and gravel; scattered yellowish red (5YR 4/6) and blue (5.0B 7/2) speckling; roots common	5.5	3.4	6
B	20-40	Pale brown (10YR 6/3) gravelly sandy loam, with angular cobbles; weak fine subangular blocky structure; very friable; shotty concretions; pale olive (5Y 6/3) clinker-like concretions, with yellowish red (5YR 5/8) staining; dappled, strong brown (7.5YR 5/8) coatings on cobbles and gravel; roots moderately common	5.8	2.1	8
B	40-70	Light yellowish brown (2.5Y 6/4) gravelly sandy loam, with numerous angular cobbles; weak fine subangular blocky structure; very friable, becoming weakly cemented with increasing depth; numerous olive gray (5Y 6/2) clinker-like concretions; dappled, yellowish red (5YR 5/8) coatings on cobbles and gravel; roots sparse, although fine roots common above the ortstein layer	6.0	2.0	9
Ortstein	70-	Gray brown (2.5Y 5/2) gravelly sandy loam; irregular thick platy structure; cemented; reddish yellow staining, particularly in the upper part; roots absent	6.2	1.0	7
PLOT L3 (Lower Deadwood)					
Ao F	3-2	Very dark brown (10YR 2/2) partially decomposed litter	4.9	-	-
H	2-0	Black (10YR 2/1) granular to felty mor, up to 4 cm. thick among surface cobbles; roots common	5.0	-	-
A2	0-2	Gray (5Y 6/1) sandy loam; weak fine subangular blocky structure; very friable	4.9	6.4	11
B	2-10	Brown (10YR 5/3) gravelly sandy loam, with angular cobbles, in places very numerous; weak fine subangular blocky structure; loose; numerous shotty concretions, with yellowish red (5YR 5/8) coatings; light, dappled, strong brown (7.5YR 5/8) coatings on cobbles and gravel; roots common	5.7	3.6	8
B	10-20	Light yellowish brown (10YR 6/4) gravelly sandy loam, with angular cobbles; weak fine subangular blocky structure; very friable; shotty concretions; dappled, strong brown (7.5YR 5/8) coatings on cobbles and gravel; roots common	5.6	2.8	7
B	20-55	Pale brown (10YR 6/3) gravelly sandy loam, with scattered angular cobbles; weak fine subangular blocky structure; very friable; shotty concretions; dappled, strong brown (7.5YR 5/8) coatings on cobbles and gravel; roots moderately common	5.7	2.1	5
B	55-70	Pale olive (5YR 6/3) gravelly sandy loam, with scattered angular cobbles; weak fine subangular blocky structure; very friable, becoming weakly cemented with increasing depth; numerous light olive gray (5Y 6/2) clinker-like concretions, with yellowish red (5YR 5/8) staining; dappled yellowish red (5YR 5/8) coatings on cobbles and gravel; roots sparse, although fine roots common above the ortstein layer	5.9	1.9	6
Ortstein	70-	Light olive gray (5Y 6/2) gravelly sandy loam; irregular thick platy structure; cemented; reddish yellow (5YR 6/8) staining, particularly in the upper part; roots absent	6.2	1.1	4
PLOT L2 (Valley)					
Ao F	2-1	Very dark brown (10YR 2/2) partially decomposed litter	-	-	-
H	1-0	Black (10YR 2/1) granular to felty mor; roots common	5.1	-	-
A2	0-1	Gray (5Y 6/1) sandy loam, often poorly defined, but up to 2 cm. thick among surface cobbles; weak fine subangular blocky structure; very friable	5.4	3.6	-
B	1-10	Brown (10YR 5/3) gravelly sandy loam, with scattered angular cobbles; weak fine subangular blocky structure; very friable; shotty concretions, with strong brown (7.5YR 5-6) coatings; light, dappled, strong brown (7.5YR 5/8) coatings on cobbles and gravel; roots common	5.4	3.4	7
B	10-20	Yellowish brown (10YR 5/4) gravelly sandy loam, with scattered angular cobbles; weak fine subangular blocky structure; very friable; shotty concretions; dappled, reddish yellow (5YR 6/8) coatings on cobbles and gravel; roots common	5.6	2.3	8
B	20-40	Light yellowish brown (10YR 6/4) gravelly sandy loam, with scattered angular cobbles; weak fine subangular blocky structure; very friable; shotty concretions; occasional light brownish gray (2.5Y 6/2) clinker-like concretions, with yellowish red (5YR 5/8) staining; dappled, reddish yellow (5YR 6/8) coatings on cobbles and gravel; roots sparse	5.7	2.2	7
B	40-55	Light yellowish brown (10YR 6/4) gravelly sandy loam, with scattered angular cobbles; weak fine subangular blocky structure; very friable, becoming weakly cemented with increasing depth; shotty concretions; numerous clinker-like concretions; dappled, reddish yellow (5YR 6/8) coatings on cobbles and gravel; roots sparse, although fine roots common above the ortstein layer	5.5	2.8	3
Ortstein	55-	Light olive gray (5Y 6/2) gravelly sandy loam; irregular thick platy structure; cemented; reddish yellow (5Y 6/8) staining, particularly in the upper part; roots absent	6.0	1.1	6
PLOT L1 (Fourth Lk.)					
Ao F	2-1	Very dark brown (10YR 2/2) partially decomposed litter	-	-	-
H	1-0	Black (10YR 2/1) felty mor; roots common	4.9	-	-
A2	0-2	Light gray (5Y 7/1) loam, varying from less than 1 cm. to 5 cm. thick among surface cobbles; weak fine subangular blocky structure; roots common	4.5	14.0	-
B	2-20	Red (2.5YR 4/6) gravelly sandy loam, with scattered angular cobbles; weak fine subangular blocky structure; friable; shotty concretions, with yellowish red (5YR 5/8) coatings; dappled, yellowish red (5YR 5/6) coatings on cobbles and gravel; roots common	5.1	3.5	5
B	20-35	Yellowish red (5YR 5/6) gravelly sandy loam, with scattered angular cobbles; weak fine subangular blocky structure; friable; shotty concretions; dappled yellowish red (5YR 5/8) coatings on cobbles and gravel; roots moderately common	5.2	4.4	6
B	35-55	Reddish yellow (5YR 6/8) gravelly sandy loam; weak fine to medium subangular blocky structure; friable; dappled reddish yellow (5YR 6/8) coatings on cobbles and gravel; scattered, faint blue (7.5 BG 7/2) mottling; roots sparse, although numerous on rock surface, commonly forming a mat; fine dead roots present	5.3	5.5	5
D	55-	Rock; seepage water occasionally present	-	-	-

and H layers above. Such areas supported a luxuriant growth of mosses, particularly Hylocomium splendens, and lichens were largely confined to protruding stones.

Soil colours were mostly pale, with light yellowish browns predominating. In the Fourth Lake plot (L1), however, yellowish red was common. The soil texture of most horizons was a gravelly sandy loam, and in most plots the 2 mm. fraction constituted less than half the 25 mm. fraction. Plot L1 was an exception, with the 2 mm. fraction forming from 60 to 70 percent of the 25 mm. fraction in the upper 20 cm. (Appendix III). Stones and angular cobbles were common. Structure was weakly defined and all layers down to the hardpan were very friable. Shotty concretions were numerous, especially in plot L1, where from 50 to 80 percent of the 2-5 mm. fraction was actually composed of concretions. Large irregular clinker-like concretions (with average diameters up to 10 cm.) were frequent in many profiles. In the lower portion of profiles on the Wolf Mountin plot (L5), such concretions occupied a large proportion of the soil volume. Mottling was essentially absent and the reddish yellow stains on the gravel and concretions were usually faint. Profiles commonly merged through a weakly cemented zone into an ortstein layer. The ortstein layers of cemented, olive gray sand and gravel had a weakly platy structure, with some yellowish red staining apparent. The pH of all horizons was acid. Most roots were concentrated in the mineral soil near the surface of the profile. There was limited root pentration of the upper hardpan layer, with a mat of roots above the ortstein and bedrock being common.

The soils of Plot L1 were comparable with those included in the Quinsam series and the soils of Plots L2, L3, L4 and L5 resembled those described as the Shawnigan series on Vancouver Island (Farstad 1957).

Pseudotsuga - Gaultheria association

Plots were located on level ground (Plot G6), on gentle slopes (Plots G4 and G5) and at midslope on a steep sidehill (Plot G3). Soil depths were commonly somewhat greater than in stands of the previous association, with the hardpan layer 90 cm. or more from the surface. (Table 14; Fig. 19 D). Stones and angular cobbles, however, frequently occupied from 10 to 40 percent of soil volume. Soil moisture was again largely derived from rainfall, although most of the plots received some moisture by lateral movement of ground water.

The litter layer (A_o), which varied from 3 to 6 cm. in depth, was composed of both granular and felty mors, the latter being more common among surface cobbles. The leached horizon (A_2) was normally well defined, although it rarely exceeded 2 cm., except among surface cobbles. Surface horizons were commonly brown, merging through pale brown to yellowish brown, the predominant colour of the greater proportion of most profiles. All horizons had a gravelly sandy loam texture, with the 2 mm. fraction constituting about half of the 25 mm. fraction. The fine subangular blocky structure was weakly defined and all soils were very friable. Shotty concretions were common, particularly in Plot G6, where concretions made up to 40 to 75 percent of the 2-5 mm. fraction. Clinker-like concretions were also common, again particularly on Plot G6. Faint mottling was present in the lower portions of some profiles. The dappled, reddish yellow coatings on cobbles and gravel were slightly stronger than in the profiles of the Pseudotsuga - Gaultheria - Peltigera association. A weakly cemented zone was normally present above the ortstein, although in most of the pits dug on Plot G5 no ortstein was encountered within 100 cm. of the surface. In Plot G3 the profile was commonly abruptly terminated by the presence of bedrock at 65 cm. All horizons were acid. It was notable, however, that in Plot G4, which had a relatively high site index (140) for the association, all pH values for the mineral soil below the A_2 layer were greater than 6.2. Roots occurred most frequently in the upper mineral layers, although there was also a network of roots in the felty mor. A root mat was commonly present above the hardpan or bedrock.

The profiles of Plots G4, G5 and G6 were comparable with those described for the Shawnigan series, whereas the profiles on Plot G3 more closely resembled the Sproat series (Farstad 1957).

Pseudotsuga - Tsuga - Gaultheria association

Both plots of this association were on the upper slope of sidehills. In most pits soil depth was less than 80cm., with a considerable proportion of the soil volume being occupied by stones, particularly in Plot G1 (Table 14; Fig. 19 B). Ground water movement supplemented soil moisture from rainfall during part of the year.

Litter layers (A_0) were deep, consisting of 2 cm. of partially decomposed needles above 3 cm. or more of very dark brown to black felty mor, which was densely interwoven with roots. In some places there were layers of litter and well rotted wood up to 15 cm. deep. The leached horizon (A_2) was well defined, the upper portion of which frequently appeared to be composed of bleached organic material. In most profiles browns and yellowish and reddish browns predominated with additional colour being supplied by the prominent reddish yellow coatings on the gravel and concretions. Soil textures were gravelly sandy loams. Concretions both shotty and clinker-like, were quite numerous. In some pits the solum merged through a zone of fractured rock into the bedrock, but more frequently there was a sharp break between B and D horizons. All horizons were acid, with the pH of the A_0 and A_2 horizons of

TABLE 14: DESCRIPTION, pH, AND ORGANIC AND CLAY CONTENTS OF TYPICAL SOIL PROFILES FROM THE PSEUDOTSUGA - GAULTHERIA AND THE PSEUDOTSUGA - TSUGA - GAULTHERIA ASSOCIATION PLOTS

PSEUDOTSUGA - GAULTHERIA ASSOCIATION

Horizon	Depth (cm.)	Description	ph	Organic content (%)	Clay content (%)
PLOT G4 (Lower Deadwood)					
Ao F	3.5-2	Very dark brown (10YR 2/2) partially decomposed litter	-	-	-
H	2-0	Black (10YR 2/1) granular mor; roots numerous	-	-	-
A2	0-1	Gray brown (10YR 5/2) gravelly loam, often poorly defined; weak fine subangular blocky structure; very friable	5.3	3.0	11
B	1-10	Light yellowish brown (10YR 6/4) gravelly sandy loam, with scattered angular cobbles; weak fine subangular blocky structure; very friable; diffuse, reddish yellow (7.5YR 6/6) coatings on cobbles and gravel; roots common	6.2	1.8	7
B	10-20	Brown (10YR 5/3) gravelly sandy loam, with scattered angular cobbles; weak fine subangular blocky structure; very friable; numerous shotty concretions, with reddish yellow (7.5YR 6/6 coatings; dappled, reddish yellow (7.5YR 6/8) coatings on cobbles and gravel; roots common	6.3	1.5	5
B	20-40	Light yellowish brown (10YR 6/4) gravelly sandy loam, with scattered angular cobbles; weak fine subangular blocky structure; very friable; shotty concretions common; dappled, reddish yellow (7.5YR 6/8) coatings on cobbles and gravel; roots moderately common	6.2	1.6	5
B	40-60	Light yellowish brown (2.5Y 6/4) gravelly sandy loam, with scattered angular cobbles; weak fine subangular blocky structure; very friable; shotty concretions common; dappled, reddish yellow (7.5YR 6/8) coatings on cobbles and gravel; roots moderately common	6.6	0.8	2
B	60-80	Pale olive (5Y 6/4) gravelly sandy loam, with scattered angular cobbles; weak fine subangular blocky structure; friable to weakly cemented towards the ortstein layer; shotty concretions; light olive gray (5Y 6/2) clinker-like concretions, with reddish yellow (7.5YR 6/8) staining becoming more frequent with increasing depth; dappled, reddish yellow coatings on cobbles and gravel; roots sparse, but fine roots common just above the ortstein	6.4	0.9	2
Ortstein	80-	Light olive gray (5Y 6/2) gravelly sandy loam; irregular thick platy structure; cemented; reddish-yellow (5YR 6/8) staining, prominent in the upper portion; roots absent, except near the upper surface	6.5	0.4	4
PLOT G6 (Upper Deadwood)					
Ao F	4-2	Very dark brown (10YR 2/2) partially decomposed litter	-	-	-
H	2-0	Very dark brown (10YR 2/2) felty mor; roots common	5.2	-	-
A2	0-1	Dark gray (10YR 4/1) sandy loam; thicker among surface cobbles; weak fine subangular blocky structure; very friable; roots common	4.8	2.9	7
B	1-10	Brown (10YR 5/3) gravelly sandy loam, with scattered angular cobbles; weak fine subangular blocky structure; very friable; numerous shotty concretions, with reddish yellow (7.5YR 6/6) coatings; dappled, reddish yellow (7.5YR 6/6) coatings on cobbles and gravel; roots common	5.7	2.7	5
B	10-25	Pale brown (10YR 6/3) gravelly sandy loam, with scattered angular cobbles; weak fine subangular blocky structure; very friable; shotty concretions very numerous; dappled, reddish yellow (7.5YR 6/6) coatings on cobbles and gravel; roots common	5.7	2.8	4
B	25-50	Light yellowish brown (2.5Y 6/4) gravelly loam, with angular cobbles; weak fine subangular blocky structure; very friable; numerous shotty concretions; light yellowish brown (2.5Y 6/4) clinker-like concretions, with reddish yellow (7.5YR 6/8) staining; dappled, strong brown (7.5YR 5/8) coatings on cobbles and gravel; roots moderately common	5.9	2.5	10
B	50-80	Pale olive (5Y 6/3) gravelly sandy loam, with scattered angular cobbles; weak fine subangular blocky structure; firm to weakly cemented with increasing depth; clinker-like concretions common, becoming numerous towards the ortstein layer; dappled, reddish yellow (5YR 6/8) coatings on cobbles and gravel; reddish yellow (5YR 6/8) staining common above the ortstein; roots sparse, but fine roots common just above the ortstein	6.2	1.5	9
Ortstein	80-	Olive gray (5Y 5/2) gravelly sandy loam; irregular thick platy structure; cemented; yellowish red (5YR 5/8) staining, prominent in the upper portion; roots absent	6.5	0.6	5
PLOT G5 (Wolf Mt.)					
Ao F	3-2	Very dark brown (10YR 2/2) partially decomposed litter	5.9	-	-
H	2-0	Black (10YR 2/1) granular mor; roots numerous	5.7	-	-
A2	0-0.5	Dark gray (10YR 4/1) sandy loam, often poorly defined, but up to 2 cm thick in places; weak fine subangular blocky structure; very friable	5.3	6.5	10
B	0.5-10	Pale brown (10YR 6/3) gravelly sandy loam, with scattered angular cobbles, weak fine subangular blocky structure; very friable; shotty concretions; faint, reddish yellow (7.5YR 6/6) coatings on cobbles and gravel; roots common	5.7	2.8	8
B	10-20	Yellowish brown (10YR 5/4) gravelly sandy loam; weak fine subangular blocky structure; very friable; shotty concretions; diffuse, reddish yellow (7.5YR 6/6) coatings on gravel; roots common	6.0	2.1	13
B	20-45	Light yellowish brown (10YR 6/4) gravelly sandy loam; weak fine subangular blocky structure; friable; shotty concretions; occasional light yellowish brown (2.5Y 6/4) clinker-like concretions, with faint, reddish yellow (7.5YR 6/8) staining; diffuse, reddish yellow (7.5YR 6/6) coatings on gravel; roots moderately common	6.2	1.5	10
B	45-65	Light brownish yellow (10YR 6/5) gravelly sandy loam, with angular cobbles and scattered stones; weak fine subangular blocky structure; very friable; shotty concretions; occasional clinker-like concretions; diffuse, reddish yellow (7.5YR 6/8) coatings on cobbles and gravel; roots sparse	6.4	1.0	7
B	65-100	Yellowish brown (10YR 5/8) gravelly sandy loam, with angular cobbles and stones; weak fine subangular blocky structure; very friable, diffuse, reddish yellow (7.5YR 6/8) coatings on cobbles and gravel; roots sparse	6.4	2.0	-
		(In some places the root zone was terminated by an ortstein layer at 90-100 cm.)			
PLOT G3 (Valley)					
Ao F	6-5	Very dark brown (10YR 2/2) partially decomposed litter	5.1	-	-
H	5-0	Very dark brown (10YR 2/2) felty mor, up to 10 cm. thick among surface stones and angular cobbles, elsewhere commonly granular mor 2 cm. thick; roots common	5.0	-	-
A2	0-6	Gray (10YR 6/1) gravelly sandy loam, among surface stones and angular cobbles, elsewhere 1-2 cm. thick; weak fine subangular blocky structure; very friable; roots common	4.5	2.8	7
B	6-10	Brown (7.5YR 5/4) gravelly sandy loam, with numerous angular cobbles and stones; weak fine subangular blocky structure; very friable; shotty concretions; dappled, strong brown (7.5YR 5/8) coatings on cobbles and gravel; roots common	5.1	3.5	5
B	10-35	Light brown (7.5YR 6/4) gravelly sandy loam, with numerous angular cobbles; weak fine subangular blocky structure; very friable; shotty concretions; dappled, strong brown (7.5YR 5/3) coatings on cobbles and gravel; occasional patches of reddish brown (5YR 5/4) sandy loam; scattered clusters of pale olive (5Y 6/3) clinker-like concretions, with yellowish red (5YR 5/8) staining; roots moderately common	5.3	3.5	5
B	35-65	Yellowish brown (10YR 5/6) gravelly sandy loam, with angular cobbles; weak fine subangular blocky structure; loose; faint, strong brown (7.5YR 5/8) coatings on cobbles and gravel; roots moderately common	6.1	3.8	7
D	65-	Rock; normally with a well defined boundary between soil and rock	-	-	-
		(In some places the root zone was terminated by an ortstein layer)			

TABLE 14 - Continued

PSEUDOTSUGA - TSUGA - GAULTHERIA ASSOCIATION

Horizon	Depth (cm.)	Description	pH	Organic content (%)
PLOT G2 (Echo Mt.)				
Ao F	5-3	Very dark brown (10YR 2/2) partially decomposed litter	-	-
H	3-0	Very dark brown (10YR 2/2) to black (10YR 2/1) felty mor; roots forming dense network	4.6	-
A2	0-4	Light gray (10YR 7/1) gravelly sandy loam, in places up to 10 cm. thick among surface cobbles; upper part often including bleached humus; weak fine subangular blocky structure; very friable; shotty concretions; roots numerous	4.6	2.7
B	4-35	Strong brown (7.5YR 5/6) gravelly sandy loam, with scattered angular cobbles; weak fine subangular blocky structure; very friable; shotty concretions common, sometimes with heavy red (2.5YR 4/8) coatings; dappled, yellowish red (5YR 5/8) coatings on cobbles and gravel; scattered, faint, yellowish red (5YR 5/8) mottling; roots common	5.5	3.5
B	35-55	Yellowish brown (10YR 5/6) gravelly sandy loam, with scattered angular cobbles; weak fine subangular blocky structure; very friable; shotty concretions common; dappled, faint, reddish yellow (7.5YR 6/8) coatings on cobbles and gravel; roots moderately common	5.7	2.5
B	55-75	Light yellowish brown (10YR 6/4) gravelly sandy loam, with numerous angular cobbles and rock fragments; weak fine subangular blocky structure; very friable; dappled, faint, reddish yellow (7.5YR 6/8) coatings on cobbles and gravel; roots sparse	5.4	2.7
D	75-	Rock; fine soil merges into bedrock through a zone of fractured rock, with soil between rock fragments; roots sparse (In some places the root zone was terminated by an ortstein layer)	-	-
PLOT G1 (Fourth Lk.)				
Ao F	5-3	Very dark brown (10YR 2/2) partially decomposed litter	5.4	-
H	3-0	Very dark brown (10YR 2/2) to black (10YR 2/1) felty mor; often up to 10 cm. thick among surface cobbles and stones; roots numerous	5.0	-
A2	0-7	Light gray (10YR 7/1) gravelly sandy loam, in places up to 15 cm. thick; usually among surface cobbles but elsewhere 2 cm. thick; upper part infiltrated with dark organic matter and bleached humus; weak fine subangular blocky structure; very friable; shotty concretions; roots common	5.4	6.2
B	7-20	Pale brown (10YR 6/3) gravelly sandy loam, with numerous angular cobbles and stones; weak fine subangular blocky structure; very friable; shotty concretions common; dappled, reddish yellow (5YR 6/8) coatings on cobbles and gravel; roots common	5.0	2.8
B	20-30	Reddish brown (5YR 5/4) gravelly sandy loam, with angular cobbles; weak fine subangular blocky structure; very friable; numerous shotty concretions, with reddish yellow (5YR 6/8) coatings; dappled, reddish yellow (5YR 6/8) coatings on cobbles and gravel; roots common	5.1	6.2
B	30-50	Reddish yellow (7.5YR 6/6) gravelly sandy loam, with angular cobbles; weak fine subangular blocky structure; very friable; shotty concretions; dappled, yellowish red (5YR 5/8) coatings on cobbles and gravel; roots common	5.3	5.2
B	50-60	Yellowish brown (10YR 5/6) gravelly sandy loam, with numerous angular cobbles and stones; weak fine subangular blocky structure; very friable; shotty concretions; scattered light yellowish brown (2.5Y 6-4) clinker-like concretions, with heavy, yellowish red (5YR 5/8) staining; heavy, dappled reddish yellow (5YR 6/8) coatings on cobbles and gravel; roots common	5.2	3.8
B	60-70	Dark yellowish brown (10YR 4/4) gravelly loam, with numerous angular cobbles; weak fine to medium subangular blocky structure; friable; numerous heavily stained clinker-like concretions; dappled, reddish yellow (5YR 6/8) coatings on stones and cobbles; scattered faint, yellowish red (5YR 5/8) mottling; roots common, including some blackened decayed roots	5.1	6.0
D	70-	Rock; roots numerous on rock surface, frequently forming a mat; seepage water commonly present	-	-

TABLE 15: DESCRIPTION, pH, AND ORGANIC AND CLAY CONTENTS OF TYPICAL SOIL PROFILES FROM THE *PSEUDOTSUGA* - *TSUGA* - *HYLOCOMIUM* - *EURHYNCHIUM* ASSOCIATION PLOTS

Horizon	Depth (cm.)	Description	pH	Organic content (%)	Clay content (%)
PLOT M5 (Wolf Mt.)					
Ao F	2-1	Very dark brown (10YR 2/2) partially decomposed litter	5.5	-	-
H	1-0	Black (10YR 2/1) duff mull; roots moderately common	5.5	-	-
A_1	0-1	Very dark brown (10R 2/2) loam; weak crumb structure; friable; roots moderately common	5.7	12.0	10
B	1-10	Red (2.5YR 4/6) loam; weak medium subangular blocky structure; friable; shotty concretions, with yellowish red (5YR 5/6) coatings; diffuse, yellowish red coatings on gravel; roots common	6.4	3.0	8
B	10-20	Yellowish red (5YR 4/6) sandy loam; weak fine subangular blocky structure; friable; numerous shotty concretions; yellowish red (5YR 5/6) coatings on gravel and shot; roots common	6.5	2.4	4
B	20-45	Yellowish red (5YR 5/6) sandy loam; weak fine subangular blocky structure; friable; numerous shotty concretions; yellowish red (5YR 5/6) coatings on gravel and shot; roots moderately common	6.4	2.1	8
B	45-70	Yellowish brown (10YR 5/8) sandy loam; weak fine subangular blocky structure; friable shotty concretions; scattered, red (2.5YR 5/8) coatings on gravel; roots moderately common	6.1	2.5	7
B	70-100	Light olive brown (2.5Y 5/4) sandy loam; weak fine subangular blocky structure; friable to firm; red (2.5YR 5/8) coatings on gravel and scattered red staining above compact horizon below; faint; bluish (7.5BG 7/2) cast and weak, red mottling; roots sparse, although some fine roots present just above the compact horizon	6.3	1.4	1
D	100-130	Pale olive (5Y 6/4) sandy loam; weak medium subangular blocky structure; firm to weakly cemented; compact; diffuse, red (2.5YR 5/8) coatings on gravel; red staining and mottling; roots absent	6.1	0.5	9
PLOT M2 (Echo Mt.)					
Ao F	2-1	Very dark brown (10YR 2/2) partially decomposed litter	5.2	-	-
H	1-0	Very dark brown (10YR 2/2) felty mor; roots moderately common	5.3	-	-
A_2	0-1	Dark gray (10YR 4/1) sandy loam, in places poorly defined; weak fine subangular blocky structure; very friable.	5.7	5.7	11
B	1-20	Yellowish red (5YR 5/8) gravelly sandy loam, with angular cobbles; weak fine subangular blocky structure; friable; shotty concretions common; dappled, strong brown (75YR 5/8) coatings on cobbles, gravel and shot; roots common	5.6	2.7	-
B	20-40	Yellowish red (5YR 5/8) gravelly sandy loam, with scattered angular cobbles; weak fine subangular blocky structure; friable; shotty concretions; strong brown (7.5YR 5/8) coatings on cobbles, gravel and shot; roots common	5.9	2.2	10
B	40-75	Strong brown (7.5YR 5/6) gravelly sandy loam, with scattered angular cobbles; weak fine subangular blocky structure; friable; shotty concretions; strong brown (7.5YR 5/8) coatings on cobbles, gravel and shot; roots sparse	5.9	1.3	11
B (G)	75-100	Yellowish brown (10YR 5/6) gravelly sandy clay loam, with stones and angular cobbles; medium subangular blocky structure; firm; strong brown (7.5YR 5/8) coatings on cobbles and gravel; faint bluish (7.5BG 7/2) mottling; roots sparse	5.7	2.1	23
PLOT M4 (Lower Deadwood)					
Ao F	3-2	Very dark brown (10YR 2/2) partially decomposed litter	5.3	-	-
H	2-0	Black (10YR 2/1) felty mor; roots common	5.5	-	-
A_2	0-1	Gray (10YR 5/1) sandy loam, often thin but well defined; weak fine subangular blocky structure; very friable	5.6	3.2	5
B	1-10	Brown (7.5YR 5/4) gravelly loamy sand, with angular cobbles; weak subangular blocky structure; very friable; numerous shotty concretions; faint, strong brown (7.5YR 5/8) coatings on cobbles, gravel and shot; roots common	6.0	2.0	6
B	10-20	Yellowish brown (10YR 5/4) gravelly loamy sand, scattered cobbles; weak fine subangular blocky structure; very friable; numerous shotty concretions; faint, strong brown (7.5YR 5/8) coatings on cobbles, gravel and shot; roots common.	6.0	1.3	5
B	20-40	Yellowish brown (10YR 5/6) gravelly sandy loam, scattered cobbles and stones; weak fine subangular blocky structure; very friable; shotty concretions common; light yellowish brown (2.5Y 6/4) clinker-like concretions, with faint, strong brown (7.5YR 5/8) staining; faint, strong brown (7.5YR 5/8) coatings on cobbles, gravel and shot; very slight bluish (7.5BG 7/2) mottling; roots moderately common	6.0	1.3	2
B	40-70	Yellowish brown (10YR 5/8) gravelly loamy sand, scattered cobbles; weak fine subangular blocky structure; very friable; shotty and clinker-like concretions common; faint, strong brown (7.5YR 5/8) coatings on cobbles, gravel and shot; roots sparse	6.7	1.1	3
B	70-100	Light yellowish brown (2.5Y 6/4) gravelly loamy sand, with cobbles; very weak granular structure; loose; cobbles and gravel largely unstained; roots sparse	6.2	1.0	5
PLOT M3 (Valley)					
Ao F	3-2	Very dark brown (10YR 2/2) partially decomposed litter	5.3	-	-
H	2-0	Very dark brown (10YR 2/2) to black (10YR 2/1) felty mor; roots moderately common	5.2	-	-
A_2	0-2	Gray (10YR 5/1) sandy loam, up to 10 cm. thick among surface stones; weak fine subangular blocky structure; very friable	5.0	3.8	6
B	2-20	Brown (10YR 5/3) gravelly sandy loam, with numerous angular cobbles and stones; weak fine subangular blocky structure; very friable; shotty concretions common; faint, strong brown (7.5YR 5/8) coatings on cobbles, gravel and shot; roots common	5.5	5.1	7
B	20-45	Yellowish brown (10YR 5/6) gravelly sandy loam, with angular cobbles; weak fine subangular blocky structure; very friable; shotty concretions; occasional, pale olive (5YR 6/3) clinker-like concretions, with yellowish red (5YR 5/6) staining; dappled, strong brown (7.5YR 5/8) coatings on cobblesand gravel; roots moderately common	5.3	4.3	4
B	45-75	Yellowish brown (10YR 5/6) gravelly loamy sand, with angular cobbles; weak fine subangular blocky structure; friable; shotty concretions; clinker-like concretions more common; strong brown (7.5YR 5/8) coatings on cobbles and gravel; roots sparse	5.8	2.8	4
B	75-100	Yellowish brown (10YR 5/8) gravelly loamy sand, with scattered angular cobbles; weak fine subangular blocky structure; becoming weakly cemented; shotty concretions; clinker-like concretions nearly continuous; strong brown (7.5YR 5/8) coatings and mottling; faint bluish (7.5BG 7/2) mottling; roots sparse	5.4	4.0	5
Ortstein	100-	Olive gray (5Y 5/2) gravelly sandy loam; irregular thick platy structure; cemented; yellowish red (5YR 4/8) staining; no roots	-	-	-
PLOT M1 (Fourth Lk.)					
Ao F	7-5	Very dark brown (10YR 2/2) partially decomposed litter	4.7	-	-
H	5-0	Very dark brown (10YR 2/2) to black (10YR 2/1) felty mor; roots numerous (In places the surface horizon consisted of up to 15 cm. of decayed wood)	4.2	-	-
A_2	0-6	Light brownish gray (2.5Y 6/2) sandy loam, up to 15 cm. thick under decayed wood; weak fine subangular blocky structure; very friable; roots common	4.3	2.1	10
B	6-6.5	Dark reddish brown (5YR 3/4) loam, discontinuous	-	-	-
B	6.5-20	Reddish brown (5YR 5/4) gravelly sandy loam, with angular cobbles and stones; weak fine subangular blocky structure; very friable; shotty concretions with yellowish red (5YR 5/8) coatings; dappled, yellowish red (5YR 5/8) coatings on cobbles and gravel; roots common	5.3	3.4	5
B	20-40	Reddish brown (5YR 5/4) gravelly sandy loam, with angular cobbles; weak fine subangular blocky structure; friable; shotty concretions common; occasional light yellowish brown (2.5Y 6/4) clinker-like concretions, with heavy, yellowish red (5YR 4/8) staining; heavy, dappled, reddish yellow (5YR 6/8) staining on cobbles and gravel; roots common	5.3	4.0	10
B	40-65	Brown (7.5YR 5/4) gravelly sandy loam, with angular cobbles and stones; weak fine subangular blocky structure; friable; shotty concretions; clinker-like concretions more common; heavy, dappled, yellowish red (5YR 5/8) staining on cobbles and gravel; faint bluish (7.5BG 7/2) mottling; roots moderately common	5.3	3.8	9
B	65-90	Yellowish brown (10YR 5/6) gravelly sandy loam, with angular cobbles and stones; weak fine to medium subangular blocky structure; friable; shotty concretions; clinker-like concretions numerous; heavy, dappled, yellowish red (5YR 5/8) coatings on cobbles and gravel; scattered bluish (7.5BG 7/2) mottling; roots sparse, although fine roots common above ortstein layer	5.7	1.2	11
Ortstein	90-	Olive gray (5Y 5/2) gravelly sandy loam; irregular thick platy structure; cemented; yellowish red (5YR 4/8) staining; no roots	-	-	-

Plot G2 as low as 4.6. There was commonly a dense network of roots in the upper portion of the profile, with the roots of Tsuga and Thuja being concentrated in the A_0 and A_2 layers. Normally there was also a concentration of fine roots in the moist zone above the bedrock.

The profiles of these plots were comparable to those described for the Quinsam series (Farstad) (1957).

Pseudotsuga - Tsuga - Hylocomium - Eurhynchium association

Plots M1 and M3 of the subassociation typicum were on sidehills, whereas Plot M4 was in a small gully. Plot M5 of the subassociation nudum was on a gentle slope and Plot M2 on a steeper sidehill. Average soil depth was from 80 to 100 cm., with the root zone being terminated in most cases by a compact soil layer or by ortstein (Table 15). Stones were frequent in most plots. In Plots M1, M3 and parts of M4 30 to 40 percent of the soil volume consisted of material over 25 mm. in diameter. The soil of Plot M5, however, was largely composed of material less than 2 mm. in diameter (Fig. 18 E). Lateral movement of ground water was evident in Plots M1, M2 and M3 during a considerable portion of the year.

Litter layers (A_0) in the subassociation typicum plots consisted of from one to two centimeters of very dark brown to black felty mor. Deep H layers were common among surface stones. Leached horizons (A_2) were well defined in most profiles and varied from a few millimeters to more than 6 cm. deep in Plot M1. The H layer in Plot M5 of the subassociation nudum consisted of a shallow layer of black duff mull above a layer of very dark brown loam (A_1), which had a weak crumb structure. No A_2 was encountered in Plot M5, and in Plot M2 there was only a poorly defined leached layer.

The upper profiles of Plots M3 and M4 were brown, merging to yellowish brown with increasing depth. Soils in Plot M1 were more highly coloured.

The upper portion of the profiles was reddish brown, and yellowish red coatings on the gravel and concretions were prominent throughout. Shotty concretions were common in all plots, and clinker-like concretions were very common in Plot M1 and in Plot M3, where they constituted a major proportion of the soil volume in the lower part of the profile. In these two plots soil textures were gravelly sandy loams, with the 2 mm. fraction forming only 30 to 40 percent of the 25 mm. fraction. An ortstein layer of cemented sand and gravel, with an irregular platy structure, was present at 80 to 100 cm. in Plots M1 and M3. The soil of Plot M4 consisted largely of coarse outwash material, and soil textures were normally gravelly loamy sands. A layer of raw gravel and rounded cobbles was commonly present at the bottom of the profile.

The profile in Plot M5 was composed of a deep deposit of fine, yellowish red, outwash material above a compact layer of pale olive sandy loam. This compact layer served to restrict root penetration and downward movement of soil water. In Plot M2 the lower part of the profile in many places consisted of a faintly mottled gravelly sandy clay loam layer.

Values of pH 6 and above were common in the mineral soils of Plots M4 and M5. The other plots in the western end of the valley had lower values, with a pH of 4.2 being recorded for the H layer of Plot M1. Most roots were found in the upper part of the mineral soil, although <u>Tsuga</u> roots were largely restricted to the A_0 and A_2 horizons and there was some concentration of roots above the ortstein in Plots M1 and M3.

The profiles of Plot M1 resembled those described for the Stamp series (Farstad 1957). Profiles developed from coarse materials on Plot M2 were also comparable with those of the Stamp series, but in some parts of the plot the parent materials were finer and these profiles more closely

TABLE 16: DESCRIPTION, pH, AND ORGANIC AND CLAY CONTENTS OF TYPICAL SOIL PROFILES FROM THE PSEUDOTSUGA - POLYSTICHUM ASSOCIATION PLOTS

Horizon	Depth (cm.)	Description	pH	Organic content (%)	Clay content (%)
PLOT P4 (Upper Deadwood)					
Ao F	3-2	Very dark brown (10YR 2/2) partially decomposed litter	5.5	-	-
H	2-0	Black (10YR 2/1) granular mor; roots common	5.2		
A_1	0-1	Black (10YR 2/1) sandy loam, somewhat discontinuous; crumb structure; friable; roots numerous	-	-	-
B	1-10	Dark reddish brown (5YR 3/3) gravelly sandy loam, with occasional rounded cobbles; weak fine subangular blocky structure; friable; scattered shotty concretions; scattered, faint, strong brown (7.5YR 5/8) coatings on cobbles; roots common	6.3	6.0	7
B	10-20	Yellowish brown (10YR 5/6) sandy loam, with occasional rounded gravel and cobbles; weak fine subangular blocky structure; friable; scattered shotty concretions; scattered, faint, strong brown (7.5YR 5/8) coatings on cobbles; roots common	6.3	4.3	8
B	20-40	Yellowish brown (10YR 5/8) sandy loam, with occasional rounded gravel and cobbles; very weak fine subangular blocky structure; very friable; scattered shotty concretions; scattered, faint, strong brown (7.5YR 5/8) coatings on cobbles and gravel; roots common	6.1	2.6	8
B	40-50	Gray and brown sand, rounded gravel and cobbles; single grain structure; loose, scattered, faint, strong brown (7.5YR 5/8) coatings on cobbles and gravel; roots sparse	-	-	-
B	50-75	Strong brown (7.5YR 5/6) gravelly sandy loam, with scattered rounded coarse gravel and cobbles; weak fine subangular blocky structure; very friable; scattered faint, strong, brown (7.5YR 5/8) coatings on cobbles and gravel; roots moderately common	6.4	3.5	10
B	75-100	Yellowish brown (10YR 5/8) gravelly loamy sand, with scattered rounded coarse gravel and cobbles; very weak fine subangular blocky structure; scattered faint, strong brown (7.5YR 5/8) coatings on cobbles and gravel; roots sparse	6.3	3.0	5
B	100-130	Light yellowish brown (2.5Y 6/4) gravelly loamy sand, with scattered rounded coarse gravel and cobbles; very weak fine subangular blocky structure; very friable; scattered, faint, strong brown (7.5YR 5/8) coatings on cobbles and gravel; roots very sparse	6.2	3.7	6
PLOT P1 (Fourth Lk.)					
Ao F	4-3	Very dark brown (10YR 2/2) partially decomposed litter	5.0	-	-
H	3-0	Very dark brown (10YR 2/2) felty mor; roots common	4.5	-	-
A_2	0-1	Reddish brown (5YR 5/3) sandy loam; weak fine subangular blocky structure; friable; shotty concretions; roots common; merging into the next horizon	-	-	-
B	1-4	Yellowish red (5YR 5/6) gravelly sandy loam, often discontinuous, weak fine subangular blocky structure; friable; numerous shotty concretions, with heavy, yellowish red (5YR 5/8) coatings; roots common	-	-	-
B	4-20	Yellowish red (5YR 4/6) gravelly sandy loam, with scattered angular cobbles; weak fine to medium subangular blocky structure; friable; numerous shotty concretions; scattered reddish yellow (5YR 6/8) coatings on gravel and shot; roots common	5.3	2.6	5
B	20-45	Strong brown (7.5YR 5/6) gravelly loam; with scattered angular cobbles; weak medium subangular blocky structure; friable; shotty concretions; scattered reddish yellow (5YR 6/8) coatings on gravel and shot; roots moderately common	5.6	3.4	15
B	45-75	Yellowish brown (10YR 5/6) gravelly loam, with scattered angular cobbles; weak medium subangular blocky structure; friable; diffuse reddish yellow (5YR 6/8) coatings on cobbles and gravel; roots common	5.8	2.5	13
B	75-100	Yellowish brown (10YR 5/8) gravelly loam, with scattered stones and angular cobbles; weak medium to coarse subangular blocky structure; firm; faint, dappled, yellowish red (5YR 5/8) coatings on cobbles and gravel; roots sparse	5.9	0.7	13
B	100-120	Light yellowish brown (2.5Y 6/4) gravelly loam, with stones and angular cobbles; weak coarse subangular blocky structure; slightly plastic; very firm; dappled, yellowish red (5YR 5/8) coatings on cobbles and gravel; roots sparse	5.6	0.6	22
PLOT P2 (Echo Mt.)					
Ao F	8-6	Very dark brown (10YR 2/2) partially decomposed litter	5.4	-	-
H	6-0	Very dark brown (10YR 2/2) felty mor; often including dark reddish brown (2.5YR 3/4) woody peat from decayed logs; where peat absent humus about 2 cm. deep; roots common	5.4	-	-
A_2	0-1	Dark reddish gray (5YR 4/2) loam; under peaty decayed wood, this horizon may be up to 10 cm. thick; weak fine subangular blocky structure; friable; roots common	-	-	-
B	1-3	Dark red (2.5YR 3/6) sandy loam; weak fine subangular blocky structure; friable; shotty concretions with heavy, red (2.5YR 5/8) coatings; dappled, yellowish red (5YR 5/8) coatings on gravel; roots numerous	5.6	4.1	5
B	3-10	Red (2.5YR 4/8) sandy loam; weak fine to medium subangular blocky structure; numerous shotty concretions; yellowish red (5YR 5/8) coatings on gravel and shot; roots common	5.9	1.7	9
B	10-20	Yellowish red (5YR 4/8) sandy loam; weak fine to medium subangular blocky structure; friable; numerous shotty concretions; yellowish red (5YR 5/8) coatings on gravel and shot; roots common	6.1	1.6	13
B	20-50	Yellowish red (5YR 4/8) sandy loam; weak fine to medium subangular blocky structure; friable; shotty concretions; yellowish red (5YR 5/8) coatings on gravel and shot; roots moderately common	6.0	1.5	13
B	50-75	Red (2.5YR 4/6) sandy loam; weak fine to medium subangular blocky structure; friable; shotty concretions; diffuse yellowish red (5YR 5/8) coatings on gravel; roots sparse; this horizon is commonly below the water table	6.1	1.9	13
Ortstein	75-	Olive gray (5Y 5/2) sandy loam; irregular thick platy structure; cemented; prominently mottled with yellowish red (5YR 5/8) on exposure to air; roots absent	-	-	-
PLOT P5 (Wolf Mt.)					
Ao F	3-2	Very dark brown (10YR 2/2) partially decomposed litter	-	-	-
H_1	2-1	Very dark brown (10YR 2/2) felty mor; roots common	-	-	-
H_2	1-0	Black (10YR 2/1) granular duff mull; roots common	-	-	-
A_2	0-1	Dark gray brown (10YR 4/2) loam, often discontinuous and poorly defined; weak fine subangular blocky structure; friable; roots common	-	-	-
B	1-2	Dark reddish brown (5YR 3/2) loam, often discontinuous; weak fine subangular blocky structure; friable; roots common	-	-	-
B	2-10	Dark red (2.5YR 3/6) sandy loam; weak fine to medium subangular blocky structure; friable; numerous shotty concretions, with yellowish red (5YR 5/8) coatings; roots numerous	6.0	2.6	9
B	10-25	Red (2.5YR 4/8) sandy loam; weak fine to medium subangular blocky structure; friable; numerous shotty concretions, with yellowish red coatings; roots common	6.2	2.8	8
B	25-40	Yellowish red (5YR 5/6) sandy loam; weak fine subangular blocky structure; friable; shotty concretions common; roots common	6.1	3.2	7
B	40-70	Yellowish brown (10YR 5/6) gravelly sandy loam; weak fine subangular blocky structure; friable; occasional shotty concretion with bright, yellowish red (5YR 5/8) coatings; scattered, faint, yellowish red (5YR 5/8) coatings on gravel; scattered, distinct, yellowish red (5YR 5/8) mottling; roots sparse	6.1	1.3	8
G	70-100	Light olive grey (5Y 6/2) gravelly sandy loam, with occasional rounded cobbles; fine to medium subangular blocky structure; firm; compact; gleyed; scattered faint yellowish red (5YR 5/8) coatings on gravel; occasional yellowish red (5YR 5/8) mottling; roots very sparse	6.5	0.4	7
PLOT P3 (Valley)					
Ao F	1.5-0.5	Very dark brown (10YR 2/2) partially decomposed litter	-	-	-
H	0.5-0	Very dark brown (10YR 2/2) duff mull; roots common	5.1	-	-
A_1	0-2	Black (10YR 2/1) loam; weak fine to medium crumb structure; friable; roots common	5.2	-	-
B	2-3	Very dark brown (10YR 2/2) loam; fine subangular blocky structure; friable; occasional shotty concretions; roots common	-	-	-
B	3-8	Dark brown (10YR 3/3) loam; weak fine subangular blocky structure; friable; occasional shotty concretions; roots common	5.6	4.5	10
B	8-20	Dark yellowish brown (10YR 4/4) sandy loam; very weak fine subangular blocky structure; very friable; roots common	5.4	2.1	7
B	20-50	Yellowish brown (10YR 5/6) sandy loam; very weak fine subangular blocky structure; very friable, with bands of loose sand; roots moderately common	6.2	2.6	6
B	50-70	Dark yellowish brown (10YR 4/4) loam; weak fine subangular blocky structure; very friable; roots common	6.0	3.3	9
		(Probably the upper part of a buried profile)			
B	70-95	Yellowish brown (10YR 5/8) sandy loam; very weak fine subangular blocky structure; very friable; roots moderately common	6.4	1.6	4
D	95-120	Light grey and brown raw river gravel and sand; single grain structure; loose; occasional, light, dappled, strong brown (7.5YR 5/8) coatings on gravel; roots very sparse	6.2	-	-

resembled the Alberni series. The soils of Plot M3 were comparable with the Sproat series, while those of Plot M4 were similar to the Qualicum series. Plot M5 was somewhat like the Royston series.

Pseudotsuga - Polystichum association

The topographic locations and soil profiles of the stands of this association varied considerably (Table 16.). Plot P4 was on mixed outwash material in the bottom of a wide U-shaped valley. Plot P1 was towards the base of a steep sidehill and Plots P2 and P5 were on gentle slopes. Plot P3 was on a sandy river terrace. Except in the plots with a high water table (Plots P2 and P5), soil volume available for rooting was good, because profiles were deep and not excessively stony. Lateral movement of ground water was prominent in Plots P1, P2 and P5, but in Plot P4 the water table was normally more than 100 cm. from the surface, and in Plot P3 there was no evidence of a water table within the upper 100 cm. of the profile.

