An Introduction to the H. J. Andrews Experimental Forest

The H. J. Andrews Experimental Forest is located in the rugged Cascade Mountains approximately 50 miles (80 km) east of Eugene, Oregon. It is 15,815 acres (6400 hectares) in size and ranges from 1350 feet (412 m) to 5350 feet (1630 m) in elevation. The landscape is deeply dissected and heavily forested. Pristine stands of old-growth forest with dominant trees in excess of 400 years of age cover about 45 percent of the Andrews Forest with the remainder in younger age-class forests; the most common forest types at lower elevations are dominated by Douglas-fir, western hemlock and western red cedar. Going up in elevation, western hemlock is gradually upland by Pacific silver fir, and Douglas-fir and western red cedar decline in importance. Upper elevation stands consist of mixtures of true firs and mountain hemlock. Approximately one third of the Andrews Forest has been logged or manipulated for research as shown in the following table.

Forest Type	Areas in Acres (hectares)		
	Undisturbed	Logged/Manipulated	Total
Low elevation douglas-fir--western hemlock	3363 (1362)	2807 (1136)	6170 (2498)
Mid-elevation transitional	3959 (1603)	1331 (539)	5290 (2142)
Upper elevation true fir-mountain hemlock	2756 (1115)	981 (379)	3737 (1512)
Non-forest types	618 (250)	-- --	618 (250)
Grand Totals	10,696 (4330)	5119 (2072)	15,815 (6402)

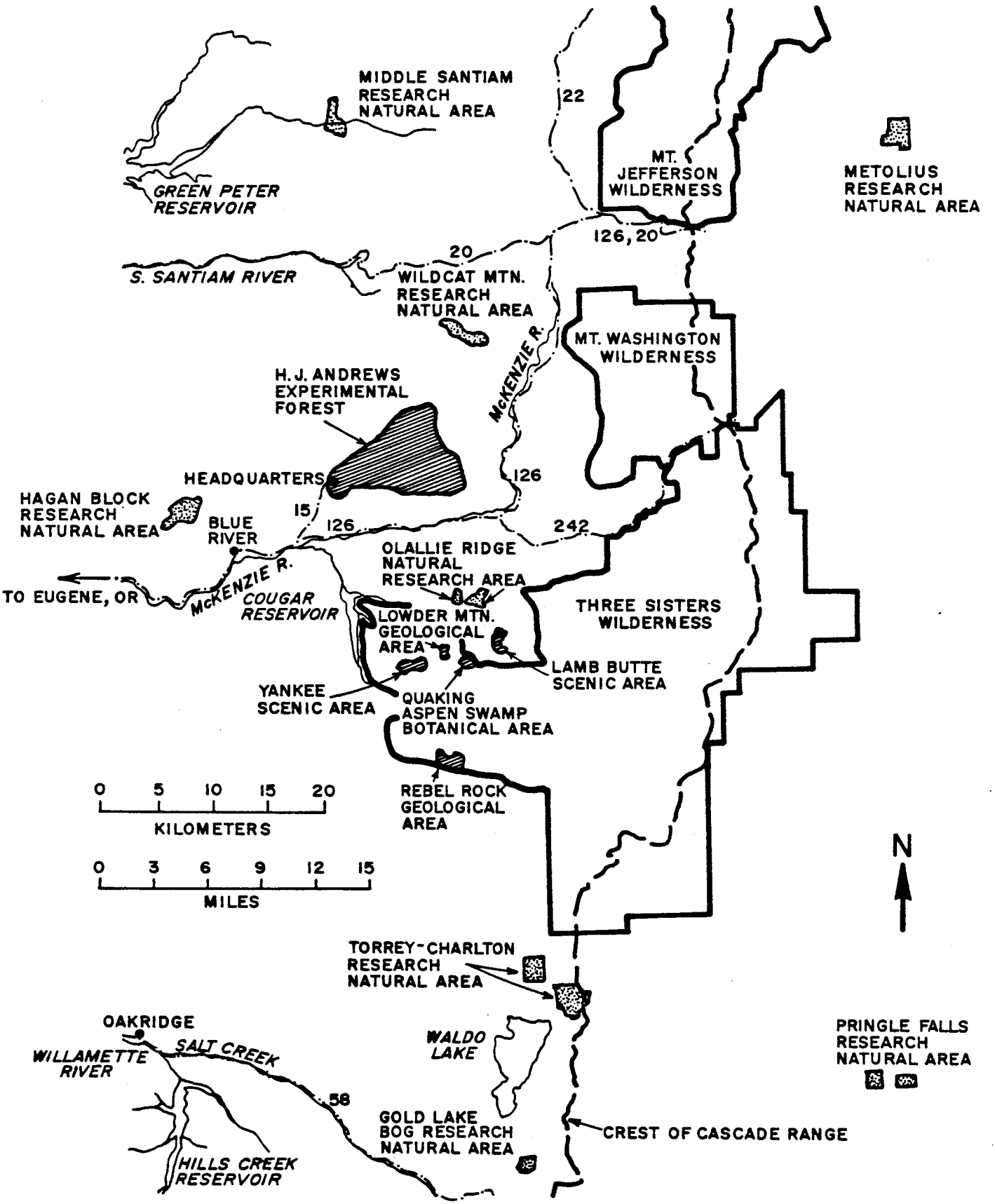
The maritime climate is mild with wet winters and cool, dry summers. Annual precipitation normally exceeds 100 inches (2540 mm) and is concentrated in the winter. Deep snowpacks are common above 3300 feet (1000 m). Little or no rain falls during July and August.

