

INTERNAL REPORT 43

Vegetation and Soils of the Hi-15 Watersheds,
H. J. Andrews Experimental Forest

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Early in the planning of the Coniferous Biome research program, it was recognized that Experimental Watersheds 6, 7, and 8 in the H. J. Andrews Experimental Forest might provide ideal study sites for certain phases of the Biome program. A study was funded during year 1 (1970) to provide necessary background ecological information about these watersheds, which then would be available before intensive studies were undertaken. This report contains a summary of the information obtained as a result of an inventory of vegetation and soils present on the watershed. It contains the vegetation mapping legend, vegetation maps, descriptions of mapped vegetation units, a generalized soil map, and a brief description of soils present. In addition to the small maps included with this report, large-scale vegetation maps (scale 1 in. = 2 chains: 1 chain = 66 feet) also are available.

VEGETATION OF THE HI-15 WATERSHEDS
H. J. ANDREWS EXPERIMENTAL FOREST
C. T. DYRNESS & GLENN HAWK

General Description of the Area

The Hi-15 Watersheds are three gaged watersheds, numbered 6 through 8, that are situated along the northwest boundary of the H. J. Andrews Experimental Forest. The elevation of the watersheds ranges from about 2,900 feet at watershed 6 to 3,900 feet at the top of watershed 8. The three watersheds drain in a southerly direction from Blue Ridge which terminates above watershed 8 at Carpenter Mountain, constituting the northern-most extension of the H. J. Andrews Forest.

The combined area of the watersheds is 123 acres--32 acres in watershed 6, 38 acres in watershed 7, and 53 acres in watershed 8, respectively. In addition, the interfluvial areas between watersheds 6 and 7 and 7 and 8 also were mapped making the total mapped area 169 acres. Slopes within the watersheds are generally gentle with the exception of small areas within the upper portion of watershed 8 where steeper slopes are encountered.

The vegetation within the mapped area is classed best as occupying the transition between the Tsuga heterophylla and Abies amabilis zones as defined by Franklin and Dyrness (1969). As a result of fire disturbance, the area is currently occupied largely by stands of Douglas-fir. Stands in watersheds 6 and 7 are made up largely of second-growth or 125-year-old Douglas-fir with scattered old-growth (approximately 450 years old) Douglas-fir in certain locations. As may be seen in figure 1, watershed 8 contains a considerably higher proportion of stands dominated by old-growth Douglas-fir. Based on present advance tree regeneration, it is probably safe to predict that climax tree stands in this area would be made up of both western hemlock (Tsuga heterophylla) and Pacific silver fir (Abies amabilis). A striking, contemporary feature of these watersheds is the unusually large amount of western hemlock regeneration in the understory despite the virtual absence of this species in the overstory.

Plant Communities of the Hi-15 Watersheds

As indicated in the map legend, five basic plant groupings were mapped within the Hi-15 Watersheds. These include one near climax association, two seral communities, a phase of a community, and an intergrade between two communities. These units, listed in the same order, are: Tsuga heterophylla-Abies amabilis/Rhododendron macrophyllum/Berberis nervosa association (R/OG), Pseudotsuga menziesii/Acer circinatum/Berberis nervosa community (VM/OG), Pseudotsuga menziesii/Acer circinatum/Whipplea modesta community (VM/W), Tsuga heterophylla/Rhododendron macrophyllum/Berberis nervosa-Xerophyllum tenax phase (R/OG [B]), and an intergrade between the

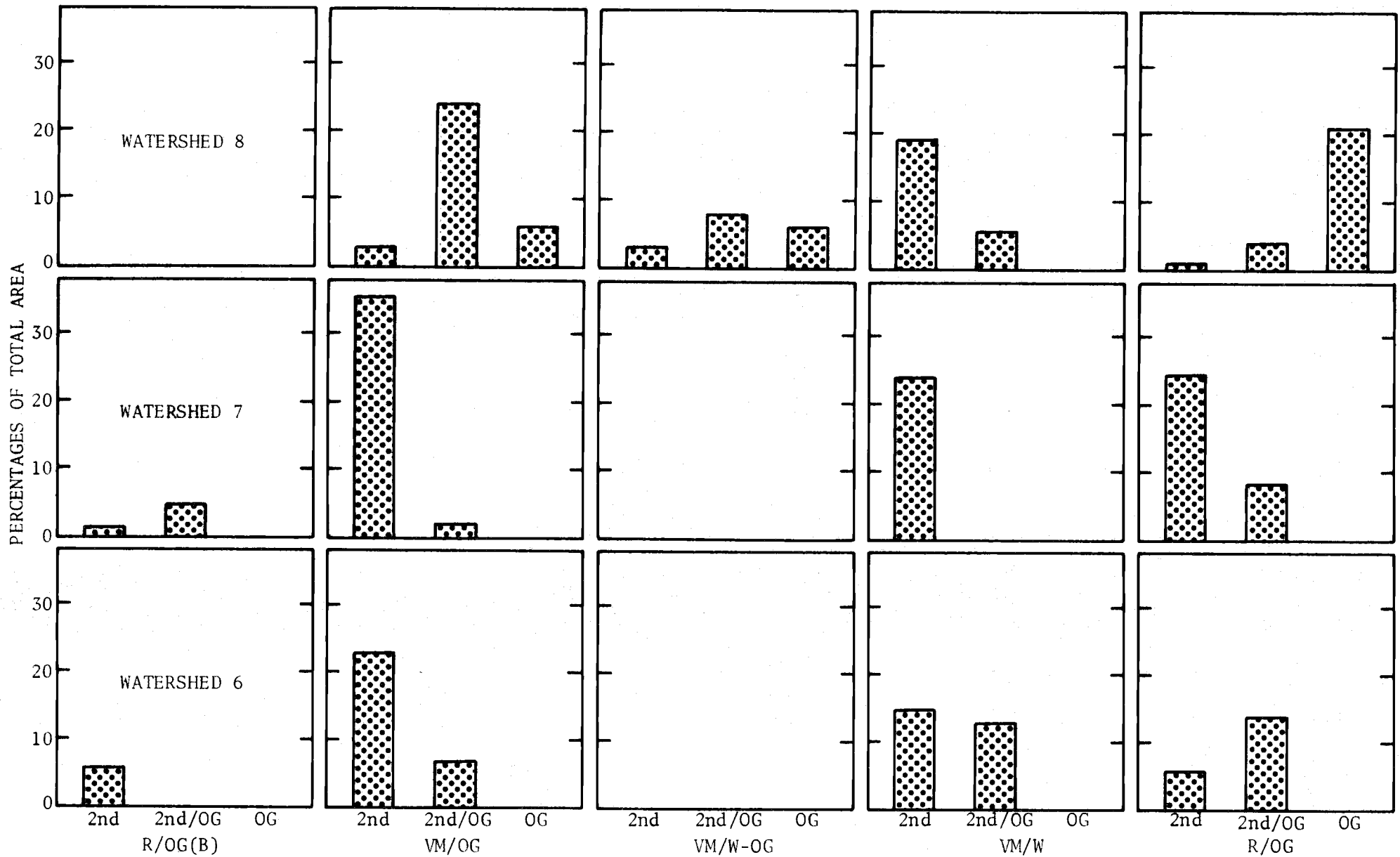


Figure 1. Distribution of Plant Communities by Overstory Tree Age Class in the Hi-15 Watersheds.

Pseudotsuga menziesii/Acer circinatum/Whipplea modesta and Pseudotsuga menziesii/Acer circinatum/Berberis nervosa communities (VM/W-OG).

The Tsuga-Abies/Rhododendron/Berberis (R/OG) association constitutes the most commonly occurring plant grouping within the transitional zone. This community is found on generally moderate slopes of at least medium productivity and is tentatively considered to be the "climatic climax" of the transitional zone. Its position with respect to the other communities of the H. J. Andrews Experimental Forest is shown diagrammatically in figure 2.

