

ALPINE PLANT COMMUNITIES OF BRITISH COLUMBIA AND THEIR OCCURRENCE IN EXISTING OR PROPOSED ECOLOGICAL RESERVES

by
George W. Douglas
Douglas Ecological Consultants Ltd.
2049 Crescent Road
Victoria, B.C. V8S 2G9
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Alpine vegetation in British Columbia has received little attention from scientists and land managers. Unfortunately, most of the work that has been done remains unpublished and generally unavailable in thesis or report form. In some instances (i.e., Brink 1959, 1964; McLean 1970; Welsh and Rigby 1971; van Ryswyk and Okazaki 1979; and others), even though the authors spent time in the alpine zone and indicate in their papers that they are going to describe alpine plant communities or vegetation, no quantitative or qualitative data or specific plant communities are given. This makes it extremely difficult or often impossible to document the plant communities of an alpine area and therefore characterize general features such as wildlife, soils or mesoclimate.

This paper will review studies pertaining to plant communities in the alpine zone (or that area above trees or krummholz) of British Columbia and immediately adjacent regions (see Table 1). Studies in adjacent regions are included since more work has been conducted in the latter than inside British Columbia and since all the study areas are within several kilometers of the border most of the plant communities may be expected to occur within British Columbia. The occurrence of these plant communities in established or proposed ecological reserves is also documented (Table 1).

In southwestern British Columbia alpine vegetation studies have been conducted by Archer (1963) in Garibaldi Provincial Park, by Eady (1971) on Big White Mountain (Cascade Range) and by Douglas (1973) and Douglas and Bliss (1977) in the Skagit Range and Similkameen-Ashnola River drainages (Cascade Range). A small productivity study, involving four plant communities, was also done in the Garibaldi and Ashnola areas by Brink et al. (1972). Extensive work has also been carried out in the Cascade Range of adjacent Washington (Douglas and Ballard 1971; Douglas 1971, 1973; Douglas and Bliss 1977; Douglas and Taylor 1978).

The most intensively studied alpine region in Canada has been in the southern Rocky Mountains, especially in Alberta. Studies in British Columbia include the work of Kuchar (1978) in Yoho National Park. In adjacent Alberta numerous studies have been carried out in Banff National Park (Beder 1967, Bryant 1968, Bryant and Scheinberg 1970, Broad 1973, Knapik *et al.* 1973, Trottier 1972, and Waterton National Park (Kuchar 1973, Douglas *et al.* 1975). Ogilvie (1976) reviewed and summarized many of the alpine plant communities of the Rocky Mountains of Alberta. Farther north, in Jasper National Park, alpine vegetation studies have been conducted by Hrapko (1970), Kuchar (1975), Crack (1977) and Hrapko and La Roi (1978). In the northern Rocky Mountains of British Columbia wildlife, soils and related vegetation were studied in the alpine zone on Nevis Mountain by Brink et al. (1972), Luckhurst (1973) and Lord and Luckhurst (1974). Raup (1934), in a phytogeographic study of the Liard and Peace River regions, mentions a single alpine plant community from Mount Selwyn.

In northwestern British Columbia the only alpine vegetation studies are those of Pojar (1976) in the Spatsizi Plateau area and Douglas (1977, 1979, 1980a) in the Haines Road area (St. Elias Mountains). Douglas (1980b) has also carried out extensive alpine studies in the St. Elias Mountains of the adjacent Yukon Territory. In north-central British Columbia a small study was conducted by Polster (1975).

A second objective of this paper is to establish a framework for the future establishment of ecological reserves in British Columbia. The vast size and the markedly varying climate of the province results in a remarkably high diversity of alpine flora and fauna - a diversity that few other regions possess. After examination of the existing knowledge of the alpine flora and vegetation of the province, a physiographic framework has been constructed that includes at least the minimum variation of the alpine vegetation (Figure 1 - **unavailable for printing**). This physiographic framework subdivides the province into 14 major

alpine regions within which the vegetation varies to a degree which would be readily recognizable. This subdivision is a modification or further subdivision of the three major physiographic systems proposed by Holland (1964).