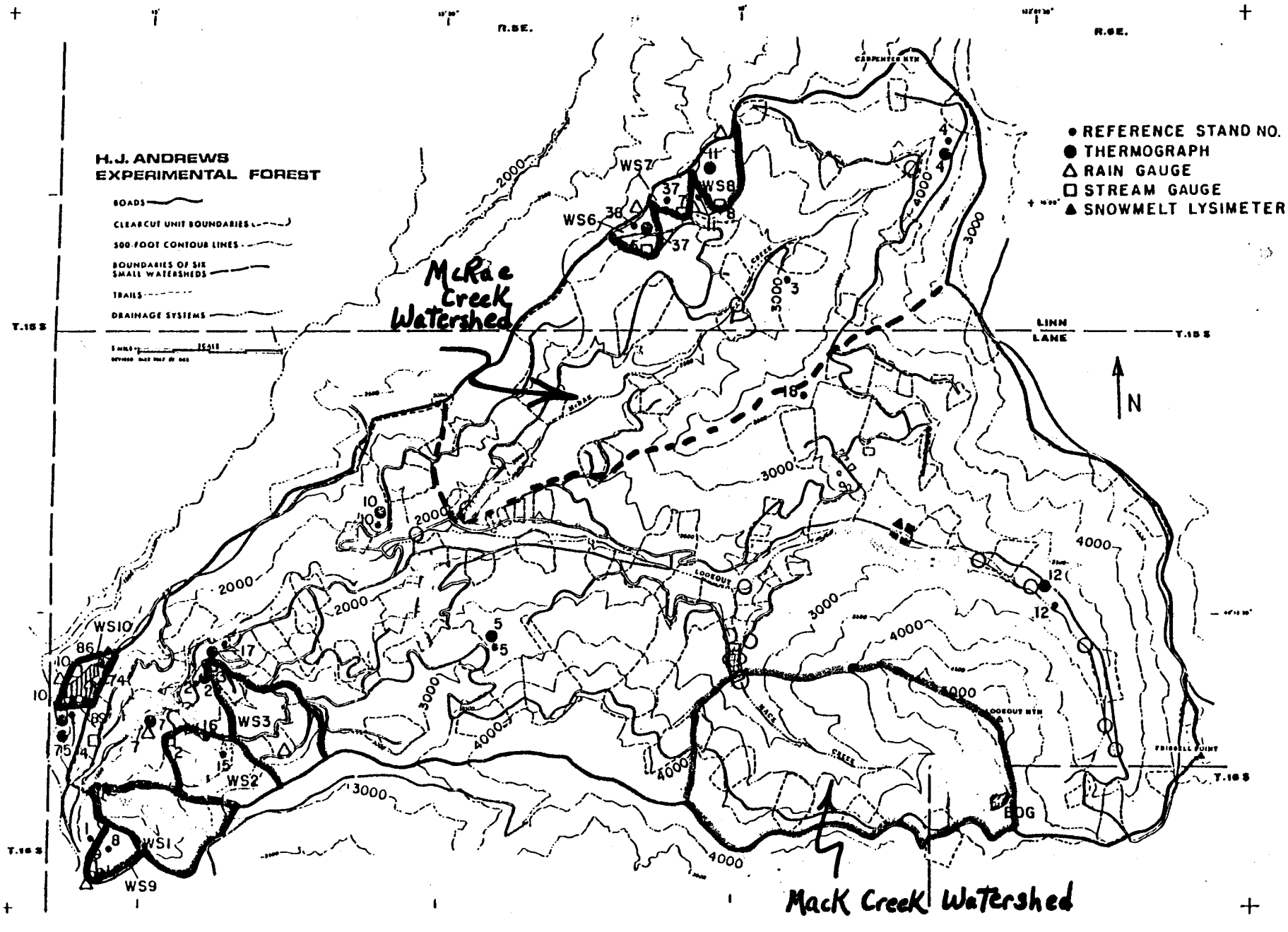
Rapidly flowing mountain streams are the primary type of aquatic ecosystem on the Andrews Forest. Streamflow follows the precipitation pattern with winter maximum flows three orders of magnitude larger than summer minimum. First and second order streams under natural conditions are dominated by coarse woody debris and receive large annual inputs of litter which provide the energy base for the aquatic organisms. Larger order streams have an increasing proportion of the energy base provided by in-stream photosynthesis, but processed organic matter (litter) washed down from the smaller tributaries remains an important part of the energy base.

The Andrews Forest was established by the U.S.D.A. Forest Service in 1948. Research efforts focused on logging and regeneration in the 1950's, shifted to a watershed emphasis in the 1960's and to an ecosystem orientation in the 1970's. Research use of the site expanded rapidly in the 1970's, with National Science Foundation support. In 1977, Oregon State University and the Forest Service agreed to jointly administer the site with the common management objective of enhancing research and educational use. The success of this joint management is apparent in the continuing expansion of the overall program, which includes basin and applied research.

During 1983, 87 scientists and 51 graduate students were involved in research at the Andrews Forest. Fifty-six separately funded projects used the site; if broken down into subprojects, well 100 studies could be listed. Total research expenditure is large, over $1,750,000 during 1983. The major contributors are:

Agency/Source	Amount
National Science Foundation	$ 855,000
Pacific Northwest Forest and Range Exp. Stat.	$ 401,000
Oregon State University	$ 170,000
Bureau of Land Management	$ 110,000
Department of Energy	$ 96,000
Other	$ 121,000
Total	$1,753,000


MIDDLE SANTIAM RESEARCH NATURAL AREA
22
MT. JEFFERSON WILDERNESS
METOLIUS RESEARCH NATURAL AREA
GREEN PETER RESERVOIR
126, 20
20
S. SANTIAM RIVER
WILDCAT MTN. RESEARCH NATURAL AREA
MT. WASHINGTON WILDERNESS
McKENZIE R.
H.J. ANDREWS EXPERIMENTAL FOREST
HEADQUARTERS
126
HAGAN BLOCK RESEARCH NATURAL AREA
15
126
BLUE RIVER
242
OLALLIE RIDGE NATURAL RESEARCH AREA
TO EUGENE, OR
McKENZIE R.
COUGAR RESERVOIR
THREE SISTERS WILDERNESS
LOWDER MTN. GEOLOGICAL AREA
LAMB BUTTE SCENIC AREA
YANKEE SCENIC AREA
QUAKING ASPEN SWAMP BOTANICAL AREA
REBEL ROCK GEOLOGICAL AREA
0 5 10 15 20
KILOMETERS
0 3 6 9 12 15
MILES
N
TORREY-CHARLTON RESEARCH NATURAL AREA
OAKRIDGE
WILLAMETTE RIVER
SALT CREEK
WALDO LAKE
PRINGLE FALLS RESEARCH NATURAL AREA
58
GOLD LAKE BOG RESEARCH NATURAL AREA
CREST OF CASCADE RANGE
HILLS CREEK RESERVOIR


