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Publishers Note

The FHABC is pleased to host this file on our server, in support of Bill Bourgeois' article:

HISTORY AND INFLUENCE OF THE MACMILLIAN BLOEDEL LAND USE PLANNING ADVISORY TEAM (LUPAT).

in our December 2023 Newsletter Issue 116.

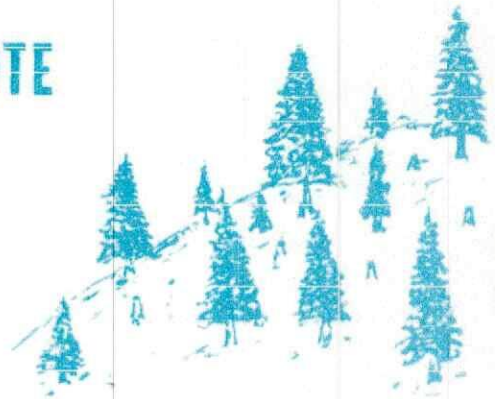
In it, Bourgeois makes reference to Edmond C. Packee's 1972 MacMillan Bloedel Limited Forest Research Note, which we share in the following pages.

Bourgeois' article can be accessed via
https://www.fhabc.org/newsletter-archive/2023/116.pdf

FOREST RESEARCH NOTE

MacMILLAN BLOEDEL LIMITED
FORESTRY DIVISION

NANAIMO, B.C.



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THE BIOGEOCLIMATIC SUBZONES OF VANCOUVER ISLAND AND THE ADJACENT MAINLAND AND ISLANDS

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ABSTRACT

Vancouver Island and adjacent areas are divided into Biogeoclimatic Zones and Subzones which are described. A tentative map (1 inch = 6 miles) has been prepared and is available for purchase at cost. A practical example applying the system to a forest management program is given.

THE BIOGEOCLIMATIC SUBZONES OF VANCOUVER ISLAND AND THE ADJACENT MAINLAND AND ISLANDS[1/]

Edmond C. Packee[2/]

FOREWORD

This Research Note and the Biogeoclimatic Subzone maps are advance results from a larger project and the author's Ph.D. thesis--hence the necessity for copyright. Publication in a preliminary form at this time was deemed necessary by several factors:

1) The urgency for an ecological base for forest management decision making.

2) The interest shown by other research workers who wish to test the approach in their own specialized fields.

3) The interest and concern shown by various industrial forest managers for this information.

Further refinement is necessary to what is only one approach to a rational ecological classification.

I acknowledge the work of Dr. V.J. Krajina of the University of British Columbia, who more than a decade ago put forward the concept of Biogeoclimatic Zones for British Columbia on which this more detailed work is based.

BASIC CONCEPTS

A sound ecological foundation is essential for proper forest management. This ecological foundation must categorize the environment so that similarities and dissimilarities are perceived easily in the field. In practice, similar environments should respond similarly to the same management prescription.

Since the environment is a function of climate, geology (including soil and topography), biota, and time, knowledge of each is necessary in order to understand the whole. The forest is a product of the environment, thus the forest occupying a particular site at a given moment in time is a function of the environmental factors. The recognition of broad vegetation zones, based on climax vegetation, which reflect differences in environment is a major initial step in building the ecological base.

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A basic understanding of plant succession is essential for the proper application of the Biogeoclimatic Zone concept. The successional status of the species must be known since the classification is based on the climax species and not on the seral ones. Tables 2 and 3 in Appendix I show the successional position of the tree species.

The climax community is one which "characterizes normal topography and soils, and shows no dependency for its character upon the maintenance of recurrent disturbance, such as by animals or fire" and "might be appropriately called a 'normal climax' or a 'zonal climax'" (Daubenmire 1968). Where the climax community is the result of a particular environmental factor a special climax occurs. For example, if the soil is the dominating factor, the climax is an edaphic one.