Plot P4, which had the largest tree volume per acre of any of the plots studied, was typical of stands of the association growing on fertile soils under moderately dry climatic conditions. The A_0 layer consisted of one centimeter of partially decomposed needles, beneath which was a layer of black loam, with a crumb structure. No A_2 horizon was present, though under decaying wood there was some bleaching of materials. The remainder of the profile consisted of gravelly sandy loam, with layers of gravel and cobbles being present throughout the profile (Fig. 16). Soil structure was very weakly developed and all layers varied from friable to loose. Concretions were uncommon. There were some faint brown coatings on the gravel and cobbles, but there was little sign of mottling. The pH of all mineral horizons was above 6. Fine roots, especially of the subordinate vegetation, were very common in the A horizon, with the majority of rooting being near the surface. Pseudotsuga roots also reached considerable depths. The profiles of this plot resembled those described for the Qualicum series, although the soil colours were somewhat darker, showing their affinity to the Somas series (Farstad 1957).

Although Plot P1 was towards the upper margin of the site, the profile was typical for stands of the association developed on sidehills under moist climatic conditions (Fig. 19 F). The H layer consisted of some 3 cm. of very dark brown felty mor, in which roots were common. The A_2, although well defined, was a shallow layer of reddish brown sandy loam, indicating that leaching of surface layers was not complete. The upper B horizon, which corresponded to the B_2 of the typical podzol profile, was a yellowish red, gravelly sandy loam, with numerous heavily stained shotty concretions. Shotty concretions were also common in the remainder of the profile. The B horizon merged from a yellowish red gravelly sandy loam to a pale yellowish brown gravelly loam at 100 cm. Yellowish red coatings on the angular cobbles and gravel were prominent. The lower portion of the profile had a clay content of 22 percent so that when this layer was wet it had a slightly plastic consistency and a firm consistency at lower moisture contents. There was some bluish mottling in this zone. A pH of 4.5 was measured in the H layer and values in the mineral soil were all below pH 6. Roots were concentrated towards the upper part of the profile and were quite sparse in the dense gravelly loam at the bottom of the profile. Profiles on this plot resembled those described for the Stamp series (Farstad 1957).

The A_0 horizon in Plot P2 was commonly up to 10 cm. deep, much of it being made up of woody peat from decayed logs (Fig. 19 H). Elsewhere the H layer consisted of 2 cm. of very dark brown felty mor. The A_2 was a dark reddish gray loam, usually conspicuously streaked with brown stains. The B horizon directly under the A_2, again appeared to correspond to the B_2 of a typical podzol and consisted of a shallow layer of dark red sandy loam with numerous heavily coated shotty concretions. The remainder of the B horizon varied from red to yellowish red sandy loam. The presence of fine gravel and shotty concretions gave the profile a porous structure. Although in most profiles examined the water table was commonly less than 40 cm. from the surface there was no evidence of gray gleization. The lack of gray colour probably resulted from the ease with which ground water moved through these porous profiles, and in this feature profiles resembled those described for the Bowser series (Farstad 1957). The pH of the upper horizons varied from 5.4 to 5.9, reflecting the more extreme leaching conditions at this altitude (1400 ft.). Deeper horizons had values above pH 6.0. The soil zone commonly terminated in an ortstein layer at 75 cm., although in all the pits excavated there was no root penetration to this depth. Rooting of all species was very shallow.

In Plot P5 the A_0 horizon was usually shallower than in Plot P2 (Fig. 19 I). It normally consisted of an H_1 layer of very dark brown felty mor, with a black H_2 layer of granular duff mull beneath. Wood peat was also present in some areas. The A_2 horizon was a dark gray brown loam, which was often discontinuous and poorly defined. The upper B horizon consisted of a somewhat discontinuous dark reddish brown layer below the A_2, beneath which was a dark red sandy loam layer. These layers had numerous heavily coated shotty concretions, and coatings were common on the gravel. The majority of roots were concentrated in and above the upper B horizon. The remainder of the profile, which was commonly below the water table, merged from a yellowish red sandy loam, through a yellowish brown gravelly sandy loam to a gleyed, light olive gray loamy gravel. This gleyed layer was rarely above the water table. The pH of all mineral layers was above 6. These profiles resembled those of the Puntledge series in consisting of a shallow loamy deposit overlying an impervious layer (Farstad 1957). This impervious layer caused a high water table.

The H layer in Plot P3 consisted of a thin layer of very dark brown duff mull (Fig. 19 G). This was followed by a shallow A_1 horizon of black loam, with a crumb structure. The upper B horizon consisted of a very dark brown loam, with a fine subangular blocky structure and friable consistency. Shotty concretions were present in this region. The remainder of the B horizon consisted of dark brown to yellowish brown sandy loam, with very weak structure. There were occasional bands of darker material, indicating the presence of buried profiles. The B horizon was underlain by a bed of raw gravel and river cobbles, which occurred at various depths in the sampling pits, the average being 95 cm. The B horizon was largely free from gravel and cobbles, and the 2 mm. fraction constituted nearly 100 percent of the 25 mm. fraction in most samples. Roots, though more common in the upper profile, extended to the gravel layer. Soils of this plot corresponded to those described as the Chemainus series (Farstad 1957).

Thuja - _Lysichitum_ association

Profiles in the swampy areas of this association consisted of varying depths of black muck, underlain by olive gray, gleyed, sandy loam (Table 17; Fig. 19 J). Between the muck and the gleyed layer there was commonly a narrow transition zone of gray, mucky sandy loam, indicating an area with intense gleization conditions. The gleyed layers were usually heavily infiltrated with organic matter, causing brown staining. On exposure to air some reddish and bluish mottling was evident. In Plot Ly1 the gleyed layer was fairly gravelly, but in the other plots it was largely devoid of coarse particles in the upper profile. Most roots were confined to the muck layer, but _Lysichitum_ roots were fairly common in the gleyed layer.

TABLE 17: DESCRIPTION, pH, AND CLAY CONTENTS OF TYPICAL SOIL PROFILES FROM THE *THUJA* - *LYSICHITUM* ASSOCIATION

Depth (cm.)	Description	pH	Clay content (%)
PLOT Ly3 (Wolf Mt.)			
A - SWAMP			
0-1	Moss and debris (needles, twigs, wood fragments)	-	-
1-20	Black muck; water level varying from 0 to 10 cm. below the moss layer	5.6	-
20-23	Olive gray (5Y 4/2) mucky sandy loam; firm; compact; roots sparse (mostly *Lysichitum*)	-	-
23-35+	Olive gray (5Y 5/2) gleyed sandy loam; plastic; slightly sticky; firm, compact; hard when dry; brown and yellowish red mottling (faint before exposure to air); roots absent	6.8	14
B - BANKS AND HUMMOCKS			
0-1	Partially decomposed litter	-	-
1-2	Very dark brown (10YR 2/2) felty mor	4.7	-
2-10	Dark red (2.5YR 3/6) fibrous peat, containing twig and wood fragments; roots forming a dense network	4.2	-
20-40	Very dark brown (10YR 2/2) to black muck; roots sparse.	-	-
40-	Olive gray (5Y 5/2 to 4/2) gleyed gravelly sandy loam; upper portion heavily infiltrated with muck; slightly plastic; slightly sticky; firm; compact; hard when dry; water commonly running over the surface	6.8	-
PLOT Ly2 (Upper Deadwood)			
A - SWAMP			
0-1	Moss and debris	-	-
1-20	Black muck; water level varying from 0 to 20 cm. below the moss layer	5.2	-
20-30	Black muck, somewhat more compact than above	5.5	-
30-	Olive gray (5Y 5/2) gleyed gravelly sandy loam; plastic; slightly sticky; firm; compact; hard when dry; roots absent	-	-
A' - MARGIN OF SWAMP			
0-1	Partially decomposed litter	4.7	-
1-10	Very dusky red (10R 2/2) greasy peat; roots moderately common	4.8	-
10-20	Black muck; roots moderately common	5.2	-
20-30	Olive gray (5Y 5/2) gleyed sandy loam, heavily infiltrated with dark brown (7.5YR 3/2) organic matter, particularly along root channels; plastic; slightly sticky; firm; compact; roots moderately common (mostly *Lysichitum*); water commonly running over the surface	5.8	7
30-80	Olive gray (5Y 5/2) gleyed sandy loam; plastic, slightly sticky; firm; compact; hard when dry; roots becoming very sparse with increasing depth	-	-
B - BANKS AND HUMMOCKS			
0-1	Partially decomposed litter	-	-
1-2	Dark reddish brown (2.5YR 2/4) felty mor	-	-
2-10	Very dusky red (10R 2/2) fibrous peat; roots forming dense network	4.7	-
10-20	Reddish black (10R 2/1) greasy peat; relatively homogeneous, containing few recognizable fragments; roots forming dense network	4.9	-
20-30	Air space sometimes present.		
30-50	Olive gray (5Y 5/2) gleyed gravelly sandy loam; upper portion infiltrated with organic matter; firm; slightly plastic, slightly sticky; compact; hard when dry; roots absent; water commonly running over the surface	5.7	-
PLOT Ly1 (Echo Mt.)			
A - SWAMP			
0-1	Moss and debris	-	-
1-20	Gray brown (2.5Y 5/2) sandy loam, with numerous fragments of organic debris; structureless; friable; roots moderately common; water level from 0 to 10 cm. below the moss layer	5.8	-
20-	Olive gray (5Y 5/2) gleyed gravelly sandy loam; plastic; slightly sticky; firm; compact; hard when dry; roots absent	-	-
B - BANKS AND HUMMOCKS			
0-1	Partially decomposed litter	-	-
1-2	Very dark brown (10YR 2/2) felty mor	4.4	-
2-10	Dark reddish brown (2.5YR 2/4) fibrous peat; roots numerous	4.6	-
10-30	Black muck; roots common	5.5	-
30-40	Light brownish gray (2.5Y 6/2) gleyed sandy loam; upper portion heavily infiltrated with very dark brown (10YR 2/2) organic matter; slightly plastic; firm; slightly hard when dry; roots sparse; water commonly running over the surface.	5.9	5
40-50	Olive gray (5Y 5/2) gleyed gravelly sandy clay loam; slightly plastic; sticky; firm; compact; hard when dry; roots absent	6.0	22

The surface of the banks and hummocks surrounding the swampy areas was covered by partially decomposed litter and a layer of very dark brown felty mor. These layers were followed by reddish brown to dark brown fibrous peat, interwoven by a dense network of Thuja roots. In some areas there was a layer of greasy peat beneath the fibrous peat, but in most cases the fibrous peat became moister with depth and merged into a black muck layer overlaying an olive gray, gleyed, gravelly sandy loam layer. Tree roots were concentrated in the peat and muck layers and rarely penetrated the water table above the gleyed layer.

WEATHER

Weather patterns in the Nanaimo River Valley during the years 1951 to 1953 were in accordance with the climatic averages for the region. Rainfall was light during each growing season and winter months were wet. In 1951 rainfall was in fact below average April, through August, increasing the normal seasonal drought. Low rainfalls were recorded at all stations in the study area (Table 18), as was true of other stations on Vancouver Island. Cassidy, for example, on the east coast received only 2.88 inches compared with an average of 10.75 inches for this period and Nitinat Camp in the central mountains received 6.60 inches compared with an average of 16.44 inches. In 1952, spring and early summer rainfall was average, but the summer drought extended later into the autumn than usual. Rainfall at Deadwood Creek for September and October was 1.3 inches compared with an average of 7.5 inches and even at Fourth Lake rainfall for these months was only 5.0 inches compared with an average of 16.4 inches. A similar autumn dry spell was recorded at other stations in the central mountains and on the east coast. Spring and summer rainfall in 1953 was little different from the climatic averages, although in June there was some variation in the

TABLE 18. MONTHLY PRECIPITATION AT STATIONS ADJACENT TO PLOTS SAMPLED FOR SOIL MOISTURE, 1951-1953 (in cm.)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	1951											
WOLF MOUNTAIN												
(Ly3, P5, M5, G5, L5)	-	-	-	-	-	1.1	0.4	1.8	8.9	19.0	21.8	17.7
LOWER DEADWOOD												
(M4, G4)	-	-	-	-	-	1.1	0.4	1.8	9.7	19.0	21.8	18.0
(L3, L4)	-	-	-	-	-	1.1	0.4	1.3	9.5	17.2	21.0	17.8
UPPER DEADWOOD												
(Ly2, P4, G6)	-	-	-	-	-	1.1	0.5	2.3	9.7	17.3	20.5	17.0
VALLEY												
Valley floor (P3, L2)	-	-	-	-	-	1.0	0.4	0.6	12.2	23.6	33.0"	17.0
Sidehill (M3, G3)	-	-	-	-	-	1.0	0.5	0.6	13.0	26.1	38.0"	21.8
ECHO MOUNTAIN												
Midslope (Ly1, P2, M2)	-	-	-	-	-	0.9	0.6	0.3	14.2	28.1	39.0"	19.2
Upper Slope (G2)	-	-	-	-	-	1.1	0.8	0.5	15.0	29.2	40.0"	21.2
FOURTH LAKE												
Valley floor (P1, M1)	-	-	-	-	-	0.9	0.3	1.0	15.2	28.0	42.0"	26.8
Ridge (G1, L1)	-	-	-	-	-	1.0	0.4	1.0	17.5	30.0	45.0"	27.0
	1952											
WOLF MOUNTAIN												
(Ly3, P5, M5, G5, L5)	26.0"	16.0"	7.0'	8.0'	2.6	2.6	0.7	2.2	1.0	2.4	10.8	33.8
LOWER DEADWOOD												
(M4, G4)	26.0"	16.0"	7.0'	8.0'	2.8	2.5	0.8	3.1	1.0	2.4	10.9	35.0
(L3, L4)	26.0"	16.0"	7.0'	8.0'	2.3	2.2	0.7	2.3	1.1	2.4	11.2	33.0
UPPER DEADWOOD												
(Ly2, P4, G6)	26.0"	16.0"	5.5'	6.5'	3.1	3.2	0.8	3.1	1.1	3.2	8.0	30.0
VALLEY												
Valley floor (P3, L2)	33.0"	22.0"	11.0'	13.0'	3.2	4.1	1.0	4.4	2.1	4.7	20.8	43.0
Sidehill (M3, G3)	35.0"	23.0"	14.0'	16.0'	3.3	4.7	1.1	4.7	2.7	5.4	21.2	52.0"
ECHO MOUNTAIN												
Midslope (Ly1, P2, M2)	36.0"	28.0"	14.0'	16.0'	4.0	5.8	0.9	4.6	3.1	6.2	23.0	47.0
Upper slope (M2)	41.0"	32.0"	16.0"	18.0"	3.9	6.0	1.0	4.8	3.9	6.8	-	-
FOURTH LAKE												
Valley floor (P1, M1)	46.0'	34.0'	17.0'	21.0'	4.5	8.0	1.0	7.0	4.4	8.3	23.0	60.0"
Ridge (G1, L1)	51.0"	36.0"	18.0"	22.0"	4.8	8.5	1.2	7.4	4.6	8.3	24.0	62.0"
	1953											
WOLF MOUNTAIN												
(Ly3, P5, M5, G5, L5)	47.0	10.3	10.3	5.5	3.1	5.0	2.6	1.8	9.5	8.5	26.7	16.8
LOWER DEADWOOD												
(M4, G4)	47.0	11.5	10.4	5.2	3.0	4.2	2.0	1.7	10.2	10.0	-	-
(L3, L4)	48.0	11.6	9.9	5.3	2.6	3.6	2.0	2.5	10.1	8.9	26.7	17.6
UPPER DEADWOOD												
(Ly2, P4, G6)	45.0	10.4	10.2	4.8	3.1	4.8	2.6	3.9	10.2	9.9	27.0	19.0
VALLEY												
Valley floor (P3, L2)	55.0	13.6	19.0	6.4	4.8	5.1	5.0	5.2	13.3	19.4	47.0	27.0
Sidehill (M3, G3)	71.0"	15.2	20.5	7.5	4.7	4.9	5.5	4.5	15.0	21.2	51.0	32.0
ECHO MOUNTAIN												
Midslope (Ly1, P2, M2)	72.0"	15.3	18.1	8.3	4.8	3.4	6.0	5.0	14.5	23.6	50.5	32.0
Upper slope (G2)	-	-	-	-	-	-	-	-	-	-	-	-
FOURTH LAKE												
Valley floor (P1, M1)	80.0"	15.7	24.0	5.6	7.6	2.3	4.3	9.0	16.4	32.1	65.0"	41.0
Ridge (G1, L1)	83.0"	16.0	26.0	7.2	8.5	3.0	5.3	9.1	17.4	33.1	-	-

' Interpolated from 2 month record

" Raingauge overflowed; value estimated.

customary trend from west to east. Somewhat more rainfall was recorded at the eastern end of the study area than at the western end. Such deviations could be caused by variations in the direction of rain bearing winds. Different topographic features might then cause local rain-shadows or downpowers in unusual places. During the summer dry periods of 1951 and 1952 mean daily and mean maximum temperatures were fairly high, accentuating the normal summer drought.

The winter of 1951/1952 was cold with considerable snowfall from December to March. During the winter of 1952/1953 temperatures were more moderate and most of the precipitation fell as rain. Precipitation during December 1952 and January 1953 was unusually heavy with Deadwood Creek receiving 31.9 inches compared with an average of 20.6 inches and Echo Mountain 47.8 inches compared with an average of 29.1 inches. Similarly Cassidy received 23.60 inches compared with an average of 14.16 inches and Nitinat Camp 59.35 inches compared with 34.07 inches. Other winter precipitation values from 1951 to 1953 showed little deviation from the climatic averages.

MICROCLIMATE

Precipitation and Interception

A comparison of the average amounts collected in the four plot raingauges with the averages obtained using the additional nine check gauges showed the four gauges to be a satisfactory measure of the amount of rainfall penetrating tree canopies (Appendix IV).

The percentage of interception by the tree canopy varied with stand density, amount and kind of precipitation, and season. Similar variations have been recorded in other studies (Geiger 1950). The highest mean annual interception occurred in <u>Pseudotsuga</u> - <u>Polystichum</u> stands,

TABLE 19: AVERAGE MONTHLY PRECIPITATION AND INTERCEPTION IN PLOTS SAMPLED FOR SOIL MOISTURE, 1951-1953 (cm.)

PSEUDOTSUGA - GAULTHERIA - PELTIGERA ASSOCIATION

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC		ANN	SUM[1]
PLOT L5 (Wolf Mt.)															
Precipitation(cm)	32.7	10.7	5.5	4.4	1.5	1.5	0.7	0.9	4.9	8.0	10.8	18.2	Σ[2]	100	3.1
Interception(%)	11	20	34	36	45	50	67	54	35	34	36	28	M[3]	37	57
PLOT L4 (Deadwood)															
Precipitation(cm)	32.5	11.8	7.0	5.2	1.3	1.3	0.5	1.2	6.1	8.4	13.2	20.8	Σ	109	3.0
Interception(%)	17	14	17	21	28	37	43	39	21	9	18	20	M	24	40
PLOT L3 (Deadwood)															
Precipitation(cm)	30.3	10.7	6.0	4.5	1.5	1.5	0.5	1.3	5.5	7.2	11.5	19.4	Σ	100	3.3
Interception(%)	19	22	28	32	36	39	51	35	31	21	28	26	M	31	42
PLOT L2 (Valley)															
Precipitation(cm)	38.0	12.2	10.4	6.5	2.5	2.3	1.9	2.1	7.1	12.3	20.7	25.5	Σ	141	6.3
Interception(%)	17	32	31	32	36	33	17	36	30	24	24	18	M	28	29
PLOT L1 (Fourth Lk.)															
Precipitation(cm)	57.2	20.9	19.6	12.7	4.8	2.8	1.9	4.9	10.7	20.4	28.2	36.7	Σ	221	9.6
Interception(%)	16	18	11	13	28	39	28	10	21	15	16	20	M	20	26
MEAN INTERCEPTION	16	21	24	27	35	39	41	35	27	21	25	22	M	28	39

PSEUDOTSUGA - GAULTHERIA ASSOCIATION

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC		ANN	SUM[1]
PLOT G5 (Wolf Mt.)															
Precipitation(cm)	31.0	10.5	5.6	4.7	1.5	1.6	0.8	0.9	5.1	7.2	10.9	20.9	Σ	101	3.3
Interception(%)	16	21	35	39	47	47	41	56	33	32	36	19	M	35	48
PLOT G4 (Deadwood)															
Precipitation(cm)	30.6	10.7	6.0	4.8	1.5	1.1	0.5	0.7	5.0	6.9	10.5	22.0	Σ	100	2.3
Interception(%)	17	22	31	35	48	59	56	69	41	36	37	18	M	40	61
PLOT G6 (Deadwood)															
Precipitation(cm)	33.4	12.4	6.2	4.9	1.9	1.7	0.7	1.9	5.5	7.6	11.7	19.6	Σ	107	4.3
Interception(%)	10	15	18	14	37	43	49	37	34	27	15	20	M	27	43
PLOT G3 (Valley)															
Precipitation(cm)	43.2	14.1	13.7	9.3	3.0	2.3	4.0	3.1	9.4	15.4	26.3	31.8	Σ	176	9.4
Interception(%)	20	24	20	20	27	39	41	55	14	10	12	15	M	25	45
MEAN INTERCEPTION	16	21	26	27	40	47	47	54	30	26	25	18	M	31	49

PSEUDOTSUGA - TSUGA - GAULTHERIA ASSOCIATION

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC		ANN	SUM[1]
PLOT G1 (Fourth Lk.)															
Precipitation(cm)	60.4	22.5	20.7	11.9	6.0	3.8	2.0	4.9	12.0	21.4	32.7	36.2	Σ	234	10.7
Interception(%)	11	13	16	15	10	27	21	29	11	9	5	22	M	16	26
PLOT G2 (Echo Mt.)															
Precipitation(cm)	50.2	20.3	15.0	11.5	2.8	2.6	1.8	2.7	8.9	17.1	28.5	28.6	Σ	190	7.1
Interception(%)	15	20	19	20	38	34	37	30	27	17	10	16	M	29	34
MEAN INTERCEPTION	13	17	18	18	24	30	29	29	19	13	7	19	M	20	30

[1] Summer: June, July, August
[2] Total
[3] Mean

PSEUDOTSUGA - TSUGA - HYLOCOMIUM - EURHYNCHIUM ASSOCIATION

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC		ANN	SUM[1]
PLOT M5 (Wolf Mt.)															
Precipitation(cm)	25.7	8.6	4.0	3.1	0.6	0.8	0.7	0.4	3.7	5.1	7.4	18.4	Σ[2]	78	1.9
Interception(%)	29	36	51	55	79	73	68	82	60	56	57	28	M[3]	56	74
PLOT M2 (Echo Mt.)															
Precipitation(cm)	46.2	20.0	12.5	8.7	2.1	1.9	1.5	2.1	7.2	14.3	24.6	26.7	Σ	169	5.5
Interception(%)	18	18	29	31	51	48	49	54	40	27	20	19	M	34	50
PLOT M4 (Deadwood)															
Precipitation(cm)	29.6	9.9	6.0	4.3	1.5	1.3	0.6	0.8	5.7	7.9	12.6	21.6	Σ	102	2.7
Interception(%)	19	26	31	34	49	56	49	63	34	27	25	20	M	36	56
PLOT M3 (Valley)															
Precipitation(cm)	47.7	15.7	14.8	9.0	2.6	2.1	1.8	3.6	8.0	16.5	27.3	37.3	Σ	186	7.5
Interception(%)	12	17	15	24	35	43	39	47	28	14	8	10	M	24	43
PLOT M1 (Fourth Lk.)															
Precipitation(cm)	57.0	17.0	18.1	11.9	4.2	2.6	1.6	4.6	10.6	21.3	31.1	37.6	Σ	217	8.8
Interception(%)	11	12	10	11	33	41	23	37	18	8	4	11	M	18	34
MEAN INTERCEPTION	18	22	27	31	49	52	45	56	36	26	27	18	M	34	51

PSEUDOTSUGA - POLYSTICHUM ASSOCIATION

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC		ANN	SUM[1]
PLOT P4 (Deadwood)															
Precipitation(cm)	23.5	7.4	3.2	2.6	0.9	1.2	0.6	1.4	4.5	6.6	7.1	14.5	Σ	73	3.2
Interception(%)	37	42	57	54	69	63	59	53	52	36	50	41	M	51	58
PLOT P1 (Fourth Lk.)															
Precipitation(cm)	52.0	17.7	16.1	10.6	3.7	2.2	1.5	4.3	9.5	19.2	27.1	33.0	Σ	197	8.0
Interception(%)	20	28	22	21	39	48	21	41	27	18	17	23	M	27	37
PLOT P2 (Echo Mt.)															
Precipitation(cm)	45.5	16.4	13.5	9.8	3.2	2.5	2.0	2.8	9.3	17.4	40.0	30.5	Σ	192	7.3
Interception(%)	19	21	15	18	28	28	23	17	20	11	10	9	M	18	23
PLOT P5 (Wolf Mt.)															
Precipitation(cm)	28.7	10.3	5.3	3.9	1.1	1.2	0.8	0.5	4.9	6.3	10.0	21.7	Σ	95	2.5
Interception(%)	22	21	37	44	61	59	64	72	43	44	44	20	M	44	65
PLOT P3 (Valley)															
Precipitation(cm)	36.0	13.3	10.1	10.5	1.8	1.9	1.4	3.0	6.8	12.7	18.7	25.0	Σ	141	6.3
Interception(%)	19	25	34	46	55	45	42	58	34	23	30	20	M	36	48
MEAN INTERCEPTION	23	28	33	37	51	49	42	48	35	26	30	23	M	35	46

THUJA - LYSICHITUM ASSOCIATION

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC		ANN	SUM[1]
PLOT Ly3 (Wolf Mt.)															
Precipitation(cm)	29.1	10.0	5.6	4.5	1.6	2.1	0.9	1.0	5.3	7.2	10.6	21.6	Σ	99	4.0
Interception(%)	21	23	34	33	33	36	30	50	34	30	36	18	M	32	39
PLOT Ly2 (Deadwood)															
Precipitation(cm)	26.1	9.1	4.0	3.2	1.1	1.2	0.6	1.7	5.0	7.1	10.2	15.4	Σ	85	3.5
Interception(%)	28	31	46	44	64	57	60	45	45	32	29	39	M	43	54
PLOT Ly1 (Echo Mt.)															
Precipitation(cm)	41.7	15.2	12.4	8.7	3.3	2.4	1.9	2.6	8.5	16.3	27.8	27.9	Σ	169	6.9
Interception(%)	26	26	23	26	25	33	30	21	21	15	11	18	M	23	28
MEAN INTERCEPTION	25	27	34	35	41	42	40	38	33	26	25	25	M	33	40

where crowns were large and the canopy was dense (Table 19). Plots P1 and P2 had below average values because of low stocking. The lowest mean annual interception was in the open stands of the Pseudotsuga - Tsuga - Gaultheria and Pseudotsuga - Gaultheria - Peltigera associations. In these stands crowns were small and there were few trees below the main canopy. Other associations had intermediate interception values.

Interception was greater in summer than winter months. With low rainfall a large proportion of the rain from individual showers was needed to wet the tree needles before any could penetrate the canopy and the high summer temperatures and low humidities caused rapid evaporation. In the Pseudotsuga - Polystichum plots the average interception during the summer was 46 percent compared with an annual average of 35 percent. During light showers interceptions as high as 90 to 100 percent were recorded (Appendix IV). With heavy rains the amount intercepted was commonly less than 20 percent and in some of the more open stands values were as low as 5 percent. It was noted that there were high percentages of interception with light snowfalls, for much of the snow which lodged on the tree branches evaporated before it had an opportunity to reach the ground. Even late in winter, snow depth beneath the trees was less than in adjacent open areas.

Air Temperature

Air temperatures reflected the moderating influence of stand density and the cooling effect of moist soils. Thus the highest monthly maximum temperatures measured were in the relatively open Pseudotsuga - Gaultheria - Peltigera plots and the lowest recorded were in the dense Pseudotsuga - Tsuga - Hylocomium - Eurhynchium and Pseudotsuga - Polystichum plots and the moist Thuja - Lysichitum plots (Appendix IV).

Temperature differences between corresponding Fourth Lake and Wolf Mountain plots were inconsistent. In the Pseudotsuga - Gaultheria -

Peltigera association maxima at Fourth Lake during June and August (76°F. and 87°F.) were lower than at Wolf Mountain (82°F. and 90°F.), although the reverse was the case in July. In the *Pseudotsuga* - *Tsuga* - *Hylocomium* - *Eurhynchium* and *Pseudotsuga* - *Polystichum* associations the Fourth Lake plots were warmer than their Wolf Mountain counterparts, possibly because the former were less dense and closer to cutover areas. The Fourth Lake *Pseudotsuga* - *Tsuga* - *Gaultheria* plot, however, had lower maxima than the Wolf Mountain *Pseudotsuga* - *Gaultheria* plot. These plots had comparable stand densities, but the former was towards the top of a north slope and the latter was at the base of a southwest slope.

Soil Surface Temperature

Soil surface temperatures also reflected the moderating influence of greater stand density. The lowest summer mean monthly maxima occurred in the *Thuja* - *Lysichitum* and *Pseudotsuga* - *Polystichum* associations (65°F. and 72°F.), whereas the highest were in the *Pseudotsuga* - *Gaultheria* - *Peltigera* association (111°F.) (Appendix IV). The *Pseudotsuga* - *Gaultheria* - *Peltigera* stands were the only ones where monthly value as high as 120°F. were recorded in undisturbed soils, although in July 1953 a temperature of 135°F. was recorded on Plot G4, which had been swept by a ground fire the previous fall.

The effect of the tree canopy in reducing the range of temperatures was also apparent. The widest average monthly ranges recorded were at the open stations outside forest stands. Differences in minima among stands were slight, although again the relatively open *Pseudotsuga* - *Gaultheria* - *Peltigera* stands generally had the lowest minimum temperatures and the widest ranges. There was also a relation between stand density and the rate of temperature increase in spring. The more open stands warmed more quickly than the denser and moister stands.

More frequent observations than monthly records would have been necessary to determine the length of time soil surfaces remained frozen. Monthly minimum temperatures of 32°F. and lower were recorded on all plots during the winter of 1952/1953 when snow cover was light and discontinuous. However, frozen ground was only occasionally encountered and infiltration was apparently not prevented for high moisture contents were recorded in the upper soil layers. During the winter of 1951/1952 snow covered the ground on all plots for considerable periods. Although monthly minimum temperatures of 32°F. were recorded in most plots, it was noted that under the snow at the time these records were taken temperatures were above freezing and the ground was not frozen. Therefore, even though infiltration of fresh precipitation was restricted for the duration of the snow pack, soils were not frozen when the snow began to melt in the spring.

Monthly records were also insufficiently frequent to show adequately differences among stands of the same association. It was, however, apparent that the soil surfaces of stands in the western end of the study area were cooler and warmed up more slowly in the spring than equivalent stands further east. Soil surfaces at higher altitudes and on north slopes were also cooler and warmed up later than those in comparable plots at lower altitudes and on south slopes.

Soil Temperature

During the summer, average soil temperatures were highest in the Pseudotsuga - Gaultheria - Peltigera plots, with values decreasing in the other association with increasing stand density (Appendix IV). The soils of plots at higher altitudes and at the western end of the valley were cooler than their lower and more easterly counterparts. Similarly the soils of those plots of the Pseudotsuga - Polystichum association with high water tables (Plots P2 and P5) were cooler than the soils in other stands of the association. The highest temperatures recorded occurred in the upper layers during early September. Temperatures of the deeper layers, however, continued to rise into October. In the autumn of 1953 inversion of the gradient with depth had occurred by October 1, while in 1952, when September and October were warm and dry, the inversion was not recorded until the end of the month.

During the winter, soil temperatures at a depth of 50 cm. did not fall below 38°F., except for a few of the higher altitude plots. Therefore it is likely that moisture uptake, though retarded, would not have been prevented in deep-rooted species. In the upper layers, however, temperatures ranged from 34° to 38°F. during the winter and early spring. Freezing or near freezing temperatures were recorded in all plots (except in the swampy areas of Thuja - Lysichitum association) at a depth of one centimeter. In those plots measured in early January 1952 (Plots M2 and P4) frost extended to a depth of 10 cm., but in the milder winter of 1952/53 temperatures below 34°F. were infrequent, even at a depth of 5 cm.

Soil temperatures started to rise again in March and the normal gradient of decreasing temperature with increasing depth became reestablished during April. The soils of the denser associations, as in the case of surface temperatures, warmed up more slowly than the soils of the more open stands. Earlier warming in the more easterly stands was also noted.

Evaporation

Within the forest stands evaporation rates at one meter above the ground were highest in the open Pseudotsuga - Gaultheria - Peltigera association and lowest in the moist Thuja - Lysichitum association (Table 20).

The rates in the other associations fell between, for evaporation rates decreased with increased stand density. Evaporation at the open stations was always more rapid than under the tree canopies.

Exposure to wind also played a prominent part in controlling water losses from the atmometers. The Echo Mountain station, located on a shoulder which was freely exposed to wind movement, had the highest evaporation rates among the open stations. Plot P1 was exposed to abnormal air movement because of its proximity to the cutover. Evaporation rates on this plot were higher than average for the association.

The plots at higher altitudes commonly had lower evaporation rates than equivalent plots at lower altitudes. The rates on Plot L1 were normally lower than on other plots of the same association at lower altitudes.

The effects of shrubby and herbaceous vegetation on evaporation rates were reflected more closely by the losses from bulbs at 5 cm. above the ground than by those at one meter. Thus, although the rates at one meter in the Pseudotsuga - Gaultheria stands were greater than those in the denser Pseudotsuga - Tsuga - Hylocomium - Eurhynchium stands, at 5 cm. the reverse was true. This reduction in rate was presumably due largely to the influence of Gaultheria shallon. Humidity beneath the Gaultheria bushes would be raised both on account of their transpiration and because they obstructed air movement. In the latter association there was an almost complete lack of subordinate vegetation. The effect of surface soil moisture content was also seen by the rates in the Plot P2, which were lower than average for the association. Surface soils on this plot were usually moist and there was a well developed herb layer.

The highest evaporation rates occurred in July, with the rates in August being only slightly lower. In both months the rates during the first

TABLE 20. AVERAGE RELATIVE MONTHLY EVAPORATION AT OPEN STATIONS AND IN PLOTS SAMPLED FOR SOIL MOISTURE, 1951-1952[1]

	JUNE		JULY		AUGUST		SEPT.		AVERAGE	
Height above ground (cm)	100	10	100	10	100	10	100	10	100	10
CABIN	-	30	-	72	-	53	-	34	-	47
ECHO MOUNTAIN	-	41	-	100	-	72	-	43	-	64
FOURTH LAKE	-	36	-	87	-	61	-	36	-	50
PSEUDOTSUGA - GAULTHERIA - PELTIGERA ASSOCIATION										
PLOT L5	55	32	74	49	61	40	49	31	60	38
PLOT L4	54	37	78	55	67	48	57	42	64	45
PLOT L3	46	31	58	40	48	33	42	26	48	32
PLOT L2	55	32	68	47	59	42	42	28	56	37
PLOT L1	50	35	64	52	55	46	36	30	51	41
AVERAGE	52	34	68	49	58	42	45	31	56	39
PSEUDOTSUGA - GAULTHERIA ASSOCIATION										
PLOT G5	39	20	53	28	43	23	33	15	42	21
PLOT G4	46	27	65	40	50	33	36	23	49	31
PLOT G6	43	21	49	25	38	20	26	16	39	40
PLOT G3	54	27	70	34	59	30	38	18	55	27
AVERAGE	46	24	59	32	47	26	33	18	46	25
PSEUDOTSUGA - TSUGA - GAULTHERIA ASSOCIATION										
PLOT G1	33	12	42	21	37	13	26	11	34	14
PLOT G2	36	18	46	27	41	24	34	18	39	22
AVERAGE	34	15	44	24	39	19	30	14	37	18
PSEUDOTSUGA - TSUGA - HYLOCOMIUM - EURHYNCHIUM ASSOCIATION										
PLOT M5	36	23	50	33	41	26	32	21	40	26
PLOT M2	36	24	48	36	43	32	36	25	41	29
PLOT M4	41	27	57	44	46	35	35	25	45	33
PLOT M3	44	34	60	40	48	35	36	35	47	33
PLOT M1	34	23	48	35	39	29	25	18	36	26
AVERAGE	38	26	53	38	43	31	33	23	42	29
PSEUDOTSUGA - POLYSTICHUM ASSOCIATION										
PLOT P4	33	22	42	31	36	27	38	27	37	27
PLOT P1	33	16	50	28	41	23	27	14	38	20
PLOT P2	31	15	41	21	35	19	26	11	33	16
PLOT P5	35	17	39	27	32	22	24	15	32	20
PLOT P3	37	17	44	28	37	24	23	13	35	20
AVERAGE	34	17	43	27	36	23	28	16	35	21
THUJA - LYSICHITUM ASSOCIATION										
PLOT Ly3	28	8	37	12	28	9	21	6	28	9
PLOT Ly2	29	9	42	15	34	12	32	11	34	12
PLOT Ly1	28	10	38	14	34	13	25	8	31	11
AVERAGE	28	9	39	14	32	11	26	9	31	11

[1] Average evaporation (in ml.) was divided by the largest monthly value (Echo Mountain: July) reducing amounts to relative values.

half of the month were almost double those of the second half. During the latter periods there was rainfall and more cloudy days occurred.

Relative Evaporation between Black and White Bulb Atmometers

A comparison of relative evaporation rates from the black and white bulb atmometers indicated that greater insolation reached the ground of open stands such as Plot L1 than penetrated the dense canopies of stands like Plot P5 (Appendix IV). The same trend was shown among the various stands of the Pseudotsuga - Polystichum association. Plot P2, which was fairly open, showed the greatest relative differences. The dense Plot P5 showed the least differences and Plot P1 was intermediate. Small percentage increases in black bulb rates were also recorded in the dense Pseudotsuga - Tsuga - Hylocomium - Eurhynchium plots.

The values from the open stations, however, showed some inconsistencies. At Nanaimo, during August 1952, more than 60 percent of the hours of bright sunshine occurred in the first half of the month (Meteorological Division, Canada, Department of Transport, 1952), yet in the study area the relative difference between the rates for black and white bulbs during this period was half that of the latter period. It would seem that during periods of warm dry weather when rates were high, radiant energy had a relatively smaller influence on evaporation rates than it did in damp weather. Nevertheless, when compared during the same periods, the percentage increases did form a measure of the differences in amounts of insolation reaching the ground of various plots.

SOIL MOISTURE

Considerable variations in available soil moisture were encountered. The differences were both seasonal and between plots.

In the Pseudotsuga - Gaultheria - Peltigera plots, depletion of soil

TABLE 21: MONTHLY VALUES OF AVAILABLE SOIL MOISTURE IN THE PSEUDOTSUGA.- GAULTHERIA - PELTIGERA ASSOCIATION PLOTS, 1951-1953.

(Percentage by weight of the 5 mm soil fraction)

DEPTH (cm.)	1951						1952												1953										
	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
PLOT L5 (Wolf Mt.)																													
Ao	0	0	0	-	-	90	-	-	-	-	85	0	+	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0-10	+	+	+	13	-	12	-	-	-	-	9	4	2	2	1	0	3	20'	14	13	12	13	15	11	12	4	4	16	12
10-20	1	1	+	17	-	13	-	-	-	-	8	3	1	2	+	2	2	6	9	24'	24'	20'	17'	13	10	3	2	3	13
20-30	+	1	+	12	-	9	-	-	-	-	6	5	+	1	0	2	2	4	7	11'	11'	8	8	7	4	2	2	3	8
30-40	2	+	1	10	-	8	-	-	-	-	7	5	2	1	0														
40-50	3	+	1	9	-	8	-	-	-	-	7	5	1	1	+														
50-60	1	+	+	11	-	9	-	-	-	-	5	6	1	-	-	3	2	14'	14'	12	9	11	13'	7	6	3	2	16'	7
60-70	2	1	1	9	-	9	-	-	-	-	6	6	1	-	-	2	2	2	16'	13'	10	10	11'	7	6	5	3	17'	8
70-80	2	5	2	8	-	9	-	-	-	-	-	-	2	-	-														
80-90	1	-	-	-	-	10	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
90-100	2	-	-	-	-	11	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PLOT L4 (Lower Deadwood)																													
Ao	0	-	0	-	-	-	-	-	-	-	185	70	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0-10	3	-	+	18	-	9	-	-	-	-	32	11	+	+	3	1	2	17'	18'	16	15	17'	17'	14	9	2	2	2	2
10-20	1	-	1	15	-	13	-	-	-	-	25	3	4	2	+	0	0	13'	16'	11	10	12'	12'	8	5	0	0	4	13'
20-30	1	-	2	15	-	12	-	-	-	-	13	6	2	1	+	6	7	18'	24'	14	14	15'	19'	9	8	6	4	4	22'
30-40	2	-	+	15	-	13	-	-	-	-	16	6	2	2	+														
40-50	2	-	1	17	-	3	-	-	-	-	16	6	+	2	+	+	+	16'	18'	16'	14	15'	16'	10	7	2	1	14	15'
50-60	3	-	1	13	-	4	-	-	-	-	13	6	3	1	+														
60-70	3	-	1	14	-	6	-	-	-	-	13	7	2	2	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
70-80	-	-	+	15	-	6	-	-	-	-	-	7	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
80-90	-	-	1	13	-	5	-	-	-	-	-	5	-	1	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
90-100	-	-	-	14	-	7	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PLOT L3 (Lower Deadwood)																													
Ao	0	-	0	-	-	195	-	-	-	-	140	120	0	0	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0-10	2	-	+	18	-	14	-	-	-	-	15	8	2	0	0	2	5	27'	32'	32'	22	22	28'	15	20	0	+	2	22
10-20	2	-	1	14	-	13	-	-	-	-	15	5	2	1	+	3	20	23'	23'	22	18	20	21	17	17	7	6	25'	23'
20-30	1	-	1	13	-	11	-	-	-	-	13	5	2	+	+	1	20'	22'	24'	17	13	14	15	12	11	1	1	23'	18
30-40	1	-	1	14	-	11	-	-	-	-	13	6	3	+	1														
40-50	1	-	1	12	-	8	-	-	-	-	11	6	3	1	1														
50-60	0	-	1	12	-	5	-	-	-	-	11	3	6	1	+	3	8	12'	11	11	9	9	10	9	7	3	3	14'	12'
60-70	0	-	1	15	-	6	-	-	-	-	15	5	6	+	1														
70-80	-	-	-	9	-	8	-	-	-	-	-	4	7	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
80-90	-	-	-	8	-	-	-	-	-	-	-	-	7	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
90-100	-	-	-	8	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PLOT L2 (Valley)																													
Ao	0	-	16	120	-	140	-	-	-	-	160	6	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0-10	2	-	4	25	-	20'	-	-	-	-	17	18	2	1	3	5	24'	23'	21'	20	16	18	17	12	18	4	5	20'	21'
10-20	1	-	+	19'	-	14	-	-	-	-	12	18	2	2	+	5	21'	20'	17'	15	13	14	14	12	15	6	5	6	19'
20-30	1	-	1	17'	-	14	-	-	-	-	11	11	1	1	2	5	6	19'	15'	14'	11'	12	12	10	9	4	2	4	16'
30-40	1	-	1	18'	-	15'	-	-	-	-	==	7	3	1	3														
40-50	1	-	+	23'	-	15'	-	-	-	-	-	6	3	1	4														
50-60	2	-	4	9	-	11	-	-	-	-	-	7	4	-	3	4	5	15'	23'	14'	12	12	12	9	8	6	3	5	13'
60-70	2	-	2	8	-	-	-	-	-	-	-	9	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
70-80	-	-	-	-	-	-	-	-	-	-	-	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
80-90	-	-	-	-	-	-	-	-	-	-	-	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
90-100	-	-	-	-	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PLOT L1 (Fourth Lk.)																													
Ao	0	-	40	195	-	205	-	-	-	-	199	140	120	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0-10	7	-	5	28'	-	30'	-	-	-	-	26	12	25	3	5	14	33'	26	31'	25	27	26	28'	23	16	31'	27	15	28'
10-20	7	-	4	29'	-	28'	-	-	-	-	18	5	18	4	10	12	24'	22'	24'	20	20	20	21'	18	13	17	15	14	22'
20-30	9	-	2	23	-	33'	-	-	-	-	20'	18	17	4	19	11	20'	23'	20'	17	18	17	18	17	11	12	13	10	20'
30-40	11	-	1	26'	-	37'	-	-	-	-	18	49'	21	4	22														
40-50	11	-	2	49'	-	==	-	-	-	-	21'	==	22	6	20	8	36'	34'	34'	30'	30'	32'	31'	29'	13	29	21	34'	32'
50-60	==	-	6	==	-	-	-	-	-	-	22'	-	24'	6	26	==	==	==	==	==	==	==	==	==	==	==	==	==	==
60-70	-	-	==	-	-	-	-	-	-	-	==	-	==	5	30														
70-80	-	-	-	-	-	-	-	-	-	-	-	-	-	6	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-
80-90	-	-	-	-	-	-	-	-	-	-	-	-	-	==	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-
90-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	==	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Soil pit number:[1]	1	2	3	4	-	5	6	-	-	-	7	8	9	10	11	12	12	12	12	12	12	12	12	12	12	12	12	12	12

[1] Soil pits 1-11 were measured gravimetrically; pits 1-3 and 7-11 within the first ten days of the month, and pits 4 and 5 during the last ten days. Soil pit 12 was measured electrometrically on the first day . each month.

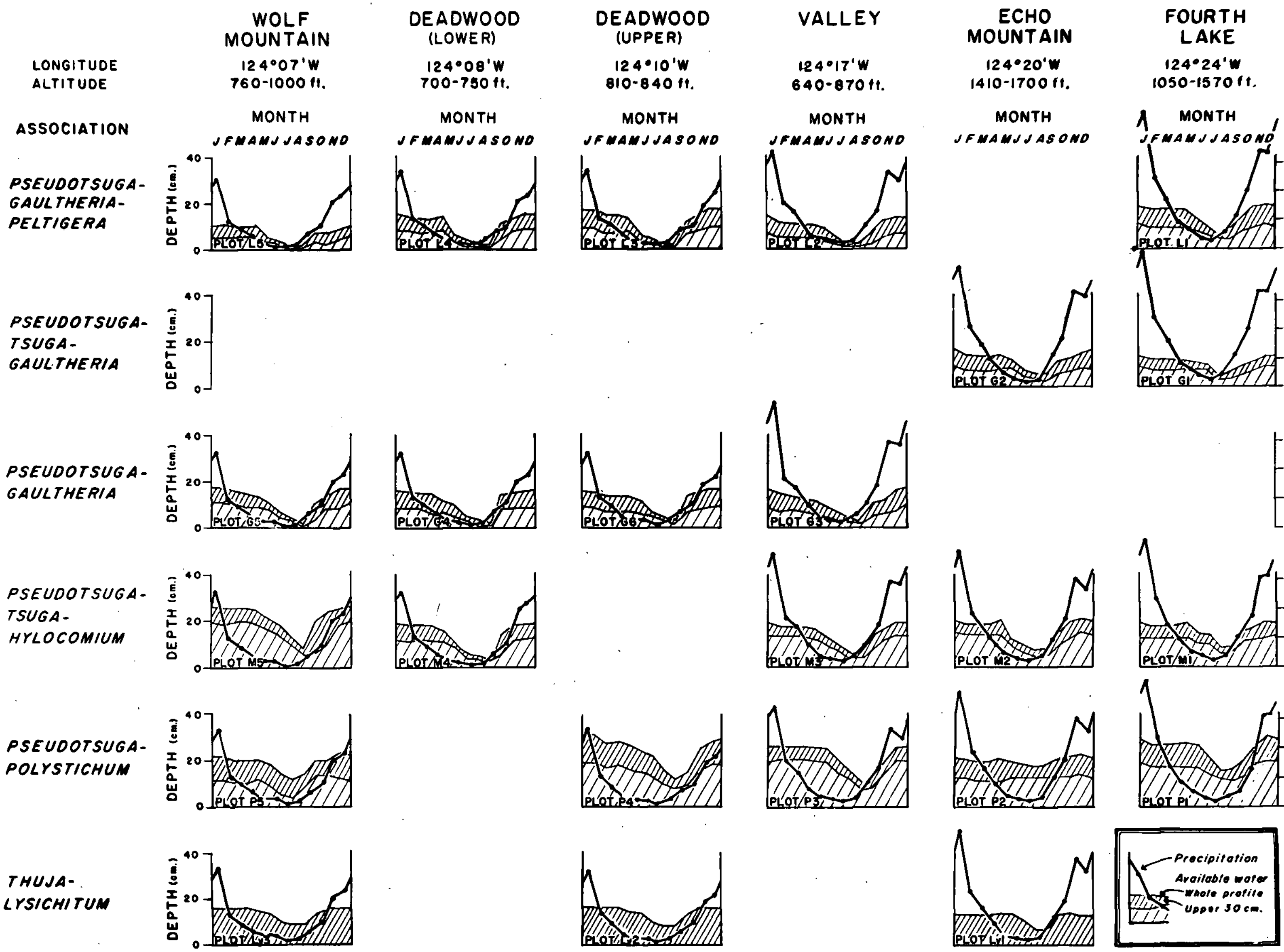
' Gravitational water present (greater than field capacity).
+ Circa wilting percentage.
0 Less than wilting percentage.