H.J. ANDREWS
EXPERIMENTAL FOREST
ROADS
CLEARCUT UNIT BOUNDARIES
500-FOOT CONTOUR LINES
BOUNDARIES OF SIX SMALL WATERSHEDS
TRAILS
DRAINAGE SYSTEMS
REFERENCE STAND NO.
THERMOGRAPH
RAIN GAUGE
STREAM GAUGE
SNOWMELT LYSIMETER
McRae Creek Watershed
Mack Creek Watershed
R.5E.
T.15 S
T.16 S
LINN
LANE
N
WS1
WS2
WS3
WS6
WS7
WS8
WS9
WS10
BOG
2000
3000
4000

3

Community name	Abbreviation
Tsuga heterophylla zone	
Pseudotsuga menziesii/Holodiscus discolor	Psme/Hodi
Pseudotsuga menziesii-Tsuga heterophylla/Corylus cornuta	Psme-Tshe/Coco
Tsuga heterophylla/Castanopsis chrysophylla	Tshe/Cach
Tsuga heterophylla/Rhododendron macrophyllum/Gaultheria shallon	Tshe/Rhma/Gash
Pseudotsuga menziesii/Acer circinatum/ Gaultheria shallon	Psme/Acci/Gash
Tsuga heterophylla/Rhododendron macrophyllum/Berberis nervosa	Tshe/Rhma/Bene
Pseudotsuga menziesii/Acer circinatum/ Berberis nervosa	Psme/Acci/Bene
Tsuga heterophylla-Acer circinatum/ Polystichum munitum	Tshe/Acci/Pomu
Tsuga heterophylla/Polystichum munitum	Tshe/Pomu
Tsuga heterophylla/Polystichum munitum-Oxalis oregana	Tshe/Pomu-Oxor
Transition zone	
Tsuga heterophylla-Abies amabilis/ Rhododendron macrophyllum/Berberis nervosa	Tshe-Abam/Rhma/ Bene
Tsuga heterophylla-Abies amabilis/ Rhododendron macrophyllum/Linnaea borealis	Tshe-Abam/Rhma/ Libo
Tsuga heterophylla-Abies amabilis/ Linnaea borealis	Tshe-Abam/Libo
Pseudotsuga menziesii/Acer circinatum/ Whipplea modesta	Psme/Acci/Whmo
Abies amabilis zone	
Abies amabilis-Tsuga mertensiana/ Xerophyllum tenax	Abam-Tsme/Xete
Abies amabilis/Vaccinium membranaceum/ Xerophyllum tenax	Abam/Vame/Xete
Abies amabilis/Rhododendron macrophyllum-Vaccinium alaskense/Cornus canadensis	Abam/Rhma-Vaal/ Coca
Abies amabilis/Vaccinium alaskense/ Cornus canadensis	Abam/Vaal/Coca
Abies procera/Achlys triphylla	Abpr/Actr
Abies amabilis/Achlys triphylla	Abam/Actr
Abies procera/Clintonia uniflora	Abpr/Clun
Abies amabilis/Tiarella unifoliata	Abam/Tiun
Chamaecyparis nootkatensis/Oplopanax horridum	Chno/Opho

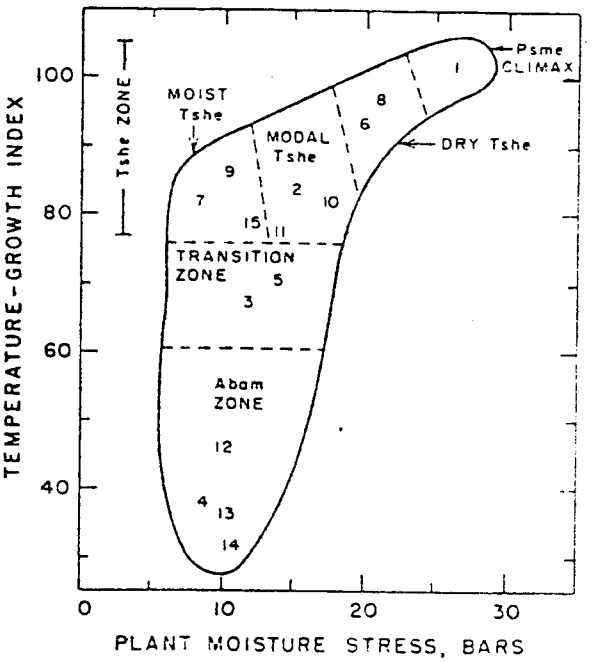


FIG. 7. Position of reference stands in a two-dimensional environmental field. Temperature is represented by Temperature Growth Index computed by the method of Cleary and Waring (1969). Moisture is assessed as the late-summer predawn moisture stress on conifer saplings