The Tsuga-Abies/Rhododendron/Berberis association occupies approximately 24 percent of the total mapped area. It is most abundant in watershed 7, where it occupies about one-third of the area (table 1). This association occurs with all overstory age classes but is most commonly associated with old-growth Douglas-fir or second-growth with scattered old-growth (figure 1). The Tsuga-Abies/Rhododendron/Berberis unit is found on gently sloping (about 25 percent) sites having moderate to deep loam to silt loam soil. Stone content of these soils is generally quite low, averaging perhaps 10 to 30 percent by volume of gravel and cobbles.

Seventeen reconnaissance plots were established and inventoried within this association in the mapped area. Vegetation data collected on these plots are summarized in table 2.

The overstory tree canopy in the Tsuga-Abies/Rhododendron/Berberis association is dominated by Pseudotsuga menziesii. Other tree species in the overstory include small amounts of Thuja plicata, Abies amabilis, and Tsuga heterophylla, in that order of occurrence. Tsuga heterophylla regeneration averaged a suprisingly high 23 percent cover, thus indicating its climax status within this association. Thuja plicata and Abies amabilis regeneration was also present in over half the sampled stands.

The tall shrub layer is generally dominated by Rhododendron macrophyllum although moderate amounts of Acer circinatum are also frequently present. Although present in every sampled stand, quantities of Rhododendron are not high and averaged only 6 percent cover. Other commonly occurring tall shrubs included Vaccinium parvifolium, Vaccinium membranaceum, and Castanopsis chrysophylla.

The low shrub layer is generally fairly well developed and in most cases is dominated by appreciable quantities of Berberis nervosa. The only other low shrubs of fairly consistent occurrence were Rubus ursinus (present in all sampled stands), Rubus nivalis, and Rosa gymnocarpa.

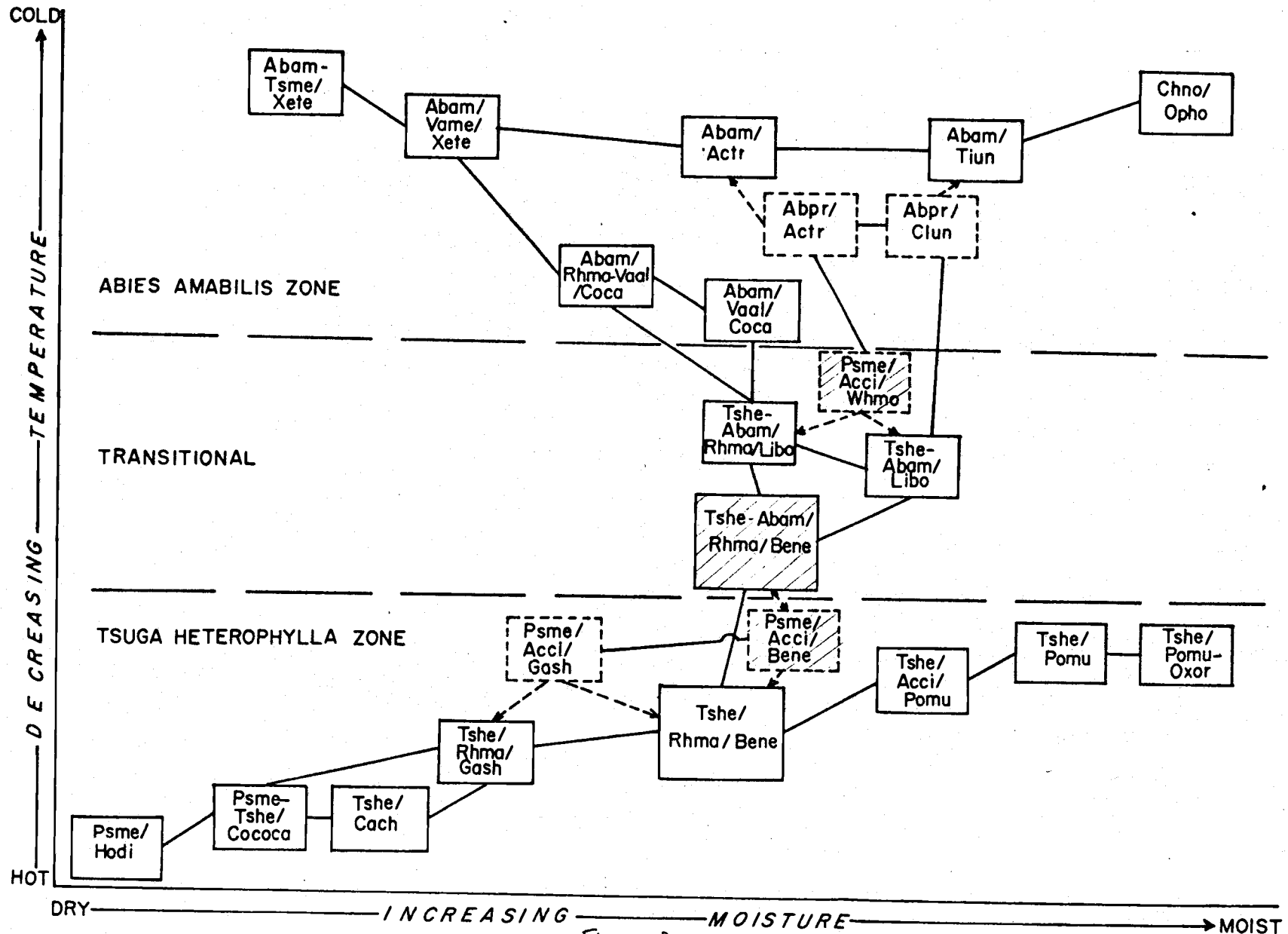


Figure 2

Plant Communities of the H.J. Andrews Experimental Forest.

The herb layer in Tsuga-Abies/Rhododendron/Berberis stands is generally poorly developed, averaging only 25 percent total cover. In most sampled stands, Linnaea borealis was clearly the dominant herb layer species. Other species which occurred in over 50 percent of the sampled stands listed in order of decreasing importance are Whipplea modesta, Chimaphila umbellata, Viola sempervirens, Goodyera oblongifolia, Cornus canadensis and Trillium ovatum.

The Tsuga-Abies/Rhododendron/Berberis association in the Hi-15 Watersheds differs in several respects from those stands similarly classified elsewhere in the H. J. Andrews Experimental Forest. These differences are undoubtedly largely attributable to the fact that in the Hi-15 area this association occurs with a much younger timber stand than is generally encountered elsewhere. Accordingly, in the Hi-15 area there is much less Tsuga heterophylla in the overstory canopy despite the fact that there is considerably more Tsuga regeneration in understory (23 percent average cover for the Hi-15 versus an average of 7 percent cover for the remainder of the H. J. Andrews). Other differences include a considerably lower coverage of Rhododendron macrophyllum in the Hi-15 area than the average for the unit as a whole and a consistently higher cover contributed by Linnaea borealis. Modal stands of the Tsuga-Abies/Rhododendron/Berberis association are characterized by an extremely depauperate herb layer which is largely made up of scattered Linnaea borealis and Polystichum munitum and very little else. The fact that the herb layer is better developed in the Hi-15 area may perhaps be attributed to its earlier successional stage.

The Pseudotsuga menziesii/Acer circinatum/Berberis nervosa (VM/OG) community occupies the highest proportion of the total area within the mapped zone. It occupies from between 30 to 37 percent of each watershed area and 34 percent of the total mapped area (table 1). This is a seral community which is thought to constitute an earlier successional stage within the Tsuga-Abies/Rhododendron/Berberis habitat type (figure 2). The Pseudotsuga/Acer/Berberis community is generally associated with second growth stands of Douglas-fir. However, it also occurs under old-growth stands in watershed 8 (figure 1).

The Pseudotsuga/Acer/Berberis community is found in large tracts throughout the mapped area. It occurs primarily on gentle slopes within the watershed boundaries. Occasional extensions of this community reach across nonstony ridges and virtually all stands occurred on south-facing slopes ranging from 13 to 37 percent in gradient. This community occupies soil of variable depths ranging from loams to silt loams in texture. These soils are markedly nonstony with an average of 15 percent stones by volume, most of which are in the gravel size class. Soils supporting the Pseudotsuga/

Acer/Berberis community are noticeably less stony than those soils supporting the Tsuga/Abies/Rhododendron/Berberis association.