== Bedrock
— Ortstein
··· Compact soil zone

PLATE VIII, Figure 20

PLATE VIII. Precipitation and Depth of Available Water

Figure 20. Average monthly precipitation and depth of available water in the whole profile and the upper 30 cm. of plots sampled for soil moisture, 1951 to 1953. (The heavily cross-hatched portion between the soil moisture curves indicates the depth of water within the upper 30 cm. of the profile and the lightly cross-hatched portion the depth in the remainder of the profile).



20

to follow page 78

moisture reserves began in May and continued throughout the growing season (Table 21; Fig. 20). Available soil moisture in the Wolf Mountain (L5), Deadwood Creek (L3 and L4) and Valley (L2) plots was reduced to very small amounts at all depths by July in both 1951 and 1952, and although 1953 was somewhat wetter, low percentages were recorded in August. At Fourth Lake (Plot L1) however, moisture deficiencies were less marked. Appreciable reduction of soil moisture did not occur until August, and even in the dry years of 1951 and 1952 pronounced soil drought was not evident below the surface layers. In the easterly plots litter layers remained dry most of the summer, but at Fourth Lake even these layers were not reduced below wilting percentage for such a long period. Thus, rainfall in late August and early September 1951 was sufficient to wet the litter layers of the westerly plots (L1, L2), but it was not adequate to increase available moisture contents in the easterly plots. Similarly in 1952, litter layers at Fourth Lake still contained available moisture into early July, while none was present in the other plots.

In the _Pseudotsuga_ - _Gaultheria_ plots, since soil moisture reserves were somewhat greater than in the previous association, available water was not depleted so early in the season. Marked reductions were evident by July, and amounts of available water remained small until replenished by the autumnal rains. As in the previous association, litter layers remained below wilting percentage during much of the growing season.

The importance of vegetation in moisture depletion was made evident by the results from Plots G4 and G6. In the autumn of 1952, these plots were swept by ground fires which removed all the subordinate vegetation and on Plot G6 killed some trees. Although in the previous growing seasons soil moisture reduction had been as great as in Plots G3 and G5, in 1953 moisture depletion was small in the disturbed plots.

TABLE 22: MONTHLY VALUES OF AVAILABLE SOIL MOISTURE IN THE PSEUDOTSUGA - GAULTHERIA AND THE PSEUDOTSUGA - TSUGA - GAULTHERIA ASSOCIATION PLOTS, 1951-1953 (Percentage by weight of the 5 mm soil fraction)

PSEUDOTSUGA - GAULTHERIA ASSOCIATION

DEPTH (cm.)	1951						1952												1953										
	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
PLOT 05 (Wolf Mt.)																													
Ao	0	0	0	-	-	165	-	-	-	-	70	125	25	0	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0-10	3	6	4	21	-	17	-	-	-	-	9	18	3	+	1	0	2	31'	17'	14	13	15	16'	14	16'	10	+	29'	25'
10-20	3	3	2	15	-	14	-	-	-	-	6	11	1	+	1	1	+	17	20'	20'	17	18	19	17	19	12	2	21'	20'
20-30	4	2	1	13	-	10	-	-	-	-	6	10	3	2	1														
30-40	4	2	1	11	-	9	-	-	-	-	5	10	1	2	+	1	+	10'	13'	9	9	8	9	8	8	6	2	8	8
40-50	5	3	1	10	-	9	-	-	-	-	3	7	1	2	+														
50-60	4	3	1	9	-	6	-	-	-	-	4	10	2	1	+	4	3	11'	15'	15'	10	10	11'	6	10	6	4	3	9
60-70	3	3	3	7	-	5	-	-	-	-	4	7	4	2	1														
70-80	4	3	2	9	-	5	-	-	-	-	5	7	4	1	-	1	+	5	19'	18'	13'	11	12'	9	11	5	3	-	10
80-90	4	2	1	5	-	-	-	-	-	-	7	8	6	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
90-100	5	2	2	6	-	-	-	-	-	-	8	9	7	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PLOT 04 (Lower Deadwood)																													
Ao	0	0	0	125	-	200	-	-	-	-	150	50	0	0	35		ground fire	-	-	-	-	-	-	-	-	-	-	-	-
0-10	2	1	1	18	-	14	-	-	-	-	18	19	1	2	4	-		-	-	-	-	-	-	-	-	-	-	-	-
10-20	2	2	1	15	-	15	-	-	-	-	14	9	3	+	+	-	-	14	18'	18'	13	15	15	11	11	9	7	19'	16'
20-30	2	3	+	14	-	14	-	-	-	-	10	7	2	+	+	-	-	15	20'	19'	16	18'	17'	16	15	12	8	20'	19'
30-40	3	1	1	15	-	14	-	-	-	-	10	8	3	+	+														
40-50	2	+	+	13	-	16	-	-	-	-	9	8	2	1	+														
50-60	1	1	+	11	-	21'	-	-	-	-	11	12	3	1	+														
60-70	2	0	3	12	-	18'	-	-	-	-	16'	14	2	1	+	-	-	19'	21'	22'	21'	22'	18	13	11	9	4	22'	20'
70-80	1	2	0	19'	-	21'	-	-	-	-	13'	8	1	1	+														
80-90	-	2	3	6	-	15'	-	-	-	-	-	23	1	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
90-100	-	1	-	9	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PLOT 06 (Upper Deadwood)																													
Ao	+	-	0	-	-	400	-	-	-	-	210	190	55	0	0		ground fire	-	-	-	-	-	-	-	-	-	-	-	-
0-10	3	-	1	23	-	24'	17	-	-	-	15	15	8	2	+	7	7	19	21'	18	18	19	20'	18	19	16	18	23'	20'
10-20	4	-	3	17	-	20'	17	-	-	-	18	12	5	3	+	6	6	16	22'	18'	16	16	16	15	16	13	15	21'	17'
20-30	5	-	3	19	-	18'	17	-	-	-	11	12	5	3	+														
30-40	7	-	2	17	-	19'	17	-	-	-	11	9	6	2	1	5	5	15'	21'	17'	12	13	13	13	11	11	10	13	14'
40-50	9	-	3	11	-	19'	16	-	-	-	11	10	7	2	1														
50-60	7	-	1	11	-	13	15'	-	-	-	11	12	7	2	2	3	4	11	13'	11	10	11	11	10	10	10	10	12'	11
60-70	5	-	2	15	-	19'	15'	-	-	-	12	13	5	3	1														
70-80	6	-	2	17'	-	-	16'	-	-	-	11	9	6	1	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
80-90	-	-	2	20'	-	-	15	-	-	-	12	-	8	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
90-100	-	-	2	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PLOT 03 (Valley)																													
Ao	0	-	25	210	-	180	-	-	-	-	155	145	100	-	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0-10	+	-	13	22	-	29'	-	-	-	-	18	18	11	3	4	8	12	34	30'	24'	19	21'	20	17	17	13	8	9	27'
10-20	3	-	+	21	-	25'	-	-	-	-	15	17	7	3	4	2	6	53'	45'	33'	25	26'	25	21	13	17	1	1	33'
20-30	5	-	1	21	-	17'	-	-	-	-	14	16	7	3	7														
30-40	4	-	2	22	-	17'	-	-	-	-	7	10	8	2	6	3	12	25'	24'	19'	16	19'	17'	16	11	15	2	19'	22'
40-50	7	-	4	18	-	18'	-	-	-	-	8	13	7	1	7	3	24'	22'	24'	24'	20	23'	21	21	13	16	2	22'	25'
50-60	6	-	8	10	-	13'	-	-	-	-	-	-	-	2	10														
60-70	=	-	5	=	-	=	-	-	-	-	-	-	-	4	7	=	=	=	=	=	=	=	=	=	=	=	=	=	=
70-80	-	-	=	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
80-90	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
90-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

PSEUDOTSUGA - TSUGA - GAULTHERIA ASSOCIATION

DEPTH (cm.)	1951						1952												1953										
	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
PLOT 01 (Fourth Lk.)																													
Ao	25	-	-	-	-	-	-	-	-	-	260	180	135	0	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0-10	4	-	40	16	-	245	-	-	-	-	25'	8	19	4	13	6	29'	24'	24'	20	23	23	24'	18	8	6	17	30'	23
10-20	6	-	22	50'	-	31	-	-	-	-	20'	42'	20	7	17	9	32'	30'	31'	22	25	21	25	20	14	11	18	5	22
20-30	12	-	5	31'	-	25	-	-	-	-	23'	16'	28	3	22	9	8	15'	13'	11	11	11	12'	12'	10	10	12'	1	13'
30-40	11	-	4	71'	-	22	-	-	-	-	38'	-	29'	3	14														
40-50	14	-	5	-	-	18	-	-	-	-	44'	-	27'	4	15	8	11	17'	13'	12	12	13'	13'	12	10	10	15'	11	13'
50-60	20'	-	6	-	-	19	-	-	-	-	-	-	-	4	19														
60-70	18'	-	4	-	-	20'	-	-	-	-	-	-	-	3	-	9	20'	17'	17'	15	16'	16'	16'	16'	13	13	17'	18'	17'
70-80	29'	-	-	-	-	25'	-	-	-	-	-	-	-	6	-	=	=	=	=	=	=	=	=	=	=	=	=	=	=
80-90	29'	-	-	-	-	36'	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
90-100	=	-	-	-	-	29'	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PLOT 02 (Echo Mt.)																													
Ao	1	-	70	240	-	-	-	-	-	-	220	140	66	0	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0-10	2	-	4	9	-	350	-	-	-	-	30	21	7	+	5	8	27'	22	26'	19	22	21	24'	19	16	17	16	27'	23'
10-20	5	-	3	15	-	20'	-	-	-	-	18	14	6	+	7	7	8	15'	20'	13	13	13	13	12	10	11	9	17'	15'
20-30	6	-	3	14	-	17	-	-	-	-	16	13	8	3	7														
30-40	7	-	1	15	-	15	-	-	-	-	14	16	8	5	11	0	15'	14'	15'	11	12'	11	13'	12'	11	12'	10	13'	13'
40-50	7	-	2	13	-	18'	-	-	-	-	13	13	8	=	-														
50-60	8	-	2	14	-	21'	-	-	-	-	12	13	12	-	6														
60-70	7	-	4	14'	-	24'	-	-	-	-	8	13	22	-	10	5	16'	16'	16'	13	13	13	14	14	12	14	7	16'	15'
70-80	8	-	5	11'	-	-	-	-	-	-	-	19'	8	-	-	=	=	=	=	=	=	=	=	=	=	=	=	=	=
80-90	8	-	6	13'	-	-	-	-	-	-	-	18'	-	-	-														
90-100	=	-	7	20'	-	-	-	-	-	-	-	16'	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1 Soil pit number:	1	2	3	4	-	5	6	-	-	-	7	8	9	10	11	12	12	12	12	12	12	12	12	12	12	12	12	12	12

1 Soil pits 1-11 were measured gravimetrically; pits 1-3, 6 and 7-11 within the first ten days of the month, pits 4 and 5 during the last ten days. Soil pit 12 was measured electrometrically on the first day of each month.

' Gravitational water present (greater than field capacity).
+ Circa wilting percentage.
0 Less than wilting percentage.

═ Bedrock
— Ortstein
--- Compact soil layer

During late autumn, after periods of heavy rainfall, high moisture percentages were recorded and temporary water tables above the hardpans were common. When Plot G6 was sampled in early December 1951, this water table was 10 cm. deep. On sampling in early January 1952, by which time snow had covered the ground for some two weeks, there was no gravitational water above the hardpan and the percentages of all layers were lower. It was apparent that further addition of water was prevented by the blanket of snow. In these gravelly soils drainage quickly removed excess water, even though the plot was on an almost level bench. In the winter of 1952/1953 such perched water tables were present more continuously, for there was little snow or frozen soil to restrict infiltration of rainfall.

In the Pseudotsuga - Tsuga - Gaultheria plots moisture values were in the upper part of the available range for much of the growing season. Available moisture was even present in the litter layers during considerable periods in summer. Low values, particularly in the upper 20 cm., were recorded in July 1951 and August 1952, but periods with small amounts of available moisture were of relatively short duration. On Plot G1, which was on a 20° slope, gravitational water flowed over the bedrock until July.

In the subassociation typicum plots of the Pseudotsuga - Tsuga - Hylocomium - Eurhynchium association available water was largely exhausted from the surface layers of the more easterly plots (M3 and M4) during the summers of 1951 and 1952. Moisture in the deeper layers was also reduced to small amounts in the latter part of the growing season. This reduction was quite marked in Plot M4. In the Fourth Lake plot (M1), depletions were less pronounced and of shorter duration. Litter layers were below wilting percentage much of the growing season in the easterly plots, but at Fourth Lake available water was present even in these layers during most months. Moisture depletion was less severe in all layers during 1953.

In the subassociation nudum plots of the Pseudotsuga - Tsuga - Hylocomium - Eurhynchium association soil moisture deficiencies were not pronounced, although low values were recorded in the surface layers at the end of the unusually prolonged summer drought of 1952.

During the spring and autumn, gravitational water was present above the clayloam layer at the base of the profile in Plot M2. Depletion of soil moisture reserves during the growing season was therefore delayed by the addition of seepage water early in the season. Ground water flow, however, was absent during the summer. Also, when the plot was sampled in early January 1952, two weeks after heavy snow cover restricted further infiltration, no gravitational water was present to a depth of 100 cm., even though water had been encountered three weeks earlier before the snow blanket was complete. Accumulations of water did occur in an open observation pit on Plot M5 after prolonged autumnal rains in 1951, but normally the soils on this plot were well drained for a depth of one meter or more. The deep, fine textured soils of this plot provided good moisture reserves, and these delayed moisture depletions until late in the growing season.

In the Pseudotsuga - Polystichum plots considerable depths of available water were present in most plots at all seasons, and very low moisture values were uncommon. High water tables and seepage water, present in four of the plots, contributed to these favourable moisture conditions.

There was relatively little fluctuation in the height of the water table in an observation pit on Plot P2. The level of the water was commonly only 40 cm. below the soil surface, although in the later summer of 1952 it dropped to 50 cm. and during the winter it sometimes rose to within 20 cm. of the surface. This high water table maintained even the upper

TABLE 23: MONTHLY VALUES OF AVAILABLE SOIL MOISTURE IN THE PSEUDOTSUGA - TSUGA - HYLOCOMIUM - EURHYNCHIUM ASSOCIATION PLOTS, 1951-1953

(Percentage by weight of the 5 mm soil fraction)

DEPTH (cm.)	1951 JUL	AUG	SEP	OCT	NOV	DEC	1952 JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	1953 JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
PLOT M5 (Wolf Mt.)																													
Ao	3	60	0	120	-	65	-	-	-	-	30	90	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0-10	15	11	3	18	-	17	-	-	-	-	14	25	6	9	6	+	+	15	23'	22	17	19	23'	17	22	14	8	12	23'
10-20	16	12	5	18	-	16	-	-	-	-	10	22	7	11	6	1	1	10	15	21'	14	14	16'	12	14	11	8	19'	17'
20-30	8	16	7	21	-	19	-	-	-	-	9	18	10	13	6	9	8	11	14	21'	18'	17	17	16	16	14	5	16	22'
30-40	14	18	5	23	-	18	-	-	-	-	11	16	10	14	6														
40-50	22'	17	7	17	-	19	-	-	-	-	16	16	6	15	7														
50-60	18	20	8	22	-	18	-	-	-	-	14'	16	4	16	7	9	8	8	24'	27'	23	22	21	20	19	17	4	13	14
60-70	15	19	7	24	-	23	-	-	-	-	12	12	6	15	6														
70-80	15	19	8	25'	-	16	-	-	-	-	20'	17	5	19	4														
80-90	11	21	7	25'	-	7'	-	-	-	-	24'	13	6	20	4	14	13	13	32'	32'	32'	31'	30'	28	28	25	7	16	18
90-100	14	21	6	19	-	8	-	-	-	-	38'	10	6	26	5														
120	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14	13	12	21'	22'	23'	23'	23'	21'	20'	18'	7	15	15
PLOT M2 (Echo Mt.)																													
Ao	35	-	0	270	-	270	-	-	-	-	140	85	45	0	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0-10	9	-	4	12	-	20'	16	-	-	-	16	5	6	9	15	2	12'	7	9'	9'	7	8	8	7	8	7	7	16'	10'
10-20	9	-	3	14	-	20'	14	-	-	-	14	5	4	10	11	2	3	9	12'	11	9	10	10	9	9	9	8	10	12'
20-30	7	-	3	13	-	20'	15	-	-	-	16	7	4	7	10	2	2	9'	10'	9'	8	8	8	7	7	7	7	8	9'
30-40	9	-	4	12	-	20'	14	-	-	-	15	10	5	7	11														
40-50	9	-	3	14	-	19'	15	-	-	-	13	7	6	7	11	5	6	10'	10'	10'	9	9	9	8	7	7	7	6	9
50-60	6	-	3	15	-	16'	15	-	-	-	13	9	7	7	15														
60-70	9	-	5	15	-	16'	16	-	-	-	14	11	7	10	19														
70-80	8	-	5	16	-	15	15	-	-	-	15'	13	6	11	17														
80-90	10	-	2	14'	-	16'	16'	-	-	-	17'	15	6	11	17	6	14	19'	19'	20'	17'	18'	16	17'	16	16	14	18'	20'
90-100	9	-	3	10	-	20'	19'	-	-	-	21'	-	7	10	12														
PLOT M4 (Lower Deadwood)																													
Ao	+	0	0	-	-	250	-	-	-	-	140	40	10	0	75	ground fire		-	-	-	-	-	-	-	-	-	-	-	-
0-10	2	3	+	16	-	28'	-	-	-	-	17	5	2	4	+	-	-	20'	19'	18	14	18	18	13	16	11	11	20'	18
10-20	4	3	3	15	-	12	-	-	-	-	8	3	3	2	2	-	-	10'	11'	11'	7	8	9	7	8	6	6	11'	10'
20-30	5	2	3	15	-	10	-	-	-	-	6	5	3	2	1	-	-	13	16'	17'	14	15	16'	15	16'	10	12	17'	17'
30-40	3	3	2	15	-	11	-	-	-	-	7	5	4	2	1														
40-50	4	3	3	14	-	7	-	-	-	-	7	5	3	2	+														
50-60	5	3	3	12	-	9	-	-	-	-	6	6	4	4	1	-	-	19	22'	21'	19	20'	20'	19	19	18	17	21'	21'
60-70	4	3	2	7	-	8	-	-	-	-	4	8	6	5	1														
70-80	3	4	3	7	-	8	-	-	-	-	5	9	3	4	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
80-90	1	4	2	7	-	6'	-	-	-	-	4	9	3	5	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
90-100	6	1	1	10	-	5'	-	-	-	-	-	11	6	5	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PLOT M3 (Valley)																													
Ao	0	-	+	-	-	130	-	-	-	-	135	100	35	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0-10	2	-	1	23	-	19	-	-	-	-	15	23	12	1	3	3	18'	18'	14	14	14	14	15'	14	18'	12	8	5	19'
10-20	3	-	2	13	-	20	-	-	-	-	12	11	12	6	5	7	6	14'	7	6	6	7	8'	7	8'	5	5	12'	8'
20-30	4	-	3	13	-	19	-	-	-	-	13	13	9	5	3	7	6	21'	20	19	19	19	20	21'	21'	19	16	21'	20
30-40	3	-	3	15	-	19	-	-	-	-	16	13	8	7	5														
40-50	4	-	4	17	-	21	-	-	-	-	15	13	8	8	7														
50-60	4	-	4	17	-	11	-	-	-	-	18	12	12	5	7	6	22'	20'	14'	13	12	14'	17'	13	12	12	9	20'	16'
60-70	4	-	6	16	-	11	-	-	-	-	17	10	11	4	6														
70-80	6	-	5	16	-	12	-	-	-	-	17'	9	6	4	-	4	14'	7'	5'	4	4	4	4	6'	6'	6'	5'	5'	6'
80-90	-	-	8	16	-	13'	-	-	-	-	10'	11	-	6	-														
90-100	-		11	18'	-	13'	-	-	-	-	12'	14	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PLOT M1 (Fourth Lake)																													
Ao	37	-	65	-	-	185	-	-	-	-	190	135	225	-	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0-10	11	-	+	-	-	27	-	-	-	-	90	20	20	0	7	14	33'	27	19	19	22	22	27	27	19	21	31'	34'	30'
10-20	12	-	3	21	-	25	-	-	-	-	37	15	19	7	5	9	4	11	11	11	11	11	12'	11	10	11	13'	14'	12'
20-30	12	-	4	22'	-	25'	-	-	-	-	20	13	15	8	0														
30-40	14	-	5	21'	-	21	-	-	-	-	17	13	15	10	1	15	23'	17'	17'	15	13	14	15	14	13	14	16'	19'	17'
40-50	15	-	3	19'	-	26'	-	-	-	-	16	15	16	10	+														
50-60	15	-	5	18'	-	22'	-	-	-	-	13	15	16	11	4	22'	26'	23'	22'	14	14	14	14	14	13	14	15'	16'	15'
60-70	16	-	5	20'	-	21'	-	-	-	-	10	14	15	10	4														
70-80	13	-	7	23'	-	20'	-	-	-	-	13'	18'	17	10	6														
80-90	14	-	14	23'	-	=	-	-	-	-	16'	-	18	-	8	8	16'	8	7	5	5	5	5	5	4	4	8	8	9'
90-100	17	-	10	23'	-	-	-	-	-	-	-	-	15	-	-														
[1] Soil pit number:	1	2	3	4	-	5	6	-	-	-	7	8	9	10	11	12	12	12	12	12	12	12	12	12	12	12	12	12	12

[1] Soil pits 1-11 were measured gravimetrically; pits 1-3, 6 and 7-11 within the first ten days of the month, and pits 4 and 5 during the last ten days. Soil pit 12 was measured electrometrically on the first day of each month.

' Gravitational water present (greater than field capacity).
+ Circa wilting percentage.
0 Less than wilting percentage.

== Bedrock
— Ortstein
--- Compact soil zone

TABLE 24: MONTHLY VALUES OF AVAILABLE SOIL MOISTURE IN THE

PSEUDOTSUGA - POLYSTICHUM ASSOCIATION PLOTS, 1951-1953

(Percentage by weight of the 5 mm soil fraction)

DEPTH (cm.)	1951 JUL	AUG	SEP	OCT	NOV	DEC	1952 JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	1953 JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
PLOT P4 (Upper Deadwood)																													
Ao	50	-	0	92	-	120	-	-	-	-	60	40	60	0	0	ground fire		-	-	-	-	-	-	-	-	-	-	-	-
0-10	32	-	9	44	-	65'	44	-	-	-	-	-	25	3	1	0	35'	-	38'	33'	23	28	29	31'	36'	37'	20	35'	29
10-20	12	-	12	10	-	65'	50	-	-	-	19	12	25	4	4	0	+	16	23	29	27	37	36	37	37	30	16	14	28
20-30	7	-	6	24	-	51'	52	-	-	-	11	31	21	3	7	4	3	16	37'	36	33	35	36	36	35	29	19	17	36
30-40	15	-	5	12	-	46'	37	-	-	-	7	13	25	2	3														
40-50	32	-	8	50	-	21	51'	-	-	-	9	8	25	3	3														
50-60	-	-	14	36	-	27'	21	-	-	-	20	8	25	5	3	+	+	8	12'	15'	11	12'	11	11	10	6	4	3	11
60-70	33	-	9	30	-	44'	16	-	-	-	11	10	13	5	3														
70-80	24	-	8	37	-	51'	17	-	-	-	23	35	8	5	3														
80-90	18	-	12	36	-	-	19'	-	-	-	16	38	5	21	3	4	4	-	24	27'	25	26'	26'	24	22	19	9	5	25
90-100	21	-	9	35	-	-	21'	-	-	-	12	18	9	14	28														
120	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	4	10	19'	23'	17	22'	22'	19'	16	13	5	5	20'
PLOT P1 (Fourth Lake)																													
Ao	0	-	110	-	-	180	-	-	-	-	160	140	135	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0-10	7	-	4	21	-	22'	-	-	-	-	29'	25	22	6	5	5	18'	16	16	15	16	16	16	14	10	7	11	8	16
10-20	9	-	12	20	-	22'	-	-	-	-	26'	21	19	8	6	11	12	38'	27'	17	19	19	23'	38'	38'	23'	20	11	29'
20-30	8	-	14	22'	-	21'	-	-	-	-	19'	19	14	7	-														
30-40	12	-	9	30'	-	20'	-	-	-	-	16'	19	13	11	11	8	6	34'	34'	31	33	33	34'	32	27	21	17	6	34'
40-50	11	-	8	27'	-	18'	-	-	-	-	20'	19	11	9	16														
50-60	7	-	8	27'	-	21'	-	-	-	-	-	21	14	10	17	10	12	13'	13'	12	11	12	10	11	10	10	10	6	13'
60-70	7	-	8	33'	-	26'	-	-	-	-	-	24	12	14	17														
70-80	11	-	6	31'	-	22'	-	-	-	-	-	16	11	12	12														
80-90	8'	-	6	31'	-	24'	-	-	-	-	-	18'	9	10	7	18	20'	20'	20'	20'	20'	20'	20'	20'	20'	19	20'	10	20'
90-100	11	-	8	-	-	21'	-	-	-	-	-	19'	8	9	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PLOT P2 (Echo Mt.)																													
Ao	-	-	55	140	-	-	-	-	-	-	150	160	-	+	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0-10	110	-	21	215	-	230	-	-	-	-	23	26	165	15	56	6	9	13'	13'	14'	8	8	10'	10'	9	12'	14'	-	-
10-20	26	-	55'	56'	-	25'	-	-	-	-	22'	12	101'	10	29	11	15'	15'	16'	16'	12	12	13'	13'	13'	13'	15'	-	-
20-30	25	-	41'	33'	-	40'	-	-	-	-	19'	18	24'	12	28'	12	20'	20'	20'	19'	19'	19'	19'	19'	19'	19'	20'	-	-
30-40	23	-	35'	39	-	-	-	-	-	-	26'	19'	21'	18'	36'														
40-50	33'	-	37'	38'	-	-	-	-	-	-	26'	22'	17'	18'	40'	24'	24'	24'	24'	23'	24'	23'	24'	24'	24'	24'	24'	-	-
50-60	-	-	39'	38'	-	-	-	-	-	-	29'	23'	24'	17'	-														
60-70	-	-	-	27'	-	-	-	-	-	-	-	26'	-	22'	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
70-80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
80-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
90-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PLOT P5 (Wolf Mt.)																													
Ao	120	40	30	-	-	135	-	-	-	-	120	150	180	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0-10	18	7	15	29	-	29	-	-	-	-	18	88	185	13	3	1	16	26'	26'	25'	25'	25'	23	25'	25'	24	12	23	26'
10-20	35	11	18	29	-	22	-	-	-	-	20	40'	42	9	4	5	10	27'	28'	27'	26	27'	25	27'	27'	26	17	27'	27'
20-30	18	14	16	31'	-	34'	-	-	-	-	22'	23'	24'	21	4	6	5	23'	23'	23'	20'	20'	17	20'	20'	19'	14	18'	20'
30-40	12'	18	28	33'	-	30'	-	-	-	-	23'	14	20	18	4														
40-50	13'	13	21	24'	-	28'	-	-	-	-	28'	-	14'	11	6														
50-60	11'	12	13	22'	-	-	-	-	-	-	15'	-	-	7	6	5	5	14'	17'	17'	17'	17'	7	15'	15'	13	10	16'	17'
60-70	-	11	13	11'	-	-	-	-	-	-	18'	-	-	10'	7														
70-80	-	13'	10	-	-	-	-	-	-	-	-	-	-	-	9	6	7	12'	12'	12'	12'	12'	6	13'	13'	12'	11'	12'	13'
80-90	-	12'	8	-	-	-	-	-	-	-	-	-	-	-	18														
90-100	-	11'	8	-	-	-	-	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PLOT P3 (Valley)																													
Ao	36	-	4	-	-	24	-	-	-	-	50	45	0	0	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0-10	11	-	5	22	-	20	-	-	-	-	20	24	21	16	13	0	+	22'	24'	22'	20	20	20	19	19	17	17	4	24'
10-20	30	-	4	13	-	18	-	-	-	-	13	24	15	5	12	+	13	18	19'	18	19'	18	18	18	18	18	16	18	21'
20-30	27	-	5	19	-	16	-	-	-	-	10	22	10	11	8	+	1	17	20	21	20	21	21	20	19	19	17	18	21
30-40	17	-	3	17	-	11	-	-	-	-	20	30	8	23	6														
40-50	13	-	2	19	-	11	-	-	-	-	24	32	7	12	4														
50-60	11	-	4	20	-	14	-	-	-	-	32	24	7	6	3	1	1	25	26	30'	28	29	29	29	29	28	23	21	31'
60-70	21	-	1	13	-	24'	-	-	-	-	18	32	7	15	5														
70-80	20	-	2	12	-	12	-	-	-	-	8	15	6	7	3														
80-90	12	-	3	8	-	7'	-	-	-	-	5	25	5	3	2	2	2	13	18	21'	18	18	19	17	17	15	10	8	20
90-100	6	-	2	5	-	7'	-	-	-	-	4	18	3	6	2														
125	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	11	24'	24'	22	24'	24'	23'	22	20	11	9	24'
[1] Soil pit number:	1	2	3	4	-	5	6	-	-	-	7	8	9	10	11	12	12	12	12	12	12	12	12	12	12	12	12	12	12

[1] Soil pits 1-11 were measured gravimetrically; pits 1-3, 6 and 7-11 within the first ten days of the month, and pits 4 and 5 during the last ten days. Soil pit 12 was measured electrometrically on the first day of each month.

' Gravitational water present (greater than field capacity).
+ Circa wilting percentage.
0 Less than wilting percentage.

— Ortstein
--- Compact soil layer
〰 Water table

layers of the mineral soil continuously damp, and moisture values in the litter layer were above wilting percentage most of the growing season. The observation pit, however, being towards the edge of a slight depression, represented a moister part of the stand.

Although the water table on Plot P5 dropped 100 cm. below the ground line during the latter part of the summer, even the upper layers of the soil profile remained moist. At other seasons, observations on an open pit showed the water table to fluctuate at a depth of 40 cm. below the soil surface. At the end of January 1953, after prolonged precipitation, the level rose to within 10 cm. of the top of the pit.

On plot P1 water was present in an observation pit at most periods except late summer and early autumn. Normally this water flowed over the compact soil zone of the lower profile, some 80 cm. from the surface. In early spring and late autumn, however, it was frequently higher. During a wet spell in late December 1952, for example, water overflowed from the pit, even though the plot was on a 20° slope.

The only occasion on which a water table was encountered on Plot P4 was in early December 1951 following heavy rainfall in November. Water flowed into the sampling pit at 60 cm. from the surface. When the same pit was resampled in early January, about two weeks after winter snowfall prevented further infiltration, no ground water occurred within 100 cm. of the soil surface. Although some supplementary soil water may have been provided by seepage on Plot P4, both Plots P3 and P4 were largely dependent on rainfall for the maintainance of soil moisture reserves. During 1952, these reserves were depleted to fairly low levels by the extension of the normal drought into autumn. Moisture deficiencies were quite marked in Plot P3 during October and November 1952. In other years the autumnal rains replenished reserves before deficiencies became pronounced.

In the swampy areas of the Thuja - Lysichitum plots the water table was close to the surface at all seasons. This water table was perched above the gley layer. Late in the summer water levels dropped 10 or 15 cm., but the muck layer remained saturated.

On the banks at the margins of these swamps the litter layers on Plots Ly2 and Ly3 dried out in late summer. On Plot Ly1, however, available moisture was always recorded in the litter layer. The upper portions of the peaty layers showed some moisture deficiencies during the summer, but they did not drop below wilting percentage. During much of the year the water table remained above the gleyed gravel layer beneath the peat, although in Plot Ly1 the water level did drop 10 to 20 cm. below the gravel surface in late summer. The lower peat layers, however, were always moist even in summer and they were often saturated during the winter.

DISCUSSION

In most temperate regions differences among soil moisture regimes are the most critical aspect of water relations that determine tree growth. It has been shown that even seedlings can withstand atmospheric drought if their roots are supplied with adequate moisture (Daubenmire 1943). In certain cases atmospheric humidity can be important for seedling survival and may control forest distribution, as in the case of the California redwoods (Cooper 1917). Elsewhere soil moisture appears to be the most significant factor, with variations in atmospheric humidity only modifying the differences imposed by soil moisture regimes. In the study area several factors were regulatory among the different regimes. The coincidence of these different regimes with various forest associations suggested that soil moisture did, in fact, play an important role in forest distribution and

TABLE 25: MONTHLY VALUES OF AVAILABLE SOIL MOISTURE IN THE

THUJA - LYSICHITUM ASSOCIATION PLOTS, 1951-1953

(Percentage by weight)

DEPTH (cm.)	1951						1952								
	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
PLOT Ly3 (Wolf Mt.)															
A (SWAMP)															
0-10	670'	150'	490'	565'	-	680'	-	-	-	-	540'	640'	550'	640'	205'
10-20	-	330'	510'	-	-	-	-	-	-	-	-	-	-	-	156'
20-30	-	590'	-	-	-	-	-	-	-	-	-	-	-	-	32
B (BANK)															
L	10	0	-	190	-	-	-	-	-	-	140	-	-	0	0
2-10	270	291'	0	110	-	210'	-	-	-	-	200'	175'	0	110	160'
10-20	405'	42'	250'	370'	-	520'	-	-	-	-	345'	410'	460'	375'	220'
20-30	-	-	220'	380'	-	32'	-	-	-	-	355'	41'	254'	485'	245'
30-40	-	-	32'	110'	-	-	-	-	-	-	78'	30	58'	190'	620'
40-50	-	-	-	-	-	-	-	-	-	-	-	-	-	14	290'
50-60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9'
PLOT Ly2 (Upper Deadwood)															
A (SWAMP)															
0-10	640'	-	620'	700'	-	810'	-	-	-	-	600'	640'	635'	520'	500'
10-20	-	-	500'	-	-	-	-	-	-	-	-	-	-	-	370'
A*															
L	-	-	330	485'	-	450'	-	-	-	-	350'	130	340'	35	150
2-10	360'	-	157	530'	-	540'	-	-	-	-	505'	335'	380'	305'	380'
10-20	250'	-	175	352'	-	400'	-	-	-	-	420'	300'	70'	180'	140'
20-30	195'	-	84	116'	-	370'	-	-	-	-	160'	276'	60'	87'	69'
30-40	-	-	61'	60'	-	78'	-	-	-	-	117'	60'	68'	60'	60'
40-50	-	-	-	69'	-	20'	-	-	-	-	-	99'	77'	-	-
50-60	-	-	-	68'	-	-	-	-	-	-	-	-	-	-	-
60-70	-	-	-	70'	-	-	-	-	-	-	-	-	-	-	-
70-80	-	-	-	88'	-	-	-	-	-	-	-	-	-	-	-
B (BANK)															
L	0	-	0	150	-	220	-	-	-	-	170	160	-	0	0
2-10	60	-	150	155	-	70	-	-	-	-	175	150	20	45	5
10-20	85	-	350'	110	-	90	-	-	-	-	275'	200	145	45	65
20-30	81	-	490'	330'	-	210'	-	-	-	-	244'	295'	160'	155'	-
30-40	-	-	-	520'	-	120'	-	-	-	-	-	325'	150'	183'	-
40-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	290'
PLOT Ly1 (Echo Mt.)															
A (SWAMP)															
0-10	-	-	305'	245'	-	110'	-	-	-	-	209'	171'	335'	217'	181'
10-20	-	-	710'	-	-	-	-	-	-	-	-	-	-	-	-
20-30	-	-	430'	-	-	-	-	-	-	-	-	-	-	-	-
B (BANK)															
L	-	-	-	-	-	-	-	-	-	-	245	180	-	3	90
2-10	22	-	30	140	-	300	-	-	-	-	320'	170	200	5	250'
10-20	200'	-	40	130	-	80	-	-	-	-	207'	281'	216'	165	246'
20-30	315'	-	120	290'	-	270'	-	-	-	-	28'	143'	184'	492'	33'
30-40	-	-	370'	90'	-	-	-	-	-	-	22'	-	-	490'	26'
40-50	-	-	41'	-	-	-	-	-	-	-	-	-	-	415'	36'
[1] Soil pit number:	1	2	3	4	-	5	6	-	-	-	7	8	9	10	11

* Margin of swamp.

[1] Soil pits 1-11 were measured gravimetrically, pits 1-3 and 7-11 within the first ten days of the month, and pits 4 and 5 during the last ten days.

' Gravitational water present (greater than 1/3 atmosphere capacity).
0 Less than wilting percentage.

..... Gleyed gravel layer.
~~~ Water table.
~~~

growth in the Douglas-fir region.

FACTORS REGULATING SOIL MOISTURE REGIMES

Soil moisture regimes were controlled by the factors affecting soil water storage capacity, moisture depletion and replenishment, and soil drainage.

Since most soils in the study area were coarse textured and had low organic matter contents, variations in the amount of water that could be held within the available range were limited. Differences in water storage capacities were largely determined by soil depth and the proportions of stones, gravel and concretions. Profiles in the *Pseudotsuga* - *Gaultheria* - *Peltigera* plots were shallow and in many cases the bulk of their soil volume was composed of coarse materials. Such profiles had storage capacities as low as 10 to 15 cm. of water (Fig. 20). The soils of some plots of the *Pseudotsuga* - *Polystichum* association, on the other hand, had storage capacities of 25 to 30 cm. of water, because profiles were deeper and their gravel and stone contents were lower. Storage capacities of other soils were intermediate.

According to Thornthwaite and Hare (1955) variations in the amount of radiant energy reaching the vegetative cover of the earth's surface are more important in controlling evapotranspiration than differences in the vegetation itself. Data presented by Zahner (1955) and others lend support to this contention. Since in the study area all stands (with the exception of the *Thuja* - *Lysichitum* association) were fully stocked, and both the principal trees were conifers (*Pseudotsuga* and *Tsuga*), it is possible that differences in crown sizes between the various plots had little bearing on rates of soil moisture extraction.

Variations in rooting habits, on the other hand, may have had more pronounced effects. Soil moisture below the surface layers was available only to deep rooted species. Examination of profiles showed that Pseudotsuga was the only species with an appreciable number of roots in the deeper layers. This species could, therefore, extract moisture from a greater soil volume than others, such as Tsuga and Thuja, which were more shallow rooted, although even with Pseudotsuga the majority of mycorrhizal roots were concentrated in the surface layers (McMinn 1955). If all species had been shallow rooted the amount of utilizable moisture storage capacity would have been smaller.

It may be assumed that the highest transpiration rates, and hence the greatest demands upon soil moisture reserves occurred when evaporation rates from the atmometers were highest, even though atmometers are disproportionately sensitive to wind movement (Briggs and Shantz 1917). In the study area the largest amounts were evaporated in July and August. The rates at the open stations in July were double those in June. Evaporation rates were lower during rainy periods. Such periods would not only reduce transpiration losses by lowering vapour pressure deficits, but they probably made moisture directly available to the plants through uptake by foliage (Breazeale et al. 1950, Stone and Fowells 1955).

Water uptake by roots is affected by soil temperatures, with rates being reduced by both low and high values (Kramer 1949). In the study area, soil temperatures in winter were sufficiently low that rates of moisture uptake would have been reduced. However, soil moistures were rarely below field capacity in that season, so reduced rates of uptake were of no benefit in conserving moisture. Transpiration rates would also normally have been sufficiently low that removal of water by the vegetation could have played little part in alleviation of any moisture excesses. Only soil surface temperatures reached high enough values (over 90°F.) to be inhibitory to moisture uptake. Any reduction in moisture losses that might have resulted would have been more than offset by evaporation losses from this layer.

Losses by evaporation influenced depths of available water, both by direct evaporation of moisture and by drying exposed soils below their wilting percentages. Even more precipitation was needed to replenish such desiccated layers than would have been required had no evaporation losses occurred. Reduction of soil moisture by evaporation was presumably greatest in the less dense stands where the largest amounts of evaporation occurred from the atmometers 5 cm. above ground level. Evaporation losses were small in stands with dense subordinate vegetation, but as was shown by the results from Plots G4 and G6 after the fire, transpiration losses from these plants more than offset any reductions. Evaporation losses in early summer on the higher altitude and westerly plots were also smaller, than they were in plots of the same association at lower altitudes and farther east.

Replenishment of water losses was mainly by precipitation and ground water movement.

Rainfall during the growing season was light. At the eastern end of the study area average rainfall for the months of June, July and August was 8 cm. and even at the western end it was only 15 cm. The effectiveness of these small amounts in supplying soil moisture was reduced by interception. Average interception values for the summers of 1951 to 1953 ranged from 26 to 74 percent. The amounts actually reaching the soil were further reduced by absorption in the litter layers. These normally had dried below wilting percentage by the end of June in those plots with adverse moisture regimes.

Litter layers were capable of absorbing from one half to one centimeter of water before infiltration into the mineral soil could take place.

In the summers of 1951 and 1952 the plots east of Second Lake received less than 2.5 cm. of rainfall in any one month. As these small amounts were subjected to maximum interception by the tree canopy and absorption by the litter layers, additions to soil moisture reserves were negligible. The westerly plots on the other hand received from 4 to 8 cm. in June and August 1952, which was sufficient to add some moisture to the mineral soil. Additions during other summer months were negligible. Even in 1953, when summer rainfall was slightly higher, replenishment of soil moisture reserves by rainfall during the growing season was very limited. It would seem probable that in rainshadow areas, such as the Nanaimo River Valley, precipitation during the growing season is just as important in reducing transpiration losses and adding moisture by foliage uptake as it is in replenishment of soil moisture reserves. During wetter summers than those of 1951 to 1953, however, additions to soil moisture by rainfall might be more appreciable.

Soil moisture reserves were normally replenished by the autumnal rains which began during September. Average rainfall for the period September through November was from 36 to 70 cm., which was adequate to recharge storage capacities. In some years, however, summer moisture deficiencies might extend well into the autumn. For example, in the autumn of 1952, rainfall was abnormally light. The stations east of Second Lake received only 3.5 cm. before mid-November. In those soils where moisture reserves had been exhausted, all layers were not recharged to field capacity until the latter part of the month. Moisture reserves in the westerly plots, on the other hand, were mostly replenished by early November because autumnal rain in this area, though light, was somewhat greater than farther east, and moisture reserves had not been so fully depleted. However, even in some westerly plots, such as P3, which was entirely dependent on rainfall for moisture recharge, only the upper layers had been brought to field capacity by November 1, and all layers were not replenished until later in the month (Table 24). In other years, such as 1953, September rainfall was sufficiently high to bring all plots to field capacity by the end of the month.

In winter the maximum depth of the snow pack was quite variable. During the years 1951 to 1956 it ranged from one to six feet on the valley floor at Fourth Lake and from a few inches to two feet east of Second Lake. The duration of the snow pack, and hence the period during which it supplied melt-water was also quite variable. At lower altitudes, little snow remained on the easterly plots by the end of March, although in the more westerly plots the ground was often not clear until May. At higher altitudes in the western end of the study area snow was often present into July and supplied seepage moisture well into the growing season. Spring rainfall on the westerly plots was heavier than on those further east. Even in years with a small snow pack, rainfall in the more westerly plots maintained soils near field capacity during late spring and early summer.

Whether soil moisture reserves received supplementary water through ground water movement depended on the topographic position of the plot, the topography of the surrounding areas and the location in the study area. Essentially no supplementary water was added to moisture reserves in those plots located on ridge tops, benches and other level areas which were separated from seepage water moving down the sidehills. The amount and duration of additions to plots situated on slopes depended on the extent of the slope above the plot and whether the plot was located on a convex or concave portion. Particularly in the western end of the study area, where upper slopes received considerable snowfall, seepage moisture was present for much of the growing season on plots located towards the base of long slopes. Most slopes, however, were not entirely smooth. Sidehills were commonly differentiated into convex and concave portions by the presence of small ridges and depressions which ran both up and down and across the slope. Movement of seepage water ceased on convex portions of sidehills fairly early in the growing season, but ground water movement in the concave parts often continued for the entire summer.

Internal drainage in most profiles was rapid. In addition to being coarse textured, many soils had numerous concretions which helped to make profiles porous. Downward movement of water, however, was commonly restricted by the presence of bedrock, ortstein or compact, gleyed layers from two to five feet beneath the surface. Accumulations of water occurred above these layers at the base of profiles. Relief on many plots was such that these accumulations drained rapidly when further additions of water were prevented. This rapid removal of ground water was shown on Plots G6 and M2 by the absence of a water table in January 1952 after snow cover blocked further infiltration. In other cases, such as on Plot P1, additions of seepage water were sufficiently sustained that water tables remained for much of the year. In depressions, like those in which the plots of the Thuja - Lysichitum association were located, drainage was restricted enough for water tables to remain high during the entire year. In these areas the ground water was not stagnant, but in some depressions drainage was so completely impeded that Sphagnum swamps had developed.

THE ROLE OF SOIL MOISTURE REGIMES

Soil moisture may limit plant growth either because it is deficient or because it is in excess. When plants are not supplied with sufficient water, nutrient uptake and the normal processes of metabolism are restricted. Excess moisture is usually at the expense of soil air. Without adequate aeration nutrient uptake by the roots of most mesophytes is interrupted and toxic compounds may be produced as the products of anaerobic respiration, either by the plants themselves or by soil microorganisms (Kramer 1949).

Although it is generally accepted that plants cannot obtain water fast enough nor easily enough to maintain normal growth when soil moisture is reduced to permanent wilting percentage, opinion varies on whether water is equally available over the entire range between field capacity and wilting percentage (Veihmeyer and Hendrickson 1950). Hendrickson and Veihmeyer (1942) have termed the water between field capacity and permanent wilting percentage as "readily available moisture" and state that there is no difference in the rate of soil moisture extraction within this range. They considered that with the plants and soils they have studied no one moisture content could be termed optimum for plant growth. Richards and Wadleigh (1952) on the other hand conclude that:

> "From the irrigation and soil moisture experiments mentioned in the foregoing sections it is apparent that there is considerable evidence that significant differences in growth rates occur along with varying degrees of moisture depletion within the so-called available soil-moisture range . . . Throughout the moisture-depletion process the soil-moisture stress increases continuously, and much experimental evidence supports the hypothesis that the growth rate of various plants decreases markedly in the available soil-moisture range ......"

However, the greatest reduction in the availability of moisture is likely to occur close to the wilting percentage because in most soils change in moisture tension with variation in moisture content is curvilinear (Wadleigh 1950). Especially in coarse textured soils, there is usually little change in tension even when two-thirds of the available moisture has been depleted, but as wilting percentage is approached there is a large increase in moisture tension with reduction in moisture content. Moisture deficits within the plants of the study area were therefore unlikely to be severe until soil moisture contents approached wilting percentage.