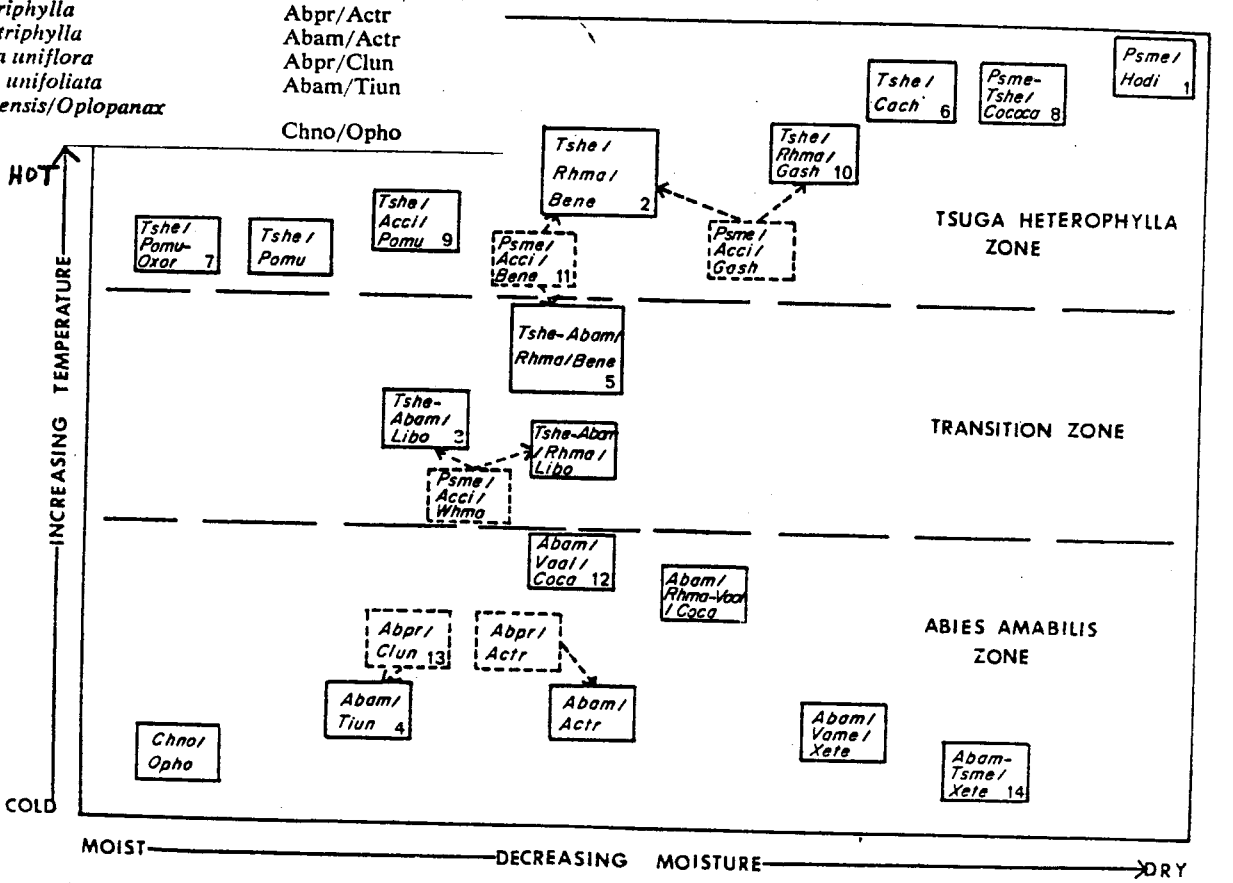
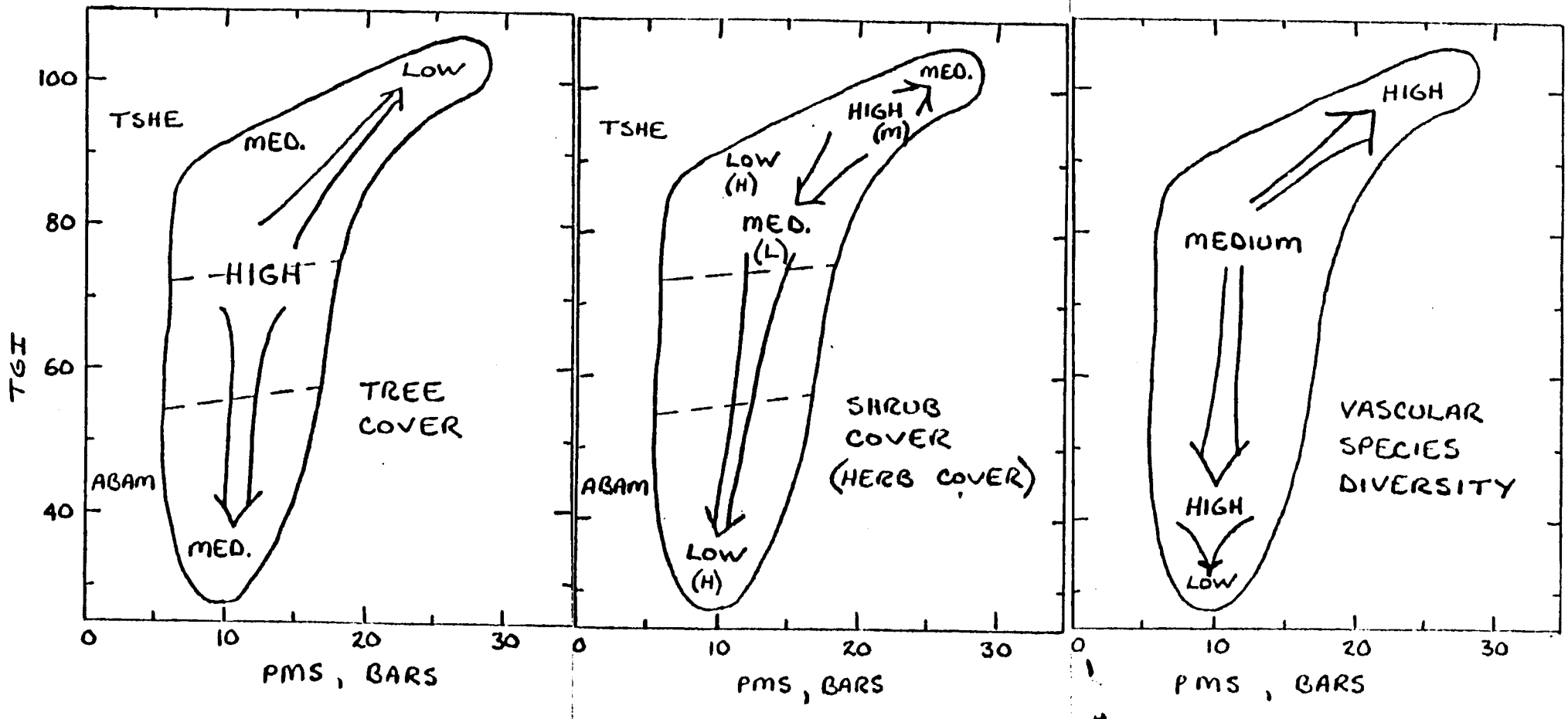
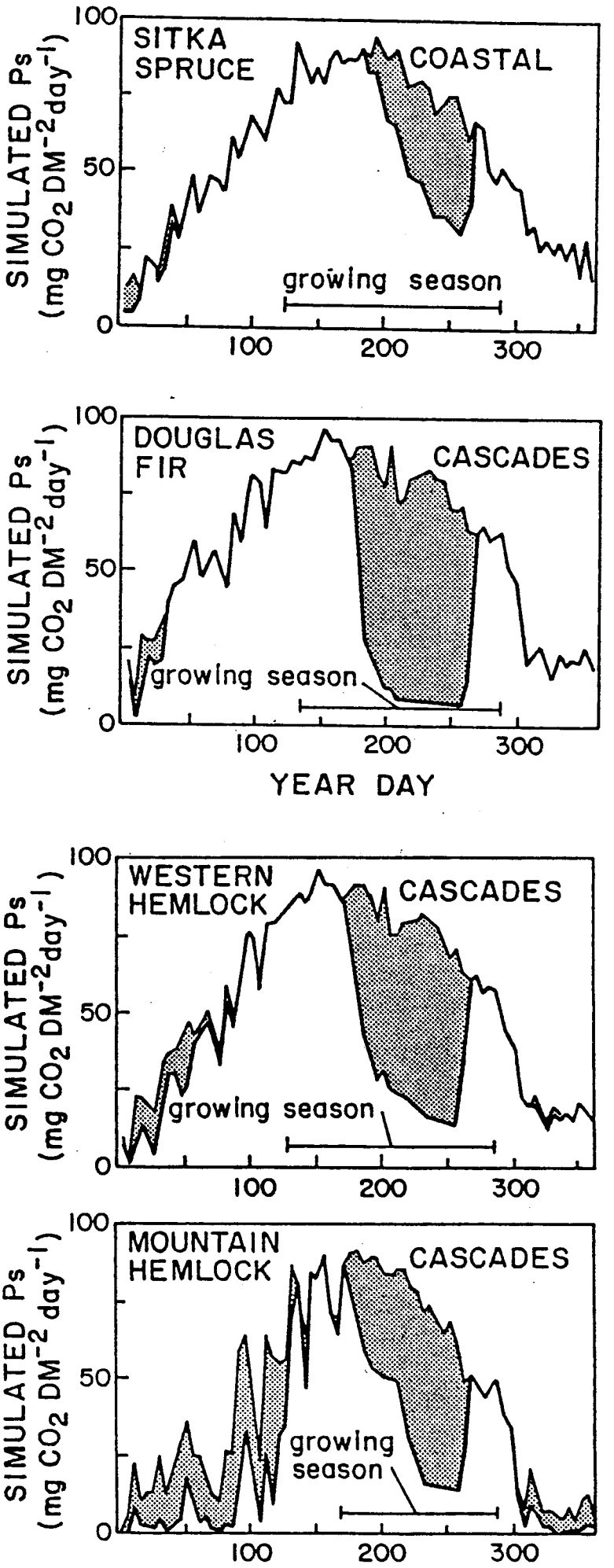
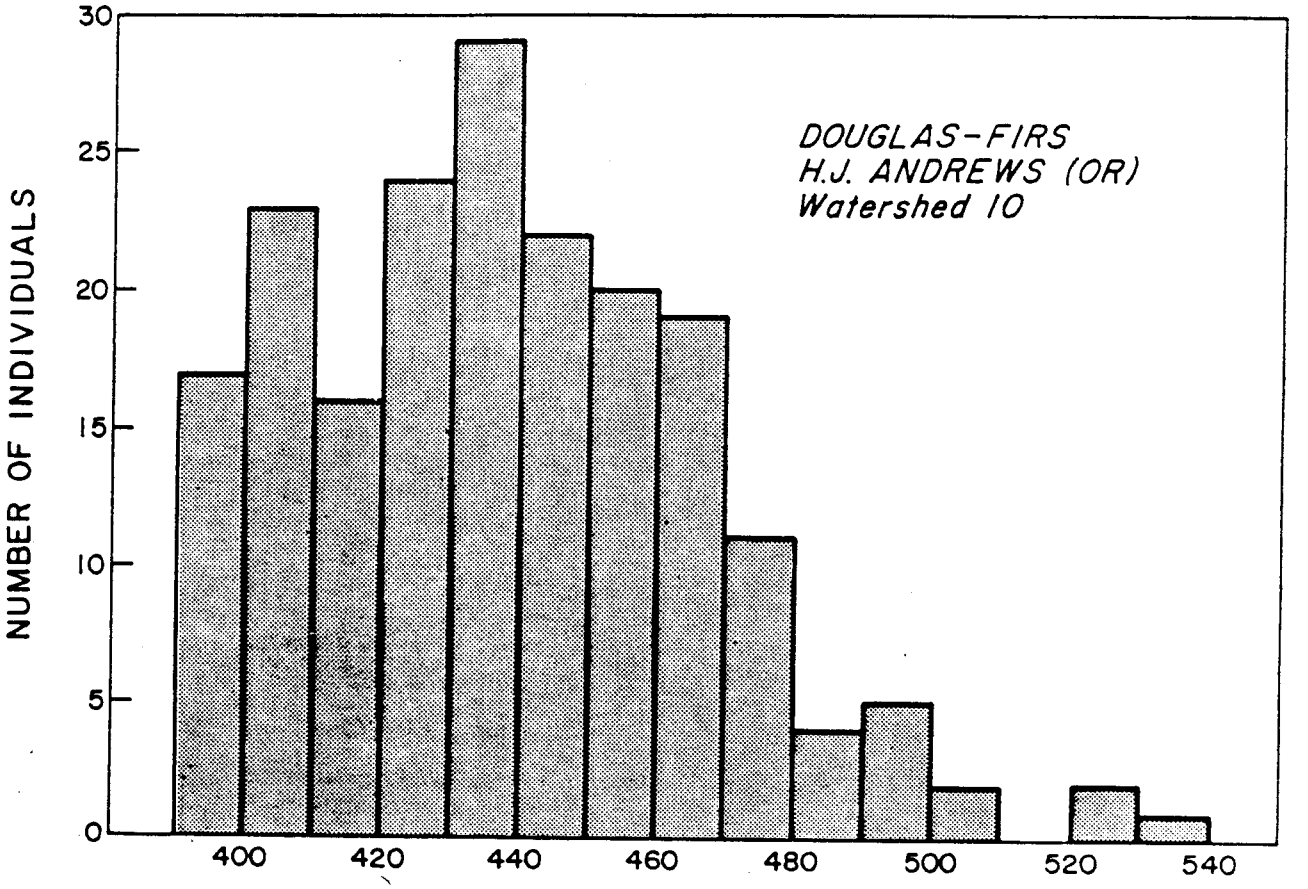