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TABLE 1. ALPINE ZONE PLANT COMMUNITIES: THEIR LOCATION, CHARACTERISTICS AND OCCURRENCE IN EXISTING OR PROPOSED ECOLOGICAL RESERVES

Plant community (association) ^{1,2/} with references to literature documentation (see Lit. Cited)	Location with respect to Regions (see map)	Existing representation	Proposed representation	Soil Type	Habitat	Remarks
<i>Anemone occidentalis</i> (24)	4			Cumulic Regosols	Snowbed	
<i>Anemone occidentalis</i> - <i>Carex nigricans</i> (27)*	4			Regosols	Snowbed	Rare
<i>Antennaria lanata</i> (2,9, 11, 17, 20, 24, 27)	2, 3, 4		ERA 280& 281	Regosols Brunisols	Snowbed	
<i>Antennaria lanata</i> - <i>Vaccinium scoparium</i> (20)	2			Regosols	Snowbed	More common in subalpine zone
<i>Arctostaphylos rubra</i> var. <i>alpina</i> (<i>A. alpina</i>)	10	ER 59	ERA 123			No information available
<i>Arctostaphylos uva-ursi</i> (9, 11, 17)	1, 2, 3, 4,7		ERA 203	Regosols	Dry, well drained ridges	Common in subalpine regions of northern B.C.

¹ In some instances it has been necessary to include more than one community name from the literature within a single community in this list. This is due to differences between workers with respect to the recognition or naming of plant communities or associations. A good example of this occurs in the work of Hrapko and La Roi (1978) where seven plant communities, with *Dryas octopetala* as part of the name, are presented. Since only a single, subjectively selected stand of each was quantitatively sampled it is therefore quite possible that their data merely reflects natural variation within the *Dryas octopetala* community rather than separate communities. Upon reviewing their quantitative data I find only two types (*Dryas octopetala* and *Dryas octopetala*-*Empetrum nigrum*) worthy of community status. It should be recognized, however, that widespread plant communities such as the *Dryas octopetala* do vary (often markedly) from northern to southern British Columbia. This variation will be included in the Ecological Reserve system if an example of the *Dryas octopetala* community is included in every established Ecological Reserve in each of the alpine zone regions within which it occurs.

² Nomenclature follows either Welsh (Flora of Alaska, 1974) or Hitchcock and Cronquist (Vascular Plants of the Pacific Northwest, 1973).

TABLE 1. (CONTINUED)

Plant community (association) with references to literature documentation (see Lit. Cited)	Location with respect to Regions (see map)	Existing representation	Proposed representation	Soil Type	Habitat	Remarks
<i>Betula glandulosa</i> (2, 12, 13, 15, 31, 32)	4, 10, 12, (13?)	ER 68	ERA 68 & 76	Regosols, Brunisols	Moderate to poorly drained slopes	Common in lower alpine subalpine zones of northern B.C
<i>Betula glandulosa</i> - <i>Vaccinium uliginosum</i> (29)	11			Regosols, Brunisols	Mesic lower alpine slopes	Similar to above community
<i>Betula glandulosa</i> - <i>Vaccinium vitis-idaea</i> (29)	11			Regosols, Brunisols	Mesic lower alpine slopes	Similar to above community
<i>Calamagrostis japonica</i> - <i>Hierochloe alpina</i> (5, 28)	11			Brunisols	Seepage sites	
<i>Calamagrostis purpurascens</i> (11, 15, 17)	2			Orthic Regosols, Brunisols	Dry south slopes high alpine	Rare
<i>Caltha leptosepala</i>	10		ERA 121			No information available
<i>Carex breweri</i> (11, 17, 20)	2			Regosols	Snowbed	Usually restricted in size
<i>Carex capitata</i> (11, 17)	2			Regosols, Brunisols	Snowbed	Often extensive
<i>Carex eleusinoides</i> (24, 27)	4			Rego Gleysols	Seepage sites	
<i>Carex nardina</i> (7, 8, 11, 17)	2,4,7 (3?)		ERA 226	Regosols	Dry south slopes, high alpine	
<i>Carex nigricans</i> (1, 2, 6, 9, 10, 11, 17, 20, 22, 23, 24,	1, 2, 4, 8, (3, 6, 9?) 27, 31, 35)	ER 46 & 64	ERA 76, 82, 121, 155, 188, 243, 280, 281, & 292	Regosols	Snowbed	Extremely common and widespread
<i>Carex phaeocephala</i> (11, 17, 19, 20)	1, 2, 7, 10		ERA 122, 202, & 203	Regosols	Dry south slopes	