Since tree growth and distribution is influenced by soil nutrient regimes as well as by soil moisture regimes, it was considered desirable to have some measure of the nutrient status of the plots in which water relations were being studied. In humid temperate climates, such as that of the coastal regions of British Columbia, there is a correlation between pH and the degree of soil leaching and base saturation, even though such correlation may not be exact (Lutz and Chandler 1946, Daubenmire 1947, Webster 1951). Soil pH values are used to suggest the degree of leaching and nutrient status of each plot.

Various plants have different degrees of tolerance to extreme conditions, with some plants being excluded by drought or flooding and others by deficiencies of certain nutrients. In natural plant communities, growth and distribution are further affected by competition, for although environmental factors may not be sufficiently extreme to prevent growth, the less vigourously growing plants may be suppressed by those better able to grow under the conditions prevailing. Soil moisture regimes are but one factor in the environmental complex modifying plant growth and distribution (Billings 1952), but in the study area the marked differences in moisture regimes can be related to the distribution of the various forest associations.

Pronounced soil moisture deficiencies occurred in the lower altitude Pseudotsuga - Gaultheria - Peltigera plots. The reduction of soil moisture to the wilting range during a considerable portion of the growing season apparently restricted the growth of Pseudotsuga, giving the association a low site index (70 to 90). The height and density of Gaultheria shallon in the shrub layer was also low. Such deficiencies, particularly in the surface layers, resulted in the poor growth of mosses and higher plants of the ground cover, and permitted the development of lichens able to withstand periods of desiccation. Tsuga and Thuja were largely absent from the Pseudotsuga - Gaultheria - Peltigera association. Both species are shallow rooted. Their growth and even survival on a site subject to soil drought, particularly in the surface layers, would not be as good as that of Pseudotsuga. The latter, being more deep rooted, could draw moisture from greater depths. It was noted that by the year following the dry autumn of 1952 some of the small Tsuga growing in clumps on the Fourth Lake plot had died. Soil moisture deficiencies at Fourth Lake, however, were not nearly so marked as in the other plots. The occurrence of occasional soil drought (such as in the years 1951 and 1952) nevertheless, appeared to be sufficient to favour lichens and xeric mosses and restrict the density of other plants in the subordinate layers. The growth of Pseudotsuga was also poorer on Plot L1 than in other stands of the association. This reduction was consistent with the poor rates in other plots at the western end of the study area which had highly leached, acidic soils.

In the Pseudotsuga - Gaultheria plots moisture deficiencies were also pronounced, although usually soils did not approach the wilting range as early in the growing season as in the Pseudotsuga - Gaultheria - Peltigera plots. The site index for Pseudotsuga (120 to 140) and the increased height and density of Gaultheria shallon reflected this improvement. With an increase in density of the tree canopy and shrub layer, the soil surface received less insolation and was less subject to prolonged desiccation. A dense layer of the shade tolerant mosses Hylocomium splendens and Eurhynchium oreganum, which was present in all stands, prevented the establishment or survival of lichens and the greater abundance of xeric mosses. The soil moisture deficiencies which did occur and the lack of ability of Tsuga to compete with Pseudotsuga on such sites were apparently sufficient to prevent Tsuga from reaching large sizes in this association. In Plot G3 the presence of Polystichum munitum indicated some addition of moisture and amelioration of leaching conditions by seepage water. Soil leaching was largely unrelieved by ground water movement in the other plots.

In the Pseudotsuga - Tsuga - Gaultheria plots depletion of soil moisture was not as pronounced as in the Pseudotsuga - Gaultheria plots. Moisture was reduced to fairly low levels by midsummer in the dry years of 1951 and 1952, with values within the wilting range being recorded on Plot G2. On Plot G1, however, seepage water in the lower portion of the profile maintained moisture at high levels into July, and even in 1952 autumnal rains recharged the surface layers earlier than in plots farther east. Poor growth of Pseudotsuga accompanied the moisture deficiencies and highly leached soils of the plots in this association. On Plot G2, where the site index for Pseudotsuga was only 70, the average height and volume of Tsuga nearly equalled that of the stunted Pseudotsuga. The site index for Pseudotsuga of 90 on Plot G1 was somewhat greater and Tsuga was not abundant. This plot was transitional between conditions equally favourable for either Tsuga or Pseudotsuga. However, even at similar elevations, Tsuga was more abundant on other parts of this slope, indicating that circumstances at the time of stand establishment (e.g. availability of seed) in large measure controlled species representation.

In Plots M3 and M4 of the Pseudotsuga - Tsuga - Hylocomium - Eurhynchium association (subassociation typicum) soil moistures were reduced to low values for considerable periods during the growing season.

The site index for Pseudotsuga of 130 reflected these droughty periods and the growth of Tsuga in the lower canopy was poor (average height 86 ft.). Gaultheria shallon was rare on both plots, so that a continuous green carpet of Hylocomium and Eurhynchium formed virtually the only plant cover of the subordinate layers.

The absence of Gaultheria on these sites, despite their strongly leached surface layers, presented an interesting problem in plant distribution. On Plot M3 seepage moisture, a normal feature of Pseudotsuga - Tsuga - Hylocomium - Eurhynchium stands was present in deeper layers during a considerable portion of the year. However, the very coarse nature of the soil prevented much supplement to soil moisture reserves in the surface layers and even in the lower profile drainage was sufficiently rapid that the beneficial influence of seepage moisture was less than might be expected in a plot midway down a long slope. Growth of the tree layer was consequently poor, although on this north slope conditions for the establishment of a two-layered canopy of Pseudotsuga and Tsuga were favourable enough for stand density to be moderately high. It would appear that the habitat provided by the surface layers of mineral soil, when coupled with the light intensities prevalent in this stand, was sufficiently unfavourable for Gaultheria to impair its ability to survive. More shade tolerant oxylophytes (acidophiles), such as Hylocomium and Eurhynchium could flourish on the litter layer. The leached nature of the surface layers, on the other hand, excluded shade-tolerant species of the Pseudotsuga - Polystichum association. After logging, adjacent areas did support Gaultheria growth, although the shrubs were not really vigourous. The hollow in which Plot M4 was located also appeared to provide the necessary conditions for the establishment of Tsuga reproduction. However, the coarse droughty soil did not favour *Tsuga* growth and *Pseudotsuga* formed the upper tree canopy, even though heights and diameters were no better than in the *Pseudotsuga* - *Gaultheria* association. The density of the tree canopy, together with the droughty soil, appeared sufficient to exclude *Gaultheria*.

Moisture deficiencies on Plot M1 at Fourth Lake were less pronounced. Low moisture values were recorded in September in the dry summers of 1951 and 1952, but soil moisture was not reduced to the wilting range for any extended periods. The A_2 horizon on this plot was deep and very acid (pH 4.3), indicating a highly leached surface soil. Under such poor nutritive conditions the stature of *Pseudotsuga* (average height 144 ft., average diameter 22 in.) was as poor as in the more droughty plots farther east. *Tsuga*, on the other hand, benefitting from the improved soil moisture regime, was able to compete with *Pseudotsuga* on more equal terms (average height 136 ft., average diameter 18 inches).

Soil moisture deficiencies were infrequent in the subassociation nudum plots of the *Pseudotsuga* - *Tsuga* - *Hylocomium* - *Eurhynchium* association, even though surface layers on Plot M5 were depleted of available moisture during the dry autumn of 1952 and each year moisture reserves in all layers were low by the end of the growing season. Although there was little evidence of seepage water movement on Plot M5 leaching was not pronounced. The surface horizon consisted of duff mull and no A_2 was present. The dry climate and fine texture of the soil presumably helped to retard leaching of nutrients. Seepage moisture on Plot M2 apparently moved more slowly through the soil than on Plot M3, where drainage was accelerated by the preponderance of coarse material in the profile. Even though Plot M2 was in a wet climate, leaching of nutrients must have been retarded or ameliorated, for the A_2 layer was poorly developed. Growth of *Pseudotsuga* on both plots of this subassociation was very good (site index 170) when compared with the more highly leached and often droughty soils of the subassociation typicum plots (site index 120 - 130). Despite this improvement in soil moisture conditions, Tsuga was so completely dominated by Pseudotsuga that the average height of Tsuga was no greater than on Plots M3 and M4. The low abundance of oxylophytes, such as Hylocomium splendens, was another indication that surface layers were weakly leached and it also showed the affinity of this subassociation with the Pseudotsuga - Polystichum association.

On Echo Mountain, the site index for Pseudotsuga (170) in the Pseudotsuga - Tsuga - Hylocomium - Eurhynchium plot was in marked contrast to the index (70) in the Pseudotsuga - Tsuga - Gaultheria plot. The difference in altitude between the two plots was only 100 feet. Such disparity in site quality was largely attributable to the location of the latter plot (G2) on a convex portion of the slope, while the former plot (M2) was in a concave part. The acidity (pH 4.6) and depth (4 cm.) of the A_2 horizon on Plot G2 showed its soils to be more highly leached than those on Plot M2, where the A_2 horizon had a pH of 5.7 and its depth was rarely more than 1 cm. Growth of both species was poor in such highly leached soils as those of Plot G2. The growth of Pseudotsuga, however, was so impaired that Tsuga could compete with it on nearly equal terms, even though the soils of Plot G2 did not remain as moist as those of Plot M2. On Plot M2 Pseudotsuga completely dominated Tsuga, indicating that Pseudotsuga can grow well in wet climates when the leaching action of rainfall is counteracted by seepage moisture. Such site differentiation was quite prominent on Echo Mountain, with the Pseudotsuga - Tsuga - Hylocomium - Eurhynchium association being confined to the troughs between the ridges. At higher elevations these ridges were covered by the Pseudotsuga - Tsuga - Gaultheria association and at lower altitudes by the Pseudotsuga - Gaultheria association.

In most plots of the Pseudotsuga - Polystichum association soil moisture was rarely reduced to the wilting range. The presence of seepage moisture and high water tables maintained soil moisture high in the available moisture range most of the growing season and counteracted the leaching influence of rainfall. Such moist and relatively nutritive soils resulted in Pseudotsuga reaching its maximum size in this association, and it was the predominant tree in Pseudotsuga - Polystichum stands under all the climatic conditions represented within the study area. Although the average height of Tsuga (76 to 111 ft.) was greater in these stands than in most of the other plots in the study area, it was still less than half that of Pseudotsuga (199 to 248 ft., site index 160 to 200). In most stands of this association Thuja surpassed Tsuga, for average heights ranged from 137 to 178 ft. Even larger Thuja were common in the moist Thuja - Lysichitum plots, where the pH of the water and mineral soils was greater than 6. In the droughty and more highly leached soils of the other associations growth of Thuja was poor. Polystichum, Achlys, Tiarella, Trillium, Adenocaulon, Disporum and other ferns and herbs were the characteristic cover of the subordinate layers growing in the moist and weakly acidic soils of the Pseudotsuga - Polystichum plots. Gaultheria shallon, abundant in leached soils, did not occur on mineral material in these plots. In the moss layer Hylocomium and Eurhynchium had low abundance, and mosses such as Mnium insigne, which grow where the surface soil is not strongly leached, were locally common.

Plot P3 in the Valley area represented a separate subassociation. In this plot seepage or ground water played little part in water or nutrient regimes. Growth-water was entirely supplied by rainfall, with the deep sandy profiles storing reserve moisture. In most years this reserve was sufficient to provide readily available moisture throughout the growing season, although with prolonged droughts, such as in the autumn of 1952, moisture was reduced to the wilting range. Nutrient conditions favourable for the growth of Pseudotsuga were provided by the varied alluvial deposits which formed the parent material. That leaching had not progressed far was shown by the presence of the duff mull and A_1 layers. The predominance of Achlys over Polystichum in the subordinate layer reflected the droughtier nature of the plot and was used to differentiate the site as the Achlys subassociation (Krajina 1952). In most areas oxylophytes were not abundant, but on some hummocks and benches, which may have been composed of somewhat coarser materials than surrounding areas, leaching of surface layers had taken place. Such areas supported the growth of oxylophytes such as Hylocomium splendens and Mahonia nervosa, and in some cases Gaultheria shallon had spread beyond the decaying wood, which was its normal habitat when it did occur in Pseudotsuga - Polystichum stands.

In the swampy areas of the Thuja - Lysichitum plots the water table was too high for tree growth. Although this high water table resulted in the trees of the surrounding areas being shallow rooted, fluctuations of the water table were sufficiently small that moisture deficiencies were very slight, even though the surface layers of the marginal hummocks showed some desiccation by late summer in the plots east of Second Lake. The height reached by Thuja in these stands was second only to those measured in stands of the Thuja - Abies - Adiantum association (Krajina 1952). Large Pseudotsuga were also present on the marginal areas and the tallest Tsuga trees encountered in the present study (average height 186 ft.) occurred at the edges of the Echo Mountain plot. This stand was sufficiently open for all three species (Pseudotsuga, Thuja and Tsuga) to utilize these moist, relatively nutritive soil conditions to attain large sizes and reach the dominant canopy. Many of the herbs and bryophytes of the swampy areas were restricted to such wet sites, although a few, such as *Claytonia sibirica* and *Tiarella trifoliata* were also common in the *Pseudotsuga - Polystichum* plots.

FOREST DISTRIBUTION IN THE DOUGLAS-FIR REGION

It may be concluded that the forest associations of the study area are referable to four principal habitats, with the following correlation between site and association:

Very wet, relatively nutritive sites (alpha gley soils[2]): *Thuja - Lysichitum* association.

Wet to moist, relatively nutritive sites (beta gley soils): *Pseudotsuga - Polystichum* association and *Pseudotsuga - Tsuga - Hylocomium - Eurhynchium* association (subassociation nudum).

Moist, strongly leached sites (gamma gley soils): *Pseudotsuga - Tsuga Hylocomium - Eurhynchium* association (subassociation typicum) and *Pseudotsuga - Tsuga - Gaultheria* association.

Droughty, strongly leached sites: *Pseudotsuga - Gaultheria* and *Pseudotsuga Gaultheria - Peltigera* associations.

Environmental conditions between any such characterization of sites inevitably intergrade. However, since the competitive ability of plants growing under suboptimal conditions is impaired, ecotones between associations are commonly narrow compared with the areas covered by their typical development. This division of sites may be taken, therefore, as the basis for a consideration of the role of water relations in forest distribution in the Douglas-fir region on Vancouver Island.

It is apparent that *Pseudotsuga*, *Tsuga* and *Thuja* can all make good growth on weakly acidic, relatively nutritive sites. However, where these sites are wet, only marginal areas can support tree growth, and even though

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[2] According to a terminology for hydromorphic soils advanced by Wilde (1940).

all three species did reach large sizes at maturity in some plots, such saturated soils are suboptimal. The best growth of Pseudotsuga is to be found on moist, relatively nutritive sites. Although Tsuga may develop into fairly large trees at maturity on these sites, Pseudotsuga can apparently dominate Tsuga by attaining larger size. Tsuga therefore remains restricted to the secondary canopy when both species are represented in the stand. While Thuja does not reach the uppermost tree canopy when in competition with Pseudotsuga on moist, relatively nutritive sites, it can attain fairly large sizes. Its best growth, however, is made in wet, or at least periodically flooded, relatively nutritive soils (Krajina 1952).

The growth of all three tree species is evidently impaired in highly acidic soils. In climates where such soils remain moist throughout the growing season, leaching is apparently sufficiently intense for the growth rate of Pseudotsuga to be reduced enough for Tsuga to compete with it on nearly equal terms. Consequently, in mature stands on moist, strongly leached sites both species may occur in the upper canopy. On the other hand, in droughty soils the growth of Tsuga is even more impaired than that of Pseudotsuga. Tsuga therefore remains limited to the secondary canopy and forms small to negligible proportions of stand volumes on strongly leached sites in rainshadow areas where soil moisture deficiencies are a characteristic feature. Thuja is also restricted to the secondary canopy in highly acidic soils, whether these are moist or droughty, for the species appears to be vigourous only in relatively nutritive soils.

The subordinate vegetation of the Douglas-fir region may be readily divided into plants characteristic of highly acidic soils and those restricted to more weakly acidic soils (Krajina 1952). Gaultheria shallon and Hylocomium splendens are the most ubiquitous oxylophytes of the ground cover in both moist and droughty, strongly leached soils. Growth, however, is usually more vigourous on less droughty sites, which differentiates the Pseudotsuga - Gaultheria association from the Pseudotsuga - Gaultheria - Peltigera association. Both species are present when the density of the tree canopy is low, whether this low density is caused by soils being very droughty or very highly leached. It would seem, however, that where stand density is high and there is some amelioration of leaching in subsurface layers, Gaultheria becomes less frequent while Hylocomium remains abundant. These factors would appear to form the basis of site differentiation between the Pseudotsuga - Gaultheria and Pseudotsuga - Tsuga - Hylocomium - Eurhynchium associations. The subordinate vegetation of relatively nutritive sites is characterised by the absence of oxylophytes and the presence of various plants, such as Polystichum munitum and Achlys triphylla whose distribution is limited to moist or wet, weakly leached soils, and Lysichitum americanum which is restricted to very wet, essentially unleached soils. In the subassociation nudum stands of the Pseudotsuga - Tsuga - Hylocomium - Eurhynchium association the infrequency of both oxylophytes and subordinates plants characteristic of more nutritive sites, suggests that leaching in the upper profile is only partially ameliorated. However, the ability of Pseudotsuga to dominate Tsuga in this association would seem to reflect more favourable moisture and nutrient conditions in subsurface layers.

The dominant influence differentiating the Douglas-fir region on Vancouver Island appears to be its rainshadow climate. Within this rainshadow region, summer rainfall is light and upland soils were seen to be droughty. Therefore, since Pseudotsuga can dominate other species both on moist, relatively nutritive sites and on strongly leached sites when these are droughty, this species is the predominant tree on most sites in the rainshadow region on the eastern side of Vancouver Island. Other rain-shadow regions in coastal British Columbia where Douglas-fir forests have been found to predominate, include the head of some coastal inlets, such as the vicinities of Alberni and Kemano, the coastal mainland in the Powell River district, and the Pemberton Meadows area of the Coast Mountains (Schmidt 1957).

It is apparent that outside such summer drought regions, stands dominated by _Pseudotsuga_ are restricted to moist, relatively nutritive sites. Where strongly leached soils are normally moist throughout the growing season, _Tsuga_ may codominate with _Pseudotsuga_. This restriction of associations dominated by _Pseudotsuga_ to relatively nutritive soils in wet climates also suggests one aspect of the altitudinal limitation of the Douglas-fir zone on eastern Vancouver Island. At higher elevations, soils in which leaching is ameliorated are presumably infrequent, not only because leaching conditions are more intense than at lower altitudes since rainfall is usually higher, summers are shorter, soils are moister and cooler, and litter layers deeper, but also because most slopes are too short for the accumulation of base saturated seepage water. In such intensely leached soils _Pseudotsuga_ appears to lose its competitive advantage over other species.

Another factor influencing the predominance of _Pseudotsuga_ in rain-shadow climates has been the relative frequency of forest fires in such regions (Schmidt 1957). _Pseudotsuga_ regenerates most readily when sites have been cleared by fires or logging. Some regeneration was noted in the droughty, open stands of the _Pseudotsuga_ - _Gaultheria_ - _Pelgeria_ association, and even stands of the _Pseudotsuga_ - _Gaultheria_ association may eventually become uneven-aged when openings are formed by overmature trees dropping out

(Krajina 1952). However, Pseudotsuga regeneration was not apparent in the denser stands of moister sites. Re-establishment of Pseudotsuga on such sites has evidently been dependent on their denudation by fire. The widespread occurrence of Douglas-fir forests on Vancouver Island has undoubtedly been favoured by the former prevalence of forest fires. The ubiquity of such fires was evident in the study area, where all the plots investigated were established following fires some 220 to 280 years ago. However, while fire may be necessary for the establishment of Pseudotsuga stands in wet climates and on moist, relatively nutritive sites, it would seem that stands of the Pseudotsuga - Gaultheria and Pseudotsuga - Gaultheria - Peltigera associations can maintain themselves without the intervention of fire on droughty sites in rainshadow regions. The Pseudotsuga - Gaultheria association may therefore be considered as the climatic climax in such regions (Krajina 1952).

Within the various climatic areas encountered, topographic position and the concomitant climatic and edaphic factors associated with that position are evidently the major influences differentiating sites. Site differentiation on hillsides follows a catenary sequence. In regions with dry summers, droughty, strongly leached sites are typically situated at the top of slopes and wet, relatively nutritive sites are located at their bases. Other sites are intermediate. This distribution of sites controls the sequence of stands forming the forest association catena typical of the eastern portion of the Nanaimo River Valley (Plate IV). A similar correlation between site and Douglas-fir associations has been reported from Washington and Oregon (Becking 1956). In climates with wetter summers, moist rather than droughty, strongly leached sites commonly occupy upper slopes. The sequence on the lower slopes appears similar to that found in drier climates. However, since soil moisture and nutrient regimes are influenced by local topography, aspect, parent material, soil depth and soil texture, variations in these factors may cause deviations from such typical catenary arrangements of stands.

SUMMARY

1. From this study of water relations in the Douglas-fir region on Vancouver Island, it was concluded that variation in soil moisture regimes is a most significant factor in site differentiation and forest distribution.

2. It was apparent that on relatively nutritive sites *Pseudotsuga*, *Tsuga* and *Thuja* can all attain large size by maturity. Only the margins of very wet, relatively nutritive sites are able to support tree growth and all species reach larger sizes on less saturated soils. The best growth of *Pseudotsuga* can be found on moist, relatively nutritive sites. On such sites *Pseudotsuga* is capable of attaining larger size than *Tsuga*, so that in stands stocked with both species, *Tsuga* is so completely dominated by *Pseudotsuga* that it remains restricted to the secondary canopy. *Thuja* attains maximum vigour on moist to wet, relatively nutritive sites.

3. It was also apparent that on strongly leached sites, the growth of both *Pseudotsuga* and *Tsuga* is impaired, so that both species were smaller than on more nutritive sites. Where strongly leached soils are moist throughout the growing season, it would seem that *Tsuga* can compete with *Pseudotsuga* on nearly equal terms and both species may reach the upper tree canopy. On droughty, strongly leached soils the growth of *Tsuga* is evidently more impaired than the growth of *Pseudotsuga*. In stands stocked

with both species, Tsuga is again restricted to the secondary canopy and forms small to negligible proportions of stand volume. Thuja appears restricted to the secondary canopy in highly acidic soils, whether these are moist or droughty.

4. Since the distribution of plants in the subordinate vegetation layers are similarly differentiated by variations in site quality, the forest associations of the study area are referable to the following principal habitats: Thuja - Lysichitum association on very wet, ralatively nutritive sites; Pseudotsuga - Polystichum association and Pseudotsuga - Tsuga - Hylocomium - Eurhynchium association (subassociation nudum) on wet to moist, relatively nutritive sites; Pseudotsuga - Tsuga - Hylocomium - Eurhynchium association (subassociation typicum) and Pseudotsuga - Tsuga - Gaultheria association on moist, strongly leached sites; and Pseudotsuga - Gaultheria and Pseudotsuga - Gaultheria - Peltigera associations on droughty, strongly leached sites.

5. The dominant influence in the geographical location of the Douglas-fir region on Vancouver Island is its rainshadow climate. Within this region of low summer rainfall, Pseudotsuga may dominate other species on nearly all sites. In wetter climates, outside pronounced rainshadow areas, stands dominated by Pseudotsuga are evidently confined to moist, relatively nutritive sites.

6. Within these different climatic areas, topographic position and the concomitant climatic and edaphic factors associated with that position appear to be the major influences differentiating

sites. Site differentiation follows a definite catenary sequence, which regulates the sequence of forest associations on hillsides. Differences in local topography, aspect, parent material, soil texture and soil depth, however, sometimes cause deviations from the typical catenary arrangements of stands.

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APPENDICES

APPENDIX I.

CLIMATIC RECORDS

TABLE OF CONTENTS

TABLE 1. MONTHLY PRECIPITATION AT VARIOUS STATIONS IN THE NANAIMO RIVER VALLEY, 1951-1956 (inches)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL ANN.	SUM.[1]
CABIN														
1952	-	-	-	-	1.1	1.0	0.3	0.9	0.4	0.9	3.8	13.8	-	2.1
1953	17.1	3.5	3.6	2.0	0.9	1.4	0.4	0.7	4.4	3.9	10.6	6.3	55	2.6
1954	13.4	15.3	2.7	3.7	0.5	1.4	0.8	2.2	2.4	3.8	13.1	7.4	67	4.4
1955	4.0	3.1	2.8	5.6	0.9	2.2	2.1	0.1	1.5	7.0	12.4	7.9	50	4.4
1956	15.3	3.3	6.7	0.5	0.7	3.6	0.3	0.5	2.6	9.5	2.8	9.2	55	4.4
Average	12.4	6.3	3.9	2.9	0.8	1.9	0.8	0.9	2.3	5.0	8.5	8.9	55	3.6
WOLF MOUNTAIN														
1951	-	-	-	-	-	0.4	0.2	0.7	3.5	7.5	8.6	7.0	-	1.3
1952	10.2"	6.3"	2.7'	3.1'	1.0	1.0	0.3	0.9	0.4	0.9	4.2	13.3	44	2.2
1953	18.5	4.0	4.0	2.2	1.2	2.0	1.0	0.7	3.7	3.3	10.5	6.6	58	3.7
1954	14.6	15.7	2.4	3.7	0.7	1.2	0.8	2.1	2.3	3.6	12.2	7.5	67	4.2
1955	4.2	3.1	2.6	5.7	1.1	2.0	2.2	0.1	1.4	6.5	12.0	8.5	49	4.3
Average	11.9	7.3	2.9	3.7	1.0	1.3	0.9	0.9	2.3	4.4	9.5	8.6	55	3.2
LOWER DEADWOOD (L3)														
1951	-	-	-	-	-	0.4	0.2	0.5	3.7	6.8	8.3	7.0	-	1.1
1952	10.2"	6.3"	2.7'	3.1'	0.9	0.9	0.3	0.9	0.4	0.9	4.4	13.0	44	2.0
1953	18.9	4.6	3.9	2.1	1.0	1.4	0.8	1.0	4.0	3.5	10.5	6.9	59	3.2
1954	11.0	13.0	3.1	4.2	1.5	1.7	1.0	2.1	2.4	3.6	12.9	8.1	65	4.8
1955	3.7	2.5	2.5	5.6	1.0	1.6	1.8	0.1	1.2	6.9	12.2	8.7	48	3.6
1956	15.3	3.1	6.5	0.7	0.4	3.6	0.3	0.4	2.8	8.9	2.3	9.0"	57	4.3
Average	11.8	5.9	3.7	3.1	1.0	1.9	0.7	0.8	2.4	5.1	8.4	8.8	54	3.2
VALLEY - Valley Floor (P3)														
1951	-	-	-	-	-	0.4	0.2	0.2	4.8	9.3	13.0"	6.7	-	0.8
1952	13.0"	8.7"	4.3'	5.1'	1.3	1.6	0.4	1.7	0.8	1.8	8.2	16.9	64	3.7
1953	21.6	5.3	7.5	2.5	1.9	2.0	2.0	2.0	5.9	7.6	18.5	10.6	87	6.0
1954	11.8	18.1	3.7	5.7	0.8	2.0	1.9	2.4	3.3	6.9	22.8	16.5	96	6.4
1955	5.0	4.6	3.8	7.5	1.3	2.0	2.8	0.1	2.2	11.8	16.2	8.4	66	4.9
1956	22.4	8.7	14.2	0.3	0.5	5.3	0.8	0.3	4.5	13.4	4.3	12.1	87	6.4
Average	14.3	9.1	6.7	4.2	1.2	2.2	1.3	1.1	3.5	8.5	13.8	11.9	78	4.7

TABLE 1 - Continued

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL ANN.	TOTAL SUM.
VALLEY - Sidehill (M3)														
1951	-	-	-	-	-	0.4	0.2	0.2	5.1	10.3	15.0"	8.6	-	0.8
1952	13.8"	9.0"	5.5'	6.3'	1.3	1.8	0.4	1.8	1.1	2.1	8.3	20.5"	72	4.1
1953	27.9	6.0	8.1	2.9	1.8	1.9	2.2	1.8	5.9	8.3	20.1	12.6	100	5.9
1954	13.8	22.0	3.9	6.1	0.5	2.2	2.2	2.4	3.4	7.7	22.8	18.1	105	6.9
1955	5.7	5.5	3.9	8.0	1.8	2.4	2.7	T	2.7	13.2	17.9	11.0	75	5.2
1956	7.8	9.8	15.7	0.4	0.6	5.9	1.1	0.4	4.8	14.6	4.5	13.7	79	7.4
Average	13.8	10.5	7.4	4.7	1.2	2.4	1.5	1.1	3.8	9.4	14.8	14.1	85	5.0
ECHO MOUNTAIN														
1951	-	-	-	-	-	0.3	0.2	0.1	5.6	11.1	15.3"	7.6	-	0.7
1952	14.2"	11.0"	5.5'	6.3'	1.6	2.3	0.3	1.8	1.2	2.4	9.0	18.5	74	4.4
1953	28.3	6.0	7.1	3.3	1.9	1.3	2.4	2.0	5.7	9.3	19.9	12.6	100	5.7
1954	16.5	24.0	4.3	7.3	0.9	2.7	1.8	2.1	3.3	8.3	22.4	16.9	111	6.6
1955	6.2	5.3	4.4	7.8	1.7	1.8	2.7	T	1.8	13.5	18.3	9.4"	73	4.6
1956	15.0	6.7	15.0"	1.5	0.5	5.8	0.6	0.4	6.4	11.8	4.0	13.8	81	6.0
Average	16.0	10.6	7.3	5.2	1.3	2.4	1.3	1.1	4.0	9.4	14.8	13.1	88	4.8
FOURTH LAKE														
1951	-	-	-	-	-	0.3	0.1	0.4	6.0	11.0	16.5"	10.5		0.9
1952	18.1'	13.4'	6.7'	8.3'	1.8	3.1	0.4	2.7	1.7	3.3	9.0	23.6"	92	6.3
1953	31.5	6.2	9.4	2.2	3.0	0.9	1.7	3.5	6.4	12.6	25.6	16.1	119	6.1
1954	20.1	26.8	4.8	8.7	0.7	3.1	2.7	2.5	4.4	10.5	28.7	20.1	133	8.3
1955	6.9	5.5	4.8	8.9	1.8	1.7	3.5	0.1	2.7	16.0	19.7	11.0	83	5.4
1956	21.2	11.4	16.5"	1.0	1.4	7.5	0.8	0.2	7.6	16.5	6.8	16.1	107	8.5
Average	19.6	12.7	8.4	5.8	1.7	2.8	1.5	1.6	4.8	11.6	17.7	16.2	107	5.9

[1] Summer: total for June, July, August.
' Interpolated from two month record.
" Raingauge overflowed, value estimated.
T Trace.

TABLE 2. MONTHLY PRECIPITATION AT VARIOUS STATIONSIN THE NANAIMO RIVER VALLEY, 1951-1956 (cm.)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	1951											
WOLF MT.	-	-	-	-	-	1.1	0.4	1.8	8.9	19.0	21.8	17.7
DEADWOOD (Lower;L3)			-	-	-	1.1	0.4	1.3	9.5	17.2	21.0	17.8
VALLEY (valley floor;P3)			-	-	-	1.0	0.4	0.6	12.2	23.6	33.0"	17.0
VALLEY (sidehill; M3)	-		-	-	-	1.0	0.5	0.5	13.0	26.1	38.0"	21.8
ECHO MT. (midslope)	-		-	-	-	0.9	0.6	0.3	14.2	28.1	39.0"	19.2
FOURTH LK. (valley floor)			-	-	-	0.9	0.3	1.0	15.2	28.0	42.0"	26.8
	1952											
CABIN	-	-	-	-	2.7	2.5	0.7	2.2	1.0	2.4	9.6	35.0
WOLF MT.	26.0"	16.0"	7.0'	8.0'	2.6	2.6	0.7	2.2	1.0	2.4	10.8	33.8
DEADWOOD	26.0"	16.0"	7.0'	8.0'	2.3	2.3	0.7	2.3	1.1	2.4	11.2	33.0
VALLEY (P)	33.0"	22.0"	11.0'	13.0'	3.2	4.1	1.0	4.4	2.1	4.7	20.8	43.0
VALLEY (M)	35.0"	23.0"	14.0'	16.0'	3.3	4.7	1.1	4.7	2.7	5.4	21.2	52.0"
ECHO MT.	36.0"	28.0"	14.0'	16.0'	4.0	5.8	0.9	4.6	3.1	6.2	23.0	47.0
FOURTH LK.	46.0'	34.0'	17.0'	21.0'	4.5	8.0	1.0	7.0	4.4	8.3	23.0	60.0"
	1953											
CABIN	43.5	9.0	9.1	5.2	2.3	3.7	1.1	1.8	10.3	9.9	27.0	16.1
WOLF MT.	47.0	10.3	10.3	5.5	3.1	5.0	2.6	1.8	9.5	8.5	26.7	16.8
DEADWOOD	48.0	11.6	9.9	5.3	2.6	3.6	2.0	2.5	10.1	8.9	26.7	17.6
VALLEY (P)	55.0	13.6	19.0	6.4	4.8	5.1	5.0	5.2	13.3	19.4	47.0	27.0
VALLEY (M)	71.0"	15.2	20.5	7.5	4.7	4.9	5.5	4.5	15.0	21.2	51.0	32.0
ECHO MT.	72.0"	15.3	18.1	8.3	4.8	3.4	6.0	5.0	14.5	23.6	50.5	32.0
FOURTH LK.	80.0"	15.7	24.0	5.6	7.6	2.3	4.3	9.0	16.4	32.1	65.0"	41.0
	1954											
CABIN	34.0	39.0	6.8	9.5	1.4	3.6	2.0	5.6	6.0	9.8	33.4	18.7
WOLF MT.	37.0'	40.0'	6.2	9.3	1.7	3.2	2.0	5.4	5.8	9.1	31.0	19.0
DEADWOOD	28.0'	33.0'	7.8	10.8	3.8	4.4	2.5	5.3	6.1	9.2	32.9	20.5
VALLEY (P)	30.0	46.0	9.4	14.5	2.0	5.1	4.9	6.2	8.5	17.6	58.0	42.0
VALLEY (M)	35.0'	56.0'	10.0'	15.4	1.2	5.7	5.6	6.2	8.6	19.7	58.0	46.0
ECHO MT.	42.0'	61.0'	11.0	18.6	2.4	6.8	4.7	5.4	8.5	21.1	57.0	43.0
FOURTH LK.	51.0'	68.0'	12.2	22.0	1.7	7.9	7.0	6.4	11.3	26.8	73.0	51.0
	1955											
CABIN	10.2	8.0	7.2	14.3	2.4	5.6	5.4	0.3	3.9	17.7	31.4	20.0
WOLF MT.	10.6	7.9	6.7	14.5	2.8	5.1	5.6	0.3	3.7	16.6	30.4	21.5
DEADWOOD	9.5	6.5	6.4	14.3	2.5	4.1	4.7	0.3	3.2	17.6	30.9	22.0
VALLEY (P)	12.8	11.8	9.6	19.1	3.3	5.0	7.2	0.3	5.7	29.9	41.3	21.4
VALLEY (M)	14.5	14.1	10.0	20.4	4.7	6.0	7.0	0.1	6.9	33.5	45.4	28.0
ECHO MT.	15.7	13.4	11.2	19.8	4.3	4.7	6.8	0.1	4.6	34.2	46.6	24.0"
FOURTH LK.	17.5	13.9	12.3	22.7	4.5	4.4	8.9	0.4	7.0	40.6	50.0	28.0
	1956											
CABIN	38.9	8.4	17.1	1.3	1.8	9.2	0.7	1.3	6.6	24.0	7.1	23.5
DEADWOOD	38.9	7.9	16.5	1.8	1.2	9.2	0.7	1.2	7.0	22.6	5.8	22.5
VALLEY (P)	56.9	22.1	36.1	0.8	1.3	13.5	2.1	0.8	11.4	34.0	10.9	30.9
VALLEY (M)	19.8	24.9	39.9	1.2	1.5	15.0	2.6	1.2	12.2	37.0	11.5	34.9
ECHO MT.	38.1	17.1	38.1	3.8	1.3	14.7	1.5	1.1	16.2	30.0	11.1	35.0
FOURTH LK.	53.9	28.5	41.9	2.5	3.6	19.1	2.0	0.6	19.6	41.7	17.6	40.5

' Interpolated from two month record. " Raingauge overflowed, estimated.

TABLE 3. MONTHLY MAXIMUM AND MINIMUM TEMPERATURES AT VARIOUS STATIONS IN THE NANAIMO RIVER VALLEY 1952-1956 (°F)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
CABIN												
1952 Minimum	-	-	-	-	-	-	-	42	38	34	20	22
1953 Minimum	24	25	24	21	28	33	38	40	30	26	23	21
1954 Minimum	-2	12	9	15	19	30	34	34	26	24	27	19
1955 Maximum	-	-	-	-	-	91	85	87	95	67	55	42
Minimum	26	15	2	20	25	35	38	34	28	25	-1	0
1956 Maximum	46	44	59	78	88	74	96	90	82	70	55	50
Minimum	5	5	9	23	36	32	36	38	30	22	18	18
DEADWOOD CREEK												
1953 Minimum	-	-	-	-	-	36	40	39	33	30	27	25
1954 Minimum	5	-	10	20	20	36	38	40	26	24	27	19
1955 Maximum	-	-	-	-	-	92	87	88	93	68	55	44
Minimum	26	21	5	24	29	39	40	37	30	28	4	6
1956 Maximum	46	45	59	78	90	70	96	91	82	73	58	51
Minimum	12	8	12	26	34	34	41	39	31	26	23	18
VALLEY (valley floor)												
1953 Minimum	-	-	-	-	-	35	43	45	38	32	28	28
1954 Minimum	4	18	18	25	26	38	43	45	34	30	29	22
1955 Maximum	-	-	-	-	-	90	88	86	96	70	59	44
Minimum	30	18	7	28	35	39	42	40	32	30	4	6
1956 Maximum	41	44	54	72	88	13	97	94	84	76	56	52
Minimum	9	7	13	28	37	36	41	38	36	26	19	21
VALLEY (sidehill)												
1954 Minimum	-	-	-	-	-	-	44	47	30	30	28	22
1955 Maximum	-	-	-	-	-	90	85	85	90	62	54	42
Minimum	30	20	8	28	32	42	45	44	38	31	10	15
1956 Maximum	41	43	47	78	91	70	99	90	80	65	52	50
Minimum	11	10	16	26	38	42	45	44	40	29	27	19
ECHO MOUNTAIN												
1952 Minimum	-	-	-	-	-	-	-	-	38	32	22	26
1953 Minimum	26	26	27	30	34	40	46	47	40	40	28	30
1954 Minimum	9	-	18	26	30	38	43	45	34	30	29	22
1955 Maximum	-	-	-	-	-	87	82	84	89	64	56	40
Minimum	30	18	30	28	35	43	44	44	38	30	10	14
1956 Maximum	39	40	42	69	84	68	93	89	82	72	55	50
Minimum	12	10	24	27	37	39	44	48	38	30	26	18
FOURTH LAKE												
1952 Minimum	-	-	-	-	-	-	-	-	39	33	23	28
1953 Minimum	23	23	23	25	31	36	42	43	35	32	30	28
1954 Minimum	6	-	17	22	28	36	41	43	28	28	28	19
1955 Maximum	-	-	-	-	-	89	88	89	96	67	56	40
Minimum	26	16	-1	24	30	40	42	40	32	28	6	10
1956 Maximum	39	43	46	60	88	70	97	93	85	72	53	48
Minimum	4	5	23	22	36	38	40	38	34	25	25	20

APPENDIX I.

TABLE 4. AVERAGE VALUES FOR PRECIPITATION AND TEMPERATURE AT VARIOUS STATIONS ON VANCOUVER ISLAND

	PRECIPITATION (inches)		TEMPERATURE (°F)							
			Summer[1]				Winter[2]			
			Daily		Monthly		Daily		Monthly	
	Ann.	Sum.	mean	max.	max.	range	mean	min.	min.	range
Cumberland	58	5.3	61.0	75	90	50	37.0	28	16	38
Cassidy	42	3.2	59.6	74	85	45	37.0	29	16	36
Duncan	39	3.3	63.6	76	91	49	39.6	30	17	37
Victoria [3]	36	2.8	62.6	70	82	35	40.6	34	24	26
Cowichan Lake	73	4.0	61.3	74	87	47	38.0	29	17	31
Nitinat Camp	113	5.8	-	-	-	-	-	-	-	-
Pachena Point	109	9.3	55.0	61	72	30	42.3	35	25	27
Estevan Point	109	10.2	55.6	61	68	24	42.3	35	26	26

[1] Summer: June, July, August.
[2] Winter: December, January, February.
[3] Dominion Astrophysical Laboratory, Little Saanich Mountain.

APPENDIX I.

Figure 1.

Figure 1. Precipitation and potential evapotranspiration at various stations on Vancouver Island and the coastal mainland of British Columbia. Relative water balances are shown by the areas enclosed by the two curves; potential deficiencies are represented by the areas enclosed by the precipitation and potential evapotranspiration curves during the summer months, and potential surpluses by the areas enclosed during the winter months. It may be seen that deficiencies decreased from east to west in the study area (Deadwood Creek to Fourth Lake), while precipitation increased. Similarly there was a decrease in deficiencies from south to north on the east coast (Duncan to Port Hardy) and in the central mountains (Shawnigan Lake to Nitinat Camp). Other stations in rainshadow areas with marked summer deficiencies included Victoria and Nanaimo on the Island and Pemberton Meadows and Powell River on the mainland. There were large surpluses and little or no deficiencies at the stations on the west coast of Vancouver Island (Pachena Point and Estevan Point), and on the north coast of the mainland (Bella Bella).

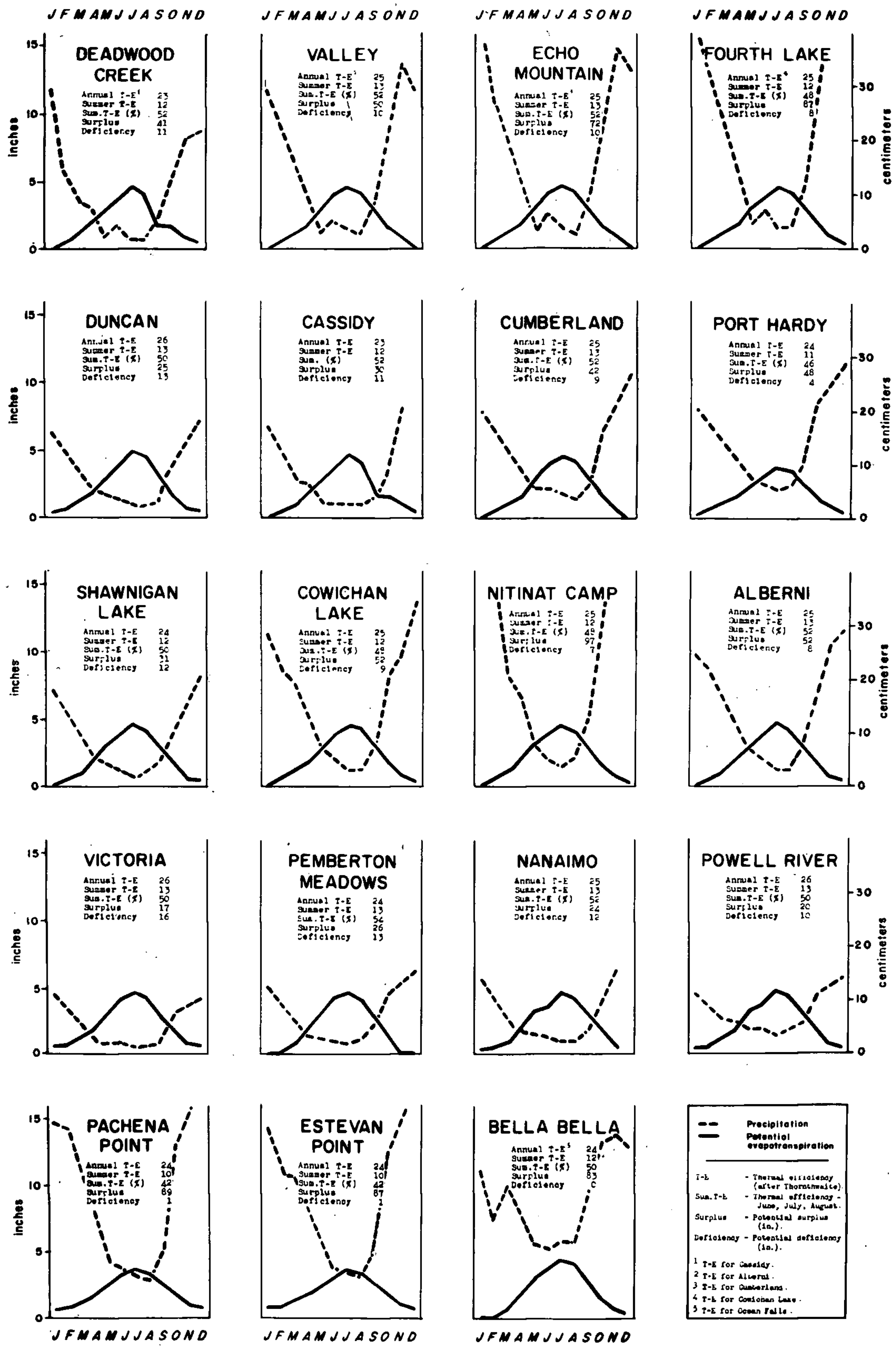

FIG. I. Precipitation and potential evapotranspiration at various stations on Vancouver Island and the coastal mainland of British Columbia.

APPENDIX II

PLANT LIST

TABLE OF CONTENTS

CHECK LIST OF SPECIES FOUND IN THE PLOTS

TREES

Abies amabilis (Dougl.) Forbes
Abies grandis Lindl.
Acer macrophyllum Pursh
Alnus rubra Bong.
Chamaecyparis nootkatensis (D.Don) Spach
Malus diversifolia (Bong.) Roem.
Pinus contorta Loud.
Pinus monticola Dougl.
Pseudotsuga menziesii (Mirbel) Franco
((P. taxifolia (Poiret) Britten))
Taxus brevifolia Nutt.
Thuja plicata D.Don
Tsuga heterophylla (Raf.) Sarg.

SHRUBS

Arctostaphylos columbiana Piper
Arctostaphylos uva-ursi (L.) Spreng.
Gaultheria ovatifolia A. Gray
Gaultheria shallon Pursh
Holodiscus discolor (Pursh) Maxim.
Lonicera sp.
Mahonia aquifolium (Pursh) Nutt.
Mahonia nervosa (Pursh) Nutt.
Oplopanax horridus (J.E. Smith) Miq.
Rosa gymnocarpa Nutt.
Rubus leucodermis Dougl.
Rubus nivalis Dougl.
Rubus spectabilis Pursh
Rubus vitifolius Cham. & Schlecht.
Salix sitchensis Sanson
Salix scouleriana Barratt
Sambucus pubens Michx.
((S. Callicarpa Greene))
Spiraea douglasii Hook.
Symphoricarpos albus (L.) Blake
Symphoricarpos mollis Nutt.
Vaccinium alaskaense Howell
Vaccinium membranaceum Dougl.
((V. macrophyllum (Hook.) Piper))
Vaccinium ovalifolium J.E. Smith
Vaccinium parvifolium J.E. Smith

VASCULAR HERBS

Achlys triphylla (Smith) DC.
Adenocaulon bicolor Hook.
Adiantum pedatum L.
Allotropa virgata Torr. & Gray
Apocynum androsaemifolium L.
Athyrium filix-femina (L.) Roth
Blechnum spicant (L.) J.E. Smith
Boschniakia hookeri Walp.
((B. strobilacea Gray))
Bromus vulgaris (Hook.) Shear
Calypso bulbosa (L.) Salisb.
Campanula scouleri Hook.
Cardamine angulata Hook.
Carex hendersonii Bailey
Carex leptopoda Mack.
Chimaphila menziesii (R.Br.) Spreng.
Chimaphila umbellata (L.) Nutt.
Circaea alpina L.
Circaea pacifica Aschers. & Magnus.
Claytonia sibirica L.
Corallorhiza maculata Raf.
Danthonia sp.
Dicentra formosa Andr.
Disporum oreganum (S.Wats.) Benth. & Hook.
Dryopteris linnaeana C.Chr.
Epilobium adenocaulon Haussk.
Epilobium paniculatum Nutt.
Equisetum arvense L.
Festuca occidentalis Hook.
Festuca subulata Trin.
((including F. subuliflora Scribn.))
Galium aparine L.
Galium boreale L.
Galium triflorum Michx.
Glyceria striata (Lam.) Hitchk.
((G. nervata (Willd.) Trin.))
Goodyera oblongifolia Raf.
((G. decipiens (Hook.) F.T. Hubbard))
Hieracium albiflorum Hook.
Hypochaeris radicata L.
Lilium columbianum Hanson
Linnaea borealis L.
Listera caurina Piper
Listera convallarioides (Sw.) Torr.
Listera cordata (L.) R.Br.
Luzula parviflora (Ehrh.) Desv.
Lysichitum americanum Hulten & St. John
Maianthemum dilatatum (Wood) Abrams
Melica smithii (Porter) Vasey
Melica subulata (Griseb.) Scribn.