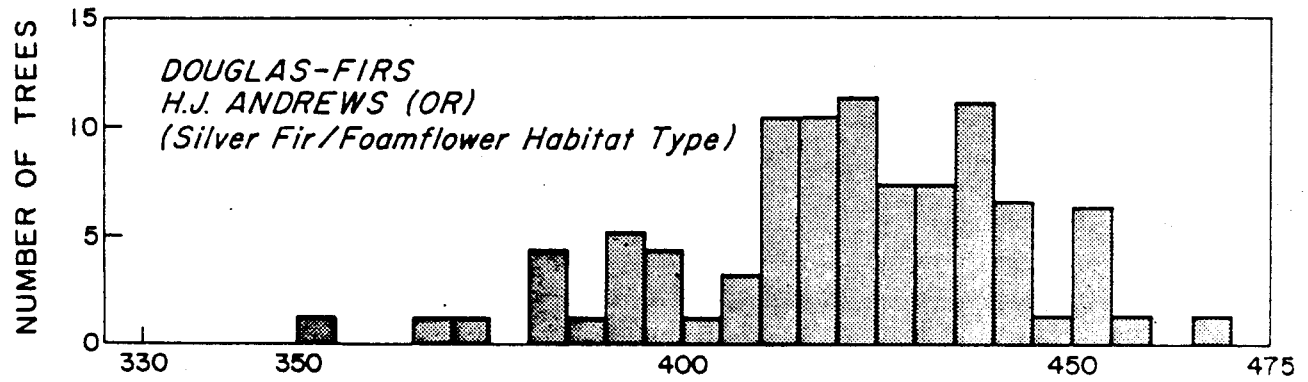
FIG. 2. Hypothesized relationships between forest communities and environment in the central western Cascades (Dyrness et al. 1974: Fig. 5). This figure is based on their vegetation ordination, somewhat modified by the intuition of the investigators. Communities enclosed with dashed borders are considered to be seral, the others, to be climax. Communities sampled in this study are identified by the reference stand number in the box. Abbreviations for communities are identified in Table 1