The Pseudotsuga/Acer/Berberis community was sampled in the Hi-15 area by the establishment and description of seven reconnaissance plots (table 3). Total overstory coverage averages between 70 and 75 percent within this community. The overstory canopy is composed primarily of Pseudotsuga menziesii except in watershed 8 where appreciable amounts of Thuja plicata, Abies amabilis, and Pinus monticola are frequently present. Once again, Tsuga heterophylla is the predominant tree regeneration, occurring in large quantities in every sampled stand and averaging 33 percent cover. Abies amabilis regeneration is also of common occurrence, although averaging only 2 percent total cover.

The tall shrub layer is dominated by Acer circinatum ranging from 5 to 20 percent cover in the sampled stand and averaging 16 percent cover. Other tall shrub species present in over 50 percent of the sampled stands include Vaccinium parvifolium and Rhododendron macrophyllum. The low shrub layer of the Pseudotsuga/Acer/Berberis community is again dominated by the Ubiquitous/Berberis nervosa, which averaged 24 percent cover. Other species which occur commonly but in small amounts are Rubus ursinus, Rubus nivalis, and Rosa gymnocarpa.

The herb layer of Pseudotsuga/Acer/Berberis community is the most poorly developed of all mapped units, averaging only 16 percent total cover. Although a total of 32 herbaceous species were encountered on reconnaissance plots, only eight of these species occurred in over half of the stands. These species, all occurring in small amounts, listed in decreasing order of importance are Linnaea borealis, Viola sempervirens, Goodyera oblongifolia, Whipplea modesta, Chimaphila umbellata, Pteridium aquilinum, Pyrola picta, and Corallorhiza maculata.

The Pseudotsuga/Acer/Berberis community, as it occurs in the Hi-15 Watersheds is, with the exception of one characteristic, typical of the community as described for the entire H. J. Andrews Forest. The single exception is the unusually dense Tsuga heterophylla regeneration which in the Hi-15 area possesses approximately three times the total cover typical for stands in other locations.

The Pseudotsuga menziesii/Acer circinatum/Whipplea modesta (VM/W) community is fairly evenly distributed over the three watersheds and occupies approximately 22 percent of the total mapped area. It occupies 24 percent of watersheds 7 and 8 and 28 percent of the total area of watershed 6 (table 1). The Pseudotsuga/Acer/Whipplea is a seral grouping occupying sites which are slightly cooler and moister than

areas supporting the Pseudotsuga/Acer/Berberis community. At present, it is hypothesized that the Acer/Whipplea unit is an early successional stage within either the Tsuga-Abies/Rhododendron/Linnaea or the Tsuga-Abies/Linnaea habitat types (figure 2). This community is confined almost completely to stands of second-growth Douglas-fir or areas where only very scattered old-growth Douglas-fir trees are intermixed with the second-growth (figure 1).

The Pseudotsuga/Acer/Whipplea community was found on a variety of slopes ranging from 10 to 45 percent, which, in all cases but one, had south aspects. Soils are deep and friable with loam to silt loam texture containing 15 to 30 percent stones, most of which are in the gravel size class. Soils supporting this community were found to be less stony than those soils under the Tsuga-Abies/Rhododendron/Berberis association.

The Pseudotsuga/Acer/Whipplea community on the Hi-15 Watersheds is characterized by data collected on ten reconnaissance plots (table 4). Again, overstory tree canopy was found to consist almost exclusively of Douglas-fir. Total overstory coverage ranged from 51 to 80 percent and averaged 64 percent. Tree species occurring only infrequently in the overstory include Tsuga heterophylla, Thuja plicata, and Abies amabilis. As typical for the Hi-15 area, Tsuga heterophylla regeneration cover averages about 30 percent cover in the understory. Abies amabilis regeneration occurred in one-half the sampled stands with an average cover of 1 percent.

The tall shrub layer is dominated generally by Acer circinatum, although the species was absent from three of the sampled stands. Vaccinium parvifolium is also commonly present in substantial amounts and averages 4 percent cover on reconnaissance plots. Vaccinium membranaceum and Castanopsis chrysophylla are also frequently present in small amounts. The low shrub layer, which is very similar in all the mapped communities, is fairly well developed and once again dominated by Berberis nervosa (21 percent average cover). The principal difference in the low shrub layer is the increased importance of Symphoricarpos mollis within the Pseudotsuga/Acer/Whipplea community. Here it is present in at least half the stands and averages about 2 percent cover.

Probably the most outstanding characteristic of the Pseudotsuga/Acer Whipplea community is its dense, well-developed herb layer. A major share of the cover is contributed by two trailing herbs--Linnaea borealis with an average of 21 percent cover and Whipplea modesta with 10 percent average cover. Other commonly occurring herbaceous species include, in decreasing order of importance, Viola sempervirens, Chimaphila umbellata, Pteridium aquilinum, grasses, Polystichum munitum, Galium oregonum, Galium triflorum and Goodyera oblongifolia.

Since the Pseudotsuga/Acer/Whipplea community occurs more frequently in the Hi-15 area than in any other location within the H. J. Andrews, this community as described here is very close to the modal concept. Minor differences which might be pointed out are the more dense understory Tsuga heterophylla and the less abundant Acer circinatum in the Hi-15 area as compared to the H. J. Andrews as a whole. Otherwise, the data presented in table 4 are very similar to data collected for the entire experimental forest.

The Xerophyllum phase of the Tsuga/Rhododendron/Berberis association (R/OG[B]) occupies only 8 percent of the total mapped area and is most abundant in the area between watersheds 6 and 7 where it comprises 53 percent (table 1). This phase usually is found as small inclusions in the Tsuga/Rhododendron/Berberis association in areas of more stony soil, rock outcrops, and steep ridgetops. Soils supporting this phase generally contain 50 percent or more by volume of stone fragments.

The characteristics of the Xerophyllum phase of the Tsuga/Rhododendron/Berberis association are shown in table 5. The Xerophyllum phase differs primarily in the composition of the herb layer, with the most obvious difference being increased Xerophyllum cover. The number of species encountered here is low and, with the exception of Xerophyllum tenax and Linnaea borealis, cover contributed by herbaceous species is also very low.

The presence of the Xerophyllum phase indicates relatively dry, less-productive sites where the limiting growth factor is apparently a lack of soil moisture. This is indicated by its occurrence on stony ridgetops and other similar locations.

The Pseudotsuga menziesii/Acer circinatum/Berberis nervosa-Pseudotsuga/Acer/Whipplea intergrade (VM/W-OG) is the least extensive vegetation unit mapped in the study area. It is limited in distribution to watershed 8 where it comprises 17 percent of the total area and to the interfluvium between watersheds 7 and 8 where it occupies 19 percent of the area (table 1). This vegetation unit, like the others on the Hi-15 Watersheds, occurs on south aspects and moderate slopes averaging approximately 30 percent in gradient. The soil generally is loam to sandy loam in texture, of only moderate depth, and possesses a high percentage of gravel- and cobble-sized stones (averaging about 40 percent by volume).

Because of its limited extent, only five reconnaissance plots were established in areas classed as the Acer/Berberis-Acer/Whipplea

intergrade (table 6). General characteristics of the unit resemble the Pseudotsuga/Acer/Berberis community except for the occurrence of unusually large amounts of such species as Linnaea borealis and Whipplea modesta. As an indication of its intergrade position, it may be seen that total herb layer coverage (35 percent) is intermediate between that found for the Acer/Whipplea (52 percent) and the Acer/Berberis (16 percent).