Mimulus moschatus Dougl.
Mitella ovalis Greene
Monotropa latisquama (Rydb.) Hulten
Montropa uniflora L.
Osmorrhiza chilensis Hook. & Arn.
((O. nuda Torr.))
Polypodium vulgare L.
Polystichum munitum (Kaulf.) Presl
Pteridium aquilinum (L.) Kuhn.
Pyrola bracteata Hook.
Pyrola picta Smith
((including P. aphylla Smith))
Ranunculus bongardii Greene
Smilacina stellata (L.) Desf. var. sessilifolia (Baker) Henderson
((S. sessilifolia (Baker) Nutt.))
Stachys ciliata Dougl.
Stellaria crispa Cham. & Schl.
Streptopus amplexifolius (L.) DC.
Tiarella laciniata Hook.
Tiarella trifoliata L.
Trientalis latifolia Hook.
Trillium ovatum Pursh
Veratrum eschscholtzii A. Gray
Veronica americana (Raf.) Schwein.
Viola glabella Nutt.
Viola orbiculata Geyer
((V. sarmentosa Dougl. var. orbiculata (Geyer) A. Gray))

BRYOPHYTES

Antitrichia curtipendula (Hedw.) Brid.
Atrichum undulatum (Hedw.) Beauv.
Aulacomnium androgynum Schw.
Bartramia pomiformis Hedw.
Blepharistoma trichophyllum (L.) Dumort.
Brachythecium washingtonianum Eaton
Bryum pallens Swartz
Calliergonella Schreberi (Bruch & Schimper) Grout
Calypogeia trichomanis (L.) Corda
Camptothecium megaptilum Sull.
Cephalozia leucantha Spruce
Cephalozia media Lindb.
Chiloscyphus rivularis (Schrad.) Loeske
Claopodium crispifolium (Hook.) R. & C.
Conocephalum conicum (L.) Dumort.
Dicranoweisia cirrhata (Hedw.) Lindb.
Dicranum bonjeanii DeNot.
Dicranum fuscescens Turn.
Dicranum scoparium Hedw.
Dicranum strictum Schleich.
Eurhynchium oreganum (Sull.) Lesquerelle & James
Eurhynchium stokesii (Turn.) Bruch & Schimp.

Frullania nisquallensis Sull.
Heterocladium procurrens Lesq. & James
Hookeria lucens (Brid.) Smith
Hylocomium splendens (Hedw.) Bruch & Schimp.
Hypnum circinale Hook.
Lepidozia reptans (L.) Dumort.
Lophocolea heterophylla (Schrad.) Dumort.
Mnium insigne Mitt.
Mnium menziesii (Hook.) C.M.
Mnium punctatum Hedw.
Mnium spinulosum Bruch & Schimp.
Neckera douglasii Hook.
Pellia columbiana Krajina & Brayshaw
Plagiochila asplenioides (L.) Dumort.
Plagiothecium denticulatum (Hedw.) Bruch & Schimp.
Plagiothecium elegans (Hook.) Sull.
Plagiothecium undulatum (Hedw.) Bruch & Schimp.
Pogonatum alpinum (Hedw.) Roehl.
Polytrichum juniperinum Hedw.
Polytrichum piliferum Hedw.
Porella navicularis (L & L.) Lindl.
Pseudisothecium stoloniferum (Hook.) Grout
Ptilidium californicum (Aust.) U. & C.
Ptilidium pulcherrimum (Web.) Hampe
Radula bolanderi Gottsche
Rhacomitrium canescens Brid.
Rhacomitrium heterostichum (Hedw.) Brid.
Rhacomitrium lanuginosum (Hedw.) Brid.
Riccardia latifrons Lindb.
Rhytidiadelphus loreus (Hedw.) Warnst.
Rhytidiadelphus triquetrus (Hedw.) Warnst.
Rhytidiopsis robusta (Hook.) Broth.
Scapania bolanderi Aust.
Scapania umbrosa (Schrad.) Dumort.

LICHENS

Alectoria jubata (L.) Ach.
Alectoria oregana Tuck.
Alectoria sarmentosa Ach.
Cetraria glauca (L.) Ach.
Cetraria lacunosa Ach.
Cetraria scutata (Wulf.) Poetsch.
((C. saepincola (Ehrh.) Ach.))
Cladonia bellidiflora (Ach.) Schaer.
Cladonia degenerans (Floerke) Spreng.
Cladonia fimbriata (L.) Fries
Cladonia furcata (Huds.) Schrad.
Cladonia gracilis (L.) Willd.
Cladonia macilenta Hoffm.
Cladonia pyxidata (L.) Hoffm.

Cladonia rangiferina (L.) Web.
Cladonia squamosa (Scop.) Hoffm.
Cladonia subsquamosa (Nyl.) Wainio
Cladonia sylvatica (L.) Hoffm.
Cladonia uncialis (L.) Web.
Cladonia verticillata Hoffm.
Graphis scripta (L.) Ach.
Graphis sp.
Icmadophila ericetorum (L.) Zahlbr.
Letharia vulpina (L.) Hue
Lobaria oregana (Tuck.) Muell
Lobaria pulmonaria (L.) Hoffm.
Mycoblastus alpinus (Fr.) Kernst.
Mycoblastus sanguinarius (L.) Norm.
Nephromopsis ciliaris (Ach.) Hue
Ochrolechia tartarea (L.) Mass.
Ochrolechia uppsaliensis (L.) Mass.
Parmelia physodes (L.) Ach.
Peltigera aphthosa (L.) Ach.
Peltigera canina (L.) Willd.
Peltigera polydactyla (Neck.) Hoffm.
Pertusaria ambigens (Nyl.) Tuck.
Pertusaria multipuncta (Turn.) Nyl.
Pilophoron cereolus (Ach.) Th.Fr.
Pilophoron hallii (Tuck.) Wainio
Sphaerophorus globosus (Huds.) Wainio
Stereocaulon paschale (L.) Hoffm.
Stereocaulon tomentosum Fries
Sticta anthraspis Ach.
Thelotrema lepadinum Ach.
Usnea plicata (L.) Wigg.

FUNGI

Amanita sp.
Cronartium harknessii Meinecke
Fomes applanatus (Pers.) Gill.
((Ganoderma applanatum (Pers.) Pat.))
Polyporus schweinitzii Fries
Sparassis radicata Weir

ALGAE

Protococcus viridis C.A.Agardh

The original specimens of plants found on the plots were accidentally destroyed by fire before they were placed on file in the Herbarium of the Biology and Botany Department, University of British Columbia.

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APPENDIX III.

PARTICLE SIZE DISTRIBUTION IN SOILS

TABLE OF CONTENTS

APPENDIX III.

TABLE 1. PARTICLE SIZE DISTRIBUTION IN SOILS FROM THE *PSEUDOTSUGA* - *GAULTHERIA* - *PELTIGERA* ASSOCIATION PLOTS

	BY WEIGHT (%)										BY VOLUME (%)		
	25mm fraction			2 mm fraction			2-5mm fraction		5-25mm fraction		Whole soil		
DEPTH (cm.)	<2 mm.	2-5 mm.	5-25 mm.	sand[1]	silt[2]	clay[3]	concr[4]	stones	concr[4]	stones	<5 mm.	5-25 mm.	>25 mm.
PLOT L5 (Wolf Mt.)													
1-10	34	18	48	76	18	6	40	60	40	60	22	20	24
10-20	37	22	41	80	12	8	21	79	36	64	26	20	24
20-45	43	16	41	77	12	11	31	69	9	91	27	19	30
45-70	29	18	53	74	15	11	16	84	6	94	20	23	40
ortstein	37	15	48	76	16	8	19	81	13	87	-	-	-
PLOT L4 (Deadwood)													
A_2	46	16	38	73	20	7	11	89	9	91	-	-	-
1-10	33	21	46	73	20	7	42	58	5	95	27	23	10
10-20	34	22	44	73	21	6	38	62	6	94	30	24	10
20-45	34	21	45	75	17	8	50	50	18	82	21	25	23
45-70	38	16	56	76	15	9	32	68	35	65	19	25	30
ortstein	42	13	45	80	13	7	29	71	53	47	-	-	-
PLOT L3 (Deadwood)													
A_2	37	10	53	69	20	11	12	88	3	97	-	-	-
1-10	32	18	50	73	19	8	41	59	7	93	20	20	23
10-20	44	15	41	74	19	7	34	66	4	96	27	18	23
20-55	44	16	40	79	16	5	47	53	15	85	32	29	8
55-70	37	18	45	82	12	6	46	54	31	69	33	29	8
ortstein	50	18	32	83	13	4	33	67	21	79	-	-	-
PLOT L2 (Valley)													
A_2	43	11	47	70	18	12	24	76	10	90	-	-	-
1-10	37	14	49	70	23	7	21	79	18	82	27	24	7
10-20	41	23	36	74	18	8	24	76	15	85	36	20	7
20-40	37	20	43	77	16	7	42	58	29	71	26	20	10
40-55	32	16	52	77	20	3	40	60	45	55	21	23	17
ortstein	46	12	42	80	14	6	36	64	21	79	-	-	-
PLOT L1 (Fourth Lake)													
A_2	72	10	18	64	23	13	79	21	9	91	-	-	-
2-20	64	10	26	60	35	5	53	47	13	87	32	11	9
20-35	59	13	28	60	34	6	70	30	18	82	34	13	5
35-55	44	25	31	76	19	5	69	31	42	58	31	15	5

1 0.02 - 2mm fraction
2 0.002 - 0.02mm fraction
3 less than 0.002mm fraction
4 shotty and clinker-like concretions.

TABLE 2. PARTICLE SIZE DISTRIBUTION IN SOILS FROM THE PSEUDOTSUGA - GAULTHERIA AND PSEUDOTSUGA - TSUGA - GAULTHERIA ASSOCIATION PLOTS

	BY WEIGHT (%)										BY VOLUME (%)		
	25mm fraction			2mm fraction			2-5mm fraction		5-25mm fraction		Whole soil		
DEPTH (cm.)	<2 mm.	2-5 mm.	5-25 mm.	sand [1]	silt [2]	clay [3]	concr. [4]	stones	concr. [4]	stones	<5 mm.	5-25 mm.	>25 mm.
				PSEUDOTSUGA - GAULTHERIA ASSOCIATION									
PLOT G5 (Wolf Mt.)													
A_2	59	19	22	74	16	10	-	-	-	-	-	-	-
0.5-10	50	21	29	76	15	8	27	73	14	86	36	14	15
10-20	47	19	34	76	11	13	27	73	14	86	33	17	15
20-45	53	19	28	78	12	10	27	73	13	87	45	17	1
45-65	52	17	31	83	10	7	25	75	12	88	39	18	3
65-80	33	18	49	-	-	-	19	81	11	89	24	23	21
80-100	25	18	57	-	-	-	-	-	-	-	17	24	35
PLOT G4 (Deadwood)													
A_2	59	18	23	85	4	11	55	45	24	76	-	-	-
1-10	48	23	28	76	17	7	17	83	15	85	35	14	8
10-20	42	21	37	78	17	5	50	50	20	80	35	20	8
20-40	53	21	26	81	14	5	16	84	24	76	39	14	7
40-60	59	17	24	97	1	2	45	55	13	87	40	13	17
60-80	60	14	26	96	2	2	51	49	24	76	39	14	17
ortstein	59	14	27	87	9	4	37	63	15	85	-	-	-
PLOT G6 (Deadwood)													
A_2	69	13	18	73	20	7	42	58	27	73	-	-	-
1-10	41	32	27	63	32	5	77	23	40	60	35	13	16
10-25	41	34	25	64	32	4	75	25	36	64	36	12	16
25-50	48	29	23	64	26	10	73	27	52	48	35	10	25
50-70	41	17	42	73	17	9	50	50	38	62	30	22	12
ortstein	44	15	41	84	11	5	-	-	-	-	-	-	-
PLOT G3 (Valley)													
A_2	55	5	40	74	19	7	23	77	13	87	-	-	-
6-10	54	13	33	67	28	5	23	77	18	82	13	6	59
10-35	49	13	38	72	23	5	30	70	15	85	19	12	45
35-65	36	15	49	81	12	7	26	74	17	83	20	20	23
				PSEUDOTSUGA - TSUGA - GAULTHERIA ASSOCIATION									
PLOT G1 (Fourth Lake)													
A_2	51	15	34	61	24	15	53	47	23	77	-	-	-
7-20	49	10	41	69	25	6	58	42	30	70	9	7	61
20-30	33	16	51	64	31	5	68	32	40	60	13	13	43
30-50	31	17	54	70	25	5	20	80	22	78	12	15	40
50-60	34	14	52	70	25	5	38	62	35	65	16	18	40
60-70	35	13	52	73	18	9	22	78	37	63	18	20	40

APPENDIX III.

TABLE 2 - Continued

PLOT G2 (Echo Mt.)													
A_2	82	6	12	74	18	8	36	64	27	73			
4-35	57	16	27	69	20	11	40	60	27	73	33	12	12
35-55	37	12	51	80	11	9	37	63	16	84	28	29	13
55-75	34	14	52	77	15	8	12	88	7	93	26	29	22

[1] 0.02-2mm fraction
[2] 0.002-0.02mm fraction
[3] less than 0.002mm fraction
[4] shotty and clinker-like concretions.

TABLE 3. PARTICLE SIZE DISTRIBUTION IN SOILS FROM THE PSEUDOTSUGA - TSUGA - HYLOCOMIUM - EURHYNCHIUM ASSOCIATION PLOTS

	By WEIGHT (%)										By VOLUME (%)		
	25mm fraction			2mm fraction			2-5mm fraction		5-25mm fraction		Whole soil		
DEPTH (cm.)	<2 mm.	2-5 mm.	5-25 mm.	sand [1]	silt [2]	clay [3]	concr. [4]	stones	concr. [4]	stones	<5 mm.	5-25 mm.	>25 mm.
PLOT M5 (Wolf Mt.)													
A_1	84	10	6	68	22	10	45	55	33	67	-	-	-
1-10	73	17	10	67	25	8	33	67	38	62	40	5	-
10-20	74	18	8	69	27	4	48	52	37	63	41	4	-
20-40	78	15	7	72	20	8	43	57	53	47	41	3	-
40-70	77	15	8	71	22	7	29	71	37	63	48	4	-
70-100	90	7	3	68	31	1	16	84	10	90	55	2	-
PLOT M2 (Echo Mt.)													
A_2	59	11	30	71	18	11	21	79	16	84	-	-	-
1-20	46	14	40	-	-	-	34	66	17	83	23	16	21
20-40	47	15	38	74	16	10	29	71	12	88	30	19	8
40-75	48	17	35	77	12	11	25	75	17	83	28	15	9
75-100	77	17	6	63	14	23	28	72	16	84	33	3	21
PLOT M4 (Deadwood)													
A_2	44	13	43	76	19	5	29	71	10	90	-	-	-
1-10	53	23	24	83	11	6	45	55	29	71	35	11	20
10-20	55	20	25	86	9	5	41	59	28	72	43	14	10
20-40	60	15	25	87	11	2	44	56	41	59	48	16	5
40-70	75	14	11	97	+	3	56	44	33	67	54	7	11
70-100	33	16	51	93	3	5	10	90	2	98	31	32	10
PLOT M3 (Valley)													
A_2	61	8	31	73	21	6	30	70	4	96	-	-	-
2-20	32	19	49	82	11	7	34	66	13	87	14	13	39
20-45	29	16	55	84	12	4	19	81	9	91	18	22	34
45-75	27	18	55	87	9	4	22	78	8	92	21	26	23
75-100	28	15	57	87	8	5	22	78	18	82	27	35	8

TABLE 3 - Continued

PLOT M1 (Fourth Lake)													
A_2	72	6	22	70	20	10	40	60	23	77	-	-	-
6-20	39	18	43	69	26	5	27	73	6	94	23	15	27
20-40	34	23	43	77	13	10	31	69	13	87	23	17	21
40-65	26	18	56	79	12	9	17	83	12	88	17	21	28
65-90	57	13	30	69	20	11	38	62	33	67	24	14	30

1 0.02-2mm fraction
2 0.002-0.02mm fraction
3 less than 0.002mm fraction
4 shotty and clinker-like concretions.

TABLE 4. PARTICLE SIZE DISTRIBUTION IN SOILS FROM THE PSEUDOTSUGA - POLYSTICHUM ASSOCIATION PLOTS

	By WEIGHT (%)										By VOLUME (%)		
	25mm fraction			2mm fraction			2-5mm fraction		5-25mm fraction		Whole soil		
DEPTH (cm.)	<2 mm.	2-5 mm.	5-25 mm.	sand[1]	silt[2]	clay[3]	concr.[4]	stones	concr.[4]	stones	<5 mm.	5-25 mm.	>25 mm.
PLOT P4 (Deadwood)													
1-10	60	12	28	70	23	7	11	89	2	98	20	8	8
10-20	99	1	+	67	25	8	9	81	2	98	55	+	8
20-40	97	2	1	67	25	8	11	89	2	98	52	1	10
40-50	-	-	-	-	-	-	-		-	-	20	38	23
50-75	31	15	54	70	20	10	12	88	2	98	26	31	10
75-100	44	18	38	87	8	5	3	97	2	98	31	19	12
100-130	38	21	41	85	9	6	8	92	3	97	30	20	6
PLOT P1 (Fourth Lake)													
1-20	55	15	30	61	34	5	50	50	45	55	36	16	9
20-45	40	21	39	59	26	15	69	31	30	70	31	19	9
45-75	54	16	30	63	24	13	50	50	16	84	29	12	15
75-100	64	11	25	62	25	13	12	78	11	89	42	14	16
100-120	68	10	22	55	23	22	24	76	7	93	43	12	16
PLOT P2 (Echo Mt.)													
1-3	-	-	-	63	32	5	-	-	-	-	26	12	5
3-10	57	11	32	77	14	9	27	73	44	56	26	12	5
10-20	60	11	29	71	16	13	39	61	43	57	27	11	5
20-50	68	10	22	70	17	13	26	74	38	62	41	12	8
50-65	64	10	26	73	14	13	19	81	16	84	39	14	8
PLOT P5 (Wolf Mt.)													
2-10	62	18	20	69	22	9	51	49	28	72	41	11	1
10-25	54	16	30	74	18	8	47	53	40	60	37	16	1
25-40	58	16	26	76	17	7	32	68	26	74	36	12	1
40-70	70	16	14	77	15	8	8	92	4	96	39	6	11
70-100	39	16	45	76	15	7	3	97	1	99	31	26	11

APPENDIX III.

TABLE 4 - Continued

PLOT P3 (Valley)													
3-8	98	1	+	62	28	10	75	25	30	70	38	+	-
8-20	93	3	3	76	17	7	1	99	6	94	37	3	-
20-40	100	+	-	74	20	6	60	40	-	-	40	-	6
40-70	100	+	-	69	22	9	53	47	-	-	45	-	-
70-95	100	+	-	82	14	4	7	91	-	-	49	-	-
95-100	-	-	-	-	-	-	1	99	1	99	18	20	40

1 0.02-2mm fraction
2 0.002-0.02mm fraction
3 less than .002mm fraction
4 shotty and clinker-like concretions.

TABLE 5. AVERAGE VOLUME WEIGHTS OF THE 25mm SOIL FRACTION AT VARIOUS DEPTHS IN PLOTS SAMPLED FOR SOIL MOISTURE

PSEUDOTSUGA - GAULTHERIA - PELTIGERA ASSOCIATION

	PLOT L5	PLOT L4	PLOT L3	PLOT L2	PLOT L1
Ao	0.34	0.23	0.16	0.13	0.17
1-10 cm.	1.5	1.5	1.4	1.5	1.3
10-20 cm.	1.6	1.6	1.5	1.6	1.3
20-40 cm.	1.8	1.6	1.7	1.4	1.3
40-60 cm.	1.9	1.7	1.8	1.4	1.3
60-80 cm.	1.9	1.7	1.9	1.5	1.3
80-100cm.	-	-	-	-	-

PSEUDOTSUGA - GAULTHERIA ASSOCIATION

	PLOT G5	PLOT G4	PLOT G6	PLOT G3
Ao	0.12	0.18	0.12	0.18
1-10 cm.	1.5	1.4	1.5	1.3
10-20 cm.	1.5	1.6	1.5	1.5
20-40 cm.	1.6	1.5	1.6	1.6
40-60 cm.	1.5	1.7	1.6	1.6
60-80 cm.	1.6	1.7	1.7	-
80-100cm.	1.7	1.3	-	-

PSEUDOTSUGA - TSUGA - GAULTHERIA ASSOCIATION

	PLOT G1	PLOT G2
Ao	0.12	0.10
1-10 cm.	1.2	1.3
10-20 cm.	1.2	1.3
20-40 cm.	1.2	1.3
40-60 cm.	1.5	1.3
60-80 cm.	1.7	-
80-100cm.	-	-

APPENDIX III.

TABLE 5 - Continued

PSEUDOTSUGA - TSUGA - HYLOCOMIUM - EURHYNCHIUM ASSOCIATION

Ao	PLOT M5	PLOT M2	PLOT M4	PLOT M3	PLOT M1
1-10 cm.	0.26	0.15	-	0.15	0.12
10-20 cm.	1.2	1.3	1.6	1.2	1.3
20-40 cm.	1.2	1.3	1.7	1.2	1.3
40-60 cm.	1.2	1.4	1.8	1.6	1.3
60-80 cm.	1.4	1.3	1.9	1.6	1.4
80-100 cm.	1.4	1.3	1.9	1.6	1.4
	1.5	1.3	1.9	1.8	-

PSEUDOTSUGA - POLYSTICHUM ASSOCIATION

	PLOT P4	PLOT P1	PLOT P2	PLOT P5	PLOT P3
Ao	0.3	0.19	0.2	0.26	0.6
1-10 cm.	0.8	1.5	1.1	1.4	1.0
10-20 cm.	1.6	1.5	1.1	1.4	1.1
20-40 cm.	1.6	1.3	1.5	1.3	1.0
40-50 cm.	2.0	1.3	1.5	1.5	1.2
50-60 cm.	1.7	1.3	1.5	1.5	1.2
60-80 cm.	1.5	1.8	-	1.8	1.3
80-100cm.	1.4	1.8	-	-	1.7

THUJA - LYSICHITUM ASSOCIATION

PLOT Ly3

A (swamp)

1-10 cm. (muck)	0.15
10-20 cm. (muck)	0.4
20-30 cm. (gleyed)[1]	1.4

B (Banks and hummocks)

L (litter)	0.15
1-10 cm. (peat)	0.12
10-20 cm. (peat)	0.15
20-30 cm. (muck)	0.2
30-40 cm. (gleyed)[1]	1.8

PLOT Ly2

A (swamp)

1-10 cm. (muck)	0.18
10-20 cm. (muck)	0.4
20-30 cm. (gleyed)[2]	0.9

A^x (margin of swamp)

L (litter)	0.12
1-10 cm. (peat)	0.15
10-20 cm. (muck)	0.3
20-30 cm. (gleyed)[2]	0.4
30-40 cm. (gleyed)[2]	0.8
40-50 cm. (gleyed)[2]	0.9

B (Banks and hummocks)

L (litter)	0.16
1-10 cm. (peat)	0.15
10-20 cm. (peat)	0.15
20-30 cm. (muck)	0.4
30-40 cm. (gleyed)[1]	1.4

PLOT Ly1

A (swamp)

1-10 (muck)[3]	0.3
10-20 (muck)[3]	0.4
20-30 (gleyed)[1]	1.0

B (Banks and hummocks)

L (Litter)	0.14
1-10 (peat)	0.15
10-20 (peat)	0.20
20-30 (muck)	0.4
30-40 (gleyed)	1.7
40-50 (gleyed)	1.7

[1] gleyed gravelly loss
[2] gleyed sandy loss
[3] gleyed muck

APPENDIX IV.

WEATHER AND MICROCLIMATE RECORDS

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TEMPERATURE - Continued

D. EVAPORATION

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APPENDIX IV.

TABLE 1. PRECIPITATION AT VARIOUS STATIONS ON VANCOUVER ISLAND, 1951-53 (inches)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
EAST COAST												
CUMBERLAND												
1951	11.2	6.7	4.2	1.4	2.0	0.4	1.0	0.2	2.1	7.0	13.1	4.4
1952	8.7	8.5	5.1	5.0	1.7	1.4	0.2	1.3	0.5	0.9	8.1	16.7
1953	14.6	4.7	7.4	1.8	2.7	2.1	1.0	3.7	3.6	4.8	14.8	5.6
Average	11.5	6.7	5.5	2.8	2.1	1.3	0.7	1.7	2.1	4.2	12.0	8.9
Long term average	7.4	6.5	4.6	3.3	2.2	2.2	1.6	1.4	2.7	6.8	8.2	10.6
CASSIDY												
1951	9.6	4.7	4.0	1.1	1.3	0.3	0.1	0.6	2.8	8.2	7.9	6.9
1952	7.1	4.5	2.3	3.5	1.4	1.4	0.3	0.7	0.4	0.7	2.8	10.2
1953	13.4	2.8	2.8	1.9	0.1	1.4	0.6	0.5	3.8	2.3	7.6	5.5
Average	10.3	4.0	3.0	2.2	1.2	1.0	0.3	0.6	2.3	3.7	6.1	7.5
Long term average	7.1	5.7	3.3	2.4	1.4	1.1	1.1	1.0	1.6	3.5	7.8	7.1
CENTRAL MOUNTAINS												
COWICHAN LAKE												
1951	15.1	10.7	6.4	2.1	2.3	0.2	0.2	0.2	5.0	10.4	13.7	6.4
1952	15.1	8.6	6.1	5.8	1.9	2.1	0.4	2.0	1.2	2.6	5.6	19.4
1953	29.7	5.5	8.3	2.8	2.7	1.2	1.1	2.2	6.6	8.7	15.9	13.8
Average	20.0	8.3	6.9	3.6	2.3	1.2	0.6	1.5	4.3	7.2	11.7	16.5
Long term average	10.3	8.8	7.8	5.1	2.8	1.8	1.1	1.1	3.0	8.1	9.6	13.7
NITINAT CAMP												
1951	20.9	14.0	7.1	1.8	3.5	0.8	0.3	0.3	7.8	11.6	18.0	8.9
1952	17.8	14.0	6.2	7.2	2.1	2.5	0.4	2.0	1.8	3.4	8.8	27.1
1953	32.4	10.0	10.8	3.0	2.9	0.9	1.8	2.9	8.2	14.5	25.5	17.9
Average	23.7	12.7	8.1	4.0	2.8	1.4	0.8	1.7	5.9	9.8	17.4	17.9
Long term average	15.2	14.7	8.5	7.2	3.1	2.1	2.0	2.1	5.1	12.3	22.3	18.9

APPENDIX IV.

TABLE 2. PRECIPITATION AND INTERCEPTION ON PLOTS OF THE PSEUDOTSUGA - GAULTHERIA - PELTIGERA ASSOCIATION, June 1951 to October 1953 (in cm)[1]

1951

	JUN 18-25	JUN 25 -JUL 9	JUL 9 -AUG 9	AUG 9 -13	AUG 13-20	AUG 20-29	AUG 29 -SEP 4	SEP 4-10	SEP 10-17	SEP 17 -OCT 1	OCT 1-31	NOV 1-30	DEC 1-31
PLOT L5 (Wolf Mt.)													
Precipitation (cm)	0	T	T	0.5	T	0.2	0	0.5	0	6.7	17.8	15.7	13.5
Interception (%)	-	±99	±99	37	±99	67	-	44	-	16	6	26	24
PLOT L4 (Deadwood)													
Precipitation (cm)	0	0.2	-	0	0	0.9	0	0.7	0	7.6	14.4	17.7	12.8
Interception (%)	-	50	-	-	-	31	-	30	-	11	16	16	28
PLOT L3 (Deadwood)													
Precipitation (cm)	0	0.1	-	0	0	1.0	0	0.6	0	7.2	12.6	15.1	11.3
Interception (%)	-	75	-	-	-	23	-	40	-	15	27	28	36
PLOT L2 (Valley)													
Precipitation (cm)	0	0.3	-	0	0	0.4	0	0.5	0	8.8	17.6	27.0	12.8
Interception (%)	-	25	-	-	-	33	-	67	-	18	25	18	25
PLOT L1 (Fourth Lk.)													
Precipitation (cm)	0	0.2	-	0	0	0.4	0	1.6	0	12.0	24.5	35±	19.1
Interception (%)	-	50	-	-	-	60	-	43	-	18	18	22	29

1952

	JAN +FEB	MAR +APR	MAY 1-31	JUN 1-16	JUN 16-30	JUL 1-16	JUL 16-31	AUG 1-16	AUG 16-31	SEP 1-16	SEP 16-30	OCT 1-31	NOV 1-30	DEC 1-31
PLOT L5														
Pptn. (cm)	36.0	11.0	1.5	0.7	0.6	0	0.4	0	1.2	0.3	T	1.2	6.1	29.0
[2] Pptn. (check)	-	-	-	-	0.6	-	0.4	0	1.3	0.4	T	1.1	5.9	23.0
Incpt.(%)	14	27	42	46	54	-	43	-	41	60	-	54	45	32
PLOT L4														
Pptn. (cm)	34.0	12.5	1.8	1.0	0.6	0	0.6	0	2.0	0.6	T	2.3	8.8	28.9
Incpt.(%)	19	17	22	29	25	-	14	-	13	45	-	4	21	12
PLOT L3														
Pptn. (cm)	32.0	11.0	1.6	0.9	0.5	0	0.6	0	1.3	0.5	T	2.0	7.9	27.6
Incpt.(%)	24	27	30	36	38	-	14	-	43	55	-	17	29	16
PLOT L2														
Pptn. (cm)	35+	15.5	2.0	2.2	0.4	0	0.8	0	2.8	1.0	T	3.3	14.4	38.2
Incpt.(%)	-	35	37	31	56	-	20	-	36	47	±99	30	31	11
PLOT L1														
Pptn. (cm)	68±	35.0	3.3	4.9	1.3	0	1.0	0	6.9	2.8	0.5	6.8	21.5	54.3
Incpt.(%)	22	12	31	27	28	-	17	-	7	20	55	18	10	12

TABLE 2 - Continued

1953

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
PLOT L5 (Wolf Mt.)										
Precipitation (cm)	43.0	8.0	6.0	3.0	1.6	2.8	1.1	0.7	7.2	5.0
Precipitation (check)	-	7.6	-	-	-	-	-	-	-	-
Interception (%)	9	26	42	45	48	44	58	61	24	41
PLOT L4 (Deadwood)										
Precipitation (cm)	44.0	10.6	8.2	3.9	1.7	2.2	0.7	0.7	9.5	8.4
Interception (%)	8	9	17	26	35	39	65	72	6	6
PLOT L3 (Deadwood)										
Precipitation (cm)	40.8	9.2	7.0	3.3	1.5	2.7	0.7	1.5	8.1	7.1
Interception (%)	15	21	29	38	42	25	65	40	20	20
PLOT L2 (Valley)										
Precipitation (cm)	53.0	9.0	13.6	4.5	3.1	3.6	4.7	3.1	10.9	16.1
Interception (%)	4	34	28	30	35	29	6	40	18	17
PLOT L1 (Fourth Lk.)										
Precipitation (cm)	35+	13.8	23.3	6.1	6.4	1.8	4.4	7.5	-	29.9
Interception (%)	-	14	10	15	25	40	17	18	-	10

[1] Precipitation values are the average collection from 4 gauges within a quarter acre plot; interception is the percentage of precipitation recorded at the adjacent open station (Table 18) not reaching the plot gauges.
[2] Check precipitation values are the collections from 13 gauges: the percentage interception is based on these values for the period the checks were maintained.
T Trace.

TABLE 3. PRECIPITATION AND INTERCEPTION ON PLOTS OF THE PSEUDOTSUGA - GAULTHERIA AND PSEUDOTSUGA - TSUGA - GAULTHERIA ASSOCIATION, June 1951 to October 1953 (in cm.) [1]

PSEUDOTSUGA - GAULTHERIA ASSOCIATION

1951

	JUN 18-25	JUN 25 -JUL 9	JUL 9 -AUG 9	AUG 9 -13	AUG 13 -20	AUG 20-29	AUG 29 -SEP 4	SEP 4-10	SEP 10-17	SEP 17 -OCT 1	OCT 1-31	NOV 1-30	DEC 1-31
PLOT G5 (Wolf Mt.)													
Precipitation (cm)	0	0.1	0	0.4	T	0.3	0	0.5	0	6.3	14.2	15.5	14.4
Interception (%)	-	75	100	50	±99	50	-	44	-	21	25	30	19
PLOT G4 (Lower Deadwood)													
Precipitation (cm)	0	0.2	T	0.5	T	0.2	0	0.5	0	5.9	12.2	13.0	13.7
Interception (%)	-	60	±99	44	±99	60	-	44	-	33	36	40	24
PLOT G6 (Upper Deadwood)													
Precipitation (cm)	0	0.2	-	-	-	1.6	0	0.6	0	6.8	12.9	16.2	11.4
Interception (%)		60	-	-	-	30	-	33	-	23	25	21	33
PLOT G3 (Valley)													
Precipitation (cm)	0	T	-	-	-	T	0	1.0	0	11.2	22.0	35.0	16.4
Interception (%)	-	90	-	-	-	±99	-	33	-	3	16	8	25

APPENDIX IV.

TABLE 3 - Continued

1952

	JAN +FEB	MAR +APR	MAY 1-31	JUN 1-16	JUN 16-30	JUL 1-16	JUL 16-31	AUG 1-16	AUG 16-31	SEP 1-16	SEP 16-30	OCT 1-31	NOV 1-30	DEC 1-31
PLOT G5														
Pptn.(cm)	33.4	10.3	1.5	0.8	0.6	0	0.5	0	1.3	0.4	T	1.2	6.3	30.3
Pptn (check)	-	-	-	-	0.6	0	0.6	0	1.3	0.4	T	1.4	6.3	27.4
Incpt.(%)	20	31	42	38	54	-	14	-	41	60	±99	42	42	19
PLOT G4														
Pptn.(cm)	-	-	1.5	0.7	0.2	0	0.4	0	1.1	0.3	-	-	7.1	30.3
Incpt.(%)	-	-	46	59	75	-	50	-	64	70	-	-	35	13
PLOT G6														
Pptn.(cm)	39.6	10.8	1.7	0.9	0.7	0	0.5	0	1.6	0.4	T	2.0	7.3	27.9
Incpt.(%)	6	10	45	47	53	-	37	-	48	64	±99	37	9	7
PLOT G3														
Pptn.(cm)	38.5	24.0	1.6	3.1	0.6	0	0.9	0	3.8	1.8	0.1	4.7	17.7	14.2
Incpt.(%)	34	20	51	14	45	-	18	-	19	25	67	13	17	10

1953

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
PLOT G5 (Wolf Mt.)										
Precipitation (cm)	41.3	8.2	6.3	2.9	1.5	3.0	1.7	0.6	8.2	6.0
Precipitation (check)	-	7.9	-	-	-	-	-	-	-	-
Interception (%)	12	23	39	47	52	40	35	67	14	29
PLOT G4 (Lower Deadwood)										
Precipitation (cm)	40.5	8.6	7.2	3.1	1.5	1.8	0.8	0.3	8.3	7.0
Interception (%)	14	25	31	40	50	57	60	82	19	30
PLOT G6 (Upper Deadwood)										
Precipitation (cm)	42.5	9.9	7.5	3.9	2.2	2.8	1.3	2.6	8.8	8.0
Interception (%)	6	5	26	19	29	42	50	33	14	19
PLOT G3 (Valley)										
Precipitation (cm)	66.3	13.1	16.3	5.9	4.5	2.7	7.2	2.4	14.0	19.4
Interception (%)	7	14	20	21	4	45	-	47	7	2

<u>PSEUDOTSUGA</u> - <u>TSUGA</u> - <u>GAULTHERIA</u> ASSOCIATION

1951

	JUN 18-25	JUN 25 -JUL 9	JUL 9 -AUG 9	AUG 9-13	AUG 13-20	AUG 20-29	AUG 29 -SEP 4	SEP 4-10	SEP 10-17	SEP 17 -OCT 1	OCT 1-31	NOV 1-30	DEC 1-31
PLOT G1 (Fourth Lk.)													
Precipitation (cm)	0	0.3	0	-	-	0.4	0	1.7	0	14.5	24.1	42±	18.0
Interception (%)	-	25	-	-	-	60	-	39	-	2	27	7	33
PLOT G2 (Echo Mt.)													
Precipitation (cm)	0	0.5	0	-	-	0.3	0	1.5	0	10.7	24.8	36±	17.3
Interception (%)	-	37	-	-	-	40	-	25	-	18	15	10	18

TABLE 3 - Continued

1952

	JAN +FEB	MAR +APR	MAY 1-31	JUN 1-16	JUN 16-30	JUL 1-16	JUL 16-31	AUG 1-16	AUG 16-31	SEP 1-16	SEP 16-30	OCT 1-31	NOV 1-31	DEC 1-31
PLOT G1														
Pptn.(cm)	71±	31.0	4.2	7.3	1.5	0	0.8	0	6.6	2.9	0.9	8.0	23.4	54.4
Incpt.(%)	18	22	12	-	17	-	33	-	11	17	18	4	3	12
PLOT G2														
Pptn.(cm)	58±	27±	2.1	3.4	0.9	0	0.5	0	3.6	1.8	0.3	5.3	-	-
Incpt.(%)	21	21	46	28	31	-	50	-	25	38	70	22	-	-

1953

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
PLOT G1 (Fourth Lk.)										
Precipitation(cm)	79±	14.6	23.4	6.6	7.8	2.1	5.0	7.6	16.0	31.8
Interception (%)	5	9	10	8	8	30	6	16	8	4
PLOT G2 (Echo Mt.)										
Precipitation (cm)	-	-	-	-	-	-	-	-	-	-
Interception (%)	-	-	-	-	-	-	-	-	-	-

[1] Precipitation values are the average collection from 4 gauges within a quarter acre plot; interception is the percentage of precipitation recorded at the adjacent open station (Table 18) not reaching the plot gauges.

[2] Check precipitation values are the collections from 13 gauges; the percentage interception is based on these values for the period the checks were maintained.

T Trace.

TABLE 4. PRECIPITATION AND INTERCEPTION ON PLOTS OF THE <u>PSEUDOTSUGA</u> - <u>TSUGA</u> - <u>HYLOCOMIUM</u> - <u>EURHYNCHIUM</u> ASSOCIATION June 1951 to October 1953 (in cm.)[1]

1951

	JUN 18-25	JUN 25 -JUL 9	JUL 9 -AUG 9	AUG 9-13	AUG 13-20	AUG 20-29	AUG 29 -SEP 4	SEP 4-10	SEP 10-17	SEP 17 -OCT 1	OCT 1-31	NOV 1-30	DEC 1-31
PLOT M5 (Wolf Mt)													
Precipitation(cm)	0	T	0	0.3	T	0.1	0	0.3	0	5.0	11.8	11.0	13.1
Interception (%)	-	±99	100	62	±99	83	-	67	-	37	38	50	26
PLOT M2 (Echo Mt.)													
Precipitation(cm)	0	0.3	-	-	-	0.1	0	0.8	0	9.7	20.8	30.7	15.5
Interception (%)	-	62	-	-	-	67	-	50	-	23	26	21	19
PLOT M4 (Lower Deadwood)													
Precipitation(cm)	0	0.1	T	0.5	T	0.3	0	0.5	0	7.9	15.3	17.7	13.1
Interception (%)	-	75	±99	44	±99	30	-	44	-	10	19	19	27
PLOT M3 (Valley)													
Precipitation(cm)	0	0.1	-	-	-	T	0	0.9	0	10.4	24.6	35±	18.7
Interception (%)	-	80	-	-	-	±99	-	40	-	10	6	8	14
PLOT M1 (Fourth Lk.)													
Precipitation(cm)	0	0.2	-	-	-	0.2	0	1.6	0	12.2	26.4	35+	22.2
Interception (%)	-	33	-	-	-	80	-	6	-	10	6	-	18

TABLE 4 - Continued

1952

	JAN +FEB	MAR +APR	MAY 1-31	JUN 1-16	JUN 16-30	JUL 1-16	JUL 16-31	AUG 1-16	AUG 16-31	SEP 1-16	SEP 16-30	OCT 1-31	NOV 1-30	DEC 1-31
PLOT M5														
Pptn.(cm)	29.9	8.8	0.6	0.3	0.1	0	0.3	0	0.4	T	0	0.9	3.5	25.1
[2] Pptn.(check)	-	-	-	-	0.2	0	0.4	0	0.6	T	0	1.0	3.8	23.8
Incpt.(%)	29	41	77	77	85	-	43	-	73	±99	100	58	65	30
PLOT M2														
Pptn.(cm)	61±	20±	1.5	2.7	0.6	0	0.5	0	3.1	1.1	T	4.4	-	-
Incpt.(%)	5	33	62	43	45	-	44	-	33	56	±99	29	-	-
PLOT M4														
Pptn.(cm)	-	-	1.1	0.9	0.3	0	0.5	0	1.2	0.3	0	1.7	7.5	30.2
Incpt.(%)	-	-	61	47	62	-	37	-	61	70	100	29	31	14
PLOT M3														
Pptn.(cm)	47±	23.8	1.7	2.1	0.4	0	0.9	0	3.8	1.5	T	3.9	19.6	56.2
Incpt.(%)	19	21	48	42	64	-	18	-	19	37	±99	28	8	-
PLOT M1														
Pptn.(cm)	-	70+	2.6	5.6	0.9	0	0.7	0	6.5	2.3	0.3	7.2	22.3	58.4
Incpt.(%)	-	-	42	16	31	-	30	-	7	30	73	12	3	3

1953

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
PLOT M5 (Wolf Mt.)										
Precipitation (cm)	33.0	5.9	4.0	1.6	0.6	1.7	1.0	0.1	-	2.4
Precipitation(check)	-	5.8	-	-	-	-	-	-	-	-
Interception (%)	30	44	61	71	81	66	62	94	-	72
PLOT M2 (Echo Mt.)										
Precipitation (cm)	-	-	-	-	-	-	-	-	-	-
Interception (%)	-	-	-	-	-	-	-	-	-	-
PLOT M4 (Lower Deadwood)										
Precipitation (cm)	43.3	8.9	7.6	3.5	1.9	2.4	1.3	0.5	8.4	6.6
Interception (%)	8	23	27	33	37	43	35	71	18	34
PLOT M3 (Valley)										
Precipitation (cm)	67±	12.9	18.6	5.4	3.6	3.4	4.5	3.4	11.4	19.3
Interception (%)	6	15	9	28	23	31	18	24	24	9
PLOT M1 (Fourth Lk.)										
Precipitation (cm)	35+	14.7	22.8	4.9	5.8	0.9	4.0	7.0	15.5	30.4
Interception (%)	-	6	5	12	24	61	7	22	5	5

[1] Precipitation values are the average collection from 4 gauges within a quarter acre plot; interception is the percentage of precipitation recorded at the adjacent open station (Table 18) not reaching the plot gauges.

[2] Check precipitation values are the collection from 13 gauges; the percentage interception is based on these values for the period the checks were maintained.

T Trace.

TABLE 5. PRECIPITATION AND INTERCEPTION ON PLOTS OF THE <u>PSEUDOTSUGA - POLYSTICHUM</u> ASSOCIATION, June 1951 to October 1953 (in cm.)[1]

1951

	JUN 18-25	JUN 25 -JUL 9	JUL 9 -AUG 9	AUG 9-13	AUG 13-20	AUG 20-29	AUG 29 -SEP 4	SEP 4-10	SEP 10-17	SEP 17 -OCT 1	OCT 1-31	NOV 1-30	DEC 1-31
PLOT P4 (Upper Deadwood)													
Precipitation (cm)	0	0.1	-	-	-	1.4	0	0.2	0	6.6	11.1	10.3	8.4
Interception (%)	-	80	-	-	-	39	-	78	-	26	36	50	51
PLOT P1 (Fourth Lk.)													
Precipitation (cm)	0	0.2	-	-	-	0.2	0	1.3	0	10.8	23.3"	35±	18.0
Interception (%)	-	33	-	-	-	80	-	24	-	20	20	17	33
PLOT P2 (Echo Mt.)													
Precipitation (cm)	0	0.5	-	-	-	0.4	0	1.1	0	12.1	25.6	35±	16.6
Interception (%)	-	17	-	-	-	20	-	31	-	4	9	10	14
PLOT P5 (Wolf Mt.)													
Precipitation (cm)	0	T	T	0.3	T	0.4	0	0.5	0	6.4	13.6	15.2	14.0
Interception (%)	-	±99	±99	56	±99	33	-	56	-	20	28	30	21
PLOT P3 (Valley)													
Precipitation (cm)	0	0.1	-	-	-	T	0	0.7	0	8.5	19.3	23.3	12.2
Interception (%)	-	75	-	-	-	+99	-	53	-	21	18	29	28

1952

	JAN +FEB	MAR +APR	MAY 1-31	JUN 1-16	JUN 16-30	JUL 1-16	JUL 16-31	AUG 1-16	AUG 16-31	SEP 1-16	SEP 16-30	OCT 1-31	NOV 1-30	DEC 1-31
PLOT P4														
Pptn.(cm)	21.7	5.8	1.1	0.6	0.3	0	0.4	0	1.1	0.1	T	2.0	3.9	20.7
Incpt.(%)	48	52	65	65	80	-	50	-	65	91	±80	37	51	31
PLOT P1														
Pptn.(cm)	-	63+	2.5	4.7	0.6	0	0.9	0	5.6	2.1	0.3	6.4	19.2	48.1
Incpt.(%)	-	-	44	30	50	-	10	-	20	36	73	23	17	20
PLOT P2														
Pptn.(cm)	42.7	23.7	2.3	3.6	0.9	0	0.6	0	4.1	1.6	0.2	5.4	-	-
Incpt.(%)	33	21	42	23	18	-	33	-	11	36	67	13	-	-
PLOT P5														
Pptn.(cm)	33±	10.3	1.2	0.6	0.4	0	0.4	0	0.6	0.1	T	1.2	4.8	29.3
2 Pptn.(check)	-	-	-	-	0.3	0	0.4	0	0.6	0.1	T	1.1	4.5	26.9
Incpt.(%)	21	31	54	54	77	-	43	-	73	90	±80	54	58	20
PLOT P3														
Pptn.(cm)	42.3	14.8	1.3	1.8	0.3	0	0.8	0	2.8	1.0	0	3.2	14.2	37.9
Incpt.(%)	23	38	59	44	67	-	20	-	36	47	100	32	32	12

TABLE 5 - Continued

	1953									
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
PLOT P_4 (Upper Deadwood)										
Precipitation (cm)	33.5	6.5	3.5	2.1	0.8	2.2	1.4	1.8	6.7	6.6
Interception (%)	26	37	66	56	74	54	46	54	34	35
PLOT P_1 (Fourth Lake)										
Precipitation (cm)	35+	11.5	19.4	4.3	5.0	0.8	3.4	7.0	13.9	29.0
Interception (%)	-	27	19	23	34	65	21	23	15	10
PLOT P_2 (Echo Mt.)										
Precipitation (cm)	-	-	-	-	-	-	-	-	-	-
Interception (%)	-	-	-	-	-	-	-	-	-	-
PLOT P_5 (Wolf Mt.)										
Precipitation (cm)	36.0	8.0	5.9	2.3	1.0	2.2	1.3	0.3	7.8	4.3
Interception (%)	23	22	43	58	68	56	50	83	18	49
PLOT P_3 (Valley)										
Precipitation (cm)	54+	9.8	13.3	2.9	2.3	3.2	3.4	3.2	10.1	15.7
Interception (%)	2	28	30	55	52	37	32	38	24	19

[1] Precipitation values are the average collection from 4 gauges within a quarter acre plot; interception is the percentage of precipitation recorded at the adjacent open station (Table 18) not reaching the plot gauges.

