

Accessory publication**Spatial variation of trends in wildfire and summer drought in British Columbia, Canada, 1920–2000**

Andrea Meyn^{A,E}, Sebastian Schmidlein^B, Stephen W. Taylor^C, Martin P. Girardin^D, Kirsten Thonicke^A, Wolfgang Cramer^A

^AEarth System Analysis, Potsdam Institute for Climate Impact Research (PIK) e.V., Telegraphenberg A62, PO Box 60 12 03, D-14412 Potsdam, Germany.

^BDepartment of Geography, University of Bonn, D-53115 Bonn, Germany.

^CNatural Resources Canada, Canadian Forest Service, Pacific Forestry Centre. 506 West Burnside Road. Victoria, BC, V8Z 1M5, Canada.

^DNatural Resources Canada, Canadian Forest Service, Laurentian Forestry Centre, 1055 du P.E.P.S., PO Box 10380, Stn. Sainte-Foy, Quebec, QC, G1V 4C7, Canada.

^ECorresponding author. Email: andrea.meyn@pik-potsdam.de

The biogeoclimatic zones of British Columbia (BC), Canada

For detailed information on the biogeoclimatic ecosystem classification system and its zones please refer to <http://www.for.gov.bc.ca/HRE/becweb/system/index.html> and to Meidinger and Pojar (1991).

Alpine ecosystems: BAFA, CMA, IMA

The ecosystems with the harshest climate in BC (low temperatures for most of the year, much wind and snow, short growing-season) are above the tree line and are dominated by alpine tundra vegetation (where vegetation is present) in the **Coastal Mountain-heather Alpine (CMA)**, the **Interior Mountain-heather Alpine (IMA)** and **Boreal Altai Fescue Alpine (BAFA)** zones. The **CMA**, is found on the windward ridge of the Coast Mountains, and in the mountains of Vancouver Island and the Queen Charlotte Islands. There is a very deep winter snowpack which persists into summer months which contributes to a lower treeline than would be expected from the mean annual temperature. Both winter and summer temperatures are tempered by maritime air masses. Approximately 45% of the CMA is covered by permanent ice and snow (Table 1).

The **IMA** is located on the leeward side of the Coast and Cascade Mountains and in the mountains of south-eastern BC (the Cariboo, Monashee, Selkirk, and Purcell Ranges, and the southern Rocky Mountains). It is the smallest of the three alpine zones and has the warmest summers. The **BAFA** is the largest of the three alpine zones and occupies the alpine elevations on the leeward side of the northern third of the Coast Mountains as well as the mountains of the northern two-thirds of the province (the

Cassiar, Omineca and northern Rocky Mountains). It has long and very cold winters, a light snowpack and short, cool summers with very long daylight.

BC Ministry of Forests – Research Branch (2006) Brochure 83 – The ecology of the Alpine Zones, Victoria, BC, Canada

Subalpine forests: MH, ESSF and SWB

The **Mountain Hemlock Zone (MH)** comprises BC's coastal subalpine elevations. It occurs between the dense forests of the Coastal Western hemlock zone and the treeless Coastal Mountain-heather Alpine zone. The MH has a climate characteristic for maritime mountains: summers are short and cool, and winters are long, cool and wet. It is BC's wettest ecological zone with up to 5000-mm annual precipitation (~70% of it falling as snow). While the lower part of the MH is dominated by dense, closed-canopy forests, these thin out to open parkland, heath and meadow at higher elevations.

BC Ministry of Forests – Research Branch (1997) Brochure 51 – The ecology of the Mountain Hemlock Zone, Victoria, BC, Canada

The **Engelmann Spruce–Subalpine Fir Zone (ESSF)** covers the uppermost forested elevations in the southern three-quarters of BC framing the Interior Plateau. Elevationally, the ESSF usually occurs above the Interior Cedar–Hemlock (ICH), Montane Spruce (MS), or Sub-Boreal Spruce (SBS) zones. Long, cold winters with deep snow cover (>3 m), and short, cool summers with a short growing-season are characteristic for the climate of this zone. Forests dominated by Engelmann spruce and subalpine fir occupy lower and middle elevations while the higher elevations of this zone are covered by subalpine parklands (islands of tree in areas covered by heath, meadow and grassland). On drier or recently burned sites, forest stands are often dominated by lodgepole pine.

BC Ministry of Forests – Research Branch (1998) Brochure 55 – The ecology of the Engelmann Spruce–Subalpine Fir Zone, Victoria, BC, Canada.