Map Legend for Vegetation Map of the Hi-15 Watersheds
H. J. Andrews Experimental Forest

Map symbols are in fractional form, with the numerator referring to overstory characteristics and denominator indicating understory features. Symbols are made up of the following components:

(Age Class of Overstory Trees)	(Cover Class of Overstory Trees)	(Tree Species other than Douglas-fir, if any)
(Cover Class of Understory Trees)	(Tree Species other than Western hemlock, if any)	(Plant Community)

Numerator

Age Class of Overstory Trees

<u>Symbol</u>	<u>Explanation</u>
2nd	Stand is made up of virtually all "Second growth" (about 125 years) Douglas-fir with less than 5% of the canopy coverage by old-growth trees.
2nd/OG	Stand is made up of second-growth Douglas-fir, with 5-40% of the canopy coverage contributed by old-growth (about 400 to 450 years).
OG	Old-growth Douglas-fir with the canopy made up of more than 50 percent old-growth crowns.

Cover Class of Overstory Trees

<u>Symbol</u>	<u>Explanation</u>
1	Less than 20% canopy coverage
3	20-40% canopy coverage
5	40-60% canopy coverage
7	60-80% canopy coverage
9	Greater than 80% coverage

Tree Species other than Douglas-fir in the Overstory

These symbols are often not present. When absent it may be assumed that the overstory tree canopy is comprised of virtually pure Douglas-fir.

<u>Symbol</u>	<u>Explanation</u>
(C)	5% or more coverage of <u>Thuja plicata</u> in the overstory
(S)	5% or more coverage of <u>Abies amabilis</u> in the overstory
(N)	5% or more coverage of <u>Abies procera</u> in the overstory

Denominator

Cover Class of Understory Trees

Indicates total coverage of western hemlock seedlings, saplings and poles unless modified by additional species symbols.

<u>Symbol</u>	<u>Explanation</u>
10	Less than 20% understory tree coverage
30	20-40% understory tree coverage
50	Greater than 40% understory tree coverage (rarely surpasses 60%).

Tree Species other than Western Hemlock in the Understory

<u>Symbol</u>	<u>Explanation</u>
(C)	More than 3% coverage of <u>Thuja plicata</u>
(S)	More than 3% coverage of <u>Abies amabilis</u>
(Ch)	More than 10% coverage of <u>Castanopsis chrysophylla</u>

Plant Community

The principal stratification as shown on the map is based on plant community. For this reason, the Solid lines on the map separate areas of different plant communities. For detailed descriptions of these units see following sections of this report.

<u>Symbol</u>	<u>Explanation</u>
R/OG	Rhododendron/Oregon Grape Community (<u>Tsuga heterophylla-Abies amabilis/Rhododendron macrophyllum/Berberis nervosa</u>)
R/OG(B)	Rhododendron/Oregon Grape-Beargrass phase (<u>Tsuga heterophylla/Rhododendron macrophyllum/Berberis nervosa - Xerophyllum tenax</u> phase)
VM/OG	Vine maple/Oregon Grape Community (<u>Pseudotsuga menziesii/Acer circinatum/Berberis nervosa</u>)
VM/W	Vine maple/Whipplea Community (<u>Pseudotsuga menziesii/Acer circinatum/Whipplea modesta</u>)
VM/W-OG	Vine maple/Whipplea - Vine maple/Oregon grape intergrade

In some cases, elements of the symbol may be circled or placed in parenthesis. This indicates a notable lack of the indicated species. For example, an area mapped as (VM)/OG would be expected to have a very low cover of Acer circinatum.

Example of Map Symbol Interpretation

<u>2nd/OG7(C)</u>	
<u>30(S)R/OG</u>	
Numerator -	Principally a stand of second growth Douglas-fir with 5 to 40% crown coverage of scattered old-growth Douglas-fir (2nd/OG). Total crown canopy coverage is from 60 to 80% (7). There is more than 5% coverage of western red cedar in the overstory (C).
Denominator -	Understory tree regeneration totals 20 to 40% coverage (30). Although understory trees are principally western hemlock, at least 3% coverage is also contributed by Pacific silver fir (S). The mapped area is classified within the <u>Tsuga heterophylla-Abies amabilis/Rhododendron macrophyllum/Berberis nervosa</u> habitat type (R/OG).

RECONNAISSANCE PLOTS

During the course of the survey 47 reconnaissance plots were established and sampled in the Hi-15 area. At each plot site cover of all plant species was estimated and some soils information collected. The approximate location of each plot is indicated on the map. Vegetation data for each plot are included in this report.

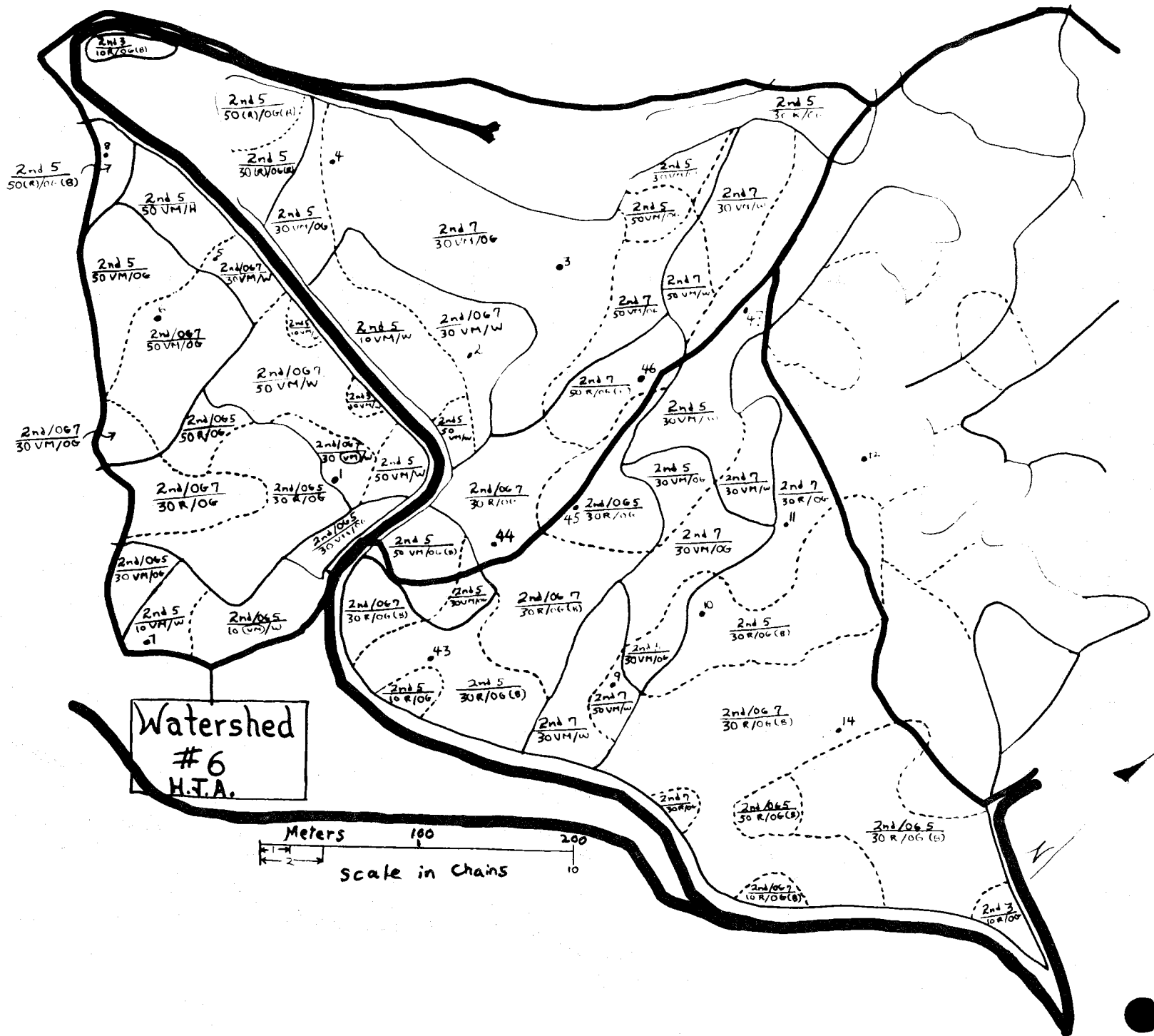


Table 1

Area Occupied by Plant Communities, Overstory Tree Age Classes,
Overstory Cover Classes, and Understory Tree Cover Classes by Individual
Watersheds and Total Mapped Area, Hi-15 Watersheds, H. J. Andrews