[2] Check precipitation values are the collection from 13 gauges; the percentage interception is based on these values for the period the checks were maintained.

[T] Trace.

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TABLE 6. PRECIPITATION AND INTERCEPTION ON PLOTS OF THE *THUJA - LYSICHITUM* ASSOCIATION, June 1951 to October 1953 (in cm.) [1]

1951

	JUN 18-25	JUN 25 -JUL 9	JUL 9 -AUG 9	AUG 9-13	AUG 13-20	AUG 20-29	AUG 29 - SEP 4	SEP 4-10	SEP 10-17	SEP 17 -OCT 1	OCT 1-31	NOV 1-30	DEC 1-31
PLOT Ly3 (Wolf Mt.)													
Precipitation (cm)	0	0.2	0.1	0.6	T	0.4	0	0.3	0	6.4	14.2	15.2	12.9
Interception (%)	-	50	50	25	±99	33	-	61	-	20	25	30	27
PLOT Ly2 (Upper Deadwood)													
Precipitation (cm)	0	0.1	-	-	-	1.5	0	0.3	0	6.8	12.7	15.1	7.4
Interception (%)	-	80	-	-	-	35	-	66	-	23	27	26	56
PLOT Ly1 (Echo Mt.)													
Precipitation (cm)	0	0.4	-	-	-	0.5	0	0.9	0	10.3	22.7	34±	14.4
Interception (%)	-	44	-	-	-	17	-	44	-	18	19	12	25

1952

	JAN +FEB	MAR +APR	MAY 1-31	JUN 1-16	JUN 16-30	JUL 1-16	JUL 16-31	AUG 1-16	AUG 16-31	SEP 1-16	SEP 16-30	OCT 1-31	NOV 1-30	DEC 1-31
PLOT Ly3														
Pptn. (cm)	31.1	10.7	1.6	0.9	0.8	0	0.6	0	1.1	0.3	T	1.5	6.1	30.4
Incp. (%)	26	29	38	31	38	-	14	-	50	70	±80	37	43	10
PLOT Ly2														
Pptn. (cm)	28.5	7.8	1.2	0.7	0.6	0	0.4	0	1.7	0.2	T	2.0	5.4	23.5
Incp. (%)	32	35	61	59	58	-	50	-	45	82	±80	37	32	22
PLOT Ly1														
Pptn. (cm)	39.7	20.3	2.8	3.1	0.9	0	0.7	0	3.4	1.7	0.3	5.3	-	-
Incp. (%)	38	32	30	34	18	-	22	-	25	32	50	14	-	-

1953

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
PLOT Ly3 (Wolf Mt.)										
Precipitation (cm)	39.0	8.2	6.3	3.4	1.6	4.2	1.9	0.7	8.8	6.0
Interception (%)	17	20	39	38	48	16	27	61	7	29
PLOT Ly2 (Upper Deadwood)										
Precipitation (cm)	34.3	7.3	4.4	2.2	1.0	2.1	1.3	1.8	7.7	6.7
Interception (%)	24	30	57	54	68	56	50	54	25	32
PLOT Ly1										
Precipitation (cm)	-	-	-	-	-	-	-	-	-	-
Interception (%)	-	-	-	-	-	-	-	-	-	-

[1] Precipitation values are the average collection from 4 gauges within a quarter acre plot; interception is the percentage of precipitation recorded at the adjacent open station (Table 18) not reaching the plot gauges.

T Trace.

TABLE 7. MONTHLY MAXIMUM, MINIMUM AND MEAN AIR TEMPERATURES IN PLOTS SAMPLED FOR SOIL MOISTURE, 1953 (°F)[1]

	JUNE			JULY			AUG.			SEPT.			OCT.		
	Max	(Mn)	Min	Max	(Mn)	Min	Max	(Mn)	Min	Max	(Mn)	Min	Max	(Mn)	Min
PSEUDOTSUGA - *GAULTHERIA* - *PELTIGERA* ASS'N															
PLOT L5 (Wolf Mt.)	82	(64)	45	92	(72)	51	90	(71)	52	-	-	44	-	-	-
PLOT L1 (Fourth Lk)	76	(58)	40	97	(72)	46	87	(68)	48	82	(61)	40	63	(49)	35
PSEUDOTSUGA - *GAULTHERIA* ASS'N															
PLOT G5 (Wolf Mt.)	78	(61)	43	91	(70)	49	86	(68)	50	-	-	-	-	-	-
PSEUDOTSUGA - *TSUGA* - *GAULTHERIA* ASS'N															
PLOT G1 (Fourth Lk.)	75	(57)	39	90	(68)	45	82	(64)	46	79	(60)	40	62	(48)	33
PSEUDOTSUGA - *TSUGA* - *HYLOCOMIUM* ASS'N															
PLOT M5 (Wolf Mt.)	72	(58)	44	84	(67)	50	82	(67)	51	78	(60)	42	64	(52)	40
PLOT M1 (Fourth Lk.)	76	(57)	38	90	(69)	47	84	(69)	53	80	(61)	42	66	(51)	36
PSEUDOTSUGA - *POLYSTICHUM* ASS'N															
PLOT P5 (Wolf Mt.)	72	(57)	42	84	(67)	49	82	(66)	50	79	(61)	42	66	(52)	39
PLOT P1 (Fourth Lk.)	76	(59)	42	90	(69)	47	86	(67)	48	80	(61)	42	60	(48)	36
THUJA - *LYSICHITUM* ASS'N															
PLOT Ly3 (Wolf Mt.)	74	(57)	39	84	(66)	47	82	(65)	48	78	(60)	41	-	-	-

[1] Measured at one meter above the ground.

TABLE 3. AVERAGE QUARTERLY MAXIMUM, MINIMUM AND MEAN SOIL SURFACE TEMPERATURES IN PLOTS SAMPLED FOR SOIL MOISTURE 1951-53 (°F)

	SPRING[2]			SUMMER[3]			AUTUMN[4]			WINTER[5]		
	Max	(Mn)	Min	Max	(Mn)	Min	Max	(Mn)	Min	Max	(Mn)	Min
OPEN STATIONS												
Cabin	84	(57)	30	102	(70)	39	63	(44)	25	46	(36)	25
Lower Deadwood	97	(63)	29	119	(79)	40	74	(51)	28	50	(38)	26
Valley	83	(56)	30	86	(64)	42	64	(46)	28	44	(38)	31
Echo Mt.	83	(56)	30	103	(72)	41	63	(46)	28	52	(40)	28
Fourth Lk.	89	(60)	30	121	(79)	38	74	(51)	28	46	(38)	29
Average	87	(58)	30	106	(73)	40	67	(47)	27	48	(38)	28
<u>PSEUDOTSUGA</u> - <u>GAULTHERIA</u> - <u>PELTIGERA</u> ASSOCIATION												
PLOT L5 (Wolf Mt.)	90	(62)	34	108	(78)	49	61	(47)	33	57	(44)	30
PLOT L4 (Deadwood)	97	(68)	39	121	(85)	48	64	(49)	33	57	(44)	30
PLOT L3 (Deadwood)	87	(62)	38	105	(76)	47	57	(45)	33	52	(42)	32
PLOT L2 (Valley)	97	(68)	39	112	(81)	49	56	(45)	34	51	(41)	32
PLOT L1 (Fourth Lk.)	89	(63)	37	108	(77)	46	54	(44)	34	47	(38)	29
Average	92	(65)	37	111	(79)	48	58	(46)	33	53	(42)	31
<u>PSEUDOTSUGA</u> - <u>GAULTHERIA</u> <u>ASSOCIATION</u>												
PLOT G5 (Wolf Mt.)	74	(57)	41	87	(69)	50	51	(43)	36	48	(40)	33
PLOT G4 (Deadwood)	89	(63)	37	101	(75)	48	53	(44)	34	52	(41)	31
PLOT G6 (Deadwood)	78	(58)	38	84	(67)	49	49	(42)	35	48	(40)	32
PLOT G3 (Valley)	63	(51)	39	71	(61)	50	51	(43)	36	41	(36)	32
Average	76	(57)	39	86	(68)	49	51	(43)	35	47	(39)	32
<u>PSEUDOTSUGA</u>- <u>TSUGA</u> - <u>GAULTHERIA</u> ASSOCIATION												
PLOT G1 (Fourth Lk.)	66	(51)	37	73	(60)	47	49	(41)	33	42	(37)	32
PLOT G2 (Echo Mt.)	70	(55)	40	94	(70)	46	48	(41)	33	-	-	-
Average	68	(53)	38	83	(64)	46	49	(41)	33	42	(37)	32
<u>PSEUDOTSUGA</u> - <u>TSUGA</u> - <u>HYLOCOMIUM</u> - <u>EURHYNCHIUM</u> ASSOCIATION												
PLOT M5 (Wolf Mt.)	61	(50)	39	76	(62)	48	50	(42)	35	46	(39)	32
PLOT M2 (Echo Mt.)	63	(52)	41	72	(60)	48	49	(41)	34	-	-	-
PLOT M4 (Deadwood)	69	(53)	38	80	(65)	49	50	(42)	34	51	(41)	31
PLOT M3 (Valley)	62	(50)	38	76	(63)	50	49	(42)	35	43	(37)	32
PLOT M1 (Fourth Lk.)	62	(49)	36	78	(63)	47	49	(42)	34	43	(37)	32
Average	63	(51)	38	76	(62)	48	50	(42)	34	46	(39)	32
<u>PSEUDOTSUGA</u> - <u>POLYSTICHUM</u> ASSOCIATION												
PLOT P4 (Deadwood)	59	(49)	39	70	(59)	47	50	(42)	33	48	(40)	32
PLOT P1 (Fourth Lk.)	59	(48)	38	72	(60)	48	51	(43)	34	42	(37)	32
PLOT P2 (Echo Mt.)	62	(51)	40	71	(60)	48	50	(42)	34	-	-	-
PLOT P5 (Wolf Mt.)	66	(52)	39	73	(61)	49	51	(43)	35	47	(39)	31
PLOT P3 (Valley)	63	(50)	37	73	(60)	48	48	(41)	34	45	(38)	32
Average	60	(49)	38	72	(60)	48	50	(42)	34	45	(38)	32

TABLE 8 - Continued

	SPRING Max	(Mn)	Min	SUMMER Max	(Mn)	Min	AUTUMN Max	(Mn)	Min	WINTER Max	(Mn)	Min
<u>THUJA</u> - <u>LYSICHITUM</u> ASSOCIATION												
PLOT Ly3 (Wolf Mt.)	57	(48)	39	66	(58)	50	48	(42)	35	45	(38)	31
PLOT Ly2 (Deadwood)	55	(47)	40	63	(55)	47	49	(42)	35	43	(38)	33
PLOT Ly1 (Echo Mt.)	62	(51)	40	65	(56)	48	48	(41)	34	-	-	-
Average	58	(49)	40	65	(56)	48	48	(42)	35	44	(38)	32

[1] Surface temperature measurements were made approximately 5mm.below the surface of the litter layer.
[2] Measurements were made early in April, May and June.
[3] Measurements were made early in July, August and September.
[4] Measurements were made early in October, November and December.
[5] Measurements were made early in January, February and March.

TABLE 9. MONTHLY MAXIMUM AND MINIMUM SOIL SURFACE TEMPERATURES AT OPEN STATIONS ADJACENT TO PLOTS SAMPLED FOR SOIL MOISTURE 1952-55 (°F) [1]

1952	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
CABIN												
Maximum	-	-	-	-	-	-	-	-	95	75	54	56
Minimum	-	-	-	-	-	-	-	-	40	30	20	22
ECHO MOUNTAIN												
Maximum	-	-	-	-	-	-	-	108	103	80	62	-
Minimum	-	-	-	-	-	-	-	46	40	32	22	-
FOURTH LAKE												
Maximum	-	-	-	-	-	-	-	116	104	82	58	48
Minimum	-	-	-	-	-	-	-	44	39	32	26	30
1953												
CABIN												
Maximum	-	-	-	80	114	111	117	112	105	72	55	46
Minimum	-	-	22	26	32	35	44	41	34	32	32	28
VALLEY												
Maximum	-	-	-	-	-	-	-	-	-	-	56	45
Minimum	-	-	-	-	-	-	-	-	-	-	32	30
ECHO MOUNTAIN												
Maximum	-	58	70	68	90	96	112	109	100	73	56	48
Minimum	-	27	24	30	32	40	48	45	42	33	31	30
FOURTH LAKE												
Maximum	-	56	68	-	84	112	128	116	106	76	58	46
Minimum	-	26	22	25	31	36	40	42	33	31	32	31

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TABLE 9 - Continued

	1954 JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
CABIN												
Maximum	-	50	53	66	98	110	107	106	76	62	58	47
Minimum	-	25	19	28	30	34	41	46	26	28	30	22
LOWER DEADWOOD												
Maximum	-	42	65	74	116	110	118	124	98	80	56	52
Minimum	-	28	20	30	28	36	42	44	30	30	29	28
VALLEY												
Maximum	-	33	62	76	105	88	91	92	73	64	55	47
Minimum	-	32	28	28	26	35	42	45	30	30	32	24
ECHO MOUNTAIN												
Maximum	-	52	59	68	95	98	108	106	90	70	72	53
Minimum	-	30	23	28	30	37	42	46	32	30	30	24
FOURTH LAKE												
Maximum	-	36	59	74	108	117	132	127	94	72	-	45
Minimum	-	32	17	26	28	35	39	42	26	26	-	30

	1955											
CABIN												
Maximum	48	48	54	76	102	129	102	89	96	62	55	-
Minimum	32	22	26	30	29	39	44	38	32	32	8	-
LOWER DEADWOOD												
Maximum	54	60	72	102	109	124	128	124	122	80	56	-
Minimum	30	23	25	28	29	40	43	39	34	32	17	-
VALLEY												
Maximum	48	48	56	79	92	98	80	82	98	66	55	-
Minimum	32	28	28	32	33	43	47	44	34	32	16	-
ECHO MOUNTAIN												
Maximum	54	56	62	77	96	105	118	114	114	74	64	-
Minimum	30	24	26	30	30	42	42	42	35	30	8	-
FOURTH LAKE												
Maximum	46	53	52	74	111	118	134	121	130	72	55	-
Minimum	36	27	34	24	32	32	44	44	34	36	8	-

[1] Measurements were made at approximately 5mm. below the soil surface in mineral soil, within the first few days of each month.

TABLE 10. MONTHLY MAXIMUM AND MINIMUM SOIL SURFACE TEMPERATURES IN THE *PSEUDOTSUGA* - *GAULTHERIA* - *PELTIGERA* ASSOCIATION PLOTS, 1951-1953 (^{o}F).

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951												
PLOT L5 (Wolf Mt.)												
Maximum	-	-	-	-	-	92	110	106	106	71	50	45
Minimum	-	-	-	-	-	51	51	50	48	34	32	31
PLOT L4 (Lower Deadwood)												
Maximum	-	-	-	-	-	100	124	-	115	84	54	45
Minimum	-	-	-	-	-	50	51	52	46	35	32	31
PLOT L3 (Lower Deadwood)												
Maximum	-	-	-	-	-	88	107	-	88	66	53	47
Minimum	-	-	-	-	-	50	51	50	48	34	32	30
PLOT L2 (Valley)												
Maximum	-	-	-	-	-	99	113	-	116	67	52	42
Minimum	-	-	-	-	-	50	49	50	48	35	34	32
PLOT L1 (Fourth Lk.)												
Maximum	-	-	-	-	-	94	112	-	92	66	47	40
Minimum	-	-	-	-	-	48	48	50	44	33	32	32
1952												
PLOT L5												
Maximum	-	53	-	84	94	97	121	122	88	98	58	53
Minimum	-	30	-	31	35	43	49	50	45	39	30	31
PLOT L4												
Maximum	-	56	-	81	103	106	125	120	109	98	60	50
Minimum	-	32	-	33	36	43	47	49	50	39	30	31
PLOT L3												
Maximum	-	44	-	77	100	98	120	124	100	76	56	48
Minimum	-	30	-	32	33	42	46	48	43	38	30	31
PLOT L2												
Maximum	-	47	-	82	102	96	123	112	106	80	51	45
Minimum	-	31	-	32	38	44	50	51	48	40	32	32
PLOT L1												
Maximum	-	-	-	58	101	91	123	121	93	72	68	33
Minimum	-	-	-	32	34	42	46	48	42	37	29	32
1953												
PLOT L5												
Maximum	-	54	70	75	100	103	124	112	84	-	-	-
Minimum	-	30	30	30	38	46	50	52	45	-	-	-
PLOT L4												
Maximum	-	68	-	80	111	107	136	116	125	82	-	-
Minimum	-	30	30	33	40	42	47	48	44	38	-	-
PLOT L3												
Maximum	-	52	58	64	100	104	112	103	95	64	-	-
Minimum	-	32	32	32	40	42	47	46	43	37	-	-
PLOT L2												
Maximum	-	52	59	-	-	83	110	110	107	68	-	-
Minimum	-	32	32	-	-	46	50	52	47	40	-	-
PLOT L1												
Maximum	-	42	60	69	109	96	128	106	100	63	-	-
Minimum	-	30	28	32	36	42	48	49	42	37	-	-

APPENDIX IV.

TABLE 11. MONTHLY MAXIMUM AND MINIMUM SOIL SURFACE TEMPERATURES IN THE <u>PSEUDOTSUGA</u> - <u>GAULTHERIA</u> AND <u>PSEUDOTSUGA</u> - <u>TSUGA</u> - <u>GAULTHERIA</u> ASSOCIATION PLOTS, 1951-1953 (°F)

<u>PSEUDOTSUGA</u> - <u>GAULTHERIA</u> ASSOCIATION

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	1951											
PLOT G5 (Wolf Mt.)												
Maximum	-	-	-	-	-	72	86	88	82	56	47	42
Minimum	-	-	-	-	-	-	52	50	48	36	35	32
PLOT G4 (Lower Deadwood)												
Maximum	-	-	-	-	-	65	85	91	69	60	47	43
Minimum	-	-	-	-	-	42	50	52	49	38	34	32
PLOT G6 (Upper Deadwood)												
Maximum	-	-	-	-	-	74	79	77	68	56	45	40
Minimum	-	-	-	-	-	-	50	52	48	38	34	33
PLOT G3 (Valley)												
Maximum	-	-	-	-	-	66	70	72	68	57	45	39
Minimum	-	-	-	-	-	-	52	52	48	37	35	34
	1952											
PLOT G5												
Maximum	-	42	-	-	84	80	101	92	70	64	50	47
Minimum	-	31	-	-	47	46	49	51	48	40	33	34
PLOT G4												
Maximum	-	-	-	-	104	98	108	110	88	-	-	-
Minimum	-	-	-	-	36	42	46	49	46	-	-	-
PLOT G6												
Maximum	-	36	-	55	78	77	99	80	79	62	48	46
Minimum	-	32	-	33	36	44	48	51	46	41	32	34
PLOT G3												
Maximum	-	34	-	52	66	68	76	80	62	58	50	58
Minimum	-	32	-	33	38	44	49	52	48	44	32	32
	1953											
PLOT G5												
Maximum	-	50	48	62	82	78	83	102	79	58	-	-
Minimum	-	32	34	33	40	46	54	52	48	44	-	-
PLOT G4												
Maximum	-	50	64	75	100	106	135	118	110	68	-	-
Minimum	-	30	30	32	37	44	48	50	42	34	-	-
PLOT G6												
Maximum	-	48	50	70	86	94	108	93	76	58	-	-
Minimum	-	32	32	32	40	44	50	50	46	38	-	-
PLOT G5												
Maximum	-	42	45	54	68	68	78	68	65	55	-	-
Minimum	-	32	33	32	42	45	51	53	46	44	-	-

APPENDIX IV.

TABLE 11 - Continued

PSEUDOTSUGA - TSUGA - GAULTHERIA ASSOCIATION

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951												
PLOT G1 (Fourth Lk.)												
Maximum	-	-	-	-	-	68	72	74	69	58	44	37
Minimum	-	-	-	-	-	47	48	48	46	34	32	33
PLOT G2 (Echo Mt.)												
Maximum	-	-	-	-	-	70	106	-	101	60	48	35
Minimum	-	-	-	-	-	46	47	48	44	33	33	32
1952												
PLOT G1												
Maximum	-	-	-	57	70	70	74	78	63	74	52	36
Minimum	-	-	-	33	34	40	46	50	44	38	29	32
PLOT G2												
Maximum	-	-	-	49	70	69	94	118	95	64	-	-
Minimum	-	-	-	33	36	42	45	48	44	38	-	-
1953												
PLOT G1												
Maximum	-	44	46	56	66	80	76	82	67	56	-	-
Minimum	-	32	32	32	38	40	48	50	42	38	-	-
PLOT G2												
Maximum	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	-	-	-	-	-	-	-	-	-	-	-	-

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TABLE 12. MONTHLY MAXIMUM AND MINIMUM SOIL SURFACE TEMPERATURES IN THE PSEUDOTSUGA - TSUGA - HYLOCOMIUM - EURHYNCHIUM ASSOCIATION PLOTS

1951	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
PLOT M5 (Wolf Mt)												
Maximum	-	-	-	-	-	73	88	77	72	64	47	35
Minimum	-	-	-	-	-	-	51	50	48	37	34	30
PLOT M2 (Echo Mt)												
Maximum	-	-	-	-	-	65	77	-	64	57	45	37
Minimum	-	-	-	-	-	48	50	50	46	36	32	33
PLOT M4 (Lower Deadwood)												
Maximum	-	-	-	-	-	62	68	67	65	58	45	43
Minimum	-	-	-	-	-	-	52	53	50	39	34	30
PLOT M3 (Valley)												
Maximum	-	-	-	-	-	70	80	-	68	56	46	40
Minimum	-	-	-	-	-	-	52	51	48	36	34	32
PLOT M1 (Fourth Lk)												
Maximum	-	-	-	-	-	62	76	-	68	57	43	40
Minimum	-	-	-	-	-	47	49	51	46	36	34	32
1952												
PLOT M5												
Maximum	-	41	-	54	62	68	73	76	70	63	50	47
Minimum	-	30	-	33	37	42	49	49	49	42	32	31
PLOT M2												
Maximum	-	-	-	48	64	62	81	73	64	62	-	-
Minimum	-	-	-	33	36	42	46	50	46	40	-	-
PLOT M4												
Maximum	-	-	-	-	65	66	80	79	63	-	-	-
Minimum	-	-	-	-	36	43	47	50	48	-	-	-
PLOT M3												
Maximum	-	-	-	52	70	70	86	87	65	61	50	44
Minimum	-	-	-	32	36	42	52	50	48	42	30	32
PLOT M1												
Maximum	-	-	-	37	72	61	83	100	63	76	50	38
Minimum	-	-	-	32	34	41	46	49	44	40	30	32
1953												
PLOT M5												
Maximum	-	50	52	52	62	68	76	75	80	58	-	-
Minimum	-	32	32	33	42	46	52	42	46	42	-	-
PLOT M2												
Maximum	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	-	-	-	-	-	-	-	-	-	-	-	-
PLOT M4												
Maximum	-	52	62	68	83	-	110	90	98	58	-	-
Minimum	-	30	32	32	38	-	48	50	46	38	-	-
PLOT M3												
Maximum	-	43	45	50	64	66	80	70	68	55	-	-
Minimum	-	32	32	33	40	40	50	52	45	41	-	-
PLOT M1												
Maximum	-	42	48	54	64	66	82	75	76	56	-	-
Minimum	-	32	32	32	37	38	48	48	43	37	-	-

TABLE 13. MONTHLY MAXIMUM AND MINIMUM SOIL SURFACE TEMPERATURES IN THE PSEUDOTSUGA - POLYSTICHUM ASSOCIATION PLOTS, 1951-1953 (^{o}F)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951												
PLOT P4 (Upper Deadwood)												
Maximum	-	-	-	-	-	60	67	68	66	57	44	42
Minimum	-	-	-	-	-	49	49	50	46	34	33	28
PLOT P1 (Fourth Lk)												
Maximum	-	-	-	-	-	60	70	-	67	57	43	43
Minimum	-	-	-	-	-	48	49	50	48	36	34	32
PLOT P2 (Echo Mt.)												
Maximum	-	-	-	-	-	64	76	-	66	56	45	39
Minimum	-	-	-	-	-	48	50	50	46	36	34	32
PLOT P5 (Wolf Mt.)												
Maximum	-	-	-	-	-	65	74	70	66	58	46	-
Minimum	-	-	-	-	-	-	51	49	48	34	34	-
PLOT P3 (Valley)												
Maximum	-	-	-	-	-	68	78	-	81	57	45	37
Minimum	-	-	-	-	-	-	49	48	45	35	34	28
1952												
PLOT P4												
Maximum	-	42	-	55	61	60	72	73	68	62	50	46
Minimum	-	28	-	32	37	42	46	48	44	38	32	32
PLOT P1												
Maximum	-	-	-	40	62	60	78	76	64	79	50	42
Minimum	-	-	-	32	35	42	46	49	45	40	32	30
PLOT P2												
Maximum	-	-	-	54	70	68	72	77	68	62	-	-
Minimum	-	-	-	32	36	43	48	50	44	40	-	-
PLOT P5												
Maximum	-	-	-	56	-	73	86	76	66	63	50	47
Minimum	-	-	-	32	34	44	48	50	46	42	32	32
PLOT P3												
Maximum	-	-	-	60	65	64	69	75	66	60	50	42
Minimum	-	-	-	28	35	38	46	48	46	40	31	32
1953												
PLOT P4												
Maximum	-	50	47	52	62	67	76	74	68	58	-	-
Minimum	-	32	33	33	40	44	50	50	44	40	-	-
PLOT P1												
Maximum	-	42	45	49	66	68	88	70	65	56	-	-
Minimum	-	32	32	33	38	40	50	50	46	40	-	-
PLOT P2												
Maximum	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	-	-	-	-	-	-	-	-	-	-	-	-
PLOT P5												
Maximum	-	50	48	54	74	76	-	70	70	58	-	-
Minimum	-	30	33	32	40	46	50	50	45	42	-	-
PLOT P3												
Maximum	-	44	49	57	65	72	70	68	68	55	-	-
Minimum	-	32	32	32	38	41	58	47	46	40	-	-

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TABLE 14. MONTHLY MAXIMUM AND MINIMUM SOIL SURFACE TEMPERATURES IN THE <u>THUJA</u> - <u>LYSICHITUM</u> ASSOCIATION PLOTS, 1951-1953 (°F)[1]

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1951												
PLOT Ly3 (Wolf Mt.)												
Maximum	-	-	-	-	-	62	68	63	61	55	44	-
Minimum	-	-	-	-	-	49	52	50	68	37	33	-
PLOT Ly2 (Upper Deadwood)												
Maximum	-	-	-	-	-	66	65	63	61	-	-	40
Minimum	-	-	-	-	-	48	50	51	42	-	-	32
PLOT Ly1 (Echo Mt.)												
Maximum	-	-	-	-	-	60	75	-	64	59	44	38
Minimum	-	-	-	-	-	48	49	50	46	34	32	32
1952												
PLOT Ly3												
Maximum	-	-	-	53	55	61	70	68	60	56	49	46
Minimum	-	-	-	32	38	42	48	52	48	44	33	32
PLOT Ly2												
Maximum	-	40	-	50	55	56	63	65	63	58	50	46
Minimum	-	32	-	32	36	43	46	48	44	38	32	35
PLOT Ly1												
Maximum	-	-	-	56	64	57	66	68	60	58	-	-
Minimum	-	-	-	32	36	42	47	50	46	40	-	-
1953												
PLOT Ly3												
Maximum	-	50	46	53	60	62	73	70	63	-	-	-
Minimum	-	32	28	34	40	45	51	54	46	-	-	-
PLOT Ly2												
Maximum	-	48	44	50	52	61	65	60	60	54	-	-
Minimum	-	32	34	36	40	43	48	50	47	42	-	-
PLOT Ly1												
Maximum	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	-	-	-	-	-	-	-	-	-	-	-	-

[1] Surface temperature measurements were made approximately 5 mm. below the surface of the muck in a swampy part of the plot.

TABLE 15. AVERAGE QUARTERLY SOIL TEMPERATURE AT VARIOUS DEPTHS IN PLOTS SAMPLED FOR SOIL MOISTURE, 1951-1953 (°F)

	PSEUDOTSUGA - GAULTHERIA PELTIGERA ASSOCIATION						PSEUDOTSUGA - GAULTHERIA ASSOCIATION					PSEUDOTSUGA - TSUGA GAULTHERIA			PSEUDOTSUGA - TSUGA HYLOCOMIUM ASSOCIATION					
PLOT	L5	L4	L3	L2	L1	AV.	G5	G4	G6	G3	AV.	G1	G2	AV	M5	M2	M4	M3	M1	AV.
SPRING[1]																				
5 cm.	47	48	47	48	42	47	45	47	46	44	45	40	43	41	46	42	47	43	42	44
15 cm.	44	45	46	46	42	45	45	47	45	43	45	41	41	41	44	42	43	43	41	44
50 cm.	45	45	45	45	42	45	44	46	44	44	44	41	42	42	44	41	45	42	41	43
SUMMER[2]																				
5 cm.	58	59	57	62	57	59	57	57	58	57	57	55	54	54	56	54	58	55	55	56
15 cm.	57	58	57	61	56	58	56	59	56	55	56	54	53	54	55	54	56	54	53	55
50 cm.	56	56	55	56	53	55	53	56	54	54	54	52	52	52	54	51	55	52	51	53
AUTUMN[3]																				
5 cm.	46	45	45	46	43	45	45	44	44	45	45	46	44	45	45	42	44	45	44	44
15 cm.	45	47	47	47	44	46	47	46	47	45	46	44	45	45	46	44	47	46	44	45
50 cm.	50	49	47	48	47	48	47	47	49	49	48	47	46	46	48	47	46	47	44	46
WINTER[4]																				
5 cm.	36	36	36	35	35	36	36	34	38	35	36	35	34	35	37	35	36	36	36	36
15 cm.	36	36	36	36	36	36	38	37	38	36	37	36	35	36	37	36	38	36	35	36
50 cm.	39	39	37	38	38	38	40	39	41	40	40	38	38	38	40	38	39	37	37	38
ANNUAL																				
5 cm.	47	47	46	48	44	46	46	46	46	45	46	44	44	44	46	44	46	45	44	45
15 cm.	45	47	46	47	44	46	46	47	47	45	46	44	44	44	46	44	46	45	44	45
50 cm.	47	47	46	47	45	47	46	47	47	47	47	45	44	44	47	44	46	46	43	45

[1] Temperatures measured in early April, May and June.
[2] Temperatures measured in early July, August and September.
[3] Temperatures measured in early October, November and December.
[4] Temperatures measured in early January, February and March.

TABLE 15 - Continued

PLOT	PSEUDOTSUGA - POLYSTICHUM ASSOCIATION						THUJA - LYSICHITUM ASSOCIATION					
	P4	Pl	P2	P5	P3	AV.			Ly3	Ly2	Lyl	AV.
SPRING												
5 cm.	45	41	43	45	45	44	Swamp:	10 cm.	45	41	45	44
15 cm.	42	41	43	44	44	43	Bank:	5 cm.	46	42	44	44
50 cm.	42	41	41	44	42	42		25 cm.	45	43	43	44
SUMMER												
5 cm.	56	55	52	56	58	56	Swamp:	10 cm.	54	52	53	53
15 cm.	55	54	52	54	56	54	Bank:	5 cm.	57	55	55	56
50 cm.	52	51	50	52	53	52		25 cm.	54	49	53	52
AUTUMN												
5 cm.	44	44	46	44	47	45	Swamp:	10 cm.	42	45	42	43
15 cm.	46	44	47	45	48	46	Bank:	5 cm.	45	41	43	43
50 cm.	49	48	49	47	48	48		25 cm.	48	44	45	45
WINTER												
5 cm.	35	35	36	36	35	35	Swamp:	10 cm.	36	36	35	36
15 cm.	36	37	38	36	36	37	Bank:	5 cm.	37	35	36	36
50 cm.	39	38	40	40	37	39		25 cm.	39	38	37	38
ANNUAL												
5 cm.	45	44	44	45	46	45	Swamp:	10 cm.	44	44	44	44
15 cm.	45	44	45	45	46	45	Bank:	5 cm.	46	43	45	45
50 cm.	45	45	45	46	45	45		25 cm.	47	43	45	45

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TABLE 16. MONTHLY VALUES OF SOIL TEMPERATURE AT VARIOUS DEPTHS IN THE <u>PSEUDOTSUGA</u> - <u>GAULTHERIA</u> - <u>PELTIGERA</u> ASSOCIATION PLOTS, 1951-1953 (°F)

	1951	1952												1953										
DEPTH (cm.)	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N
PLOT L5 (Wolf Mt.)																								
1	33+	-	-	-	-	43	53	60	59	52	57	45	39	37	43	37	42	50	55	58	61	59	53	48
10	34	-	-	-	-	44	52	59	60	52	57	46	36	36	38	35	38	46	50	54	58	57	51	46
20	36	-	-	-	-	44	51	57	60	53	58	52	40	40	38	38	40	46	52	55	58	58	54	52
40	37	-	-	-	-	44	50	57	58	53	58	53	42	41	39	40	41	45	51	53	58	56	57	53
60	-	-	-	-	-	43	49	55	57	-	56	53	43	40	39	40	42	45	51	52	56	56	57	53
80	39	-	-	-	-	-	-	53	-	-														
100	-	-	-	-	-	-	-	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PLOT L4 (Lower Deadwood)																								
1	31	-	-	-	-	44	-	-	60	57	57	43	37	38	42	35	40	52	57	59	59	58	53	50
10	34	-	-	-	-	43	-	59	60	56	56	45	37	38	39	36	40	49	52	58	60	57	55	51
20	37	-	-	-	-	43	-	58	61	56	56	48	40	40	38	37	40	48	52	55	57	58	56	50
40	38	-	-	-	-	43	-	60	60	57	56	49	42	41	38	40	41	46	51	53	55	56	55	51
60	-	-	-	-	-	44	-	54	57	56														
80	38	-	-	-	-	-	-	-	57	55	-	-	-	-	-	-	-	-	-	-	-	-	-	-
100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PLOT L3 (Lower Deadwood)																								
1	33	-	-	-	-	44	51	58	57	54	58	43	30	38	42	35	40	52	57	59	59	58	53	50
10	34	-	-	-	-	44	52	56	58	53	57	45	37	37	39	36	40	49	52	58	60	57	55	51
20	-	-	-	-	-	44	52	55	59	53	56	48	38	38	38	37	40	48	52	55	57	58	56	50
40	-	-	-	-	-	44	52	53	58	53														
60	-	-	-	-	-	43	50	52	56	54	56	49	40	41	38	40	41	46	51	53	55	56	55	51
80	35	-	-	-	-	-	49	50	55	54	-	-	-	-	-	-	-	-	-	-	-	-	-	-
100	-	-	-	-	-	-	-	-	54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PLOT L2 (Valley)																								
1	32	-	-	-	-	52	54	66	64	64	61	44	36	36	40	35	43	49	54	52	65	68	56	49
10	34	-	-	-	-	48	54	58	64	60	60	45	36	36	42	36	42	43	52	56	62	68	54	50
20	35	-	-	-	-	47	54	57	62	57	57	49	39	39	40	39	40	47	52	54	59	62	51	52
40	37	-	-	-	-	-	52	54	59	57	56	53	43	40	40	40	41	44	50	52	57	58	57	52
60	-	-	-	-	-	-	51	53	-	56														
80	-	-	-	-	-	-	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
100	-	-	-	-	-	-	48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PLOT L1 (Fourth Lk.)																								
1	33+	-	-	-	-	42	52	59	58	55	56	44	33	38	38	34	34	44	45	54	57	60	47	44
10	34	-	-	-	-	43	49	53	58	57	55	45	34	40	38	34	36	43	46	53	58	58	49	47
20	36	-	-	-	-	40	48	52	58	57	55	49	38	40	38	35	38	44	49	52	58	57	52	49
40	37	-	-	-	-	39	47	50	57	55	55	49	41	44	37	37	37	41	48	50	55	55	52	49
60	39	-	-	-	-	38		-	55	53														
80	-	-	-	-	-	-	-	-	54	53	-	-	-	-	-	-	-	-	-	-	-	-	-	-
100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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TABLE 17. MONTHLY VALUES OF SOIL TEMPERATURE AT VARIOUS DEPTHS IN THE PSEUDOTSUGA - GAULTHERIA AND PSEUDOTSUGA - TSUGA - GAULTHERIA ASSOCIATION PLOTS, 1951-1953 (°F)

PSEUDOTSUGA - GAULTHERIA ASSOCIATION

	1951	1952												1953										
DEPTH (cm)	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N
PLOT G5 (Wolf Mt)																								
1	33	-	-	-	-	46	52	59	58	52	56	44	38	39	41	37	39	46	50	55	58	59	50	48
10	36	-	-	-	-	45	51	57	57	53	56	48	39	40	40	39	40	46	51	53	57	58	51	49
20	37	-	-	-	-	45	51	56	56	53	55	49	40	42	42	40	42	42	49	50	55	55	53	49
40	39	-	-	-	-	44	49	54	56	53	53	49	42	41	41	41	41	44	49	50	53	55	53	49
60	-	-	-	-	-	44	48	53	54	-	52	50	43	43	41	41	41	44	48	50	52	54	53	51
80	40	-	-	-	-	44	47	58	53	-														
100	-	-	-	-	-	-	46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PLOT G4 (Lower Deadwood)																								
1	34	-	-	-	-	46	56	60	63	56	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	36	-	-	-	-	45	55	57	60	55	55	-	34	38	41	35	42	50	56	59	63	60	55	47
20	38	-	-	-	-	44	54	55	59	55	57	-	37	39	39	37	41	49	55	57	62	60	58	49
40	40	-	-	-	-	43	51	53	57	53														
60	-	-	-	-	-	43	50	52	55	53	57	-	43	40	40	40	43	45	51	53	58	60	59	50
80	41	-	-	-	-	-	49	52	55	52														
100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PLOT G6 (Upper Deadwood)																								
1	35	-	-	-	-	43	-	56	60	57	57	42	30	38	42	35	39	51	54	60	57	60	51	47
10	40	-	-	-	-	42	-	52	58	55	57	45	36	37	39	36	39	47	51	55	58	60	55	49
20	-	-	-	-	-	42	-	52	57	55	56	48	39	39	39	39	40	47	51	54	57	59	56	50
40	42	-	-	-	-	42	-	50	55	53														
60	-	-	-	-	-	42	-	49	-	53	55	49	43	40	40	40	42	44	49	51	55	56	55	51
80	44	-	-	-	-	-	-	49	-	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-
100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PLOT G3 (Valley)																								
1	32	-	-	-	-	48	51	55	64	57														
10	35	-	-	-	-	42	50	52	61	56	54	47	38	37	39	37	39	44	47	54	56	60	53	47
20	37	-	-	-	-	43	50	51	60	55	53	46	37	35	38	37	37	43	47	52	54	57	50	47
40	39	-	-	-	-	42	48	51	59	55	55	49	41	37	39	39	39	44	49	53	55	56	55	49
60	-	-	-	-	-	-	-	-	59	55	54	50	43	40	40	40	40	44	48	50	54	55	55	50
80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

APPENDIX IV.

TABLE 17 - Continued

<u>PSEUDOTSUGA</u> - <u>TSUGA</u> - <u>GAULTHERIA</u> ASSOCIATION

DEPTH (cm)	1951 D	1952 J	F	M	A	M	J	J	A	S	O	N	D	1953 J	F	M	A	M	J	J	A	S	O	N
PLOT G1 (Fourth Lk)																								
1	34	-	-	-	-	35	47	52	56	55	55	43	35	38	37	35	36	43	45	53	55	57	49	49
10	34	-	-	-	-	36	47	51	59	55														
20	36	-	-	-	-	37	47	50	57	54	54	45	36	39	38	35	36	43	47	52	54	55	48	48
40	37	-	-	-	-	38	45	49	56	53	53	48	39	40	38	38	38	42	47	51	54	56	50	49
60	-	-	-	-	-	-	-	-	53	52	54	49	42	42	38	38	38	42	46	49	53	54	51	49
80	38	-	-	-	-	-	-	-	53	-	52	51	43	44	38	38	38	42	46	48	51	53	52	49
100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PLOT G2 (Echo Mt.)																								
1	32	-	-	-	-	44	55	50	59	47	53	42	34	34	35	33	34	42	49	51	55	57	45	44
10	37	-	-	-	-	42	49	50	57	50														
20	-	-	-	-	-	42	47	48	55	51	54	44	36	33	31	34	36	44	42	51	54	55	49	47
40	38	-	-	-	-	40	46	47	53	50	55	48	39	37	36	35	38	45	48	50	55	55	50	48
60	-	-	-	-	-	40	43	47	-	50	52	49	42	40	38	38	38	42	47	49	52	53	52	48
80	40	-	-	-	-	-	-	-	-	-														
100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

APPENDIX IV.

TABLE 18. MONTHLY VALUES OF SOIL TEMPERATURE AT VARIOUS DEPTHS IN THE <u>PSEUDOTSUGA</u> - <u>TSUGA</u> - <u>HYLOCOMIUM</u> - <u>EURHYNCHIUM</u> ASSOCIATION PLOTS, 1951-1953 (°F)

DEPTH (cm.)	1951 D	1952 J	F	M	A	M	J	J	A	S	O	N	D	1953 J	F	M	A	M	J	J	A	S	O	N
PLOT M5 (Wolf Mt.)																								
1	32	-	-	-	-	48	52	60	58	52														
											55	46	37	37	43	34	40	46	49	54	57	58	53	46
10	34	-	-	-	-	45	50	56	58	53														
											56	47	38	38	40	36	39	45	47	54	56	57	54	47
20	36	-	-	-	-	44	49	53	57	53														
											56	50	38	38	40	38	41	44	48	52	56	57	56	50
40	37	-	-	-	-	44	47	53	55	53														
60	-	-	-	-	-	43	46	50	53	53	54	50	42	42	42	42	42	45	48	50	54	54	56	50
80	40	-	-	-	-	42	46	49	51	52														
											52	49	45	42	42	42	42	44	47	47	52	54	56	51
100	-	-	-	-	-	42	-	46	50	52														
120	-	-	-	-	-	-	-	-	-	-	48	46	44	50	40	40	40	40	44	44	48	50	54	48
PLOT M2 (Echo Mt.)																								
1	32	32	-	-	-	42	51	53	65	54														
											54	44	36	34	39	34	34	44	44	52	54	52	45	44
10	35	32	-	-	-	42	51	53	57	53														
											54	44	36	34	39	34	35	44	44	52	54	56	47	45
20	-	35	-	-	-	41	50	49	55	53														
											53	46	40	35	38	37	37	43	46	50	53	53	50	48
40	38	36	-	-	-	39	47	47	54	53														
											53	48	43	38	38	37	38	41	45	48	52	53	52	48
60	-	-	-	-	-	39	45	46	51	52														
80	41	-	-	-	-	39	44	46	50	50														
											51	49	45	41	39	39	39	41	43	47	51	51	52	47
100	-	-	-	-	-	39	-	45	48	49														
PLOT M4 (Lower Deadwood)																								
1	32	-	-	-	-	43	54	55	62	56														
											-	-	38	37	44	34	39	52	57	60	60	59	51	44
10	35	-	-	-	-	43	51	54	59	55														
											-	-	37	37	40	36	40	48	51	56	59	58	51	49
20	36	-	-	-	-	42	50	53	59	55														
											-	-	38	38	40	38	41	46	51	54	58	57	51	49
40	38	-	-	-	-	43	50	52	57	55														
60	-	-	-	-	-	42	48	51	55	54	-	-	41	40	40	40	41	46	49	53	58	57	54	49
80	40	-	-	-	-	42	-	50	55	53														
100	-	-	-	-	-	-	-	50	-	53	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PLOT M3 (Valley)																								
1	32	-	-	-	-	44	54	63	60	53														
10	35	-	-	-	-	44	50	54	61	53	54	48	37	37	40	37	38	44	47	52	54	58	51	48
20	35	-	-	-	-	44	49	53	59	53	54	48	38	37	39	39	39	43	48	51	54	58	51	48
40	36	-	-	-	-	43	49	53	56	53	54	49	38	38	39	38	38	44	42	51	54	56	51	49
60	-	-	-	-	-	42	48	51	53	53	53	49	42	39	39	39	39	42	47	49	53	56	53	49
80	40	-	-	-	-	42	48	50	52	-	51	50	43	40	40	40	40	43	47	48	52	56	52	50
100	-	-	-	-	-	-	48	-	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PLOT M1 (Fourth Lk.)																								
1	32	-	-	-	-	42	53	58	63	57														
											53	44	35	35	39	36	36	43	46	49	54	56	48	48
10	34	-	-	-	-	38	50	50	55	54														
20	34	-	-	-	-	38	48	50	55	54	54	45	37	34	37	37	37	43	46	50	54	56	50	50
40	36	-	-	-	-	37	47	48	52	53	52	47	39	36	37	37	37	42	46	50	53	54	51	50
60	-	-	-	-	-	38	44	47	51	52	52	48	41	37	37	37	38	41	45	46	52	52	52	48
80	38	-	-	-	-	-	-	-	-	-														
											50	48	43	43	38	38	38	40	43	46	50	51	51	50
100	-	-	-	-	-	-	-	-	-	-														

APPENDIX IV.