TABLE 1. (CONTINUED)

Plant community (association) with references to literature documentation (see Lit. Cited)	Location with respect to Regions (see map)	Existing representation	Proposed representation	Soil Type	Habitat	Remarks
<i>Carex podocarpa</i>		ER 46	ERA 76 & 82	Regosols, Brunisols		No information available
<i>Carex scirpoidea</i> var. <i>pseudoscirpoidea</i> (11, 17)	2			Regosols, Brunisols	Dry south slopes	Often extensive
<i>Carex spectabilis</i> (11, 17, 19, 20)	1, 2, 7 (6?)		ERA 226	Brunisols	Mesic to dry slopes	
<i>Cassiope mertensiana</i> (6, 11, 17, 19, 22, 23, 27, 37)	1, 7, 8, 12, (6?)	ER 46, 59 & 64	ERA 82, 121, 122, 123, & 155	Brunisols, Podsoles	Mesic slopes	See other closely related heath types, common in subalpine zone
<i>Cassiope mertensiana</i> - <i>Luetkea pectinata</i> (32)	10	ER 68		Brunisols, Podsoles	Snowbed	
<i>Cassiope stelleriana</i> (12, 13, 15)	10, 12, (9, 13?)		ERA 122 & 288	Regosols	Snowbed	Often associated with earth or frost hummocks
<i>Cassiope tetragona</i> (2, 9, 15, 22, 23, 27,32, 36)	4, 8, 10, 12, 13, 14	ER 46	ERA 68 & 142	Brunisols	Moist to mesic north and east slopes	
<i>Cetraria nivalis</i> (15)	12			Regosols	Dry, rocky ridges, high alpine	
<i>Cetraria nivalis</i> - <i>C. cucullata</i>	7	ER 70	ERA 155 & 226	Regosols	Dry rocky ridges high alpine	Similar to above community
<i>Cetraria nivalis</i> - <i>Dryas octopetala</i>	8, 13		ERA 68 & 82	Regosols	Dry rocky ridges high alpine	Similar to above community
<i>Cladina alpestris</i> (12, 13)	12			Regosols	Dry exposed slopes	
<i>Danthonia intermedia</i> (11, 17, 27,35)	2, 4 (3?)			Brunisols	Mesic slopes, lower alpine	Often extensive
<i>Dryas integrifolia</i> (32, 33)	7, 8, 10, 12, 13, 14 (11?)	ER 46, 68 & 70	ERA 142, 288 & 297	Regosols, Brunisols	Exposed ridges, high alpine	

TABLE 1. (CONTINUED)