Plant Community

	R/OG		R/OG(B)		VM/OG		VM/W		VM/W-OG		TOTAL	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
WS6	6.1	19.1	1.9	5.9	9.6	30.0	8.9	27.8			26.5	82.8
WS7	12.5	32.9	2.2	5.8	14.2	37.4	9.1	23.9			38.0	100.0
WS8	13.7	25.8			17.3	32.6	12.9	24.4	9.1	17.2	53.0	100.0
Between 6 & 7	4.2	21.8	10.2	53.4	2.0	10.4	2.8	14.4			19.2	100.0
Between 7 & 8	4.4	16.5			14.3	53.8	2.9	10.8	5.0	18.9	26.6	100.0
Total Mapped Area	40.9	24.2	14.3	8.5	57.4	34.0	36.6	21.7	14.1	8.4	163.3	96.7

Age Class of Overstory Trees

	2nd		2nd/OG		OG		Total	
	Acres	%	Acres	%	Acres	%	Acres	%
WS6	15.9	49.7	10.6	33.1			26.5	82.8
WS7	32.4	85.3	5.6	14.7			38.0	100.0
WS8	13.4	25.3	22.0	41.5	17.6	33.2	53.0	100.0
Between 6 & 7	9.9	51.6	9.3	48.4			19.2	100.0
Between 7 & 8	15.4	57.9	10.5	39.5	0.7	2.6	26.6	100.0
Total Mapped Area	87.0	51.5	58.0	34.4	18.3	10.8	163.3	96.7

Overstory Cover Class

	1		3		5		7		9		Total	
	< 20%		20-40%		40-60%		60-80%		> 80%		Acres	%
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
WS6			0.3	0.9	12.4	38.8	13.8	43.1			26.5	82.8
WS7	0.4	1.0			8.8	23.2	28.8	75.8			38.0	100.0
WS8	0.1	0.2			7.0	13.2	45.5	85.8	0.4	0.8	53.0	100.0
Between 6 & 7			0.7	3.6	8.4	43.8	10.1	52.6			19.2	100.0
Between 7 & 8			1.8	6.8	8.0	30.1	16.7	62.8	0.1	0.3	26.6	100.0
Total Mapped Area	0.5	0.3	2.8	1.6	44.6	26.4	114.9	68.1	0.5	0.3	163.3	96.7

^{1/} The remainder of WS6 area (5.5 acres) is in road right-of-way (2.5 acres), clear-cut (2.0 acres), and quarry (1.0 acres).

Cover Class of Understory Trees

	< 20%		20-40%		> 40%		Total	
	Acres	%	Acres	%	Acres	%	Acres	%
WS6	2.6	8.1	15.0	46.9	8.9	27.8	26.5	82.8 ^{1/}
WS7	1.8	4.7	32.2	84.7	4.0	10.5	38.0	100.0
WS8	5.9	11.1	43.4	81.9	3.7	7.0	53.0	100.0
Between 6 & 7	0.9	4.7	17.6	91.7	0.7	3.6	19.2	100.0
Between 7 & 8	3.6	13.5	17.1	64.3	5.9	22.2	26.6	100.0
Total Mapped Area	14.8	8.8	125.3	74.2	23.2	13.7	163.3	96.7

^{1/}

The remainder of WS6 area (5.5 acres) is in road right-of-way (2.5 acres), clear-cut (2.0 acres), and quarry (1.0 acres).

Table 2
Tsuga heterophylla-Abies amabilis/Rhododendron macrophyllum/Berberis nervosa (R/OG)
 Association on the Hi-15 Watersheds

SPECIES	Plot No.																	Ave. Cover %	Constancy %
	12	15	18	21	25	28	29	32	33	34	35	36	37	39	43	44	45		
<u>OVERSTORY TREE LAYER</u>																			
<i>Pseudotsuga menziesii</i>	70	65	79	65	60	65	75	45	35	30	40	50	60	60	50	65	50	57	100
<i>Tsuga heterophylla</i>															5	3		Tr	12
<i>Thuja plicata</i>	1				20			25	20	25	15				5			8	48
<i>Abies amabilis</i>									15	10	10	15	5	5		2		4	38
Total	71	65	79	65	80	65	75	70	70	65	65	65	65	70	55	70	50	69	
<u>SMALL TREE AND TALL SHRUB LAYER</u>																			
<i>Tsuga heterophylla</i>	25	35	25	20	15	35	20	15	12	12	10	20	25	15	35	35	35	23	100
<i>Thuja plicata</i>	5	2			25			15	8	10	5	2		3				5	53
<i>Abies amabilis</i>			Tr		1	3	Tr	3	5	Tr	10	15	2	5			Tr	3	71
<i>Acer circinatum</i>			5	15	10	10	20		3		3	10	3	2	1	Tr	10	5	76
<i>Rhododendron macrophyllum</i>	3	2	3	10	3	5	13	5	3	18	3	3	5	5	5	10	8	6	100
<i>Castanopsis chrysophylla</i>	Tr		Tr	Tr				Tr	Tr					3	3		1	Tr	53
<i>Taxus brevifolia</i>								1										Tr	6
<i>Cornus nuttallii</i>			1		Tr	Tr							Tr					Tr	24
<i>Vaccinium parvifolium</i>	7	7	3	3		5	Tr	5	2	5	2	Tr	3			2	1	3	88
<i>Vaccinium membranaceum</i>	2	5			1	2	Tr	2	Tr	Tr	1	Tr	Tr	2				1	71
<i>Rubus parviflorus</i>											Tr							0	6
<i>Pachistima myrsinites</i>		2									1			Tr			1	Tr	24
Total	42	53	37	48	55	60	53	46	33	45	35	50	38	35	44	47	56	46	
<u>LOW SHRUB LAYER</u>																			
<i>Berberis nervosa</i>	35	25	35	15	5	50	55		2	Tr	2	4	5	7	20	10	30	18	94
<i>Rosa gymnocarpa</i>	5		3	2		2	3				1	Tr	1	1	Tr		Tr	1	65
<i>Rubus ursinus</i>	3	5	5	5	5	5	3	2	Tr	1	2	2	2	1	8	3	3	3	100
<i>Rubus nivalis</i>	2	Tr			1						1	2	2	1	2			1	48
<i>Rubus lasiococcus</i>								Tr										0	6
<i>Symphoricarpos mollis</i>	1	2	3	Tr		1												Tr	35
Total	46	32	46	22	11	58	62	2	2	1	6	8	10	10	30	13	33	23	
<u>HERB LAYER</u>																			
<i>Linnaea borealis</i>	10	20	12	15	15	15	15	12	7	3	5	Tr	15		15	15	15	11	94
<i>Polystichum munitum</i>	2	1	Tr	5			1				1							1	35
<i>Viola sempervirens</i>	7	3	3	2		3	3	1		1	1	2	1	1	5	5	3	2	88
<i>Trientalis latifolia</i>			1	2						1	1							Tr	24
<i>Coptis laciniata</i>								5		2	3	4	2					1	30

Table 2 (continued)
Tsuga heterophylla-Abies amabilis/Rhododendron macrophyllum/Berberis nervosa(R/OG)
 Association on the Hi-15 Watersheds (cont.)