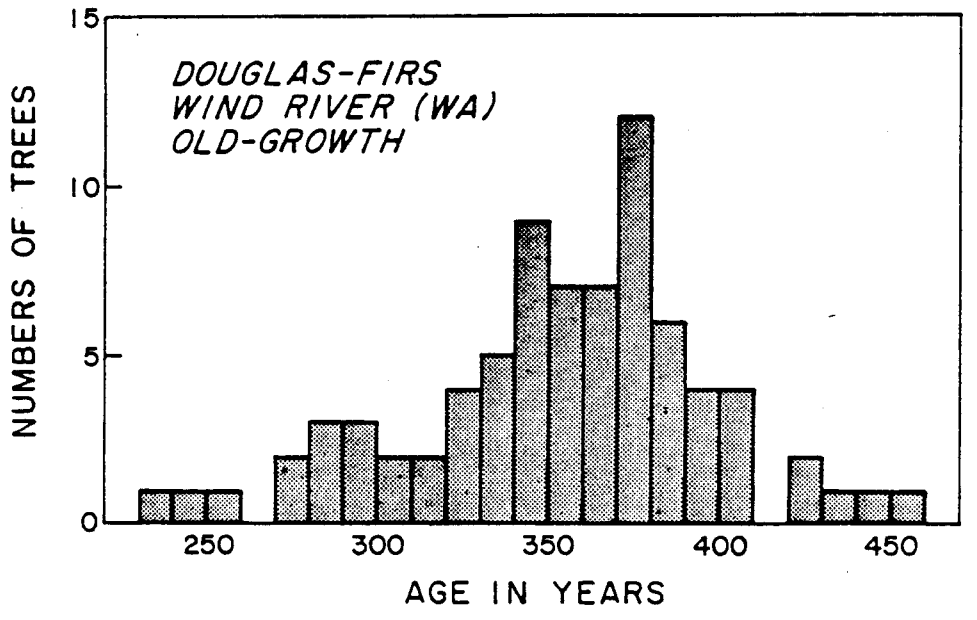

100
80
60
40
TSHE
LOW
MED.
HIGH
ABAM
MED.
TREE COVER
0
10
20
30
PMS, BARS
TSHE
MED.
HIGH (m)
LOW (H)
MED. (L)
ABAM
LOW (H)
SHRUB COVER (HERB COVER)
0
10
20
30
PMS, BARS
HIGH
MEDIUM
HIGH
LOW
VASCULAR SPECIES DIVERSITY
0
10
20
30
PMS, BARS

