



Classification of Natural Forest Communities of Coastal British Columbia

Introduction

Vegetation science, like any science, uses classification to organize knowledge about plants and plant communities. Classification is helpful for understanding how different plant communities relate to one another and their environments, for facilitating further studies of vegetation, and for conservation. To familiarize oneself with vegetation of a large area, it is very convenient and efficient to begin with a few general units, such as plant orders rather than with many very detailed units, such as plant associations and subassociation. We offer such an approach and think that the information given in this series will be sufficient to assign any forested coastal community to one of the orders or suborders.

In spite of a history of vegetation studies in British Columbia, there has not yet been any attempt to develop a comprehensive hierarchical classification of plant communities for the province. As the culmination of fifty years of detailed surveys carried out by V.J. Krajina and his students, the Ecology Program Staff of the BC Forest Service, and other workers, we used tabular and multivariate analyses of 3,779 sample plots established in natural, old-growth, submontane, montane, and subalpine forest communities in coastal BC to develop a hierarchy of vegetation units according to the methods of biogeoclimatic ecosystem classification.

Classification

Here, we give an outline of classification that is based on natural (relatively undisturbed), old-growth, coastal forest communities. The focus of this series is plant orders and suborders - the units of a high level of generalization in our hierarchy. We present a diagnostic table and give a brief description for each of the seven orders.

Synopsis of plant orders and suborders distinguished in old-growth forest communities of coastal BC.

Order	Order
Suborder	Suborder
Latin nomenclature	English nomenclature
<i>Quercus garryana</i>	Garry oak
<i>Pseudotsuga menziesii</i> – <i>Mahonia nervosa</i>	Douglas-fir – Oregon grape
<i>Tsuga heterophylla</i> – <i>Rhytidadelphus loreus</i>	Western hemlock – Lanky moss
<i>Tsuga heterophylla</i> – <i>Picea sitchensis</i>	Western hemlock – Sitka spruce
<i>Tsuga heterophylla</i> – <i>Chamaecyparis nootkatensis</i>	Western hemlock – Yellow-cedar
<i>Tsuga heterophylla</i> – <i>Pseudotsuga menziesii</i>	Western hemlock – Douglas-fir
<i>Tsuga heterophylla</i> – <i>Abies amabilis</i>	Western hemlock – Pacific silver fir
<i>Tsuga mertensiana</i>	Mountain hemlock
<i>Tsuga mertensiana</i> – <i>Coptis aspleniifolia</i>	Mountain hemlock – Goldthread
<i>Tsuga mertensiana</i> – <i>Vaccinium membranaceum</i>	Mountain hemlock – Blueberry
<i>Tsuga mertensiana</i> – <i>Streptopus roseus</i>	Mountain hemlock – Twistedstalk
<i>Thuja plicata</i> – <i>Tiarella trifoliata</i>	Western redcedar – Foamflower
<i>Thuja plicata</i> – <i>Tiarella trifoliata</i>	Western redcedar – Foamflower
<i>Picea sitchensis</i> – <i>Tiarella trifoliata</i>	Western redcedar – Foamflower
<i>Abies amabilis</i> – <i>Streptopus amplexifolius</i> & <i>S. roseus</i>	Western redcedar – Twistedstalk
<i>Thuja plicata</i> – <i>Lysichitum americanum</i>	Western redcedar – Skunk cabbage
<i>Populus trichocarpa</i>	Black cottonwood
<i>Pinus contorta</i> – <i>Sphagnum</i>	Lodgepole pine – Sphagnum

Diagnostic combinations of species for plant orders distinguished in old-growth forest communities of coastal BC