The **Spruce–Willow–Birch Zone (SWB)** covers subalpine elevations in the northern third of British Columbia's interior. The SWB generally occupies the subalpine elevations above the Boreal White and Black Spruce zone (BWBS). With long and cold, snowy winters, and short and cool summers it has the harshest climate of all forested zones in BC. The sparse forest cover is mainly dominated by coniferous species, although trembling aspen is found on warmer slopes. Deciduous shrubs, especially birch and several willow species, and grasses are other dominant vegetation types in this zone.

BC Ministry of Forests – Research Branch (1998) Brochure 61 – The ecology of the Spruce–Willow–Birch Zone, Victoria, BC, Canada.

Boreal forest: BWBS and SBS

The **Boreal White and Black Spruce Zone (BWBS)** is the largest BEC zone in B.C. and occupies that portion of the Alberta Plateau which extends into north-eastern BC lying east of the continental divide (Rocky Mountains) as well as lower elevations in the central north, and west to the Coast and

St. Elias Mountains. Subalpine elevations above the BWBS are occupied by the Spruce–Willow–Birch zone (SWB), and in the southern part of the BWBS by the Engelmann Spruce–Subalpine Fir zone. The climate of the BWBS is characterised by long and extremely cold winters and a short but warm growing season with relatively little precipitation and the thinnest snow cover of all northern zones. The two dominant vegetation types in the BWBS are coniferous forest on upland sites and well drained soils, and wetlands on the poorly drained lowlands.

BC Ministry of Forests – Research Branch (1996) Brochure 49 – The ecology of the Boreal White and Black Spruce Zone, Victoria, BC, Canada.

The **Sub-Boreal Spruce zone (SBS)** extends across the gently rolling terrain of BC's vast interior plateau. It usually occurs from the valley bottoms to 1100–1300-m elevation. The subalpine elevations above the SBS are occupied by the Engelmann Spruce–Subalpine Fir zone (ESSF). Climate in the SBS is continental with short, warm and moist summers and cold sometimes severe winters with a deep snow pack. The vegetation is dominated by dense, highly productive coniferous forests. The flat plateaus of the SBS contain wetland ecosystems such as marshes, fens and swamps as well as floodplains. The latter are due to the low gradient of the rivers and streams that drain the Interior Plateau.

BC Ministry of Forests – Research Branch (1998) Brochure 53 – The ecology of the Sub-Boreal Spruce Zone, Victoria, BC, Canada.

Montane forests: IDF, SBPS, MS, ICH

The Interior Douglas-fir Zone (IDF) occurs at low- to mid-elevations in southern interior BC, with a focus on the southern part of the Interior Plateau. Elevationally, it usually occurs below the Montane Spruce zone and – in deep enough valleys – above the Ponderosa Pine zone. The IDF has short, warm and dry summers and cool winters. Due to its location in the rain shadow of the Coast, Cascade and Columbia mountains, moisture is limited. Vegetation is diverse comprising Douglas-fir dominated forests with a grassy understorey as dominant vegetation type, grassland and open ponderosa pine forests on drier and hotter sites, dense spruce forests on wetter, cooler sites, and lodgepole pine stands at higher elevations or on recently burned sites.

BC Ministry of Forests – Research Branch (1998) Brochure 47 – The ecology of the Interior Douglas-fir Zone, Victoria, BC, Canada

The **Sub-Boreal Pine–Spruce Zone (SBPS)** occurs on the high, gently rolling terrain of the Fraser Plateau and the southernmost Nechako Plateau in central interior BC and extends on the leeward slopes of the Coast Mountains. It occurs at elevations from 850 to 1300 m (up to 1500 m in its southern and western part). Elevationally, the SBPS occurs above the Interior Douglas-fir zone (IDF) and below the Montane Spruce (MS), Sub-Boreal Spruce (SBS), and Engelmann Spruce–Subalpine Fir (ESSF) zones. Due to its location in the rain shadow of the Coast Mountains, the SBPS has dry winters and dry summer (mean annual precipitation 335–580 mm), making moisture a principal factor

that limits plant growth. Due to its relatively high elevation the SBPS has cold winters and cool summers. Thus tree growth is slow and plants able to tolerate frequent frosts and drought are abundant. Lodgepole pine forests and wetlands are the two main ecosystems in this zone.

BC Ministry of Forests – Research Branch (1998) Brochure 59 – The ecology of the Sub-Boreal Pine–Spruce Zone, Victoria, BC, Canada.