TABLE 19. MONTHLY VALUES OF SOIL TEMPERATURE AT VARIOUS DEPTHS IN THE PSEUDOTSUGA - POLYSTICHUM ASSOCIATION PLOTS, 1951-1953 (°F)

	1951						1952													1953				
DEPTH (cm)	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N
PLOT P4 (Upper Deadwood)																								
1	33	32	-	-	-	40	-	-	58	55														
											59	39	32	39	43	33	43	51	51	56	55	57	54	47
10	38	32	-	-	-	40	-	-	58	53														
20	40	34	-	-	-	41	-	-	58	53	57	45	33	40	41	36	38	46	48	53	56	57	54	48
40	42	36	-	-	-	41	-	50	56	-	57	45	38	41	39	38	39	45	49	51	55	56	55	49
60	42	38	-	-	-	42	-	47	54	-	56	46	45	45	40	39	40	45	46	48	53	54	55	48
80	43	-	-	-	-	41	-	45	51	-														
											56	49	43	43	42	39	40	43	45	47	53	54	55	49
100	-	-	-	-	-	-	-	-	50	53														
120	-	-	-	-	-	-	-	-	-	-	50	48	44	44	43	40	40	41	43	44	48	55	50	46
PLOT P1 (Fourth Lk)																								
1	32	-	-	-	-	42	51	57	59	57														
											54	42	33	39	39	34	35	42	44	52	53	57	47	47
10	34	-	-	-	-	38	47	52	57	55														
20	36	-	-	-	-	38	47	50	57	54	54	44	35	39	39	36	36	44	47	52	54	56	49	49
40	38	-	-	-	-	38	45	49	55	53	53	46	37	40	38	38	38	43	47	50	53	54	50	48
60	-	-	-	-	-	38	44	48	54	52	52	49	42	39	39	38	39	39	45	47	51	52	52	49
80	40	-	-	-	-	-	44	48	52	52	52	49	44	39	39	39	39	40	45	47	51	52	52	49
100	-	-	-	-	-	-	43	-	52	51	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PLOT P2 (Echo Mt)																								
1	32	-	-	-	-	46	49	48	57	51														
											53	46	46	38	40	37	38	43	46	50	53	54	-	-
10	36	-	-	-	-	43	47	49	55	53														
20	-	-	-	-	-	42	45	48	54	53	57	51	49	40	41	38	39	44	46	49	54	53	-	-
40	41	-	-	-	-	40	44	47	52	52	52	50	48	40	40	39	40	42	45	46	52	52	-	-
60	-	-	-	-	-	40	44	46	50	52	52	50	50	40	40	38	40	41	44	46	52	52	-	-
80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PLOT P5 (Wolf Mt)																								
1	31	-	-	-	-	50	51	59	60	53														
											54	46	37	40	41	37	40	45	50	54	59	57	50	46
10	34	-	-	-	-	44	50	54	57	53														
20	35	-	-	-	-	43	47	51	55	53	55	47	36	39	40	36	40	45	48	52	56	57	50	48
40	38	-	-	-	-	42	48	50	55	53	54	48	40	41	41	40	41	44	49	51	55	56	51	49
60	-	-	-	-	-	42	-	49	-	52	53	49	43	41	41	41	43	44	47	47	53	53	53	49
80	-	-	-	-	-	-	-	-	-	52	50	49	45	43	42	42	42	43	47	47	52	52	52	49
PLOT P3 (Valley)																								
1	32	-	-	-	-	45	55	58	64	52														
											58	40	33	33	38	36	37	46	48	54	59	65	56	46
10	34	-	-	-	-	44	54	55	61	53														
20	34	-	-	-	-	44	53	52	59	53	55	44	34	36	38	36	38	44	48	53	57	60	59	48
40	36	-	-	-	-	41	49	50	56	53	55	44	37	37	37	37	37	43	48	52	56	59	60	48
60	-	-	-	-	-	41	47	49	54	53	54	48	41	37	37	37	38	43	46	50	55	58	61	48
80	38	-	-	-	-	41	46	48	53	51														
											52	49	47	42	38	38	39	41	45	47	53	56	58	49
100	-	-	-	-	-	-	46	48	51	51														
125	-	-	-	-	-	-	-	-	-	-	50	48	43	41	39	38	38	40	43	46	51	53	56	48

APPENDIX IV.

TABLE 20. MONTHLY VALUES OF SOIL TEMPERATURE AT VARIOUS DEPTHS IN THE THUJA - LYSICHITUM ASSOCIATION PLOTS, 1951-53 (°F)

DEPTH (cm.)	1951	1952												1953										
	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N
PLOT Ly3 (Wolf Mt.)																								
A(SWAMP)																								
10	34	-	-	-	-	45	49	52	58	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B (BANK)																								
1	32	-	-	-	-	44	51	61	60	53	54	48	38	38	41	36	41	46	50	55	59	59	50	47
10	34	-	-	-	-	48	50	56	57	53														
20	37	-	-	-	-	44	49	50	56	53	56	52	43	43	41	41	43	46	50	52	56	58	50	50
40	38	-	-	-	-	43	48	49	53	52														
60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PLOT Ly2 (Upper Deadwood)																								
A (SWAMP)																								
10	41	-	-	-	-	40	-	52	52	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A (SWAMP - margin)																								
1	35	-	-	-	-	41	50	53	57	53	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	38	-	-	-	-	40	47	52	57	52	60	46	39	40	42	36	39	45	48	54	56	58	61	48
20	40	-	-	-	-	40	46	50	56	-	63	49	40	40	41	40	41	44	49	50	54	56	62	47
40	41	-	-	-	-	40	45	49	58	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-
60	42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B (BANK)																								
1	34	-	-	-	-	40	-	59	57	53	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	38	-	-	-	-	-	-	53	56	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	40	-	-	-	-	41	-	50	52	51	-	-	-	-	-	-	-	-	-	-	-	-	-	-
40	44	-	-	-	-	42	-	45	47	48	-	-	-	-	-	-	-	-	-	-	-	-	-	-
60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PLOT Ly1 (Echo Mt.)																								
A (SWAMP)																								
10	-	-	-	-	-	44	52	50	57	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B (BANK)																								
1	33	-	-	-	-	42	57	54	61	53	52	45	39	38	37	36	39	45	47	52	54	59	-	-
10	35	-	-	-	-	40	57	50	59	53														
20	-	-	-	-	-	40	47	49	57	53	52	48	43	40	37	39	40	45	48	50	54	54	-	-
40	38	-	-	-	-	39	46	48	53	53														
60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

APPENDIX IV.

TABLE 21. EVAPORATION FROM LIVINGSTON ATMOMETERS IN THE PSEUDOTSUGA - GAULTHERIA - PELTIGERA ASSOCIATION PLOTS, 1951-1952 (cc.)

Height above ground	1951 JUN 18-25	JUN 25-JUL 9	JUL 9-AUG 8	AUG 8-13	AUG 13-20	AUG 20-29	AUG 29-SEP 4	SEP 4-10	SEP 10-17
PLOT L_5 (Wolf Mt)									
100 cm.	301	502	1023	85	224	259	166	162	239
10 cm.	100	289	675	54	123	154	100	-	-
PLOT L_4 (Deadwood)									
100 cm.	-	384	...	...	...	1651	119	88	211
10 cm.	-	-	...	...	...	-	85	85	146
PLOT L_3 (Deadwood)									
100 cm.	275	382	...	...	...	1239	92	88	145
10 cm.	188	275	...	...	...	855	63	49	90
PLOT L_2 (Valley)									
100 cm.	286	448	...	...	...	1544	...	-	198
10 cm.	209	310	...	...	...	1108	...	167	132
PLOT L_1 (Fourth Lk)									
100 cm.	297	438	...	...	...	1524	...	243	198
10 cm.	225	349	...	...	...	-	...	201	147

1952	JUN 1-16	JUN 16-30	JUL 1-16	JUL 16-31	AUG 1-16	AUG 16-31	SEP 1-16	SEP 16-30
PLOT L_5 (Wolf Mt)								
100 cm.	274	160	655	396	571	274	331	342
10 cm.	182	143	441	282	414	178	220	232
PLOT L_4 (Deadwood)								
100 cm.	383	248	808	471	689	268	356	294
10 cm.	249	-	557	339	495	195	245	-
PLOT L_3 (Deadwood)								
100 cm.	267	183	531	336	459	191	221	214
10 cm.	164	78	368	243	321	169	137	133
PLOT L_2 (Valley)								
100 cm.	266	259	614	363	-	208	259	270
10 cm.	160	179	425	252	-	-	176	183
PLOT L_1 (Fourth Lk)								
100 cm.	175	182	555	327	555	129	198	171
10 cm.	83	144	478	281	475	98	140	182

\- Atmometer broken, reading lost.

... Reading not taken until next record date.

APPENDIX IV.

TABLE 22. EVAPORATION FROM LIVINGSTON ATMOMETERS IN THE <u>PSEUDOTSUGA</u> - <u>GAULTHERIA</u> AND <u>PSEUDOTSUGA</u> - <u>TSUGA</u> - <u>GAULTHERIA</u> ASSOCIATION PLOTS 1951-1952 (cc.)

<u>PSEUDOTSUGA</u> - <u>GAULTHERIA</u> ASSOCIATION

Height above ground	1951 JUN 18-25	JUN 25- JUL 9	JUL 9- AUG 8	AUG 8-13	AUG 13-20	AUG 20-29	AUG 29- SEP 4	SEP 4-10	SEP 10-17
PLOT G_5 (Wolf Mt)									
100 cm.	208	328	733	58	154	185	-	108	158
10 cm.	108	174	-	31	77	-	-	41	73
PLOT G_4 (Deadwood)									
100 cm.	232	328	695	50	147	193	100	93	127
10 cm.	131	232	367	46	89	108	62	50	93
PLOT G_6 (Deadwood)									
100 cm.	258	351	...	...	...	976	74	62	101
10 cm.	110	180	...	...	...	548	51	39	63
PLOT G_3 (Valley)									
100 cm.	300	462	...	...	...	1571	...	246	177
10 cm.	139	212	...	...	...	-	...	-	77

1952	JUN 1-16	JUN 16-30	JUL 1-16	JUL 16-31	AUG 1-16	AUG 16-31	SEP 1-16	SEP 16-30
PLOT G_5 (Wolf Mt)								
100 cm.	198	152	475	280	429	175	222	241
10 cm.	97	73	262	150	247	85	104	-
PLOT G_4 (Deadwood)								
100 cm.	333	213	760	380	566	232	302	-
10 cm.	216	154	455	270	409	162	201	-
PLOT G_6 (Deadwood)								
100 cm.	196	119	478	289	393	109	169	208
10 cm.	87	61	237	137	210	38	68	133
PLOT G_3 (Valley)								
100 cm.	219	211	669	363	574	176	214	214
10 cm.	82	97	343	-	351	70	117	105

<u>PSEUDOTSUGA</u> - <u>TSUGA</u> - <u>GAULTHERIA</u> ASSOCIATION

	1951 JUN 18-25	JUN 25- JUL 9	JUL 9- AUG 8	AUG 8-13	AUG 13-20	AUG 20-29	AUG 29- SEP 4	SEP 4-10	SEP 10-17
PLOT G_1 (Fourth Lk)									
100 cm.	201	301	...	...	...	1034	...	177	135
10 cm.	86	140	...	...	...	507	...	94	62
PLOT G_2 (Echo Mt.)									
100 cm.	207	306	...	...	...	1049	...	207	161
10 cm.	122	168	...	...	...	-	...	115	84

APPENDIX IV.

TABLE 22 - Continued

	1952 JUN 1-16	JUN 16-30	JUL 1-16	JUL 16-31	AUG 1-16	AUG 16-31	SEP 1-16	SEP 16-30
PLOT G_1 (Fourth Lk.)								
100 cm.	118	145	374	194	382	53	99	164
10 cm.	7	34	197	100	65	15	23	58
PLOT G_2 (Echo Mt)								
100 cm.	139	139	430	232	441	116	170	232
10 cm.	68	72	278	152	297	53	76	125

- Atmometer broken, reading lost. ... Reading not taken until next record date.

TABLE 23. EVAPORATION FROM LIVINGSTON ATMOMETERS IN THE PSEUDOTSUGA TSUGA - HYLOCOMIUM - EURHYNCHIUM ASSOCIATION PLOTS, 1951-52 (cc.)

Height above ground	1951 JUN 18-25	JUN 25- JUL 9	JUL 9- AUG 8	AUG 8-13	AUG 13-20	AUG 20-29	AUG 29- SEP 4	SEP 4-10	SEP 10-17
PLOT M5 (Wolf Mt)									
100 cm.	208	309	694	58	131	170	104	108	147
10 cm.	108	212	432	39	77	96	62	62	92
PLOT M2 (Echo Mt)									
100 cm.	213	324	...	...	...	1082	...	209	164
10 cm.	155	252	...	...	...	...	...	155	109
PLOT M4 (Deadwood)									
100 cm.	207	289	-	33	120	174	93	85	139
10 cm.	147	-	463	31	89	123	62	54	77
PLOT M3 (Valley)									
100 cm.	239	366	...	...	...	-	...	204	170
10 cm.	176	268	...	...	...	849	...	141	115
PLOT M1 (Fourth Lk)									
100 cm.	208	327	...	...	...	1116	...	173	123
10 cm.	154	235	...	...	...	808	...	135	85

1952	JUN 1-16	JUN 16-30	JUL 1-16	JUL 16-31	AUG 1-16	AUG 16-31	SEP 1-16	SEP 16-30
PLOT M5 (Wolf Mt)								
100 cm.	184	161	446	277	392	184	219	223
10 cm.	103	104	301	185	278	123	150	162
PLOT M2 (Echo Mt)								
100 cm.	145	145	460	245	453	122	188	268
10 cm.	84	96	334	169	346	73	119	192
PLOT M4 (Deadwood)								
100 cm.	316	193	633	328	546	223	293	-
10 cm.	235	147	509	266	436	177	232	-
PLOT M3 (Valley)								
100 cm.	197	201	508	279	488	155	205	-
10 cm.	135	154	397	216	397	104	142	185
PLOT M1 (Fourth Lk)								
100 cm.	123	119	427	254	431	34	107	154
10 cm.	69	38	296	215	323	23	61	150

- Atmometer broken, reading lost.

... Reading not taken until next record date.

APPENDIX IV.

TABLE 24. EVAPORATION FROM LIVINGSTON ATMOMETERS IN THE *PSEUDOTSUGA* - *POLYSTICHUM* ASSOCIATION PLOTS, 1951-52 (cc)

Height above ground	1951 JUN 18-25	JUN 25 JUL 9	JUL 9- AUG 8	AUG 8-13	AUG 13-20	AUG 20-29	AUG 29- SEP 4	SEP 4-10	SEP 10-17
PLOT P4 (Deadwood)									
100 cm.	206	268	...	...	...	895	69	73	126
10 cm.	145	214	...	...	...	728	65	57	96
PLOT P1 (Fourth Lk)									
100 cm.	223	334	...	...	...	1153	...	208	131
10 cm.	107	165	...	...	...	613	...	111	61
PLOT P2 (Echo Mt)									
100 cm.	193	347	...	...	...	942	...	170	135
10 cm.	100	154	...	...	...	525	...	77	69
PLOT P5 (Wolf Mt)									
100 cm.	177	270	-	42	116	100	77	81	-
10 cm.	85	-	355	39	77	93	54	46	-
PLOT P3 (Valley)									
100 cm.	192	269	...	...	...	992	...	-	100
10 cm.	99	-	...	...	...	766	...	-	61

1952	JUN 1-16	JUN 16-30	JUL 1-16	JUL 16-31	AUG 1-16	AUG 16-31	SEP 1-16	SEP 16-30
PLOT P4 (Deadwood)								
100 cm.	167	114	403	251	372	129	182	258
10 cm.	95	57	268	160	241	91	114	160
PLOT P1 (Fourth Lk)								
100 cm.	114	114	457	251	427	68	106	144
10 cm.	45	53	271	153	271	19	45	72
PLOT P2 (Echo Mt)								
100 cm.	107	107	358	200	362	77	115	165
10 cm.	42	42	183	95	210	19	38	72
PLOT P5 (Wolf Mt)								
100 cm.	158	127	403	232	356	155	186	182
10 cm.	86	65	246	134	227	88	111	107
PLOT P3 (Valley)								
100 cm.	184	169	431	234	451	103	130	115
10 cm.	76	80	236	121	251	41	64	60

\- Atmometer broken, reading lost.

... Reading not taken until next record date.

APPENDIX IV.

TABLE 25. EVAPORATION FROM LIVINGSTON ATMOMETERS IN THE <u>THUJA LYSICHITUM</u> ASSOCIATION PLOTS, 1951-1952 (cc)

Height above ground	1951 JUN 18-25	JUN 25- JUL 9	JUL 9- AUG 8	AUG 8-13	AUG 13-20	AUG 20-29	AUG 29- SEP 4	SEP 4-10	SEP 10-17
PLOT Ly3 (Wolf Mt.)									
100 cm.	154	232	521	39	100	89	69	66	100
10 cm.	46	-	-	11	31	35	19	19	31
PLOT Ly2 (Deadwood)									
100 cm.	208	289	...	...	...	-	69	62	96
10 cm.	55	94	...	...	...	273	23	16	27
PLOT Ly1 (Echo Mt.)									
100 cm.	162	255	...	...	...	888	...	158	127
10 cm.	78	101	...	...	...	310	...	43	39

1952	JUN 1-16	JUN 16-30	JUL 1-16	JUL 16-31	AUG 1-16	AUG 16-31	SEP 1-16	SEP 16-30
PLOT Ly3 (Wolf Mt.)								
100 cm.	130	92	334	200	300	115	150	146
10 cm.	35	22	103	57	84	38	45	53
PLOT Ly2 (Deadwood)								
100 cm.	164	118	401	271	351	114	164	229
10 cm.	58	37	155	96	142	33	67	117
PLOT Ly1 (Echo Mt.)								
100 cm.	103	111	357	196	353	88	126	173
10 cm.	45	38	145	68	148	42	45	61

\- Atmometer broken, reading lost.
... Reading not taken until next record date.

TABLE 26. PERCENTAGE INCREASE IN EVAPORATION FROM BLACK BULB ATMOMETERS COMPARED WITH ADJACENT WHITE BULB ATMOMETERS AT OPEN STATIONS AND IN PLOTS SAMPLED FOR SOIL MOISTURE, 1951-52

	JUNE 1-16	JUNE 16-30	JULY 1-16	JULY 16-31	AUGUST 1-16	AUGUST 16-31	SEPTEMBER 1-16	SEPTEMBER 16-30	AVERAGE	% OPEN
OPEN STATIONS (1952)										
Cabin	-	67	28	74	33	64	54	40	51	-
Echo Mt.	-	-	30	24	31	63	53	54	42	-
Fourth Lk.	-	55	30	37	28	69	15	28	37	-
<u>PSEUDOTSUGA</u> - <u>GAULTHERIA</u> - <u>PELTIGERA</u> ASSOCIATION										
PLOT L5 (Wolf Mt.)										
1951	-	-	-	-	13	4	7	15	9	-
1952	6	0	-	3	3	26	2	6	6	12
PLOT L1 (Fourth Lk.)										
1952	-	5	20	30	17	46	31	22	24	65

APPENDIX IV.

TABLE 26 - Continued.

PSEUDOTSUGA - GAULTHERIA ASSOCIATION										
PLOT G5 (Wolf Mt.)										
1951	-	-	-	-	-	10	17	1	9	-
1952	37	22	12	28	17	19	5	6	18	35
PLOT G4 (Lower Deadwood)										
1951	-	-	-	4	22	13	8	-	12	-
PSEUDOTSUGA - TSUGA - GAULTHERIA ASSOCIATION										
PLOT G1 (Fourth Lk)										
1952	-	12	8	8	25	27	30	19	18	49
PLOT G2 (Echo Mt.)										
1952	-	14	7	14	12	19	18	6	12	29
PSEUDOTSUGA - TSUGA - HYLOCOMIUM ASSOCIATION										
PLOT M5 (Wolf Mt.)										
1951	-	-	-	0	5	18	6	5	7	-
1952	8	4	2	6	4	3	3	0	4	8
PLOT M4 (Lower Deadwood)										
1951	-	-	-	-	10	4	5	15	8	-
PLOT M2 (Echo Mt.)										
1952	2	1	3	6	2	1	5	0	2	5
PLOT M1 (Fourth Lk.)										
1952	0	0	1	0	0	30	0	4	4	11
PSEUDOTSUGA - POLYSTICHUM ASSOCIATION										
PLOT P1 (Fourth Lk.)										
1952	11	2	0	6	1	21	35	7	8	22
PLOT P2 (Echo Mt.)										
1952	26	17	20	8	8	21	29	11	17	40
PLOT P5 (Wolf Mt.)										
1951	-	-	-	-	0	20	20	2	10	-
1952	6	1	4	1	3	1	-	2	3	6
THUJA - LYSICHITUM ASSOCIATION										
PLOT Ly3 (Wolf Mt.)										
1951	-	-	-	-	9	30	21	26	21	-
1952	8	4	4	7	9	1	0	0	4	8
PLOT Ly1 (Echo Mt.)										
1952	2	21	0	19	1	0	2	2	6	16

APPENDIX V.

SOIL MOISTURE RECORDS

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TABLE OF CONTENTS - Continued

TABLE 1. MONTHLY VALUES OF SOIL MOISTURE IN THE *PSEUDOTSUGA* - *GAULTHERIA* - *PELTIGERA* ASSOCIATION PLOTS, 1951-1953[1]

Gravimetric Measurement

Soil pit:	1	2	3	4	5	6	7	8	9	10	11
			1951						1952		
DEPTH (cm.)	JUL	AUG	SEP	OCT	DEC	JAN	MAY	JUN	JUL	AUG	SEP
PLOT L_5 (Wolf Mt.)											
Ao	11	18	23	-	140	-	130	60	35	35	24
0-10	5	5	7	17	17	-	14	9	11	8	7
10-20	6	6	5	19	18	-	12	9	6	8	5
20-30	5	6	5	16	13	-	10	10	6	6	4
30-40	7	5	5	17	11	-	11	11	6	7	4
40-50	8	5	5	13	11	-	10	11	5	7	4
50-60	6	5	5	15	13	-	9	11	5	6	-
60-70	8	7	6	13	13	-	9	12	5	-	-
70-80	8	10	6	12	13	-	-	-	6	-	-
80-90	6	-	-	-	13	-	-	-	6	-	-
90-100	5	-	-	-	14	-	-	-	5	-	-
PLOT L_4 (Lower Deadwood)											
Ao	20	-	27	-	-	-	260	170	50	28	70
0-10	11	-	7	24	16	-	43	17	9	8	9
10-20	7	-	7	21	19	-	36	12	9	8	7
20-30	7	-	7	21	18	-	21	12	9	8	6
30-40	8	-	6	21	18	-	23	12	8	8	7
40-50	7	-	6	23	7	-	23	12	8	7	7
50-60	8	-	6	19	8	-	18	12	10	6	7
60-70	8	-	6	19	10	-	18	13	8	7	6
70-80	-	-	5	20	10	-	-	13	-	7	6
80-90	-	-	5	17	9	-	-	10	-	5	5
90-100	-	-	-	18	11	-	-	-	-	-	5
PLOT L_3 (Lower Deadwood)											
Ao	41	-	27	-	280	-	220	220	50	30	110
0-10	7	-	5	24	21	-	26	15	8	6	6
10-20	7	-	5	20	20	-	25	12	8	7	6
20-30	5	-	5	18	17	-	24	12	8	7	6
30-40	5	-	5	19	16	-	24	12	9	6	6
40-50	5	-	5	17	12	-	21	11	8	6	6
50-60	5	-	5	16	9	-	16	8	12	6	5
60-70	5	-	5	19	9	-	21	10	12	6	5
70-80	-	-	-	13	11	-	-	7	14	6	4
80-90	-	-	-	11	-	-	-	-	12	6	-
90-100	-	-	-	11	-	-	-	-	-	5	-

[1] Percentage by weight of the 5 mm. soil fraction.

TABLE 1 - Continued.

Soil pit:	1	2	3	4	5	6	7	8	9	10	11
			1951					1952			
DEPTH (cm.)	JUL	AUG	SEP	OCT-DEC		JAN - MAY		JUN	JUL	AUG	SEP
PLOT L_2 (Valley)											
Ao	30	-	46	170	190	-	220	51	42	24	60
0-10	7	-	13	30	26	-	28	27	9	7	9
10-20	6	-	7	24	19	-	23	26	8	7	7
20-30	6	-	7	22	19	-	21	18	8	8	9
30-40	6	-	7	23	20	-	-	14	8	8	9
40-50	6	-	7	28	20	-	-	12	8	8	10
50-60	7	-	9	11	15	-	-	13	10	-	10
60-70	7	-	7	11	-	-	-	16	-	-	11
70-80	-	-	-	-	-	-	-	16	-	-	-
80-90	-	-	-	-	-	-	-	17	-	-	-
90-100	-	-	-	-	-	-	-	18	-	-	-
PLOT L_1 (Fourth Lk.)											
Ao	19	-	85	240	270	-	260	230	180	27	60
0-10	15	-	13	37	39	-	40	24	34	12	10
10-20	14	-	12	39	40	-	32	17	30	15	20
20-30	16	-	10	32	46	-	37	37	29	16	31
30-40	19	-	10	36	48	-	34	58	32	18	36
40-50	21	-	13	56	-	-	35	-	33	22	32
50-60	-	-	23	-	-	-	44	-	37	20	40
60-70	-	-	-	-	-	-	-	-	-	17	50
70-80	-	-	-	-	-	-	-	-	-	16	46
80-90	-	-	-	-	-	-	-	-	-	-	36
90-100	-	-	-	-	-	-	-	-	-	-	-

Electrometric Measurement

Soil pit:	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	1952									1953				
DEPTH (cm.)	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
PLOT L_5 (Wolf Mt.)														
5	5	9	26	20	19	18	19	21	17	18	10	10	22	18
15	8	8	12	15	30	30	26	23	19	16	9	8	9	19
30	8	8	10	13	17	17	14	14	13	10	8	8	9	14
55	9	8	20	20	18	15	17	19	13	12	9	8	22	13
70	10	10	10	24	21	18	18	19	15	14	13	11	25	16
PLOT L_4 (Lower Deadwood)														
5	8	9	24	25	23	22	24	24	21	16	9	9	9	9
15	7	7	21	24	19	18	20	20	16	13	6	5	12	21
30	13	14	25	31	21	21	22	26	16	15	13	11	11	29
50	7	7	23	25	23	21	22	23	17	14	9	8	21	22

APPENDIX V.

TABLE 1 - Continued

Soil pit:	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	1952			1953										
DEPTH (cm.)	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
PLOT L3 (Lower Deadwood)														
5	9	12	34	39	39	29	29	35	22	27	6	7	9	29
15	10	27	30	30	29	25	27	28	24	24	14	13	32	30
30	8	27	29	31	24	20	21	22	19	18	8	8	30	25
60	9	14	18	17	17	15	15	16	15	13	9	9	20	18
PLOT L2 (Valley)														
5	15	34	33	31	30	26	28	27	22	28	14	15	30	31
15	11	27	26	23	21	19	20	20	18	21	12	11	12	25
30	11	12	25	21	20	17	18	18	16	15	10	8	10	22
55	10	11	21	29	20	18	18	18	15	14	12	9	11	19
PLOT L1 (Fourth Lk.)														
5	24	43	36	41	35	37	36	38	33	26	41	37	25	38
15	22	34	32	34	30	30	30	31	28	23	27	25	24	32
30	22	31	34	31	28	29	28	29	28	22	23	24	21	31
50	22	50	48	48	44	44	26	45	43	27	43	35	48	46

TABLE 2. MONTHLY VALUES OF SOIL MOISTURE IN THE <u>PSEUDOTSUGA</u> - <u>GAULTHERIA</u> AND <u>PSEUDOTSUGA</u> - <u>TSUGA</u> - <u>GAULTHERIA</u> ASSOCIATION PLOTS, 1951-1953 [1]

<u>PSEUDOTSUGA</u> - <u>GAULTHERIA</u> ASSOCIATION

Gravimetric Measurement

Soil pit:	1	2	3	4	5	6	7	8	9	10	11
	1951					1952					
DEPTH (cm.)	JUL	AUG	SEP	OCT	-DEC	JAN	- MAY	JUN	JUL	AUG	SEP
PLOT G5 (Wolf Mt.)											
Ao	38	42	49	-	270	-	130	230	110	57	110
0-10	7	11	11	26	23	-	15	23	9	5	9
10-20	7	7	7	19	20	-	12	17	8	6	7
20-30	8	7	6	17	16	-	12	16	8	7	7
30-40	8	7	5	15	14	-	10	17	6	7	6
40-50	9	6	5	14	13	-	7	15	7	7	6
50-60	8	6	5	13	9	-	7	18	8	5	6
60-70	7	6	6	11	8	-	7	14	9	6	5
70-80	7	6	5	13	8	-	8	14	9	6	-
80-90	7	5	5	8	-	-	11	15	10	6	-
90-100	9	5	5	9	-	-	12	15	11	5	-

[1] Percentage by weight of the 5 mm. soil fraction.

APPENDIX V.

TABLE 2 - Continued

Soil pit:	1	2	3	4	5	6	7	8	9	10	11
	1951					1952					
DEPTH (cm.)	JUL	AUG	SEP	OCT -	DEC	JAN -	MAY	JUN	JUL	AUG	SEP
PLOT G4 (Lower Deadwood)											
Ao	31	44	45	210	280	-	230	140	61	31	100
0-10	7	6	6	23	21	-	25	27	7	7	12
10-20	7	7	6	20	21	-	20	16	8	6	8
20-30	6	8	5	18	20	-	17	15	7	7	7
30-40	7	6	6	18	20	-	16	16	7	7	7
40-50	6	5	5	16	22	-	17	15	8	7	8
50-60	5	5	4	14	26	-	16	20	8	6	8
60-70	6	5	6	15	23	-	21	22	8	5	6
70-80	5	6	3	23	26	-	18	17	6	5	6
80-90	-	6	8	8	17	-	-	30	6	-	6
90-100	-	5	-	12	-	-	-	-	6	-	-
PLOT G6 (Upper Deadwood)											
Ao	75	-	48	-	500	-	300	300	130	48	70
0 - 10	9	-	8	28	31	24	23	24	14	8	7
10-20	10	-	10	22	27	24	24	23	11	10	8
20-30	11	-	10	24	25	24	17	22	12	9	8
30-40	13	-	9	22	26	24	19	16	12	8	8
40-50	14	-	10	16	26	23	17	17	13	8	8
50-60	12	-	6	16	19	21	16	20	12	6	9
60-70	10	-	7	20	25	21	16	21	10	7	7
70-80	10	-	8	21	-	22	16	15	10	6	6
80-90	-	-	8	24	-	20	16	-	12	-	5
90-100	-	-	9	12	-	-	16	-	-	-	-
PLOT G3 (Valley)											
Ao	45	-	100	290	240	-	230	230	180	-	130
0-10	5	-	29	27	36	-	25	23	17	7	13
10-20	9	-	5	26	30	-	21	22	12	6	9
20-30	11	-	6	27	22	-	22	22	11	7	12
30-40	10	-	7	28	22	-	14	14	12	6	10
40-50	13	-	9	22	23	-	12	17	11	5	13
50-60	10	-	13	14	17	-	-	-	-	6	18
60-70	-	-	9	-	-	-	-	-	-	9	11
70-80	-	-	-	-	-	-	-	-	-	9	-
80-90	-	-	-	-	-	-	-	-	-	8	-
90-100	-	-	-	-	-	-	-	-	-	-	-

TABLE 2 - Continued

Electrometric Measurement

Soil pit:	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	1952			1953										
DEPTH (cm.)	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
PLOT G_5 (Wolf Mt.)														
8	4	7	36	22	19	18	20	21	19	21	15	5	34	30
15	7	6	23	26	26	23	24	25	23	25	18	8	27	26
32	7	6	16	19	15	15	14	15	14	14	12	8	14	14
55	8	7	15	19	19	14	14	15	10	14	10	8	7	13
75	8	7	12	26	25	20	18	19	16	18	12	10	-	17
PLOT G_4 (Lower Deadwood)														
15	-	-	22	26	26	21	23	23	19	19	17	15	27	24
28	-	-	22	27	26	23	25	24	23	22	19	15	27	26
70	-	-	26	28	29	28	29	25	20	18	16	11	29	27
PLOT G_6 (Upper Deadwood)														
5	14	14	26	28	25	25	26	27	25	26	23	25	30	27
18	16	16	26	32	28	26	26	26	25	26	23	25	31	27
35	16	16	26	32	28	23	24	24	24	22	22	21	24	25
60	9	10	17	19	17	16	17	17	16	16	16	16	18	17
PLOT G_3 (Valley)														
5	15	19	41	37	31	26	28	27	24	24	20	15	16	34
20	15	19	66	58	46	38	39	38	34	26	30	14	14	46
35	13	22	35	34	29	26	29	27	26	21	25	12	29	32
50	12	33	31	33	33	29	32	30	30	22	25	11	31	34

PSEUDOTSUGA - TSUGA - GAULTHERIA ASSOCIATION

Gravimetric Measurement

Soil pit:	1	2	3	4	5	6	7	8	9	10	11
	1951					1952					
DEPTH (cm.)	JUL	AUG	SEP	OCT	- DEC	JAN	- MAY	JUN	JUL	AUG	SEP
PLOT G_1 (Fourth Lk.)											
Ao	80	-	-	-	-	-	350	310	220	34	110
0-10	8	-	115	36	330	-	30	38	23	11	23
10-20	11	-	29	58	39	-	32	78	26	14	32
20-30	17	-	12	40	30	-	38	46	40	12	34
30-40	18	-	13	87	31	-	58	-	40	12	28
40-50	21	-	15	-	30	-	61	-	48	12	27
50-60	27	-	16	-	31	-	-	-	-	11	33
60-70	25	-	10	-	32	-	-	-	-	11	-
70-80	37	-	-	-	37	-	-	-	-	14	-
80-90	37	-	-	-	50	-	-	-	-	-	-
90-100	-	-	-	-	54	-	-	-	-	-	-

APPENDIX V.

TABLE 2 - continued

Soil pit:	1	2	3	4	5	6	7	8	9	10	11
	1951					1952					
DEPTH (cm.)	JUL	AUG	SEP	OCT	-DEC	JAN-MAY		JUN	JUL	AUG	SEP
PLOT G_2 (Echo Mt.)											
Ao	54	-	130	310	-	-	310	240	136	56	102
0-10	7	-	9	20	450	-	38	26	12	5	13
10-20	10	-	8	20	28	-	28	19	10	6	14
20-30	12	-	9	19	24	-	25	19	12	9	15
30-40	12	-	8	19	22	-	22	19	12	16	20
40-50	12	-	7	18	26	-	19	20	12	-	-
50-60	12	-	7	19	30	-	18	20	18	-	16
60-70	10	-	9	19	32	-	11	20	32	-	18
70-80	12	-	11	15	-	-	-	26	11	-	-
80-90	12	-	10	18	-	-	-	25	-	-	-
90-100	-	-	11	25	-	-	-	22	-	-	-

Electrometric Measurement

Soil pit:	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	1952			1953										
DEPTH (cm.)	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
PLOT G_1 (Fourth Lk.)														
5	14	37	32	32	28	31	31	32	26	16	14	25	38	31
15	19	42	40	41	32	33	31	35	30	24	21	28	15	32
30	19	18	25	23	21	21	21	22	22	20	20	22	11	23
50	17	20	26	22	21	21	22	22	21	19	19	24	20	22
70	18	29	26	26	24	25	25	25	25	22	22	26	27	26
PLOT G_2 (Echo Mt.)														
6	13	32	27	31	24	27	26	29	24	21	22	21	32	28
20	15	16	23	28	21	21	21	21	20	18	19	17	25	23
35	7	22	21	22	18	19	18	20	19	18	19	17	20	20
70	11	22	22	22	19	19	19	20	20	18	20	13	22	21

APPENDIX V.

TABLE 3. MONTHLY VALUES OF SOIL MOISTURE IN THE PSEUDOTSUGA - TSUGA - HYLOCOMIUM - EURHYNCHIUM ASSOCIATION PLOTS, 1951-1953 [1]

Gravimetric Measurement

Soil pit:	1	2	3	4	5	6	7	8	9	10	11
	1951					1952					
DEPTH (cm.)	JUL	AUG	SEP	OCT	-DEC	JAN	-MAY	JUN	JUL	AUG	SEP
PLOT M_5 (Wolf Mt.)											
Ao	38	120	19	190	110	-	90	180	22	34	57
0-10	21	17	10	24	25	-	24	35	13	17	14
10-20	22	18	11	24	23	-	20	31	15	19	15
20-30	14	23	13	28	27	-	19	25	17	21	15
30-40	20	25	12	30	25	-	21	23	17	23	14
40-50	27	24	14	24	26	-	25	23	11	23	15
50-60	23	27	15	29	25	-	23	22	9	23	15
60-70	19	25	14	30	29	-	19	17	11	23	14
70-80	19	26	15	31	22	-	28	21	9	27	10
80-90	14	26	14	31	10	-	33	17	10	28	9
90-100	17	25	12	25	11	-	48	13	11	34	8
PLOT M_2 (Echo Mt.)											
Ao	65	-	75	340	340	-	220	175	130	50	150
0-10	14	-	10	18	27	23	21	8	12	15	21
10-20	16	-	10	19	27	21	23	8	12	16	18
20-30	15	-	9	19	26	21	23	11	10	13	19
30-40	16	-	10	18	26	20	22	15	11	13	22
40-50	16	-	9	21	25	21	20	16	12	12	22
50-60	12	-	10	21	23	22	20	17	13	12	27
60-70	15	-	12	21	23	23	21	18	14	16	36
70-80	13	-	10	22	23	23	24	19	14	18	32
80-90	15	-	6	22	24	24	25	20	15	18	33
90-100	14	-	8	18	26	25	31	-	15	16	28
PLOT M_4 (Lower Deadwood)											
Ao	59	47	45	-	350	-	220	130	80	33	150
0-10	6	8	7	21	35	-	26	11	9	10	9
10-20	8	8	9	20	19	-	15	9	9	8	8
20-30	9	7	9	20	16	-	11	9	9	8	6
30-40	7	8	8	19	17	-	12	10	10	9	5
40-50	8	8	9	18	16	-	11	10	6	9	4
50-60	10	9	9	16	14	-	9	13	10	10	4
60-70	8	9	7	10	11	-	7	15	12	13	4
70-80	7	9	8	10	11	-	8	17	5	13	4
80-90	4	9	7	10	9	-	6	16	5	13	4
90-100	10	5	5	14	8	-	-	18	11	11	4

[1] Percentage by weight of the 5 mm. soil fraction.

TABLE 3 - Continued

Soil pit:	1	2	3	4	5	6	7	8	9	10	11
	1951					1952					
DEPTH (cm.)	JUL	AUG	SEP	OCT -	DEC	JAN -	MAY	JUN	JUL	AUG	SEP
PLOT M_3 (Valley)											
Ao	20	-	75	-	200	-	210	170	110	50	-
0-10	7	-	8	29	25	-	21	27	19	6	10
10-20	8	-	9	19	26	-	20	16	17	12	11
20-30	9	-	9	18	26	-	20	19	15	11	11
30-40	8	-	9	19	26	-	23	18	14	14	12
40-50	9	-	11	21	30	-	23	17	14	14	13
50-60	9	-	10	21	16	-	27	16	17	11	13
60-70	9	-	11	20	15	-	25	14	16	8	12
70-80	11	-	11	20	16	-	25	15	10	8	-
80-90	-	-	15	20	17	-	15	20	-	10	-
90-100	-	-	18	22	17	-	17	24	-	9	-
PLOT M_1 (Fourth Lk.)											
Ao	87	-	140	-	280	-	290	240	300	-	110
0-10	17	-	6	-	33	-	107	28	27	56	17
10-20	20	-	10	30	32	-	43	25	27	12	16
20-30	20	-	13	29	35	-	30	22	22	14	12
30-40	22	-	13	27	32	-	28	20	21	17	13
40-50	23	-	11	26	37	-	28	23	22	19	11
50-60	23	-	12	25	31	-	23	24	21	21	14
60-70	24	-	12	27	30	-	18	22	20	20	14
70-80	21	-	15	31	30	-	20	27	22	20	16
80-90	23	-	21	31	-	-	22	-	28	-	21
90-100	27	-	18	33	-	-	-	-	26	-	-

Electrometric Measurement

Soil pit:	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	1952			1953										
DEPTH (cm.)	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
PLOT M_5 (Wolf Mt.)														
5	8	8	23	31	30	25	27	31	25	30	22	16	20	31
15	10	10	19	24	30	23	23	25	21	23	20	17	28	26
30	16	15	18	21	28	25	24	24	23	23	21	12	23	29
60	16	15	15	31	34	30	29	28	27	26	24	11	20	21
70	21	20	20	39	39	39	38	37	35	35	32	14	23	25
120	20	19	18	27	28	29	29	29	27	26	24	13	21	21
PLOT M_2 (Echo Mt.)														
5	9	19	14	16	16	14	15	15	14	15	14	14	23	17
15	11	12	18	21	20	18	19	19	18	18	18	17	19	21
30	10	10	17	18	17	16	16	16	15	15	15	15	16	17
50	14	15	19	19	19	18	18	18	17	16	16	16	15	18
90	18	26	31	31	32	29	30	28	29	28	28	26	30	32

APPENDIX V.

TABLE 3 - Continued

Soil pit:	12	12	12	12	12	12	12	12	12	12	12	12	12	12
		1952							1953					
DEPTH (cm.)	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
PLOT M4 (Lower Deadwood														
5	-	-	27	26	25	21	25	25	20	23	18	18	27	25
18	-	-	18	19	19	15	16	17	15	16	14	14	19	18
30	-	-	20	23	24	21	22	23	22	23	17	19	24	24
58	-	-	30	33	32	30	31	31	30	30	29	28	32	32
PLOT M3 (Valley)														
10	10	25	25	21	21	21	21	22	21	25	19	15	12	26
20	13	12	20	13	12	12	13	14	13	14	11	11	18	14
30	13	12	27	26	25	25	25	26	27	27	25	22	27	26
60	12	28	26	20	19	18	20	23	19	18	18	15	26	22
80	12	22	15	13	12	12	12	12	14	14	14	13	13	14
PLOT M1 (Fourth Lk.)														
8	20	39	33	25	25	28	28	33	33	25	27	37	40	36
20	19	14	21	21	21	21	21	22	21	20	21	23	24	22
35	23	31	25	25	23	21	22	23	22	21	22	24	27	25
60	30	34	31	30	22	22	22	22	22	21	22	23	24	23
90	22	30	22	21	19	19	19	19	19	18	18	22	22	23

TABLE 4. MONTHLY VALUES OF SOIL MOISTURE IN THE *PSEUDOTSUGA - POLYSTICHUM* ASSOCIATION PLOTS, 1951-1953[1]

Gravimetric Measurement

Soil pit:	1	2	3	4	5	6	7	8	9	10	11
			1951					1952			
DEPTH (cm.)	JUL	AUG	SEP	OCT -	DEC	JAN -	MAY	JUN	JUL	AUG	SEP
PLOT P4 (Upper Deadwood)											
Ao	80	-	47	120	150	-	130	150	120	43	38
0-10	45	-	24	55	79	58	-	-	34	8	4
10-20	17	-	20	16	79	64	24	16	36	9	15
20-30	11	-	11	28	67	68	15	38	34	8	16
30-40	21	-	10	16	57	48	10	18	36	6	8
40-50	41	-	13	62	33	63	12	13	39	7	7
50-60	-	-	25	47	35	29	27	12	38	9	7
60-70	45	-	15	40	51	23	14	15	21	12	7
70-80	33	-	15	47	60	26	31	46	14	9	7
80-90	26	-	18	46	-	27	21	49	9	30	7
90-100	29	-	14	43	-	30	16	27	13	26	43

[1]Percentage by weight of the 5 mm. soil fraction.

TABLE 4 - Continued

Soil pit:	1951					1952					
	1	2	3	4	5	6	7	8	9	10	11
DEPTH (cm.)	JUL	AUG	SEP	OCT -	DEC	JAN -	MAY	JUN	JUL	AUG	SEP
PLOT P1 (Fourth Lk.)											
Ao	35	-	170	-	280	-	250	250	220	45	66
0-10	15	-	14	26	30	-	35	31	29	19	18
10-20	18	-	21	26	30	-	32	33	31	22	18
20-30	20	-	24	33	30	-	28	30	26	17	-
30-40	24	-	23	45	28	-	27	30	24	20	22
40-50	26	-	23	43	28	-	31	31	22	17	30
50-60	23	-	23	46	32	-	-	34	25	20	31
60-70	21	-	22	52	37	-	-	39	22	24	31
70-80	21	-	18	46	36	-	-	29	19	23	23
80-90	18	-	16	46	37	-	-	31	18	22	15
90-100	23	-	17	-	36	-	-	28	16	19	15
PLOT P2 (Echo Mt.)											
Ao	-	-	130	200	-	-	230	250	-	80	110
0-10	160	-	40	280	290	-	30	37	230	90	78
10-20	35	-	73	64	31	-	29	15	124	14	44
20-30	35	-	57	39	50	-	32	23	32	17	39
30-40	35	-	45	49	-	-	38	25	29	23	51
40-50	43	-	46	47	-	-	35	29	22	23	53
50-60	-	-	48	46	-	-	36	30	31	22	-
60-70	-	-	-	32	-	-	-	36	-	27	-
70-80	-	-	-	-	-	-	-	-	-	-	-
PLOT P5 (Wolf Mt.)											
Ao	150	100	90	-	220	-	160	260	280	38	48
0-10	26	14	24	37	35	-	24	110	270	19	14
10-20	44	17	26	37	29	-	27	47	56	19	14
20-30	22	20	25	38	42	-	28	29	34	29	14
30-40	18	23	38	40	37	-	29	18	28	25	15
40-50	18	18	29	30	36	-	34	-	20	19	15
50-60	15	15	19	26	-	-	21	-	-	13	13
60-70	-	15	19	14	-	-	22	-	-	14	13
70-80	-	15	14	-	-	-	-	-	-	-	15
80-90	-	14	12	-	-	-	-	-	-	-	23
90-100	-	14	11	-	-	-	-	-	-	-	19
PLOT P3 (Valley)											
Ao	44	-	18	-	48	-	90	100	42	60	54
0-10	26	-	14	33	25	-	28	33	31	23	29
10-20	33	-	12	18	27	-	18	32	23	13	22
20-30	31	-	12	25	21	-	13	28	16	16	16
30-40	22	-	8	22	16	-	25	37	13	33	15
40-50	17	-	7	24	14	-	29	38	10	16	10
50-60	15	-	9	25	19	-	38	32	10	7	7
60-70	25	-	3	16	28	-	24	37	9	19	11
70-80	24	-	5	15	14	-	11	18	8	10	9
80-90	16	-	5	10	9	-	7	31	7	5	4
90-100	9	-	5	7	9	-	6	21	5	9	4

APPENDIX V.

TABLE 4 - Continued

Electrometric Measurement

Soil pit:	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	1952			1953										
DEPTH (cm.)	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
PLOT P_4 (Upper Deadwood)														
5	5	46	-	49	44	34	39	40	42	47	48	31	46	40
15	12	13	29	36	42	40	50	49	50	50	43	29	27	41
32	18	17	30	51	50	47	49	50	50	49	43	43	31	50
58	5	5	13	17	20	16	17	16	16	15	11	9	8	16
85	15	15	-	35	38	36	37	37	35	33	30	20	16	36
120	9	9	15	24	28	22	27	27	24	21	18	10	10	25
PLOT P_1 (Fourth Lk.)														
6	13	26	24	24	23	24	24	24	22	18	15	19	16	24
15	27	28	54	43	33	35	35	39	54	54	39	36	27	45
35	23	21	49	49	46	48	48	49	47	42	36	32	21	49
60	23	25	26	26	25	24	25	23	24	23	23	23	29	26
86	29	31	31	31	31	31	31	31	31	31	30	31	21	31
PLOT P_2 (Echo Mt.)														
5	12	15	19	19	20	14	14	16	16	15	18	20	-	-
15	18	22	22	23	23	19	19	20	20	20	20	22	-	-
30	19	27	27	27	26	26	26	26	26	26	26	27	-	-
50	32	32	32	32	31	32	31	32	32	32	32	32	-	-
PLOT P_5 (Wolf Mt.)														
5	8	23	33	33	32	32	32	30	32	32	31	19	30	33
15	13	18	35	36	35	34	35	35	35	35	34	25	35	35
30	14	13	31	31	31	28	28	25	28	28	27	22	26	28
55	10	10	19	22	22	22	22	12	20	20	18	15	21	22
80	9	10	15	15	15	15	15	9	16	16	15	14	15	16
PLOT P_3 (Valley)														
5	10	13	35	37	35	33	33	33	32	32	30	30	17	17
18	10	23	28	29	28	29	28	28	28	28	28	26	28	31
30	10	11	27	30	31	30	31	31	30	29	29	27	28	31
55	10	10	34	35	39	37	38	38	38	38	37	32	30	40
85	7	7	18	23	26	23	23	24	22	22	20	15	13	25
125	7	7	17	30	30	28	30	30	29	28	26	17	15	30

APPENDIX V.