Plant order	1	2	3	4	5	6	7
Number of plots	50	159	1378	291	1324	348	229
Species	Diagnostic value ¹	Presence class ² and mean species significance ³					
Quercus garryana order							
Camassia leichtlinii	d	IV 4	I +				
Claytonia perfoliata	d	IV 2	I +	I +			
Elymus glaucus	d,c	V 2	II +	I +		I +	I 1
Galium aparine	d,c	V 4	I +	I +		I +	I +
Melica subulata	d	IV 4	II 1	I +	I +	I 1	I +
Quercus garryana	d, cd	V 7	I +				
Sanicula crassicaulis	d	IV 3	I +			I +	
Pseudotsuga menziesii – Mahonia nervosa order							
Mahonia nervosa	d		IV 5		I 1	I 1	I +
Pseudotsuga menziesii	d	II 5	V 8	II 5	I +	II 4	I 1
Rhytidiadelphus triquetrus	d	II 5	IV 5	I 2	I +	I 1	I +
Rosa gymnocarpa	d	I +	IV 3	I +	I +	I +	
Rubus ursinus	d	I +	IV 2		I +	I 1	II 1
Trientalis latifolia	d	I +	IV 2		I +	I +	I +
Tsuga heterophylla – Rhytidiadelphus loreus order							
Tsuga mertensiana order							
Abies amabilis	d		I +	II 4	IV 5	III 4	I +
Chamaecyparis nootkatensis	c			I 3	IV 5	I 3	III 5
Rhytidopsis robusta	d		I 2	II 3	IV 4	I 3	I +
Rubus pedatus	d			II 1	IV 3	II 2	I +
Tsuga mertensiana	d,cd			I 2	V 6	I 2	II 2
Vaccinium ovalifolium	d		I +	II 2	IV 4	II 2	II 1
Thuja plicata – Tiarella trifoliata and Populus trichocarpa orders							
Athyrium filix-femina	d			I +	I 2	IV 3	III 3
Plagiomnium insigne	d		I +	I +	I +	III 3	III 3
Rubus spectabilis	d		I +	I 1	I 1	IV 4	IV 5
Thuja plicata – Tiarella trifoliata order							
Hylocomium splendens	d	I 1	IV 4	IV 5	II 3	IV 4	I 1
Rhytidiadelphus loreus	d	I 1	II 2	IV 4	IV 5	IV 4	I 1
Tiarella trifoliata	d		I +	I +	II 1	IV 3	II 1
Tsuga heterophylla	d, cd		II 3	V 6	III 4	V 6	II 2
Vaccinium parvifolium	d		III 2	IV 3	I 1	IV 3	I 1
Populus trichocarpa order							
Alnus rubra	d			I +	I 1	II 4	V 6
Cornus sericea	d		I +	I +		I 1	III 4
Populus trichocarpa	d			I 1	I +	I 1	IV 6
Pinus contorta – Sphagnum							
Drosera rotundifolia	d				I +	I +	IV 2
Empetrum nigrum	d			I +	I 1	I +	IV 4
Ledum groenlandicum	d			I +	I +	I +	IV 4
Pinus contorta	d		II 4	I 3	I 1	I +	V 5
Sphagnum nemoreum	d			I +	I 2	I +	IV 6
Sphagnum papillosum	d			I +	I +	I +	IV 5
Trientalis arctica	d			I +	I 2	I +	IV 5

¹Species diagnostic values: d = differential, c = constant.

²Species presence classes as percent of frequency: I = 1-20%, II = 21-40%, III = 41-60%, IV = 61-80%, V = 81-100%.

³Species significance classes and the corresponding mid-point percent cover and range of cover (in parentheses): + = 0.2 (0.1-0.3), 1 = 0.7 (0.4-1.0), 2 = 1.6 (1.1-2.1), 3 = 3.6 (2.2-5.0), 4 = 7.5 (5.1-10.0), 5 = 15 (10.1-20.0), 6 = 26.5 (20.1-33.0), 7 = 41.5 (33.1-50.0), 8 = 60 (50.1-70.0), 9 = 85 (70.1-100).

Garry oak order

This unique, 'oak woodland' or 'Garry oak savanna' order includes Garry oak and Garry oak - Douglas-fir communities that have developed on very dry and nitrogen-medium to -rich soils within the driest and warmest variation of a dry cool mesothermal climate of the CDF zone. These communities occur either on very shallow soils of volcanic or sedimentary rock outcrops and the adjacent, steep, south-aspect colluvial slopes exposed to dry summer winds or, in the areas of lowest rainfall, on deeper, gently sloping, loamy, often gleyed, Brunisols, with Moder or Mull humus forms. On sheltered south slopes, or on upper north slopes, forest communities have a much greater component, largely of Douglas-fir and evergreen Pacific madrone, but the composition of the understory is rather similar to that found in the 'purer' Garry oak communities. Since early this century, the extent of the Garry oak forest has been rapidly diminishing, and nearly all of the forest is privately owned.