SPECIES	12	15	18	21	25	28	29	32	33	34	35	36	37	39	43	44	45	Ave.		
																		Cover %	Constancy %	
Galium triflorum	2		2			1													Tr	18
Galium oreganum		Tr		1		2													Tr	18
Hieracium albiflorum	1	2																	Tr	12
Whipplea modesta	5	5	5	5	2	15	10	2		3	3	Tr	5				3	3	4	82
Synthyris reniformis										1	Tr	1	Tr	Tr					Tr	30
Achlys triphylla		Tr	Tr			Tr	1						Tr	Tr					Tr	35
Chimaphila umbellata		1		Tr	5	2	3	1	2	1		Tr	Tr	1	10	10	8		3	82
Chimaphila menziesii				Tr															0	6
Trillium ovatum		Tr		Tr	2		Tr	1	1	2			Tr	Tr					Tr	59
Anemone deltoidea			1	1		1	Tr							Tr					Tr	30
Anemone lyallii		2											Tr						Tr	12
Xerophyllum tenax	3	3	1											4	1		1		1	35
Adenocaulon bicolor	3	3	2																Tr	18
Goodyera oblongifolia	1		Tr	1		2	1	1	2	2	1	1	Tr		1	1	Tr		1	82
Pyrola picta	1	1	1		Tr					3					1				Tr	35
Pyrola asarifolia										Tr									0	6
Pyrola aphylla			1			1													Tr	12
Tiarella unifoliata								1	3		1	1		Tr					Tr	35
Vancouveria hexandra	2		3	Tr			Tr						Tr	1					Tr	35
Bromus sp.		3		1							1								Tr	18
Pteridium aquilinum	1		Tr	3											2	1	1		Tr	35
Listera caurina			1	Tr															Tr	12
Smilacina stellata														Tr					0	6
Montia sibirica							2												Tr	6
Cornus canadensis			3		2	1	3	3	1		Tr		3	2					1	53
Campanula scouleri		1			1									2			1		Tr	24
Corallorhiza maculata								Tr				Tr						1	Tr	18
Fragaria vesca var. bracteata		Tr																	0	6
Pedicularis racemosa					1												3		Tr	12
Allotropa virgata																1			Tr	6
Total	38	46	37	34	28	43	39	27	16	19	17	9	28	9	35	37	35		25	
TOTAL UNDERSTORY	126	131	120	104	94	161	154	75	51	65	58	67	76	54	109	97	124		94	
TOTAL ALL LAYERS	197	196	199	169	174	226	229	145	121	130	123	132	141	124	164	167	174		163	

Table 3
Pseudotsuga menziesii/Acer circinatum/Berberis nervosa (VM/OG)
 Community of the Hi-15 Watersheds

SPECIES	Plot No.							Ave. Cover Constancy	
	4	6	16	19	20	22	40	%	%
<u>OVERSTORY TREE LAYER</u>									
<i>Pseudotsuga menziesii</i>	70	60	75	79	80	75	65	72	100
<i>Thuja plicata</i>							5	1	14
<i>Abies amabilis</i>		2					Tr	Tr	29
<i>Pinus monticola</i>		2						Tr	14
Total	70	64	75	79	80	75	70	73	
<u>SMALL TREE AND TALL SHRUB LAYER</u>									
<i>Tsuga heterophylla</i>	35	60	40	25	20	20	25	33	100
<i>Thuja plicata</i>							15	2	14
<i>Abies amabilis</i>		2	2	1		3	5	2	72
<i>Acer circinatum</i>	20	15	5	15	25	10	20	16	100
<i>Rhododendron macrophyllum</i>	Tr				5			1	29
<i>Castanopsis chrysophylla</i>	1		Tr	1		Tr		Tr	57
<i>Taxus brevifolia</i>	Tr							0	14
<i>Cornus nuttallii</i>			3				5	1	29
<i>Corylus cornuta</i> var. <i>californica</i>							10	1	14
<i>Vaccinium parvifolium</i>		1	3	5	2	1		2	72
<i>Vaccinium membranaceum</i>				2	1			Tr	29
<i>Pachistima myrsinites</i>	2						Tr	Tr	29
Total	58	78	53	49	53	49	65	58	
<u>LOW SHRUB LAYER</u>									
<i>Berberis nervosa</i>	35	5	45	25	40	15	2	24	100
<i>Rosa gymnocarpa</i>	3	1	1		2	1	Tr	1	86
<i>Rubus ursinus</i>	2	3	5	3	3	8	2	4	100
<i>Rubus nivalis</i>	2	2	8		2			2	57
<i>Symphoricarpos mollis</i>			5				2	1	43
Total	42	11	64	28	47	26	6	32	
<u>HERB LAYER</u>									
<i>Linnaea borealis</i>	3	3	6	15	5	Tr	3	5	100
<i>Polystichum munitum</i>				1			Tr	Tr	29
<i>Viola sempervirens</i>	3	2	5	3	3	3	1	3	100
<i>Trientalis latifolia</i>		Tr		1		1		Tr	43
<i>Coptis laciniata</i>		3						Tr	14
<i>Galium triflorum</i>				1				Tr	14
<i>Galium oreganum</i>				1		2		Tr	29
<i>Hieracium albiflorum</i>			1	1			Tr	Tr	43
<i>Whipplea modesta</i>			5	2	Tr	5		2	57
<i>Achlys triphylla</i>							1	Tr	14
<i>Chimaphila umbellata</i>	5	2		2	2			2	57
<i>Chimaphila menziesii</i>	Tr							0	14
<i>Trillium ovatum</i>		Tr						0	14
<i>Anemone deltoidea</i>		Tr					Tr	0	29
<i>Anemone lgallii</i>			1		1	Tr		Tr	43
<i>Xerophyllum tenax</i>	1			7	Tr			1	43
<i>Adenocaulon bicolor</i>							1	Tr	14
<i>Goodyera oblongifolia</i>	Tr	1	1	1	1	1	1	1	100

SPECIES	4	6	16	19	20	22	40	Ave.	
								Cover %	Constancy %
<i>Pyrola picta</i>			1	1		1	1	1	57
<i>Pyrola aphylla</i>		Tr						0	14
<i>Tiarella unifoliata</i>							1	Tr	14
<i>Vancouveria hexandra</i>		1					1	Tr	29
Grasses				1	1			Tr	29
<i>Pteridium aquilinum</i>	2		Tr	Tr	2		1	1	72
<i>Streptopus amplexifolius</i>							Tr	0	14
<i>Asarum caudatum</i>							3	Tr	14
<i>Listera caurina</i>		1						Tr	14
<i>Cornus canadensis</i>		1					2	Tr	29
<i>Campanula scouleri</i>						3		Tr	14
<i>Corallorhiza maculata</i>		Tr			Tr	Tr	Tr	0	57
<i>Fragaria vesca</i> var. <i>bracteata</i>				1				Tr	14
<i>Allotropa virgata</i>				Tr				0	14
Total	14	14	20	38	15	16	16	16	
TOTAL UNDERSTORY	114	103	137	115	115	91	87	106	
TOTAL ALL LAYERS	184	167	212	194	195	166	157	179	

Table 4
Pseudotsuga menziesii/Acer circinatum/Whipplea modesta (VM/W)
 Community on the Hi-15 Watersheds

SPECIES	1	2	5	7	9	17	23	26	41	47	Ave. Cover %	Constancy %
<u>OVERSTORY TREE LAYER</u>												
Pseudotsuga menziesii	70	65	60	50	75	75	80	65	55	48	64	100
Tsuga heterophylla		3									Tr	10
Thuja plicata				1	1						Tr	20
Abies amabilis										2	Tr	10
Total	70	68	60	51	76	75	80	65	55	50	64	
<u>SMALL TREE AND TALL SHRUB LAYER</u>												
Tsuga heterophylla	30	25	35	15	50	20	40	25	45	20	30	100
Thuja plicata	Tr				1						Tr	20
Abies amabilis		1				2	2	3	Tr		1	50
Abies grandis								Tr			0	10
Acer circinatum			5	45	5	10	10	20	25		12	70
Rhododendron macrophyllum		Tr									0	20
Castanopsis chrysophylla	Tr	4		1	Tr		Tr	Tr	Tr	Tr	Tr	80
Taxus brevifolia	Tr										0	10
Cornus nuttallii				1			3				Tr	20
Corylus cornuta var. californica			2					1			Tr	20
Vaccinium parvifolium	10	2	1	3	5	1	10	5		5	4	90
Vaccinium membranaceum	1	1	1			1					Tr	50
Rubus parviflorus							3		1		Tr	20
Pachistima myrsinites		Tr			1	2		1			Tr	40
Total	41	33	44	65	62	36	68	55	71	25	47	
<u>LOW SHRUB LAYER</u>												
Berberis nervosa	15	15	15	15	55	20	15	40		20	21	90
Gaultheria shallon				1							Tr	10
Rosa gymnocarpa	Tr			2	5	1	3	2	3		2	70
Rubus ursinus	5	2	5	3	2	5	8	5	3	5	4	100
Rubus nivalis	3		Tr	3				2			1	40
Symphoricarpos mollis			5		1	3	5		5		2	50
Total	23	17	25	24	63	29	31	49	11	25	30	