DEVELOPMENT OF THE MAP

It is readily seen, that the climax vegetation of the Western Cordillera of North America forms broad bands or zones which are correlated primarily with elevation. The vegetation of Vancouver Island shows such zonation, but the zonal pattern is strongly modified by the Pacific Ocean. The vegetation studies of Becking (1954), Fonda and Bliss (1969), Franklin and Dyrness (1969), and Krajina (1969) were reviewed. Krajina's approach, with minor modification, was selected as most applicable for recognizing the vegetation zones of the study area.

The initial or First Approximation of the mapping of the Biogeoclimatic Zones and Subzones was made on the 1 inch = 6 miles map of Vancouver Island published by the British Columbia Department of Lands, Forests, and Water Resources. The diagnostic criteria of Krajina (1965, 1969) were used for delineating the Zones and Subzones. The only major modification was the recognition and delineation of a Fog Western Hemlock/Sitka Spruce Subzone, similar to that described by Franklin and Dyrness (1969), which occurs primarily as a narrow strip along the west coast of the Island.

The Second Approximation is a major revision based on the 1947 B.C. Forest Service Cover Maps, MacMillan Bloedel Limited Forest Cover Maps, consultation with other foresters, and field checking by the author and staff of the Forestry Division, MacMillan Bloedel Limited. Field checking covered the Alberni Inlet - Barkley Sound area and the east and north portions of Vancouver Island, the islands in Johnstone Strait and Knight Inlet, and the Powell River area. Several major areas of doubtful classification are identified in a later section.

THE ZONES AND SUBZONES

Biogeoclimatic Zones are geographic areas characterized by the same macroclimate, zonal soil and biota (Krajina 1965, 1969). Each Zone is subdivided into Subzones which reflect more specific environmental conditions. It is possible to subdivide the Subzones into habitat types which are areas that now support or within recent time have supported one particular plant association or climax community (Daubenmire 1968).

Biogeoclimatic Zones and Subzones can be recognized readily in the field. Appendix I lists the environmental and vegetational features which define the zones and will assist the forester, resource manager, and technician to determine the proper Subzone with which they are concerned. Species names are after Hitchcock, et al (1955, 1959, 1961, 1964, 1969).

The Douglas-fir Biogeoclimatic Zone

This Zone is divided into Dry and Wet Subzones.

The Dry Subzone, characteristic of the lowlands adjacent to the Strait of Georgia, is the warmest and driest in the map area. In the Victoria area and some of the Gulf Islands, the vegetation resembles an oak woodland or savanna. Typical indicator species include Garry oak, manzanita, poison oak, and prickly pear cactus.

The Wet Subzone is mainly located on the east coast. It also is found in some of the interior valleys of Vancouver Island and as a narrow band along the Mainland coast. The northern portion of this Subzone is strongly influenced by the moisture laden air of the open Pacific which invades through the Queen Charlotte and Johnstone Straits thus eliminating the northward extension of the Dry Subzone. There are few species, if any, endemic only to this Subzone. Arbutus and grand fir commonly occur, particularly at the lower elevations. Western hemlock may occur as a minor climax species, and either is confined to appropriate edaphic situations or is relegated to an understorey position seldom reaching large size because of frequent severe or killing drought (Krajina 1969).

Western Hemlock Biogeoclimatic Zone

The Western Hemlock Biogeoclimatic Zone is the most extensive Zone in the map area. It is divided into three Subzones: Dry, Wet, and Fog. The Fog Subzone is not recognized by Krajina (1969) but is recognized by Franklin and Dyrness (1969) and Scott (1962) in Washington and Oregon. In support of this decision, Hutchinson (1940) states that the evaporation factor is primarily responsible for differentiating the limits of Sitka spruce.

The Dry Subzone occurs as an intermediate zone between the Douglas-fir Biogeoclimatic Zone and the Mountain Hemlock Biogeoclimatic Zone or Wet Western Hemlock Subzone. It actually may be a broad transition zone or ecotone based on the following observations: In the drier, lower-elevation portion of the Subzone, species indicative of the Douglas-fir Biogeoclimatic Zone occur frequently (e.g. Arbutus, grand fir, oceanspray, and red flowering currant). At higher elevations or on the wetter aspects, species indicative of the Mountain Hemlock Biogeoclimatic Zone or the Wet Western Hemlock Subzone are prevalent (e.g. mountain ash, twisted stalk, Tiarella unifoliata). Finally, there is a marked absence of true firs, except on edaphically suitable sites, and true firs, according to many (Fonda and Bliss 1969, Franklin and Dyrness 1969, and Thornburgh 1969), are common associates of western hemlock. The absence of Pacific silver fir and prevalence of western hemlock are the major distinguishing features of this Sub-zone.