Douglas-fir - Oregon grape order

This order includes only the communities that have developed on water-deficient and nitrogen-poor to -medium sites within a drier cool mesothermal climate of the CDF zone - predominantly on southeastern Vancouver Island, the Gulf Islands, and the adjacent southern mainland coast. On these water-deficient sites, Douglas-fir is a moderately shade-tolerant species and regenerates under its own canopy, particularly in small canopy gaps. This is reflected in the structure of old-growth stands, which show the pattern of cohorts ranging from seedlings to veterans. Nearly all of the communities of this order have a fire history and have been disturbed by early settlers and logging. A combination of exposed mineral soil, repression of salal by fire, and partial shade represents the best microenvironment for the survival and growth of Douglas-fir regeneration.

The associated soils are Dystric Brunisols with Moder humus forms. The shrub and moss layers are well developed, with salal, red huckleberry, ocean spray, Oregon grape, baldhip rose, snowberry, Oregon beaked moss, and electrified cat's tail moss dominating the understory. Lodgepole pine sporadically dominates or associates with Douglas-fir on very dry and nitrogen-poor sites; grand fir and western redcedar are found occasionally as co-dominants on moderately dry and nitrogen-medium sites.

Western hemlock - Lanky moss order

This order includes only the coastal communities that occupy slightly dry to very moist and nitrogen-poor to -medium sites within wet cool mesothermal and subarctic wet cool temperate climates of the CWH zone. Consequently, western hemlock communities cover a large area ranging from submontane to montane elevations both west and east of the coastal mountains along the entire BC coast. As early as the regeneration stage, western hemlock can form a substantial (or even entire) portion of the tree layer. Depending on climate, the major associated (and often co-climax) species are: Pacific silver fir (except on the Queen Charlotte Islands), yellow-cedar, Sitka spruce, and Douglas-fir (south of 53° N). Regardless of climate, western redcedar (south of 56° N) is nearly always associated with western hemlock. The abundance of ericaceous shrubs (salal, false azalea, and blueberries) and bryophytes (step moss, flat moss, and lanky moss) are the characteristic features of western hemlock communities. The associated soils are generally shallow to moderately deep, coarse-skeletal, Humo-Ferric or Ferro-Humic Podzols with Mor humus forms.

This order characterizes and delineates the extensive and most productive CWH zone, including the so-called 'coastal or temperate rain forest'. Four suborders stratify the prevailingly cool mesothermal CWH zone into climatically more homogeneous subzones as follows: the 'Sitka spruce' suborder delineates the wet hypermaritime subzone, the 'yellow-cedar' suborder delineates the very wet hypermaritime subzone; the 'Douglas-fir' suborder delineates the dry maritime and subarctic subzones; and the 'Pacific silver fir' suborder delineates moist, wet, and very wet maritime and subarctic subzones.

Mountain hemlock order

This order includes only the coastal mountain hemlock and Pacific silver fir-dominated communities that have developed on slightly dry to very moist and nitrogen-poor to -medium sites within subalpine boreal climates of the MH zone. These communities occur approximately between 1,000 and 1,500 m above sea level, and thus occupy the entire subalpine zone both west and east of the coastal mountains along the entire BC coast.

Mountain hemlock nearly always constitutes a substantial portion of the tree layer, with Pacific silver fir (except on the Queen Charlotte Islands) and yellow-cedar being the only major associates. In the subarctic portion of the MH zone, subalpine fir and Engelmann spruce are often found on drier and warmer sites. Pacific silver fir regenerates abundantly in the understory, while mountain hemlock regeneration becomes established in later successional stages, after canopy gaps have developed. The predominance of ericaceous shrubs (typically blueberries) and bryophytes (typically pipecleaner moss) are characteristic features of the understory. The associated soils are shallow to moderately deep, coarse-skeletal, Ferro-Humic Podzols with strongly mycelial Mor humus forms. Regardless of mineral soil depth, roots of forest trees are largely confined to very acid and thick forest floors (often > 50 cm).