Plant community (association) with references to literature documentation (see Lit. Cited)	Location with respect to Regions (see map)	Existing representation	Proposed representation	Soil Type	Habitat	Remarks
<i>Dryas integrifolia</i> - <i>Festuca scabrella</i> (28)	11			Brunisols	Exposed slopes	
<i>Dryas octopetala</i> (<i>D. hookeriana</i>)(2, 7, 8, 9, 11, 12, 13, 15, 17, 18, 22, 23, 24, 27, 36, 31)	2, 4, 7, 8, 11,12,13 (3, 10?)	ER 46 & 64	ERA 68, 76, 82, 243, 288	Regosols, Brunisols	Exposed slopes	Widespread in B.C.
<i>Dryas octopetala</i> - <i>Carex scirpoidea</i> (24)	4			Regosols, Brunisols	Exposed ridges	Similar to above community
<i>Dryas octopetala</i> - <i>Empetrum nigrum</i> (6, 22, 23)	4, 8			Brunisols	Mesic slopes	
<i>Elymus innovatus</i> (2, 31)	4			Brunisols	Mesic slopes	
<i>Elymus innovatus</i> - <i>Agropyron subsecundum</i> (5, 28)	11			Brunisols	Steep south slopes	
<i>Elymus innovatus</i> - <i>Festuca scabrella</i> (5, 28)	11			Brunisols	Steep south slopes	
<i>Empetrum nigrum</i> (11, 12, 13, 15, 17)	1, 7, 12		ERA 226	Brunisols	Mesic slopes	More common in subalpine zone in northern B.C
<i>Eriophorum scheuchzeri</i> (24, 27)	4			Gleysols	Seepage sites	
<i>Eriophorum angustifolium</i> (24, 27)	4			Gleysols	Seepage sites	
<i>Festuca altaica</i> (14, 15, 32, 34, 37)	7, 10, 12, 14 (13?)	ER 64	ERA 127, 154, 155, 195, 202, 288, & 297	Brunisols	Mesic slope	Often extensive
<i>Festuca scabrella</i> - <i>Dryas integrifolia</i> (28)	11			Humisols	Steep south slopes	
<i>Juncus parryi</i> (20)	2	ER 34(?)		Brunisols	Snowbed	
<i>Juniperus communis</i> (20)	2, 14	ER 34(?)	ERA 229	Regosols	South slopes	
<i>Kobresia myosuroides</i> (2, 9, 11, 15, 17, 22, 23, 24, 31, 32, 36)	2, 4, 7, 8, 10 12, (3, 13?)	ER 68	ERA 203	Regosols, Brunisols	Exposed upper ridges and slopes	Widespread

TABLE 1. (CONTINUED)

Plant community (association) with references to literature documentation (see Lit. Cited)	Location with respect to Regions (see map)	Existing representation	Proposed representation	Soil Type	Habitat	Remarks
<i>Loiseleuria procumbens</i>	13		ERA 68			No information available
<i>Luetkea pectinata</i> (1, 12, 13, 14, 15, 27)	1, 4, 7, 12, (6, 9?)		ERA 155	Regosols	Snowbed	
<i>Luetkea pectinata</i> - <i>Cassiope stelleriana</i>		13	ERA 68	Regosols	Snowbed	Similar to above community
<i>Lupinus arcticus</i> (=L. <i>latifolius</i> var. <i>subalpinus</i>) (11, 17, 19)	1, 2		Brunisols	Mesic well-drained south slopes, low alpine	Common in subalpine zone	
"Lush meadow" types including such species combinations as <i>Erigeron peregrinus</i> , <i>Heracleum lanatum</i> , <i>Lupinus arcticus</i> , <i>Senecio triangularis</i> , <i>Valeriana sitchensis</i> , & <i>Veratrum viride</i> (12, 13, 14, 15, 27)	2, 4, 7, 10, 12, (3, 13?)	ER 64	ERA 121, 280 & 281	Brunisols	Moist snow flush and well-drained depressions	Also common in the subalpine zone and on avalanche tracks in the montane zone
<i>Luzula piperi</i> (=L. <i>wahlenbergii</i>) (12, 13, 15)	2, 7, 12		ERA 203, 280, & 281	Regosols	Wet scree slopes (snowbed)	Rare, similar to the <i>Saxifraga tolmii</i> - <i>Luzula piperi</i> community in southern B.C.
<i>Phyllodoce empetrifomis</i> (5,6,10,11,15,16,17,20,36)	1, 2, 4, 12		ERA 68(3, 6, 9, 13?)	Podsols	Mesic slopes	Often extensive
<i>Phyllodoce empetrifomis</i> - <i>Cassiope mertensiana</i>	1, 2, 8, 11	ER 2, 34 & 39	ERA 76	Podsols	Mesic slopes	Similar to above community
<i>Phyllodoce glanduliflora</i> (5,6, 10, 11, 15, 16, 17, 20, 36)	1, 2, 4, 12			Podsols, Brunisols	Mesic slopes	
<i>Phyllodoce glanduliflora</i> - <i>Cassiope mertensiana</i>	7		ERA 153 & 188			No information available
<i>Phyllodoce glanduliflora</i> - <i>P. empetrifomis</i>	3, 7	ER 31 & 70	ERA 202	Podsols	Mesic slope	