The climax forest of the Wet Subzone consists of Pacific silver fir, western hemlock, and western red cedar. It predominates on the western and northern portions of Vancouver Island and at middle elevations on the Mainland. Both these areas receive heavy annual precipitation with sufficient rain falling during the growing season to greatly reduce or eliminate summer drought.

The Fog Subzone appears sufficiently different to the Wet Subzone to warrant separation. Typically, the Subzone occurs as a narrow band along the West Coast of Vancouver Island where frequent summer fogs are normal. Usually this area has lower summer temperatures and higher relative humidities than the rest of the Western Hemlock Zone.

Valley bottoms outside the Fog Subzone supporting Sitka spruce are considered edaphic variants of other Subzones; the valleys of the Nitinat and Salmon River probably are such variants and will be reclassified in the next revision.

Mountain Hemlock (Subalpine) Biogeoclimatic Zone

The Mountain Hemlock (Subalpine) Biogeoclimatic Zone has been divided into Forest and Parkland Subzones by Krajina (1969), but has not been separated on the map because the boundary between the Subzones is not distinct. Productivity in both Subzones is low and decreases with increasing elevation. Typical climax species are subalpine fir, Pacific silver fir, and mountain hemlock. The successional status of yellow cedar, another important dominant, is not clear. Thornburgh (1969) and Krajina (1964) list it as equal in shade tolerance to Pacific silver fir and mountain hemlock, but Franklin (1966) considers it to be less shade tolerant than its associates in the southern Cascades of Washington.

Alpine Biogeoclimatic Zone

The Alpine Biogeoclimatic Zone occurs above timberline and is most prevalent and best developed in the Coast Range and on Vancouver Island in Strathcona Park. Shrubs develop poorly and typically have a krummholz (dwarfed and distorted) form.

Urban (Metropolitan Vancouver) Zone

The landscape of the Urban Zone has been sufficiently modified by man to significantly change the environment. Presently, only Metropolitan Vancouver has been so classed, but other communities differ only in scale.

PRACTICAL APPLICATION

A general objective of the forest industry is the production of the maximum practicable volume of wood of the most desirable species. The Biogeoclimatic Zone approach can be used in various ways to attain this objective.

One use is in tree improvement. The importance of seed provenance has long been recognized by foresters. Larsen (1956) stated, "so far as possible we must work with seed from one and the same climate." Haddock and Sziklai (1966) divided British Columbia into nine Douglas-fir seed zones based on climatic differences. Their coastal seed zones, though much broader, form a pattern which has some similarity to the Biogeoclimatic Zones and Subzones.

Since the Biogeoclimatic Subzones are broad expressions of climate, MacMillan Bloedel Limited has adopted them as basic provenance zones. Although the Subzones extend over two degrees of latitude, climate is not significantly affected because of the overwhelming marine influence.

Thus, for Vancouver Island and adjacent areas, the following seed or provenance might be considered for Douglas-fir seed orchards or seed production areas:

- Dry Douglas-fir,
- Wet Douglas-fir - low elevation,
- Wet Douglas-fir - high elevation,
- Dry Western Hemlock,
- Wet Western Hemlock - low elevation,
- Wet Western Hemlock - high elevation,
- Mountain Hemlock - low elevation.

The elevational ranges within the Wet Douglas-fir and Wet Western Hemlock Subzones are 1,500 and 3,000 feet respectively, hence these subzones are further divided into high and low elevation groups in recognition of climatic differences.

Other immediate applications include species allocation to planting site, species preference guidelines for spacing, marking rules for commercial thinnings. Potenti applications include decisions on harvesting method, slash disposal, and forest nutrition.