The **Montane Spruce Zone (MS)** occupies middle elevations in the southern half of interior BC. Elevationally it occurs above the Interior Douglas-fir (IDF) or Sub-Boreal Pine–Spruce (SBPS) zones, and below the Engelmann Spruce–Subalpine Fir zone (ESSF). Due to its location on the lee side of the Coast Mountains and its elevation it has a cool, continental climate with cold winters and moderately short, warm summers. Vegetation is dominated by coniferous forests. Spruce and subalpine fir dominate mature stands while young and maturing seral stands that regenerated after fire are dominated by lodgepole pine.

Hope, G.D., W.R. Mitchell, D.A. Lloyd, W.L. Harper, and B.M. Wikeem (1991) Montane Spruce Zone. In 'Ecosystems of British Columbia'. (Eds D Meidinger, J Pojar) pp. 183–194. BC Ministry of Forests Special Report Series 6.

The **Interior Cedar–Hemlock Zone (ICH)** occurs at low- to mid-elevations below the Engelmann Spruce–Subalpine Fir zone (ESSF) in south-east and north-west BC. In south-eastern BC the ICH occupies the lower slopes of the Columbia and Rocky Mountains and in the north-west it occupies the Nass River basin. The ICH has long, warm summers and cool, wet winters due to predominantly easterly flowing air masses resulting in warm moist conditions in its south-eastern and cooler and wetter conditions in its north-western part.

The coniferous forests – the dominant vegetation type of the ICH – are the most productive of BC's Interior, and the ICH zone has the highest tree species diversity of any of the BEC zones.

BC Ministry of Forests – Research Branch (1996) Brochure 48 – The ecology of the Interior Cedar–Hemlock Zone, Victoria, BC, Canada

Cold steppe and savannah ecosystems: BG and PP

The **Bunchgrass Zone (BG)** occurs in the valley bottoms and up to ~900 m on the slopes of the major river valleys of the Okanagan, Thompson, and Fraser rivers in southern interior BC. It is the warmest and driest zone (areas with less than 250-mm annual precipitation) and includes the northern extent of the Sonoran Desert. Summers are warm to hot and winters are moderately cold. Precipitation peaks in winter and June but is, altogether, low. Vegetation is dominated by grasses since most upland sites are too dry in summer to support tree growth, while drought-tolerant shrubs and forbs are frequent.

BC Ministry of Forests – Research Branch (1998) Brochure 54 – The ecology of the Bunchgrass Zone, Victoria, BC, Canada

The **Ponderosa Pine Zone (PP)** occupies low elevations along the very dry valleys in southern interior BC. Elevationally, it usually occurs above the Bunchgrass and below the Interior Douglas-fir zones. The PP is the driest forested BEC zone in BC, with warm summers, a long growing season and little precipitation that primarily falls in winter. A mosaic of ponderosa pine forests and grassland with open, park-like stands is characteristic of this zone.

BC Ministry of Forests – Research Branch (1998) Brochure 60 – The ecology of the Ponderosa Pine Zone, Victoria, BC, Canada

Pacific coastal forests: CWH and CDF

The **coastal Douglas-Fir Zone (CDF)** occupies the lower elevations of BC's south coast in the rainshadow of the Vancouver Island and Olympic mountains. With its long dry and warm summers, and mild wet winters it has a Mediterranean-like climate. It is the smallest BEC zone and has been most developed. The majority of today's forests have regenerated after logging; less than 1% of old-growth forest remains in this zone. On upland sites, forests are dominated by the coastal variety of Douglas-fir. Depending on soil moisture and nutrient regime, Douglas-fir is frequently accompanied by western redcedar, grand fir, arbutus, Garry oak and red alder.

BC Ministry of Forests Forests – Research Branch (1999) Brochure 30 – The ecology of the Coastal–Douglas-Fir Zone, Victoria, BC, Canada.

The **Coastal Western Hemlock Zone (CWH)** occupies most lower elevations on the windward side of the Coast Mountains extending east of the Coast Mountains along major river valleys below the Mountain Hemlock zone (MH). The CWH zone experiences one of the wettest climates in Canada, with cool summers and mild winters due to the moderating maritime influences of the Pacific Ocean. The dominant vegetation type is coniferous forest that is often called 'temperate rainforest' and is Canada's most productive forest.

BC Ministry of Forests – Research Branch (1999) Brochure 31 – The ecology of the Coastal Western Hemlock Zone, Victoria, BC, Canada

References

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