TABLE 1. (CONTINUED)

Plant community (association) with references to literature documentation (see Lit. Cited)	Location with respect to Regions (see map)	Existing representation	Proposed representation	Soil Type	Habitat	Remarks
<i>Poa rupicola</i> (14, 15, 32)	10, 12 (13?)	ER 68		Regosols	Ridgetops, high alpine	Rare and small
<i>Salix arctica</i> (2, 9, 15, 22, 23, 36)	4, 7, 8, 11, 12	ER 46	ERA 76 & 82	Regosols	Moist slopes	
<i>Salix arctica</i> - <i>Antennaria lanata</i> (22, 23)	8			Regosols	Moist depression, snowbed	
<i>Salix barclayi</i> (12, 13, 15)	12			Brunisols	Moist slopes	
<i>Salix barrattiana</i> (2, 6, 9, 24, 27, 31, 32, 26)	4, 8, 10, 11, 14	ER 46	ERA 76, 82, & 297	Regosols	Drainage channels	
<i>Salix cascadiensis</i> (11, 17, 19, 20)	1, 2		ERA 280	Regosols	Level to moderate- ly steep slopes, often snowbed sites	
<i>Salix glauca</i> (2, 9, 12, 13, 15, 31, 36)	4, 12			Brunisols	Mesic slopes	
<i>Salix nivalis</i> (9, 11, 17, 24, 27, 36)	1, 2, 4, 7, (3?)	ER 70	ERA 202,226, 280 & 281	Regosols	Exposed level to moderately steep slopes	
<i>Salix nivalis</i> - <i>S. arctica</i> (31)	4			Brunisols	Snowbed	
<i>Salix polaris</i> (12, 13, 14, 15, 32)	7, 10, 12		ERA 203	Regosols	Snowbed	
<i>Salix reticulata</i> (12, 13, 14, 15, 32, 33)	7, 8, 10, 11, 12, 13	ER 46 & 59	ERA 68, 82, 123, 124, 195 & 202	Regosols	Snowbed	Snowmelt is earlier than in above community
<i>Salix reticulara</i> - <i>S. polaris</i>	7, 11, 14	ER 64	ERA 76 & 297	Regosols	Snowbed	Intermediate between

TABLE 1. (CONTINUED)

Plant community (association) with references to literature documentation (see Lit. Cited)	Location with respect to Regions (see map)	Existing representation	Proposed representation	Soil Type	Habitat	Remarks
<i>Saxifraga lyallii</i> (24, 27)	4			Regosols, Brunisols	Snowbed	above two communities
<i>Saxifraga oppositifolia</i>	14		ERA 229			No information available
<i>Saxifraga tolmiei</i> - <i>Luzula piperi</i> (10, 11, 17, 19)	1			Regosols	Snowbed	
<i>Sibbaldia procumbens</i>	7		ERA 203	Regosols	Snowbed	
<i>Vaccinium uliginosum</i> (14,15)	12, 13		ERA 68	Regosols	Mesic slopes	