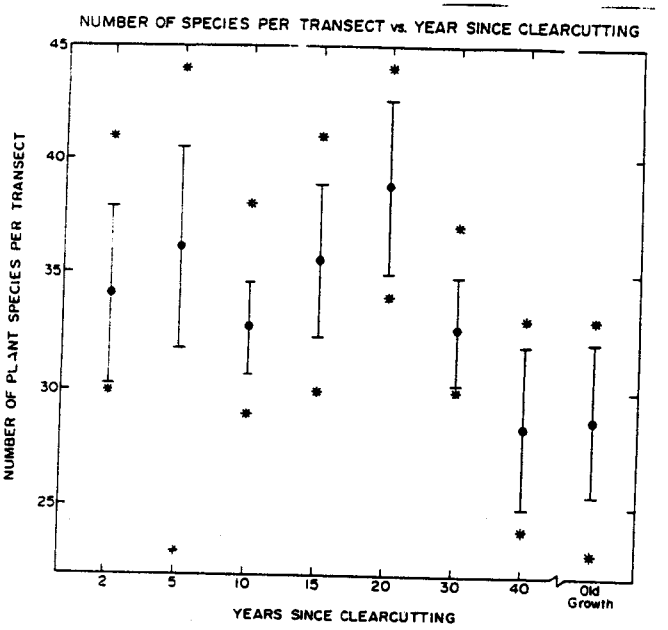
G-1

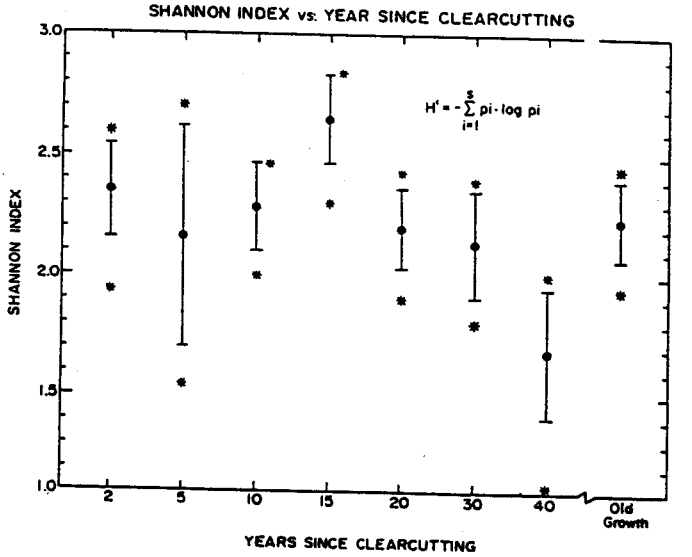

SITKA SPRUCE
COASTAL
growing season
DOUGLAS FIR
CASCADES
growing season
WESTERN HEMLOCK
CASCADES
growing season
MOUNTAIN HEMLOCK
CASCADES
growing season
SIMULATED Ps (mg CO_2 $DM^{-2}day^{-1}$)
0
50
100
100
200
300
YEAR DAY