SPECIES	1	2	5	7	9	17	23	26	41	47	Ave.	Constancy
											Cover %	%
<u>HERB LAYER</u>												
<i>Linnaea borealis</i>	25	15	15	15	55	20	15	40		20	21	90
<i>Polystichum munitum</i>	3	1	2	3		3			Tr		1	60
<i>Viola sempervirens</i>	7	2	5	15	3	5	3	4	3	5	6	100
<i>Trientalis latifolia</i>				Tr			1			Tr	Tr	30
<i>Coptis laciniata</i>	1		3								Tr	20
<i>Galium triflorum</i>	1		1	1				1			1	50
<i>Galium oreganum</i>	1		3				2	3	3	2	1	60
<i>Hieracium albiflorum</i>	1		Tr	Tr		2				1	Tr	50
<i>Whipplea modesta</i>	10	5	25	2	2	5	10	15		25	10	90
<i>Synthyris reniformis</i>	7		1						15		2	30
<i>Achlys triphylla</i>							5				Tr	10
<i>Chimaphila umbellata</i>	5	15	1	10	3	3	3	1	3		4	90
<i>Trillium ovatum</i>				1							Tr	10
<i>Anemone deltoidea</i>	1		1	1		1				1	Tr	50
<i>Xerophyllum tenax</i>		1			Tr						Tr	20
<i>Adenocaulon bicolor</i>	2		2						1	5	1	40
<i>Goodyera oblongifolia</i>		Tr	Tr	Tr	1	1	1		Tr	Tr	Tr	80
<i>Pyrola picta</i>		1								1	Tr	20
<i>Pyrola asarifolia</i>							1				Tr	10
<i>Pyrola aphylla</i>			Tr					Tr			0	20
<i>Tiarella unifoliata</i>	1					1					Tr	20
<i>Vancouveria hexandra</i>	2		1			1	3				1	40
Grasses	1		5	1			3	3	2	2	2	70
<i>Pteridium aquilinum</i>	1	3	1	3	1	1	1	1	3	1	2	100
<i>Smilacina stellata</i>							3				Tr	10
<i>Iris chrysophylla</i>			1								Tr	10
<i>Carnus canadensis</i>	2		2	1							Tr	30
<i>Corallorhiza maculata</i>		Tr				1			1		Tr	30
<i>Vicia americana</i>			2								Tr	10
<i>Fragaria vesca</i> var. <i>bracteata</i>				Tr			1	2			Tr	30
<i>Osmorhiza chilensis</i>	Tr		1								Tr	20
<i>Eburophyton austini</i>			Tr								0	10
Total	71	43	72	53	65	44	54	70	31	63	52	
TOTAL UNDERSTORY	135	93	141	142	190	109	153	174	113	113	129	
TOTAL ALL LAYERS	205	161	201	193	266	184	233	239	168	163	193	

Table 5
Tsuga heterophylla/Rhododendron macrophyllum/Berberis nervosa-Xerophyllum Phase
 (R/OG(B)) on the Hi-15 Watersheds

SPECIES	Plot No.							Ave.	
	3	8	10	11	14	24	46	Cover %	Constancy %
<u>OVERSTORY TREE LAYER</u>									
<i>Pseudotsuga menziesii</i>	80	50	45	65	65	80	65	61	100
<i>Tsuga heterophylla</i>					5			1	14
<i>Thuja plicata</i>					1	1		Tr	29
<i>Pinus monticola</i>				3	1			1	29
Total	80	50	45	68	72	81	65	63	
<u>SMALL TREE AND TALL SHRUB LAYER</u>									
<i>Tsuga heterophylla</i>	35	60	30	20	30	45	40	32	100
<i>Thuja plicata</i>			3		3	5		2	43
<i>Abies amabilis</i>	Tr						Tr	0	29
<i>Acer circinatum</i>		1			2			1	43
<i>Rhododendron macrophyllum</i>		1	8	25	15	10	5	9	86
<i>Castanopsis chrysophylla</i>	1	1	2	2	Tr	Tr	2	1	100
<i>Cornus nuttallii</i>						10		1	14
<i>Vaccinium parvifolium</i>	2	1	5	2	2	3	4	3	100
<i>Vaccinium membranaceum</i>	Tr			1	1	1	Tr	Tr	72
<i>Pachistima myrsinites</i>	1		1				2	1	43
Total	39	64	49	50	53	76	56	50	
<u>LOW SHRUB LAYER</u>									
<i>Berberis nervosa</i>	40	15	25	15	3	20	35	23	100
<i>Rosa gymnocarpa</i>		2	15			2	2	3	57
<i>Rubus ursinus</i>	2	3	5	1		5	3	3	86
<i>Rubus nivalis</i>		1	Tr					Tr	29
<i>Symphoricarpos mollis</i>	Tr	Tr					3	Tr	43
Total	42	21	45	16	3	27	43	29	
<u>HERB LAYER</u>									
<i>Linnaea borealis</i>		3	15	5	5	3	10	6	86
<i>Polystichum munitum</i>		Tr						0	14
<i>Viola sempervirens</i>	1	3	2	1		3	3	2	86
<i>Galium triflorum</i>		Tr						0	14
<i>Whipplea modesta</i>	3	3	3	1		2	10	3	86
<i>Chimaphila umbellata</i>	5	1	3	3	3	5	3	3	100
<i>Xerophyllum tenax</i>	15	5	5	10	15	5	5	9	100
<i>Goodyera oblongifolia</i>		Tr	Tr	1	1	1	1	1	86
<i>Pyrola picta</i>					1	2		Tr	29
<i>Pyrola secunda</i>			Tr					0	14
<i>Vancouveria hexandra</i>		Tr			2			Tr	29
Grasses			Tr					0	14
<i>Pteridium aquilinum</i>	1		1	1			1	1	57
<i>Cornus canadensis</i>		Tr						0	14
<i>Corallorhiza maculata</i>				Tr				0	14
<i>Pedicularis racemosa</i>						2		Tr	14
<i>Allotropa virgata</i>			Tr	Tr				0	29
Total	25	15	29	22	27	23	33	25	
TOTAL UNDERSTORY	106	100	123	88	83	126	132	104	
TOTAL ALL LAYERS	186	150	168	156	155	207	197	167	

Table 6
Pseudotsuga menziesii/Acer circinatum/Berberis nervosa -
Pseudotsuga/Acer/Whipplea Intergrade (VM/W-OG)
 on the Hi-15 Watersheds