This order characterizes and delineates the MH zone, which is the core distributional area of mountain hemlock. With increasing elevation (decreasing growing season duration), tree growth becomes progressively poorer and a more or less continuous forest canopy gives way to scattered clumps of trees along ridge crests where the snow melts earlier. Two suborders stratify the MH zone into climatically more homogeneous subzones as follows: the 'goldthread' suborder delineates the subalpine hypermaritime subzones, and the 'blueberry' suborder delineate the subalpine maritime subzones. The 'twisted stalk suborder represents the most diverse and productive communities occupying moist to very moist and nitrogen-medium and rich sites in the MH zone. Compared to low-elevation forest, mountain hemlock forest has been little disturbed, and the forest appears to be resilient, although its recovery from disturbance is slow.

Western redcedar - Foamflower order

This order includes only the submontane and montane coastal communities that have developed on fresh to wet and nitrogen (medium to) rich sites within the CDF, CWH, and marginally, MH zones. The tree layer of old-growth stands usually includes a variable proportion of western hemlock and western redcedar, and depending on climate, long-lived Douglas-fir, Pacific silver fir, or Sitka spruce may also be present. In view of its shade tolerance and edaphic adaptations, western redcedar is considered a climax species on moist

and nitrogen-rich sites. However, large accumulations of decaying wood in old-growth stands will also favour reproduction of western hemlock. Therefore, it is likely that on these sites there is no sole climax species - both western redcedar and western hemlock usually are present in climax stands, with predominance of one species over the other varying in time in relation to competitive interrelationships influencing their recruitment in the understory.

The foamflower communities occur on inherently nutrient-rich sites or seepage sites and on steep slopes that provide additional moisture and nutrient inputs. They usually feature a well developed deciduous shrub layer (devil's club, black gooseberry, thimbleberry, salmonberry, and elderberry), herb layer including both ferns and herbs, and moss layer. The associated soils include Brunisols, Gleysols, Podzols, Regosols, and Organic soils, with Moder or Mull humus formation. Thus, this order represents the most productive coastal communities famous for the majestic stature of their old-growth forests. Four suborders stratify this order into climatically and edaphically more homogeneous segments: the 'foamflower' or typic suborder delineates moderately dry through very moist sites in maritime and submaritime CWH subzones; the 'Sitka spruce' suborder delineates fresh through very moist sites in hypermaritime CWH subzones; the Pacific silver fir' suborder delineates fresh through very moist sites in montane and subalpine maritime and submaritime CWH subzones; and the 'skunk cabbage' suborder delineates wet to very wet sites in all subzones of the CDF and CWH zones.

Black cottonwood order

This order includes the submontane and montane coastal hardwood communities that have developed on fresh to very moist and nitrogen (medium to) rich sites of alluvial floodplains within the CDF and CWH zones. Although these communities are dominated by black cottonwood, similar and closely related communities, dominated by balsam poplar, occur across North America.

These riparian communities occur along major and minor rivers and are subjected to periodic overflow that results in both aggradation of new deposits and degradation of old deposits, however, along the minor, steep-gradient streams, degradation prevails. Hydrologic additions of fine alluvial sediments during flooding represents enrichment of sites by both water and nutrients. As a result, the associated soils are Regosols, occasionally Gleysols, with Moder or Mull humus forms. Shade-intolerant willows, red alder, or black cottonwood typically dominate the tree layer, and the very dense deciduous shrub layer typically includes red-osier dogwood, twinberry, devil's club, and salmonberry. Graminoids, ferns, and herbs are well represented in the species-rich understory.

Lodgepole pine - Sphagnum order

This order includes lodgepole pine dominated communities that have developed on wet and nitrogen-poor (to -medium) sites prevailing within the CWH zone. These waterlogged communities (also called bog woodlands or scrub forest) are found scattered throughout the CWH zone but are abundant over much of the subdued coastal terrain in the hypermaritime landscape (Hecate, Nahwitti, and Queen Charlotte Lowlands).

Due to a high water table, the forest canopy is open, with trees established on scattered mounds of organic material, typically decaying wood. In addition to lodgepole pine, western hemlock, mountain hemlock, western redcedar, and yellow-cedar are commonly present in the understory. The understory vegetation includes ericaceous evergreen shrubs, graminoids (typically sedges), few herbs, and the predominance of bryophytes (typically *Sphagnum* mosses). The associated soils are of the Organic soil order (Fibrisols, Mesisols and Humisols), or occasionally Gleysols, with Hydromor, Fibrimor, or Mesimor humus forms.

Reference

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