TABLE 5. MONTHLY VALUES OF SOIL MOISTURE IN THE *THUJA* - *LYSICHITUM* ASSOCIATION PLOTS, 1951-1953 [1]

Gravimetric Measurement

Soil pit:	1	2	3	4	5	6	7	8	9	10	11
			1951						1952		
DEPTH (cm.)	JUL	AUG	SEP	OCT -	DEC	JAN -	MAY	JUN	JUL	AUG	SEP
PLOT Ly3 (Wolf Mt.)											
A (SWAMP)											
0-10	760	220	560	650	760	-	620	710	630	730	270
10-20	-	400	640	-	-	-	-	-	-	-	200
20-30	-	680	-	-	-	-	-	-	-	-	41
B (BANK)											
L	90	70	-	260	-	-	230	-	-	43	56
2-10	330	325	6	210	310	-	280	250	30	200	270
10-20	430	48	430	460	610	-	440	480	560	470	320
20-30	-	-	250	470	40	-	450	50	290	580	280
30-40	-	-	39	130	-	-	90	90	70	220	690
40-50	-	-	-	-	-	-	-	-	-	22	340
50-60	-	-	-	-	-	-	-	-	-	-	12
PLOT Ly2 (Upper Deadwood)											
A (SWAMP)											
0-10	720	-	690	760	870	-	680	710	710	580	570
10-20	-	-	560	-	-	-	-	-	-	-	390
A (SWAMP - margin)											
L	-	-	390	570	540	-	450	240	440	130	250
2-10	420	-	180	600	610	-	570	420	470	360	450
10-20	280	-	200	390	440	-	480	330	120	240	170
20-30	210	-	100	130	410	-	180	300	70	100	80
30-40	-	-	72	70	90	-	130	68	80	70	70
40-50	-	-	-	80	31	-	-	110	90	-	-
50-60	-	-	-	80	-	-	-	-	-	-	-
60-70	-	-	-	80	-	-	-	-	-	-	-
70-80	-	-	-	100	-	-	-	-	-	-	-
B (BANK)											
L	60	-	91	250	320	-	270	270	-	60	47
2-10	145	-	230	240	150	-	265	250	110	130	90
10-20	160	-	450	200	180	-	360	280	240	130	120
20-30	100	-	570	420	300	-	270	380	240	230	gap
30-40	-	-	-	575	170	-	-	410	200	200	
40-50	-	-	-	-	-	-	-	-	-	-	340

[1] Percent by weight.

APPENDIX V.

TABLE 5 - Continued

Soil pit:	1	2	3	4	5	6	7	8	9	10	11
			1951						1952		
DEPTH (cm.)	JUL	AUG	SEP	OCT -	DEC	JAN -	MAY	JUN	JUL	AUG	SEP
PLOT Lyl (Echo Mt.)											
A (SWAMP)											
0-10	-	-	335	270	130	-	230	190	430	230	200
10-20	-	-	760	-	-	-	-	-	-	-	-
20-30	-	-	470	-	-	-	-	-	-	-	-
B (BANK)											
L	-	-	-	-	-	-	360	270	-	43	190
2-10	92	-	110	200	380	-	400	260	300	90	310
10-20	250	-	120	200	110	-	240	310	250	250	270
20-30	350	-	190	320	300	-	33	160	220	520	41
30-40	-	-	400	100	-	-	28	-	-	520	32
40-50	-	-	47	-	-	-	-	-	-	460	46

Electrometric Measurement

Soil pit:	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	1952								1953					
DEPTH (cm.)	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
PLOT Ly3 (Wolf Mt.)														
B (BANK)														
5	120	160	120	110	110	115	120	105	130	125	145	-	-	-
30	160	160	155	165	155	150	155	85	155	155	165	-	-	-
PLOT Ly2 (Upper Deadwood)														
A (SWAMP - margin)														
10	165	185	185	185	175	175	180	180	180	175	175	175	170	170
25	145	150	160	195	150	150	150	150	150	155	160	160	170	165
PLOT Lyl (Echo Mt.)														
B (BANK)														
5	180	185	270	190	160	180	175	225	265	325	325	315	360	320
25	150	205	240	225	210	210	225	230	245	245	260	270	260	260

APPENDIX V.

TABLE 6. WILTING PERCENTAGE OF SOILS FROM THE *PSEUDOTSUGA - GAULTHERIA - PELTIGERA* ASSOCIATION PLOTS

DEPTH (cm.)	Soil pit number 1	2	3	4	5	6	7	8	9	10	11	12
PLOT L5 (Wolf Mt.)												
Ao	21	75	40	-	50	-	45	130	35	90	75	55
0-10	5	5	7	4	5	-	5	5	9	6	6	6
10-20	5	5	5	2	5	-	4	6	5	6	5	6
20-30	5	5	5	4	4	-	4	5	6	5	5	6
30-40	5	5	4	7	3	-	4	6	4	6	5	
40-50	5	5	4	4	3	-	3	6	4	6	4	
50-60	5	5	5	4	4	-	4	5	4	5	-	6
60-70	6	6	5	4	4	-	3	6	4	-	-	8
70-80	6	5	4	4	4	-	-	-	4	-	-	
80-90	5	-	-	-	3	-	-	-	4	-	-	-
90-100	3	-	-	-	3	-	-	-	4	-	-	-
PLOT L4 (Lower Deadwood)												
Ao	85	-	33	-	-	-	75	100	65	80	85	-
0-10	8	-	7	6	7	-	11	6	9	8	6	7
10-20	6	-	6	6	6	-	11	9	5	6	7	8
20-30	6	-	5	6	6	-	8	6	7	7	6	
30-40	6	-	6	6	5	-	7	6	6	6	7	7
40-50	5	-	5	6	4	-	7	6	8	5	7	
50-60	5	-	5	6	4	-	5	6	7	5	7	7
60-70	5	-	5	6	4	-	5	6	6	5	7	-
70-80	-	-	5	5	4	-	-	6	-	5	5	-
80-90	-	-	4	4	4	-	-	5	-	4	5	-
90-100	-	-	-	4	4	-	-	-	-	-	5	-
PLOT L3 (Lower Deadwood)												
Ao	80	-	80	-	85	-	80	100	65	90	75	-
0-10	5	-	5	6	7	-	11	7	6	8	7	7
10-20	5	-	4	6	7	-	10	7	6	6	6	7
20-30	4	-	4	5	6	-	11	7	6	7	6	
30-40	4	-	4	5	5	-	11	6	6	6	5	7
40-50	4	-	4	5	4	-	10	5	5	5	5	
50-60	6	-	4	4	4	-	5	5	6	5	5	6
60-70	8	-	4	4	3	-	6	5	6	6	4	
70-80	-	-	-	4	3	-	-	3	7	5	3	-
80-90	-	-	-	3	-	-	-	-	5	4	-	-
90-100	-	-	-	3	-	-	-	-	-	3	-	-
PLOT L2 (Valley)												
Ao	55	-	30	50	50	-	60	45	70	80	80	-
0-10	5	-	9	5	6	-	11	9	7	6	6	10
10-20	5	-	7	5	5	-	11	8	6	5	7	6
20-30	5	-	6	5	5	-	10	7	7	7	7	6
30-40	5	-	6	5	5	-	-	7	5	7	6	
40-50	5	-	7	5	5	-	-	6	5	7	6	
50-60	5	-	5	2	4	-	-	6	6	-	7	6
60-70	5	-	5	3	-	-	-	7	-	-	9	
70-80	-	-	-	-	-	-	-	7	-	-	-	-
80-90	-	-	-	-	-	-	-	6	-	-	-	-
90-100	-	-	-	-	-	-	-	6	-	-	-	-

APPENDIX V.

TABLE 6 - Continued

DEPTH (cm.)	Soil pit number 1	2	3	4	5	6	7	8	9	10	11	12
PLOT L1 (Fourth Lk.)												
Ao	32	-	45	45	65	-	70	90	60	70	75	-
0-10	8	-	8	9	9	-	14	12	9	9	5	10
10-20	7	-	8	10	12	-	14	12	12	11	10	10
20-30	7	-	8	9	13	-	17	19	12	12	12	11
30-40	8	-	9	10	11	-	16	9	11	14	14	
40-50	10	-	11	7	-	-	14	-	11	16	12	14
50-60	-	-	17	-	-	-	12	-	13	14	14	
60-70	-	-	-	-	-	-	-	-	-	12	20	-
70-80	-	-	-	-	-	-	-	-	-	10	18	-
80-90	-	-	-	-	-	-	-	-	-	-	16	-
90-100	-	-	-	-	-	-	-	-	-	-	-	-

[1] Percentage by weight of water retained by the 5 mm. soil fraction against a pressure of 15 atmospheres.

TABLE 7. WILTING PERCENTAGE OF SOILS FROM THE PSEUDOTSUGA - GAULTHERIA AND PSEUDOTSUGA - TSUGA - GAULTHERIA ASSOCIATION PLOTS[1]

PSEUDOTSUGA - GAULTHERIA ASSOCIATION

DEPTH (cm.)	1	2	3	4	5	6	7	8	9	10	11	12
PLOT G5 (Wolf Mt.)												
Ao	75	85	60	-	105	-	60	105	85	110	80	-
0-10	4	5	7	6	6	-	6	5	6	5	8	5
10-20	4	4	5	4	6	-	6	6	7	6	6	6
20-30	4	5	5	4	6	-	6	6	5	5	6	6
30-40	4	5	4	4	5	-	5	7	5	5	6	
40-50	4	3	4	4	4	-	4	8	6	5	6	4
50-60	4	3	4	4	3	-	3	8	6	4	6	
60-70	4	3	3	4	3	-	3	7	5	4	4	-
70-80	3	3	3	4	3	-	3	7	5	5	-	7
80-90	3	3	4	3	-	-	4	7	4	4	-	-
90-100	4	3	3	3	-	-	4	6	4	3	-	-
PLOT G4 (Lower Deadwood)												
Ao	42	85	80	85	80	-	80	90	80	90	65	-
0-10	5	5	5	5	7	-	7	8	6	5	8	-
10-20	5	5	5	5	6	-	6	7	5	6	8	8
20-30	4	5	5	4	6	-	7	8	5	7	7	7
30-40	4	5	5	3	6	-	6	8	4	7	7	
40-50	4	5	5	3	6	-	8	7	6	6	8	7
50-60	4	4	4	3	5	-	5	8	5	5	8	
60-70	4	6	3	3	5	-	5	8	6	4	6	7
70-80	4	4	4	4	5	-	5	9	5	4	6	-
80-90	-	4	5	2	2	-	-	7	5	-	6	-
90-100	-	4	-	3	-	-	-	-	4	-	-	-

APPENDIX V.

TABLE 7 - Continued

DEPTH (cm.)	Soil pit number 1	2	3	4	5	6	7	8	9	10	11	12
PLOT G6 (Upper Deadwood)												
Ao	75	-	70	-	100	-	90	110	75	90	90	-
0-10	6	-	7	5	7	7	8	9	6	6	7	7
10-20	6	-	7	5	7	7	6	11	6	7	8	10
20-30	6	-	7	5	7	7	6	10	7	6	8	
30-40	6	-	7	5	7	7	8	7	6	6	7	11
40-50	5	-	7	5	7	7	6	7	6	6	7	
50-60	5	-	5	5	6	6	5	8	5	4	7	6
60-70	5	-	5	5	6	6	5	8	5	4	6	-
70-80	4	-	6	4	-	6	4	6	4	5	6	-
80-90	-	-	6	4	-	5	5	-	4	-	4	-
90-100	-	-	7	3	-	-	4	-	-	-	-	-
PLOT G3 (Valley)												
Ao	75	-	75	80	60	-	75	85	80	80	80	-
0-10	5	-	16	5	7	-	7	5	6	4	9	7
10-20	6	-	5	5	5	-	6	5	5	3	5	13
20-30	6	-	5	6	5	-	8	6	4	4	5	
30-40	6	-	5	6	5	-	7	4	4	4	4	10
40-50	6	-	5	4	5	-	4	4	4	4	6	
50-60	4	-	5	4	4	-	-	-	-	4	8	9
60-70	-	-	4	-	-	-	-	-	-	5	4	-
70-80	-	-	-	-	-	-	-	-	-	5	-	-
80-90	-	-	-	-	-	-	-	-	-	5	-	-

<u>PSEUDOTSUGA</u> - <u>TSUGA</u> - <u>GAULTHERIA</u> ASSOCIATION

DEPTH (cm.)	1	2	3	4	5	6	7	8	9	10	11	12
PLOT G1 (Fourth Lk.)												
Ao	55	-	-	-	-	-	90	130	85	85	85	-
0-10	4	-	75	20	85	-	5	30	4	7	10	8
10-20	5	-	7	8	8	-	12	36	6	7	15	10
20-30	5	-	7	9	5	-	15	30	12	9	12	
30-40	7	-	9	16	9	-	20	-	11	8	14	10
40-50	7	-	10	-	12	-	17	-	11	8	12	9
50-60	7	-	10	-	12	-	-	-	-	7	14	
60-70	7	-	6	-	12	-	-	-	-	8	-	
70-80	8	-	-	-	12	-	-	-	-	8	-	9
80-90	8	-	-	-	14	-	-	-	-	-	-	-
90-100	-	-	-	-	15	-	-	-	-	-	-	-
PLOT G2 (Echo Mt.)												
Ao	53	-	60	70	-	-	90	100	70	75	90	-
0-10	5	-	5	11	100	-	8	5	5	5	8	5
10-20	5	-	5	5	8	-	10	5	4	6	7	8
20-30	6	-	6	5	7	-	9	6	4	6	8	
30-40	5	-	7	4	7	-	8	3	4	11	9	7
40-50	5	-	4	4	8	-	6	7	4	-	7	
50-60	4	-	4	4	9	-	6	7	6	-	10	
60-70	3	-	5	4	8	-	3	7	10	-	8	-
70-80	4	-	6	4	-	-	-	7	3	-	-	6
80-90	4	-	6	4	-	-	-	7	-	-	-	-
90-100	-	-	8	5	-	-	-	6	-	-	-	-

TABLE 8. WILTING PERCENTAGE OF SOILS FROM THE PSEUDOTSUGA - TSUGA - HYLOCOMIUM - EURHYNCHIUM ASSOCIATION PLOTS

DEPTH (cm.)	Soil pit number 1	2	3	4	5	6	7	8	9	10	11	12
PLOT M5 (Wolf Mt.)												
Ao	35	60	35	70	45	-	60	90	65	85	60	-
0-10	6	6	7	6	8	-	10	10	7	8	8	8
10-20	6	6	6	6	7	-	10	9	8	8	9	9
20-30	6	7	6	7	8	-	10	7	7	8	9	
30-40	6	7	7	7	7	-	10	7	7	9	8	7
40-50	5	7	7	7	7	-	9	7	5	8	8	
50-60	5	7	7	7	7	-	9	6	5	7	8	
60-70	4	6	7	6	6	-	7	5	5	8	8	7
70-80	4	7	7	6	6	-	8	4	4	8	6	
80-90	3	5	7	6	3	-	9	4	4	8	5	
90-100	3	4	6	6	3	-	10	3	5	8	3	7
120-	-	-	-	-	-	-	-	-	-	-	-	6
PLOT M2 (Echo Mt.)												
Ao	30	-	90	70	70	-	80	90	85	90	70	-
0-10	5	-	6	6	7	7	5	3	6	6	6	7
10-20	7	-	7	5	7	7	9	3	8	6	7	9
20-30	8	-	6	6	6	6	7	4	6	6	9	
30-40	7	-	6	6	6	6	7	5	6	6	11	8
40-50	7	-	6	7	6	6	7	9	6	5	11	
50-60	6	-	7	6	7	7	7	8	6	5	12	9
60-70	6	-	7	6	7	7	7	7	7	6	17	
70-80	5	-	5	6	8	8	9	6	8	7	15	
80-90	5	-	4	8	8	8	8	5	9	7	16	12
90-100	5	-	5	8	6	6	10	-	8	6	16	
PLOT M4 (Lower Deadwood)												
Ao	60	70	70	-	100	-	80	90	70	85	75	-
0-10	4	5	7	5	7	-	9	6	7	6	9	7
10-20	4	5	6	5	7	-	7	6	6	6	6	8
20-30	4	5	6	5	6	-	5	4	6	6	5	8
30-40	4	5	6	4	6	-	5	5	6	7	4	7
40-50	4	5	6	4	9	-	4	5	3	7	4	
50-60	5	6	6	4	5	-	3	7	6	6	3	
60-70	4	6	5	3	3	-	3	7	6	8	3	11
70-80	4	5	5	3	3	-	3	8	2	9	3	-
80-90	3	5	5	3	3	-	2	7	2	8	2	-
90-100	4	4	4	4	3	-	-	7	5	6	2	-
PLOT M3 (Valley)												
Ao	75	-	75	-	70	-	75	70	75	80	90	-
0-10	5	-	7	6	6	-	6	4	7	5	7	7
10-20	5	-	7	6	6	-	8	5	5	6	6	
20-30	5	-	6	5	7	-	7	6	6	6	8	6
30-40	5	-	6	4	7	-	7	5	6	7	7	6
40-50	5	-	7	4	9	-	8	4	6	6	6	
50-60	5	-	6	4	5	-	9	4	5	6	6	6
60-70	5	-	5	4	4	-	8	4	5	4	6	
70-80	5	-	6	4	4	-	8	6	4	4	-	
80-90	-	-	7	4	4	-	5	9	-	4	-	8
90-100	-	-	7	4	4	-	5	10	-	5	-	-

APPENDIX V.

TABLE 8 - Continued

DEPTH (cm.)	1	2	3	4	5	6	7	8	9	10	11	12
			Soil pit number									
PLOT M_1 (Fourth Lake)												
Ao	50	-	75	-	95	-	100	105	75	-	85	-
0-10	6	-	6	-	6	-	17	8	7	105	10	
10-20	8	-	7	9	7	-	6	10	8	5	11	6
20-30	8	-	9	7	10	-	10	9	7	6	13	10
30-40	8	-	8	6	11	-	11	7	6	7	12	8
40-50	8	-	8	7	11	-	12	8	6	9	11	
50-60	8	-	7	7	9	-	10	9	5	10	10	
60-70	8	-	7	7	9	-	8	8	5	10	10	8
70-80	8	-	8	8	10	-	7	9	5	10	10	
80-90	9	-	7	8	-	-	6	-	10	-	13	
90-100	10	-	8	10	-	-	-	-	11	-	-	14

[1] Percentage by weight of water retained by the 5 mm. soil fraction against a pressure of 15 atmospheres.

TABLE 9. WILTING PERCENTAGE OF SOILS FROM THE <u>PSEUDOTSUGA</u> - <u>POLYSTICHUM</u> ASSOCIATION PLOTS [1]

DEPTH (cm.)	1	2	3	4	5	6	7	8	9	10	11	12
			Soil pit number									
PLOT P_4 (Upper Deadwood)												
Ao	30	-	50	28	30	-	-	110	60	70	75	-
0-10	13	-	15	11	14	14	70	9	9	5	3	11
10-20	5	-	8	6	14	14	5	4	11	5	11	13
20-30	4	-	5	4	16	16	4	7	13	5	9	14
30-40	6	-	5	4	11	11	3	5	11	4	5	
40-50	9	-	5	12	12	12	5	5	14	4	4	
50-60	7	-	11	11	8	8	7	4	13	4	4	5
60-70	12	-	6	10	7	7	3	5	8	7	4	
70-80	9	-	7	10	9	9	8	11	6	4	4	
80-90	8	-	6	10	-	8	5	11	4	9	4	11
90-100	8	-	5	8	-	9	4	9	4	12	15	
120	-	-	-	-	-	-	-	-	-	-	-	15
PLOT P_1 (Fourth Lk.)												
Ao	40	-	60	-	100	-	90	110	85	65	85	-
0-10	8	-	10	5	8	-	6	6	7	13	13	8
10-20	9	-	9	6	8	-	6	12	12	14	12	16
20-30	12	-	10	11	9	-	9	11	12	10	13	15
30-40	12	-	14	15	8	-	11	11	11	9	11	
40-50	15	-	15	16	10	-	11	12	11	8	14	
50-60	16	-	15	19	11	-	-	13	11	10	14	13
60-70	14	-	14	19	11	-	-	15	10	10	14	
70-80	10	-	12	15	14	-	-	13	8	11	11	
80-90	10	-	10	15	13	-	-	13	9	12	8	11
90-100	12	-	9	-	15	-	-	9	8	10	8	-

APPENDIX V.

TABLE 9 - Continued

DEPTH (cm.)	Soil pit number 1	2	3	4	5	6	7	8	9	10	11	12
PLOT P_2 (Echo Mt.)												
Ao	-	-	75	60	-	-	80	90	-	80	85	-
0-10	50	-	19	65	60	-	7	11	65	75	22	6
10-20	9	-	18	8	6	-	7	3	23	4	15	7
20-30	10	-	16	6	10	-	13	5	8	5	11	7
30-40	12	-	10	10	-	-	12	6	8	5	15	7
40-50	10	-	9	9	-	-	9	7	5	5	13	
50-60	8	-	9	8	-	-	7	7	7	5	-	8
60-70	-	-	-	5	-	-	-	10	-	5	-	-
70-80	-	-	-	-	-	-	-	-	-	-	-	-
80-90	-	-	-	-	-	-	-	-	-	-	-	-
90-100	-	-	-	-	-	-	-	-	-	-	-	-
PLOT P_5 (Wolf Mt.)												
A0	30	60	60	-	85	-	40	110	100	55	90	-
0-10	8	7	9	8	6	-	6	22	85	6	11	7
10-20	9	6	8	8	7	-	7	7	14	10	10	8
20-30	4	6	9	7	8	-	6	6	10	8	10	8
30-40	6	5	10	7	7	-	6	4	8	7	11	
40-50	5	5	8	6	8	-	6	-	6	8	9	5
50-60	4	3	6	4	-	-	6	-	-	6	7	
60-70	-	4	6	3	-	-	4	-	-	4	6	
70-80	-	2	4	-	-	-	-	-	-	-	6	3
80-90	-	2	4	-	-	-	-	-	-	-	5	
90-100	-	3	3	-	-	-	-	-	-	-	5	-
PLOT P_3 (Valley)												
Ao	8	-	14	-	24	-	40	55	70	85	24	-
0-10	15	-	9	11	5	-	8	9	10	7	16	13
10-20	3	-	8	5	9	-	5	8	8	8	10	10
20-30	4	-	7	6	5	-	3	6	6	5	8	10
30-40	5	-	5	5	5	-	5	7	5	10	9	
40-50	4	-	5	5	3	-	5	6	3	4	6	
50-60	4	-	5	5	5	-	6	8	3	1	4	9
60-70	4	-	2	3	4	-	6	5	2	4	6	
70-80	4	-	3	3	2	-	3	3	2	3	6	
80-90	4	-	2	2	2	-	2	8	2	3	2	
90-100	3	-	3	2	2	-	2	3	2	3	2	5
125	-	-	-	-	-	-	-	-	-	-	-	6

[1] Percentage by weight of water retained by the 5 mm. soil fraction against a pressure of 15 atmospheres.

APPENDIX V.

TABLE 10. WILTING PERCENTAGE OF SOILS FROM THE <u>THUJA</u> - <u>LYSICHITUM</u> ASSOCIATION PLOTS [1]

DEPTH (cm.)	Soil pit number 1	2	3	4	5	6	7	8	9	10	11	12
PLOT Ly3 (Wolf Mt.)												
A (SWAMP)												
0-10	90	70	70	85	80	-	80	70	80	90	65	-
10-20	-	70	130	-	-	-	-	-	-	-	44	-
20-30	-	90	-	-	-	-	-	-	-	-	9	-
B (BANK)												
L	80	80	-	70	-	-	90	-	-	90	120	-
2-10	60	34	180	100	100	-	80	75	110	90	110	120
10-20	25	6	90	90	90	-	95	70	100	95	100	
20-30	-	-	30	90	8	-	95	9	36	95	35	-
30-40	-	-	7	20	-	-	12	10	12	30	70	80
40-50	-	-	-	-	-	-	-	-	-	8	50	-
50-60	-	-	-	-	-	-	-	-	-	-	3	-
PLOT Ly_2 (Upper Deadwood)												
A (SWAMP)												
0-10	80	-	70	60	60	-	80	70	75	60	70	-
10-20	-	-	60	-	-	-	-	-	-	-	20	-
A (SWAMP - margin)												
L	-	-	60	85	90	-	100	110	100	95	100	-
2-10	60	-	23	70	70	-	65	85	90	55	70	
10-20	30	-	25	38	40	-	60	30	50	60	30	42
20-30	15	-	16	14	40	-	20	24	10	13	11	-
30-40	-	-	11	10	12	-	13	8	12	10	10	60
40-50	-	-	-	11	11	-	-	11	13	-	-	-
50-60	-	-	-	12	-	-	-	-	-	-	-	-
60-70	-	-	-	10	-	-	-	-	-	-	-	-
70-80	-	-	-	12	-	-	-	-	-	-	-	-
B (BANK)												
L	80	-	100	100	100	-	100	110	-	90	100	-
2-10	85	-	80	85	80	-	90	100	90	85	85	-
10-20	75	-	100	90	90	-	85	80	95	85	55	-
20-30	19	-	80	90	90	-	26	85	80	75	-	-
30-40	-	-	-	55	50	-	-	35	50	17	-	-
40-50	-	-	-	-	-	-	-	-	-	-	50	-
PLOT Ly_1 (Echo Mt.)												
A (SWAMP)												
0-10	-	-	30	25	25	-	21	19	95	13	19	-
10-20	-	-	50	-	-	-	-	-	-	-	-	-
20-30	-	-	40	-	-	-	-	-	-	-	-	-
B (BANK)												
L	-	-	-	-	-	-	115	90	-	40	100	-
2-10	70	-	80	60	80	-	80	90	100	85	60	90
10-20	50	-	80	70	30	-	33	29	34	85	24	
20-30	35	-	70	30	30	-	5	17	36	28	8	-
30-40	-	-	30	10	-	-	6	-	-	30	6	36
40-50	-	-	6	-	-	-	-	-	-	45	10	-

[1] Percentage by weight of water retained against a pressure of 15 atmospheres.

APPENDIX V.

TABLE 11. FIELD CAPACITY OF SOILS FROM THE *PSEUDOTSUGA* - *GAULTHERIA* - *PELTIGERA* ASSOCIATION PLOTS [1]

DEPTH (cm.)	Soil pit number 1	2	3	4	5	6	7	8	9	10	11	12
PLOT L5 (Wolf Mt.)												
Ao	.	.	.	-	.	-	.	.	.	.	.	-
0-10	.	.	.	.	.	-	.	.	.	.	.	22
10-20	.	.	.	.	.	-	.	.	.	.	.	21
20-30	.	.	.	.	.	-	.	.	.	.	.	14
30-40	.	.	.	.	.	-	.	.	.	.	.	
40-50	.	.	.	.	11	-	.	.	.	.	.	
50-60	.	.	.	.	13	-	.	.	.	.	-	18
60-70	.	.	.	.	13	-	.	20	.	-	-	18
70-80	.	.	.	.	13	-	-	-	.	-	-	
80-90	.	-	-	-	11	-	-	-	.	-	-	-
90-100	.	-	-	-	12	-	-	-	.	-	-	-
PLOT L4 (Lower Deadwood)												
Ao	.	-	.	-	.	-	.	.	.	.	.	-
0-10	.	-	.	.	.	-	.	.	.	.	.	23
10-20	.	-	.	.	.	-	.	.	.	.	.	19
20-30	.	-	.	.	.	-	.	.	.	.	.	21
30-40	.	-	.	.	.	-	.	.	.	.	.	
40-50	.	-	.	.	.	-	.	.	.	.	.	21
50-60	.	-	.	.	.	-	.	.	.	.	.	
60-70	.	-	.	.	.	-	.	.	.	.	.	-
70-80	.	-	.	.	13	-	-	.	-	.	.	-
80-90	-	-	.	.	12	-	-	.	-	.	.	-
90-100	-	-	-	.	14	.	-	-	-	-	.	-
PLOT L3 (Lower Deadwood)												
Ao	.	-	.	-	.	-	.	.	.	.	.	-
0-10	.	-	.	.	31	-	.	.	.	.	.	31
10-20	.	-	.	.	21	-	.	.	.	.	.	29
20-30	.	-	.	.	.	-	.	.	.	.	.	25
30-40	.	-	.	.	.	-	.	.	.	.	.	
40-50	.	-	.	.	.	-	.	.	.	.	.	
50-60	.	-	.	.	.	-	.	.	.	.	.	17
60-70	.	-	.	.	15	-	.	.	.	.	.	
70-80	-	-	-	.	14	-	-	.	.	.	.	-
80-90	-	-	-	.	-	-	-	-	.	.	-	-
90-100	-	-	-	.	-	-	-	-	-	.	-	-
PLOT L2 (Valley)												
Ao	.	-	.	.	.	-	.	.	.	.	.	-
0-10	.	-	.	30	21	-	.	.	.	.	.	30
10-20	.	-	.	23	19	-	.	.	.	.	.	21
20-30	.	-	.	21	19	-	.	.	.	.	.	19
30-40	.	-	.	19	19	-	-	.	.	.	.	
40-50	.	-	.	15	19	-	-	.	.	.	.	
50-60	.	-	.	13	16	-	-	.	.	.	.	20
60-70	.	-	.	.	-	-	-	.	-	-	.	-
70-80	-	-	-	-	-	-	-	.	-	-	-	-
80-90	-	-	-	-	-	-	-	.	-	-	-	-
90-100	-	-	-	-	-	-	-	.	-	-	-	-

TABLE 11 - Continued

DEPTH (cm.)	Soil pit number 1	2	3	4	5	6	7	8	9	10	11	12
PLOT L1 (Fourth Lk.)												
Ao	.	-	.	.	.	-	.	.	.	.	.	-
0-10	.	-	.	31	31	-	.	.	.	.	.	37
10-20	.	-	.	34	35	-	.	.	.	.	.	30
20-30	.	-	.	32	41	-	.	38	.	.	.	29
30-40	.	-	.	34	40	-	34	27	.	.	.	
40-50	.	-	43	37	-	-	34	-	33	.	.	37
50-60	-	-	44	-	-	-	32	-	35	.	.	-
60-70	-	-	-	-	-	-	-	-	-	.	.	-
70-80	-	-	-	-	-	-	-	-	-	.	.	-
80-90	-	-	-	-	-	-	-	-	-	-	.	-
90-100	-	-	-	-	-	-	-	-	-	-	-	-

[1]Percentage by weight of water retained by the 5 mm. soil fraction against a pressure of 1/3 atmosphere.
. Value not determined.

TABLE 12. FIELD CAPACITY OF SOILS FROM THE *PSEUDOTSUGA* - *GAULTHERIA* AND *PSEUDOTSUGA* - *TSUGA* - *GAULTHERIA* ASSOCIATION PLOTS

PSEUDOTSUGA - *GAULTHERIA* ASSOCIATION

DEPTH (cm.)	Soil pit number 1	2	3	4	5	6	7	8	9	10	11	12
PLOT G5 (Wolf Mt.)												
Ao	.	.	.	-	.	-	.	.	.	.	.	-
0-10	.	.	.	.	.	-	.	.	.	.	.	20
10-20	.	.	.	.	.	-	.	.	.	.	.	25
20-30	.	.	.	.	22	-	.	.	.	.	.	15
30-40	.	.	.	.	19	-	.	.	.	.	.	
40-50	.	.	.	.	.	-	.	.	.	.	.	14
50-60	.	.	.	.	.	-	.	.	.	.	.	
60-70	.	.	.	.	.	-	.	.	.	.	.	
70-80	.	.	.	.	11	-	.	.	.	.	-	18
PLOT G4 (Lower Deadwood)												
Ao	.	.	.	.	.	-	.	.	.	.	.	-
0-10	.	.	.	.	.	-	.	.	.	.	.	-
10-20	.	.	.	.	.	-	.	.	.	.	.	23
20-30	.	.	.	.	.	-	.	.	.	.	.	23
30-40	.	.	.	.	.	-	.	.	.	.	.	
40-50	.	.	.	.	22	-	17	.	.	.	.	
50-60	.	.	.	.	22	-	16	.	.	.	.	
60-70	.	.	.	16	20	-	15	.	.	.	.	25
70-80	.	.	.	14	21	-	13	.	.	.	.	
80-90	-	.	.	15	15	-	-	.	.	-	.	-
90-100	-	.	-	15	-	-	-	-	.	-	-	-

TABLE 12 - Continued

DEPTH (cm.)	Soil pit number 1	2	3	4	5	6	7	8	9	10	11	12
PLOT G6 (Upper Deadwood)												
Ao	.	-	.	-	.	-	.	.	.	.	.	-
0-10	.	-	.	.	25	24	.	.	.	.	.	26
10-20	.	-	.	.	24	24	.	.	.	.	.	26
20-30	.	-	.	.	24	24	.	.	.	.	.	
30-40	.	-	.	.	24	24	.	.	.	.	.	24
40-50	.	-	.	.	23	23	.	.	.	.	.	
50-60	.	-	.	.	20	20	.	.	.	.	.	17
60-70	.	-	.	20	17	17	.	.	.	.	.	
70-80	.	-	.	20	-	20	.	.	.	.	.	-
80-90	-	-	.	20	-	21	.	-	.	-	.	-
90-100	-	-	.	16	-	.	.	-	-	-	-	-
PLOT G3 (Valley)												
Ao	.	-	.	.	.	-	.	.	.	.	.	-
0-10	.	-	.	.	34	-	.	.	.	.	.	27
10-20	.	-	.	.	26	-	.	.	.	.	.	38
20-30	.	-	.	.	21	-	.	.	.	.	.	
30-40	.	-	.	30	21	-	.	.	.	.	.	26
40-50	.	-	.	28	20	-	.	24	.	.	.	30
50-60	.	-	.	14	16	-	-	-	-	.	.	
60-70	-	-	.	-	-	-	-	-	-	.	.	-
70-80	-	-	-	-	-	-	-	-	-	.	-	-

PSEUDOTSUGA - TSUGA - GAULTHERIA ASSOCIATION

DEPTH (cm.)	1	2	3	4	5	6	7	8	9	10	11	12
PLOT G1 (Fourth Lk.)												
Ao	.	-	-	-	-	-	.	.	.	.	.	-
0-10	.	-	.	.	.	-	26	38	.	.	.	31
10-20	.	-	.	42	.	-	30	68	.	.	.	32
20-30	.	-	.	33	.	-	34	45	.	.	.	21
30-40	.	-	.	27	.	-	42	-	35	.	.	
40-50	22	-	.	-	30	-	40	-	35	.	.	21
50-60	22	-	.	-	31	-	-	-	-	.	.	
60-70	22	-	.	-	31	-	-	-	-	.	-	24
70-80	24	-	-	-	31	-	-	-	-	.	-	
80-90	19	-	-	-	34	-	-	-	-	-	-	-
90-100	-	-	-	-	48	-	-	-	-	-	-	-
PLOT G2 (Echo Mt.)												
Ao	.	-	.	.	-	-	.	.	.	.	.	-
0-10	.	-	.	.	.	-	.	.	.	.	.	27
10-20	.	-	.	.	27	-	.	.	.	.	.	21
20-30	.	-	.	.	24	-	27	.	.	.	.	
30-40	.	-	.	.	22	-	.	.	.	.	.	18
40-50	.	-	.	.	24	-	.	.	.	-	.	
50-60	.	-	.	19	28	-	21	23	22	-	.	
60-70	.	-	.	12	28	-	13	23	35	-	.	20
70-80	.	-	.	9	-	-	-	23	15	-	-	
80-90	.	-	.	10	-	-	-	23	-	-	-	-
90-100	-	-	.	13	-	-	-	20	-	-	-	-

APPENDIX V.

TABLE 13. FIELD CAPACITY OF SOILS FROM THE <u>PSEUDOTSUGA</u> - <u>TSUGA</u> - <u>HYLOCOMIUM</u> - <u>EURHYNCHIUM</u> ASSOCIATION PLOTS[1]

DEPTH (cm.)	Soil pit number 1	2	3	4	5	6	7	8	9	10	11	12
PLOT M5 (Wolf Mt.)												
Ao	.	.	.	.	.	-	.	.	.	.	.	-
0-10	.	.	.	.	.	-	.	.	.	.	.	30
10-20	.	.	.	.	.	-	.	.	.	.	.	24
20-30	.	.	.	.	30	-	.	.	.	.	.	24
30-40	.	.	.	30	.	-	.	.	.	.	.	
40-50	.	.	.	.	.	-	.	.	.	.	.	
50-60	.	.	.	.	.	-	.	.	.	.	.	30
60-70	.	.	.	30	29	-	20	.	.	.	.	
70-80	.	.	.	30	22	-	26	.	.	.	.	
80-90	.	.	.	28	6	-	27	.	.	.	.	35
90-100	.	.	.	27	15	-	27	.	.	.	.	
120-	-	-	-	-	-	-	-	-	-	-	-	23
PLOT M2 (Echo Mt.)												
Ao	.	-	.	.	.	-	.	.	.	.	.	-
0-10	.	-	.	.	23	23	.	.	.	.	.	15
10-20	.	-	.	.	23	21	.	.	.	.	.	20
20-30	.	-	.	.	23	21	.	.	.	.	.	16
30-40	.	-	.	22	23	20	.	.	.	.	.	
40-50	.	-	.	21	22	21	.	.	.	.	.	18
50-60	.	-	.	.	22	22	.	.	.	.	.	
60-70	.	-	.	21	22	23	22	.	.	.	.	
70-80	.	-	.	22	23	23	23	19	.	.	.	
80-90	.	-	.	16	22	22	22	20	.	.	.	28
90-100	.	-	.	18	19	19	20	-	.	.	.	
PLOT M4 (Lower Deadwood)												
Ao	.	.	.	-	.	-	.	.	.	.	.	-
0-10	.	.	.	.	30	-	.	.	.	.	.	25
10-20	.	.	.	.	19	-	.	.	.	.	.	17
20-30	.	.	.	.	.	-	.	.	.	.	.	22
30-40	.	.	.	.	.	-	.	.	.	.	.	
40-50	.	.	.	.	.	-	.	.	.	.	.	
50-60	.	.	.	.	.	-	.	.	.	.	.	
60-70	.	.	.	.	.	-	.	.	.	.	.	30
70-80	.	.	.	.	11	-	.	.	.	.	.	-
80-90	.	.	.	.	8	-	.	.	.	.	.	-
90-100	.	.	.	.	6	-	-	.	.	.	.	-
PLOT M3 (Valley)												
Ao	.	-	.	-	.	-	.	.	.	.	.	-
0-10	.	-	.	.	.	-	.	.	.	.	.	21
10-20	.	-	.	.	29	-	.	.	.	.	.	13
20-30	.	-	.	.	.	-	.	.	.	.	.	26
30-40	.	-	.	.	.	-	.	.	.	.	.	
40-50	.	-	.	.	33	-	.	.	.	.	.	
50-60	.	-	.	.	.	-	27	.	.	.	.	
60-70	.	-	.	.	.	-	25	.	.	.	.	19
70-80	.	-	.	20	16	-	22	.	.	.	-	12
80-90	-	-	.	21	16	-	13	.	.	.	-	
90-100	-	-	.	16	14	-	13	.	.	.	-	-

APPENDIX V.

TABLE 13 - Continued

DEPTH (cm.)	Soil pit number 1	2	3	4	5	6	7	8	9	10	11	12
PLOT M1 (Fourth Lk.)												
Ao	.	-	.	-	.	-	.	.	.	.	.	-
0-10	.	-	.	-	42	-	.	.	.	.	.	33
10-20	.	-	.	30	32	-	.	.	.	.	.	21
20-30	.	-	.	28	31	-	.	.	.	.	.	
30-40	.	-	.	26	34	-	.	.	.	.	.	23
40-50	.	-	.	24	32	-	.	.	.	.	.	
50-60	.	-	.	24	25	-	23	29	. .	.	.	22
60-70	.	-	.	24	25	-	22	23	.	.	.	
70-80	.	-	.	25	21	-	19	24	22	.	.	
80-90	28	-	.	25	-	-	16	-	27	-	.	22
90-100	32	-	.	28	-	-	-	-	26	-	-	

[1] Percentage by weight of water retained by the 5 mm. soil fraction against a pressure of 1/3 atmosphere.

. Value not determined.

TABLE 14. FIELD CAPACITY OF SOILS FROM THE PSEUDOTSUGA - POLYSTICHUM ASSOCIATION PLOTS [1]

DEPTH (cm.)	Soil pit number 1	2	3	4	5	6	7	8	9	10	11	12
PLOT P4 (Upper Deadwood)												
Ao	.	-	.	.	.	-	-	.	.	.	.	-
0-10	.	-	.	.	58	58	.	.	.	.	.	40
10-20	.	-	.	.	64	64	.	.	.	.	.	50
20-30	.	-	.	35	66	68	.	.	.	.	.	50
30-40	.	-	.	.	48	48	.	.	.	.	.	
40-50	62	-	.	62	56	56	.	.	.	.	.	
50-60	.	-	.	.	27	29	.	.	.	.	.	16
60-70	.	-	.	.	25	25	.	.	.	.	.	
70-80	38	-	.	47	30	30	.	.	.	.	.	36
80-90	.	-	.	.	-	24	.	.	.	.	.	
90-100	.	-	.	.	-	26	.	.	.	.	.	
120	-	-	-	-	-	-	-	-	-	-	-	22
PLOT P1 (Fourth Lk.)												
Ao	.	-	.	-	.	-	.	.	.	.	.	-
0-10	.	-	.	28	28	-	27	.	.	.	.	24
10-20	.	-	.	32	28	-	26	.	.	.	.	36
20-30	.	-	.	30	29	-	24	30	.	.	.	
30-40	.	-	.	28	24	-	21	.	.	.	.	48
40-50	.	-	.	37	24	-	21	.	.	.	.	
50-60	.	-	.	37	20	-	-	.	.	.	.	
60-70	45	-	.	41	25	-	-	.	.	.	.	25
70-80	22	-	.	43	27	-	-	29	.	.	.	
80-90	16	-	38	38	25	-	-	30	.	.	.	30
90-100	24	-	38	-	26	-	-	27	.	.	.	-

APPENDIX V.

TABLE 14 - Continued

DEPTH (cm.)	1	2	3	4	5	6	7	8	9	10	11	12
				Soil pit number								
PLOT P2 (Echo Mt.)												
Ao	-	-	.	.	.	-	.	.	-	.	.	-
0-10	.	-	40	.	.	-	30	.	.	.	80	15
10-20	.	-	44	44	30	-	28	-	70	20	44	20
20-30	.	-	45	34	28	-	30	30	25	22	30	25
30-40	42	-	30	49	-	-	30	24	23	20	34	
40-50	36	-	28	27	-	-	22	22	13	20	38	29
50-60	-	-	32	30	-	-	15	22	15	19	-	
60-70	-	-	-	14	-	-	-	26	-	23	-	-
70-80	-	-	-	-	-	-	-	-	-	-	-	-
80-90	-	-	-	-	-	-	-	-	-	-	-	-
90-100	-	-	-	-	-	-	-	-	-	-	-	-
PLOT P5 (Wolf Mt.)												
Ao	.	.	.	-	.	-	.	.	.	.	.	-
0-10	30	.	.	39	.	-	25	.	.	.	.	31
10-20	45	.	.	39	31	-	30	32	.	.	.	34
20-30	25	.	39	32	34	-	25	24	30	.	.	25
30-40	16	27	55	31	29	-	25	21	28	28	.	
40-50	14	27	43	19	27	-	20	-	16	19	.	
50-60	12	22	22	16	-	-	17	-	-	13	.	18
60-70	-	18	19	12	-	-	15	-	-	13	.	
70-80	-	14	14	-	-	-	-	-	-	-	.	13
80-90	-	10	13	-	-	-	-	-	-	-	25	
90-100	-	9	11	-	-	-	-	-	-	-	20	-
PLOT P3 (Valley)												
Ao	.	-	.	-	.	-	.	.	.	.	.	-
0-10	.	-	.	.	25	-	.	.	.	.	.	33
10-20	.	-	.	.	27	-	19	.	.	.	.	28
20-30	.	-	.	31	21	-	.	.	.	.	.	31
30-40	.	-	.	.	16	-	.	38	.	.	.	
40-50	.	-	.	.	14	-	.	.	.	.	.	
50-60	.	-	.	28	19	-	.	.	.	.	.	38
60-70	.	-	.	.	27	-	26	37	.	.	.	
70-80	.	-	.	.	14	-	.	.	.	.	.	
80-90	.	-	.	10	7	-	.	.	.	.	.	24
90-100	.	-	.	.	7	-	.	21	.	.	.	
125	-	-	-	-	-	-	-	-	-	-	-	28

[1]Percentage by weight of water retained by the 5 mm. soil fraction against a pressure of 1/3 atmosphere.

. Value not determined.

APPENDIX V.

TABLE 15. FIELD CAPACITY OF SOILS FROM THE <u>THUJA</u> - <u>LYSICHITUM</u> ASSOCIATION PLOTS

DEPTH (cm.)	Soil pit number 1	2	3	4	5	6	7	8	9	10	11	12
PLOT Ly3 (Wolf Mt.)												
A (SWAMP)												
0-10	.	160	.	.	.	-	175	160	250	.	110	-
10-20	-	.	.	-	-	-	-	-	-	-	105	-
20-30	-	.	-	-	-	-	-	-	-	-	36	-
B (BANK)												
L	.	.	-	.	-	-	.	-	-	310	.	-
2-10	330	110	.	.	.	-	.	160	310	250	.	300
10-20	330	36	.	265	.	-	170	130	200	220	.	
20-30	-	-	101	230	.	-	200	38	110	240	240	
30-40	-	-	30	90	-	-	44	38	40	65	250	220
40-50	-	-	-	-	-	-	-	-	-	18	.	-
50-60	-	-	-	-	-	-	-	-	-	-	.	-
PLOT Ly2 (Upper Deadwood)												
A (SWAMP)												
0-10	.	-	.	.	.	-	180	123	.	35	.	-
10-20	=	-	.	-	-	-	-	-	-	-	.	-
A (SWAMP)												
L	-	-	.	.	.	-	235	340	.	320	.	-
0-10	.	-	.	170	.	-	115	160	.	180	.	
10-20	105	-	225	150	.	-	130	77	.	130	.	110
20-30	75	-	190	73	.	-	80	80	.	60	.	180
30-40	-	-	48	49	.	-	77	45	.	45	.	-
40-50	-	-	-	.	.	-	-	63	.	-	-	-
50-60	-	-	-	58	-	-	-	-	-	-	-	-
60-70	-	-	-	.	-	-	-	-	-	-	-	-
70-80	-	-	-	60	-	-	-	-	-	-	-	-
B (BANK)												
L	.	-	.	.	.	-	270	245	-	300	.	-
2-10	.	-	.	.	.	-	245	300	.	260	.	-
10-20	220	-	205	180	.	-	250	280	195	140	.	-
20-30	.	-	240	215	.	-	125	200	.	.	-	-
30-40	-	-	-	165	.	-	-	165	.	90	-	-
40-50	-	-	-	-	-	-	-	-	-	-	.	-
PLOT Ly1 (Echo Mt.)												
A (SWAMP)												
0-10	-	-	100	.	.	-	90	80	115	48	.	-
10-20	-	-	135	-	-	-	-	-	-	-	-	-
20-30	-	-	.	-	-	-	-	-	-	-	-	-
B (BANK)												
L	-	-	-	-	-	-	.	.	-	115	.	-
2-10	.	-	.	.	.	-	140	205	230	180	.	240
10-20	130	-	.	220	.	-	90	100	100	220	.	
20-30	180	-	270	86	.	-	27	66	105	70	.	100
30-40	-	-	135	41	-	-	22	-	-	.	.	-
40-50	-	-	31	-	-	-	-	-	-	105	.	-