FUTURE REFINEMENT

It is important to confirm or correct the boundaries of the Subzones. There are areas, the largest being the Nimpkish and Squamish drainages and south central Vancouver Island, where classification at this time is only tentative. The handling of major edaphic or topographic climaxes also must be resolved.

Future mapping should aim at subdividing the Subzones into smaller units. This should be done on a scale of 1 inch = 1.25 miles. Landscape units based on either soils or climax plant associations may be the most appropriate.

The description and terminology of landscape units should follow an internationally accepted scheme. Standardization will simplify and permit maximum and immediate utilization of data from other countries and the various disciplines outside forestry.

ECP/DLH/mh
April 5th, 1972

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APPENDIX I

Table 1. General environmental characteristics for the Biogeoclimatic Zones and Subzones of Vancouver Island and adjacent Mainland and Islands

Variable	Douglas-fir		Western Hemlock			Mountain Hemlock
	Dry	Wet	Dry	Wet	Fog	Forest and Park
Elevation - ft. a.s.l.						
Windward	0 to 500		0 to 3,000		below	3,000 to 5,000
Leeward	0 to 1,500		0 to 3,500		500'	3,600 to 6,000
Temperature °F						
Mean Annual	49 to 51		41 to		49	38 to 44
Mean January	34 to 39		24 to		41	16 to 30
Mean July	60 to 66		55 to		64	51 to 56
No. frost free days	150 to 250		120 to		250	40 to 120
Precipitation - inches						
Annual total	26-44	40-60	64-110	110-262	≥65*	70 to 170
Driest month	0.6 to 1.9		1.2 to 6.5			1.3 to 3.3
Snow - percent	4 to 10		1 to 38			20 to 70

*For the north coast of Vancouver Island and adjacent islands, precipitation may be much lower than the stated minimum of 110 inches.

Table 2. Tree species having little or no indicative value for Biogeoclimatic Zones or Subzones on Vancouver Island and adjacent Mainland and Islands

Species	Douglas-fir		Western Hemlock			Mountain Hemlock
	Dry	Wet	Dry	Wet	Fog	Forest and Park
Acer macrophyllum Bigleaf maple	c	S	s[1/]	S[1/]	S	
Alnus rubra Red alder	s	S	S[2/]	S[2/]	s	
Cornus nuttallii Pacific dogwood	c	c	c	c	c	
Pinus contorta Shore pine	S	S	s	s	$S(c_E)$	s,c
Populus trichocarpa Black cottonwood	S_E	S_E	S_E	S_E	S_E	
Pseudotsuga menziesii Douglas-fir	$C(S_E)$	$C(S_E)$	$S(C_E)$	S	S	
Taxus brevifolia Pacific yew	c	c	c	c	c	
Thuja plicata Western red cedar	C	C	C	C	C	

1/ Usually below 1,000 feet.

2/ Usually below 2,500 feet.

CODE: C = major climax species. s = minor seral spp. c = minor climax species. E = edaphic

Table 3. Tree species indicative of the Biogeoclimatic Zones and Subzones of Vancouver Island and adjacent Mainland and Islands

Species	Douglas-fir		Western Hemlock			Mountain Hemlock
	Dry	Wet	Dry	Wet	Fog	Forest and Park
Abies amabilis Pacific silver fir		?		C	C	C
Abies grandis Grand fir	C_E	C_E	c_E			
Abies lasiocarpa Subalpine fir						C
Arbutus menziesii Arbutus	c	S	s_E			
Chamaecyparis nootkatensis Yellow cedar				C	C	C
Juniperus scopulorum Rocky Mountain juniper	c					
Picea sitchensis Sitka spruce				s_E	S	
Pinus monticola Western white pine		S	S	S		
Prunus emarginata Bitter cherry	s	s				
Quercus garryana Garry oak	S					
Salix hookeriana* Hooker willow	s				s_E?	
Tsuga heterophylla Western hemlock		c_E	C	C	C	C_T
Tsuga mertensiana Mountain hemlock				c_T		

*NOTE: S. hookeriana has been reported as occurring on Forbidden Plateau within the Mountain Hemlock Zone.