SPECIES	Plot No.					Ave. Cover %	Constancy %
	13	27	30	31	40		
<u>OVERSTORY TREE LAYER</u>							
Pseudotsuga menziesii	65	60	70	65	58	64	100
Abies amabilis					2	Tr	20
Abies procera		1				Tr	20
Pinus monticola		2				Tr	20
Total	65	63	70	65	60	64	
<u>SMALL TREE AND TALL SHRUB LAYER</u>							
Tsuga heterophylla	25	35	35	45	35	35	100
Thuja plicata			5	5		2	40
Abies amabilis	3			5	Tr	2	60
Acer circinatum	15	15	15	20	25	18	100
Rhododendron macrophyllum					2	Tr	20
Castanopsis chrysophylla		5	Tr		Tr	1	60
Cornus nuttallii		5		5		2	40
Vaccinium parvifolium	8	3	7	Tr	2	4	100
Total	51	63	62	80	64	64	
<u>LOW SHRUB LAYER</u>							
Berberis nervosa	10	35	20	25	15	21	100
Rosa gymnocarpa	2	1	1		2	1	80
Rubus ursinus	3	3	3	3	3	3	100
Rubus nivalis	2		2			1	40
Symphoricarpos mollis	1					Tr	20
Total	18	39	26	28	20	26	
<u>HERB LAYER</u>							
Linnaea borealis	15	15	10	15	20	15	100
Polystichum munitum			1		Tr	Tr	40
Viola sempervirens	4	4	3	5	3	4	100
Galium triflorum			1		1	Tr	40
Galium oreganum	3					1	20
Whipplea modesta	10	7	7	10	Tr	7	100
Synthyris reniformis					1	Tr	20
Achlys triphylla	3					1	20
Chimaphila umbellata	Tr	3	1		5	2	80
Chimaphila menziesii	Tr					0	20
Trillium ovatum				1		Tr	20
Anemone deltoidea	3					1	20
Xerophyllum tenax	2	5				1	40
Goodyera oblongifolia	1	Tr	Tr	Tr	1	Tr	100
Pyrola picta	Tr	1	Tr		Tr	Tr	80
Vancouveria hexandra	2		1		3	1	60
Pteridium aquilinum	Tr	3	2			1	60
Listera caurina	1					Tr	20
Asarum caudatum					2	Tr	20
Cornus canadensis	1		1		5	1	60
Total	45	38	27	31	41	35	
TOTAL UNDERSTORY	114	140	115	138	125	125	
TOTAL ALL LAYERS	179	203	185	203	185	189	

Soils of the Hi-15 Watersheds

Soils information obtained on reconnaissance plots has been used to prepare a generalized soil map of the experimental watersheds (Fig.). Since most of our effort was directed towards vegetation mapping, the soil map is preliminary and subject to revision. However, despite its weaknesses, we feel the present map is substantially more accurate than the one previously available (Stephens, Iritani, and Meyer. 1962. Soil Survey Map of the H. J. Andrews Experimental Forest. Scale, 4 in. = 1 mile).

Four soil series were encountered on the watersheds: Carpenter, Tidbits, Blue River, and Budworm. The Carpenter series occupies about 75% of the area, Tidbits and Blue River approximately 10% each, with Budworm totalling about 5% of the area.

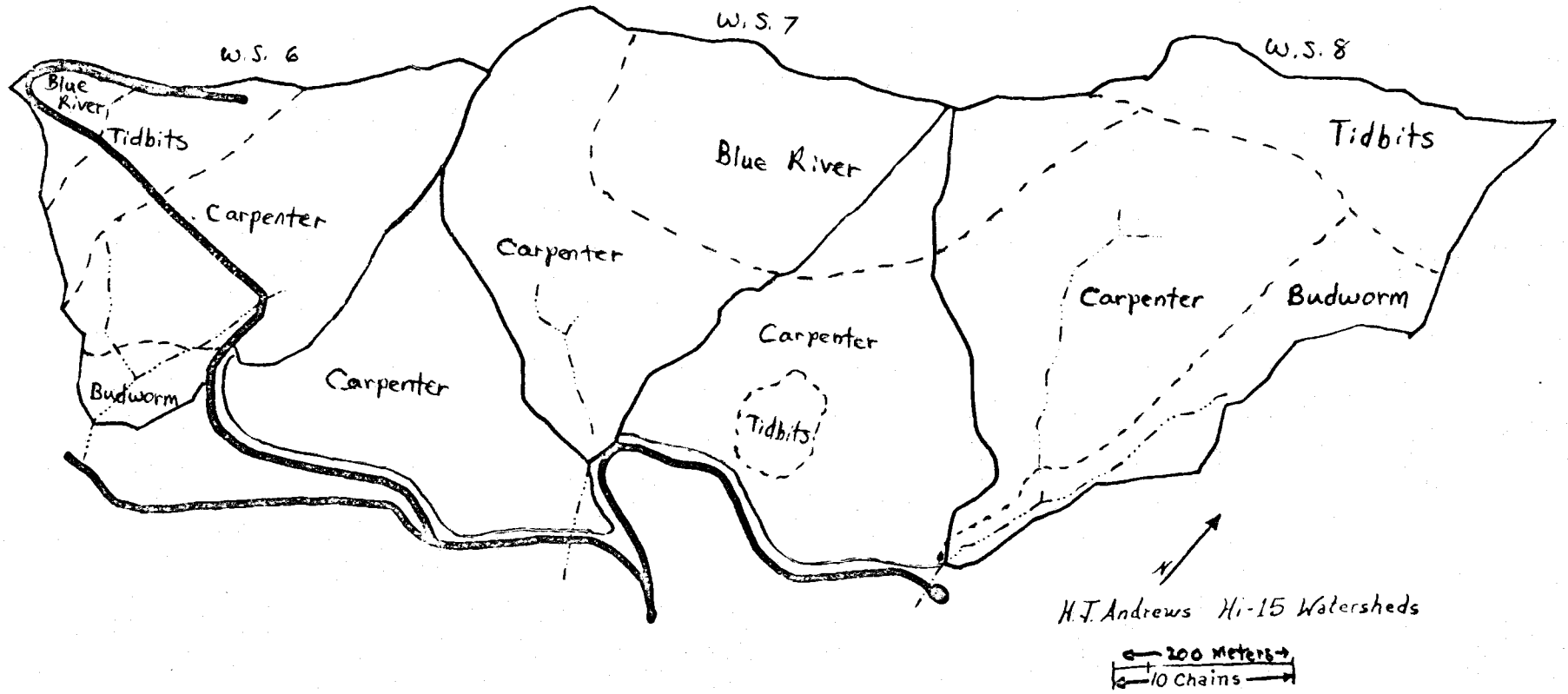
The Carpenter is a Brown Podzolic soil forming in deep landslide deposits of dominantly andesitic origin. The surface horizon is generally comprised of dark brown gravelly sandy loam of granular structure. Lower horizons are often obscure, but are generally differentiated on the basis of slightly lighter color and a tendency toward subangular blocky structure. These subsoil layers are most often dark brown gravelly sandy loam to loam. Gravel content of the Carpenter soil ranges from 10 to 30% of the soil volume. In most locations effective rooting depth is virtually unlimited because of the very deep, unconsolidated parent material.

Most of the Tidbits soil series occurs at higher elevations in Watersheds 6 and 8, with only a small area located between Watersheds 7 and 8. The Tidbits is a dark-colored Ando-like soil derived from andesite and associated tuffs and breccias. The surface layer is made up of very dark brown to black granular silt loam containing about 5 to 20% gravels by volume. The subsoil is very dark brown subangular blocky silt loam with 5 to 20% gravels and occasionally larger stones comprising up to 30% of the total volume. The Tidbits soil is generally at least moderately deep, with effective rooting depths greater than 1M.

The Blue River soil series is distributed over the upper portions of all three watersheds. This soil is generally shallower to bedrock than the other 3 soils and is especially shallow in ridgetop positions. The Blue River is a Brown Podzolic soil derived largely from andesite residuum. The surface layer is made up of very dark grayish brown sandy loam or loam generally containing about 15 to 20% gravels. The subsoil is usually dark brown subangular blocky loam with 5 to 20% gravels and occasionally larger stones comprising up to 50% of the total volume. Fractured bedrock is most often within 1 M of the soil surface, although deeper soils are encountered.

The Budworm soil is found along lower portions of the main stream channels in watersheds 6 and 8. It is a moderately well drained Brown Podzolic soil derived from greenish tuffs and breccias. The surface soil is comprised of very dark grayish brown silt loam to clay loam of granular structure. Gravel content in the surface layer ranges from 5 to 15% by volume. The subsoil is made up of dark brown to very dark grayish brown subangular blocky clay loam or silty clay loam. The Budworm soil is relatively stone-free and total soil depth is generally on the order of 2-3 M.

Examination of soil and vegetation maps reveals no close correlation between soil and vegetation types. This may be due to the fact that, with the exception of the Budworm, soils on the Hi-15 watersheds are remarkably similar in such important characteristics as texture, stoniness, and parent material. Thus, close correlation between vegetation units and soil, at least at the series level, would not be expected.



H.J. Andrews Hi-15 Watersheds