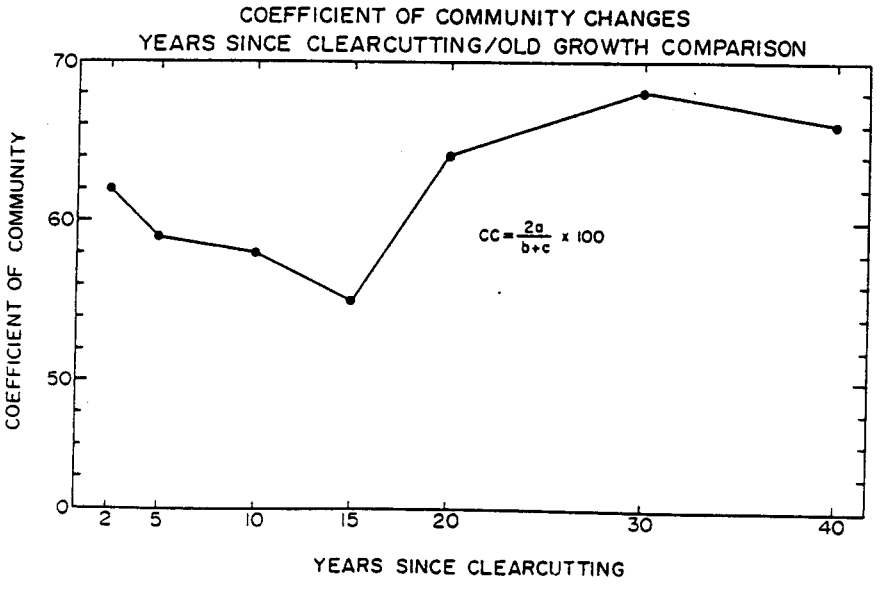

DOUGLAS-FIRS
H.J. ANDREWS (OR)
Watershed 10
NUMBER OF INDIVIDUALS
0
5
10
15
20
25
30
400
420
440
460
480
500
520
540

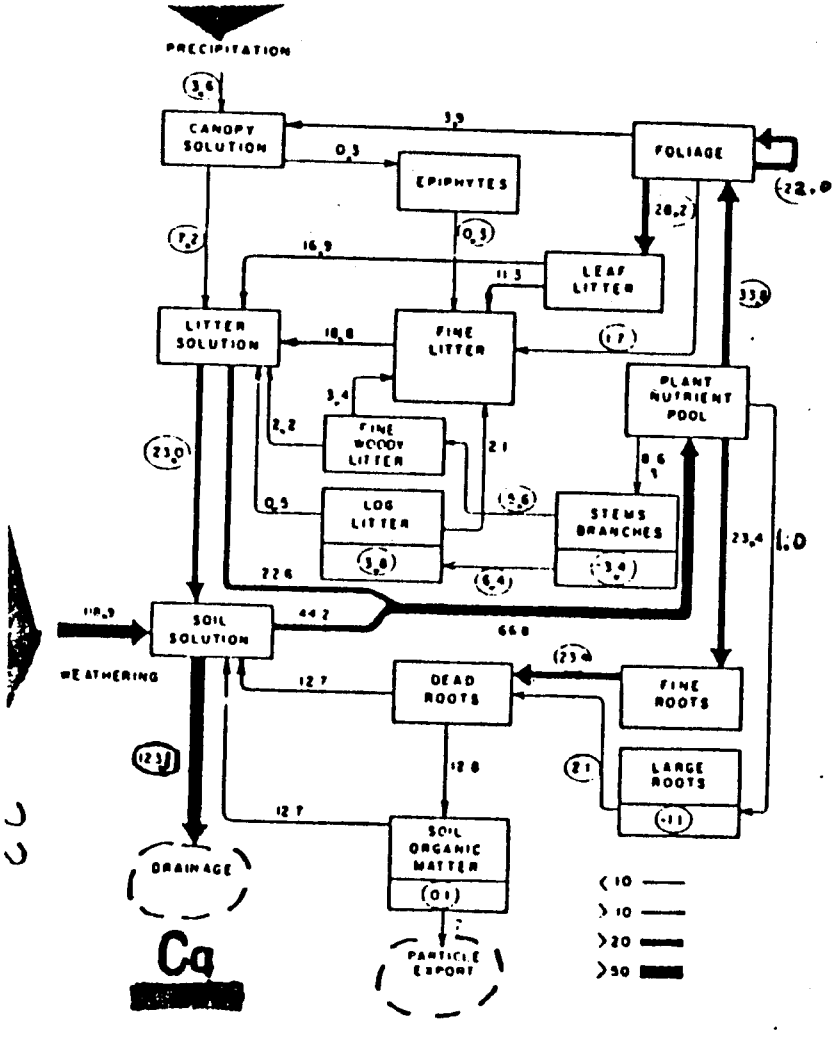

DOUGLAS-FIRS
H.J. ANDREWS (OR)
(Silver Fir/Foamflower Habitat Type)
NUMBER OF TREES
0
5
10
15
330
350
400
450
475


DOUGLAS-FIRS
WIND RIVER (WA)
OLD-GROWTH
NUMBERS OF TREES
0
5
10
15
250
300
350
400
450
AGE IN YEARS


NUMBER OF SPECIES PER TRANSECT vs. YEAR SINCE CLEARCUTTING
NUMBER OF PLANT SPECIES PER TRANSECT
45
40
35
30
25
2
5
10
15
20
30
40
Old Growth
YEARS SINCE CLEARCUTTING


SHANNON INDEX vs. YEAR SINCE CLEARCUTTING
SHANNON INDEX
3.0
2.5
2.0
1.5
1.0
$H' = -\sum_{i=1}^{s} pi \cdot \log pi$
2
5
10
15
20
30
40
Old Growth
YEARS SINCE CLEARCUTTING


COEFFICIENT OF COMMUNITY CHANGES
YEARS SINCE CLEARCUTTING/OLD GROWTH COMPARISON
COEFFICIENT OF COMMUNITY
70
60
50
0
$CC = \frac{2a}{b+c} \times 100$
2
5
10
15
20
30
40
YEARS SINCE CLEARCUTTING



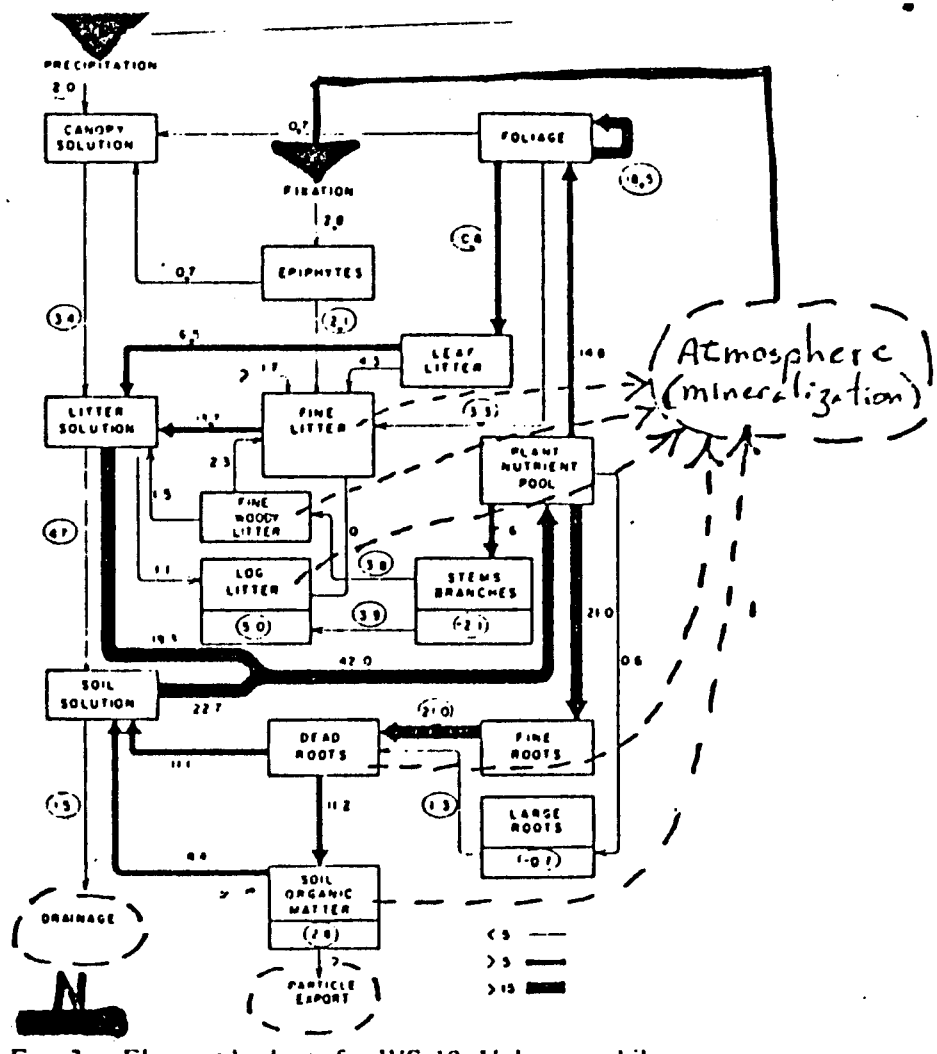


FIG. 3. Element budgets for WS-10. Values are kilograms per hectare per year. Circled values were calculated independently; others were calculated by difference from other fluxes (see text). Values in small rectangles are annual accumulation. Standing amounts are not shown. Thickness of arrow is proportional to flux.