Table 4. Shrub species having little or no indicative value for Biogeoclimatic Zones or Subzones on Vancouver Island and adjacent Mainland and Islands

Species	Douglas-fir		Western Hemlock			Mountain Hemlock
	Dry	Wet	Dry	Wet	Fog	Forest and Park
Amelanchier alnifolia Serviceberry	X	X	X	X	X	X
Chimaphila menziesii Prince's pine		X	X	X	X	?
Chimaphila umbellata Prince's pine		X	X	X	X	?
Gaultheria shallon Salal	X	X	X	X	X	
Kalmia polifolia Laurel	Bogs	Bogs	Bogs	Bogs	X	X
Ledum groenlandicum Labrador tea	Bogs	Bogs	Bogs	Bogs	X	X
Linnaea borealis Twinflower	X	X	X	X	X	X
Myrica gale Sweetgale	Bogs	Bogs	Bogs	Bogs	Bogs	
Oplopanax horridum Devil's club		X	X	X	X	
Rubus spectabilis Salmonberry	X	X	X	X	X	
Salix spp. Willow	X	X	X	X	X	X
Sambucus cerulea Blue elderberry	X	X	X	X	X	
Sambucus racemosa Red elderberry	X	X	X	X	X	
Spiraea douglasii Spiraea	X	X	X	X	X	X
Vaccinium spp. Huckleberry	X	X	X	X	X	X

Table 5. Shrub species indicative of the Biogeoclimatic Zones and Subzones of Vancouver Island and adjacent Mainland and Islands

Species	Douglas-fir		Western Hemlock			Mountain Hemlock
	Dry	Wet	Dry	Wet	Fog	Forest and Park
Alnus sinuata Sitka alder				(High)		X
Arctostaphylos columbiana Manzanita	X	(X)				
Arctostaphylos uva-ursi Kinnikinnick	X	X				
Cassiope spp. Mountain heather						X
Cladothamnus pyrolaeflorus Copper bush						X
Gaultheria humifusa Alpine wintergreen						X
Holodiscus discolor Oceanspray	X	X	(low)			
Menziesia ferruginea False azalea				(High)		X
Phyllodoce empetriformis Pink mountain heather						X
Physocarpus capitatus Ninebark	X	X				
Rhus diversiloba Poison oak	X					
Ribes sanguineum Red flowering currant	X	X	(low)			
Rosa gymnocarpa Dwarf rose	X	X				
Sorbus sitchensis Mountain ash			(?)	X		X
Symphoricarpos albus Snowberry	X	X				
Symphoricarpos mollis Snowberry	X	X				

Table 6. Herb species indicative of the Biogeoclimatic Zones and Subzones of Vancouver Island and adjacent Mainland and Islands

Species	Douglas-fir		Western Hemlock			Mountain Hemlock
	Dry	Wet	Dry	Wet	Fog	Forest and Park
Allotropa virgata Candystick	X	X				
Blechnum spicant Deer fern		(Moist, Cool)	X	X	X	
Boschniakia hookeri Ground cone	X	(?)			(?)	
Brodiaea congesta Brodiaea	X					
Brodiaea howellii Brodiaea	X					
Camassia leichtlinii Camas	X					
Camassia quamash Camas	X					
Erythronium montanum Avalanche lily						X
Hieracium albiflorum Hawkweed	X	X				
Listera caurina Twayblade		(?)	X	X	X	?
Lycopodium alpinum						X
Lycopodium clavatum			X	X	X	
Lycopodium complanatum Ground cedar		X	X	X	X	
Lycopodium sitchenses						X
Opuntia fragilis Prickly pear cactus	X					
Rubus lasiococcus				X		X
Rubus pedatus						X
Streptopus amplexifolius Twisted-stalk				X	X	X
Streptopus roseus Twisted-stalk				X	X	
Streptopus streptopoides Twisted-stalk			X	X	X	
Tiarella trifoliata	X_E	X	X	X	X	
Tiarella unifoliata			(High) elev.	(High) elev.		X
Zigadenus venenosus	X					