

Figure 6-3 Diagrammatic representation of Raunkiaer's life forms. Unshaded parts of the plant die back during unfavorable seasons, while the solid black portions persist and give rise to the following year's growth. Proceeding from left to right, the buds are progressively better protected (after Raunkiaer 1937).

conditions (Raunkiaer 1934). He distinguished five principal life forms (Figure 6-3):

phanerophytes (from the Greek *phaneros*, visible) carry their buds on the tips of branches, exposed to extremes of climate. Most trees and large shrubs are phanerophytes. As one might expect, this plant form dominates in moist, warm environments where buds require little protection.

chamaephytes (from the Greek *chamai*, on the ground, dwarf) comprise small shrubs and herbs which grow close to the ground (prostrate life form). Proximity to the soil protects the bud. In regions of heavy snowfall, the buds are protected beneath the snow from extreme air temperatures. Chamaephytes are most frequent in cool, dry climates.

hemicryptophytes (from the Greek *kryptos*, hidden) persist through the extreme environmental conditions of the winter months by dying back to ground level where the regenerating bud is protected by soil and withered leaves. This growth form is characteristic of cold, moist zones.

cryptophytes are further protected from freezing and desiccation by having their buds completely buried beneath the soil. The bulbs of irises and

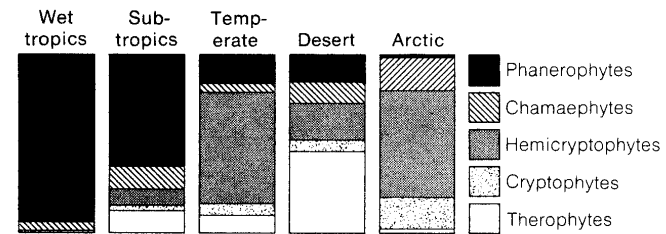


Figure 6-4 Proportion of plant life forms, classified according to Raunkiaer (1934, 1937), in various climatic regions (after compilations of Richards 1952, Dansereau 1957, Daubenmire 1968).

daffodils are representative of the regenerating buds of cryptophyte plants. Like hemicryptophytes, cryptophytes are also found in cold, moist climates.

therophytes (from the Greek *theros*, summer) die during the unfavorable season of the year and do not have persistent buds. Therophytes are regenerated solely by seeds, which resist extreme cold and drought. The therophyte form includes most annual plants and occurs most abundantly in deserts and grasslands.

The proportional occurrence of Raunkiaer's life forms in the floras of various climatic regions is summarized in Figure 6-4. Life form and climate go closely together. Phanerophytes dominate vegetation forms in warm, moist environments. They are progressively replaced by chamaephytes, hemicryptophytes, and cryptophytes in temperate and arctic regions. Deserts are distinctive in having a large proportion of therophytes.

Macro and Mesoscale Factors Controlling Alpine Vegetation

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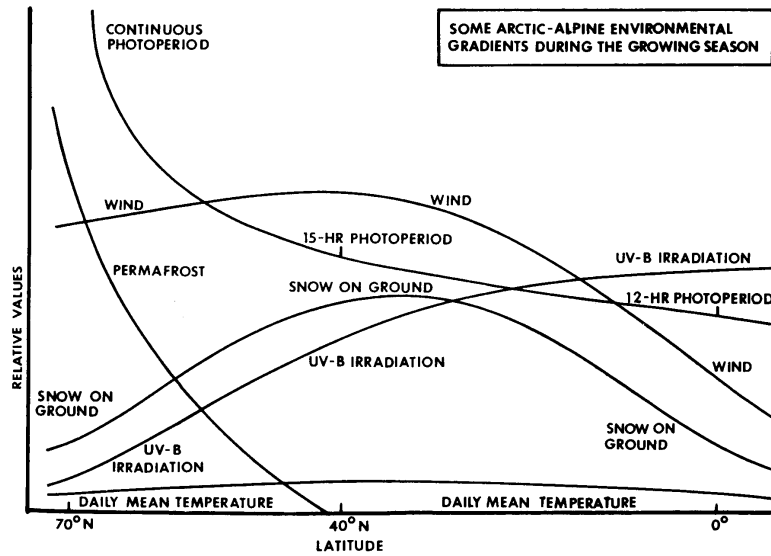


Figure 13.1. Relative values for six principal environmental factors in arctic and alpine ecosystems along a latitudinal gradient from the equator to the Arctic. The factor that changes the least along the gradient is daily mean air temperature. Factor combinations differ considerably at any given latitude (from Billings 1979).

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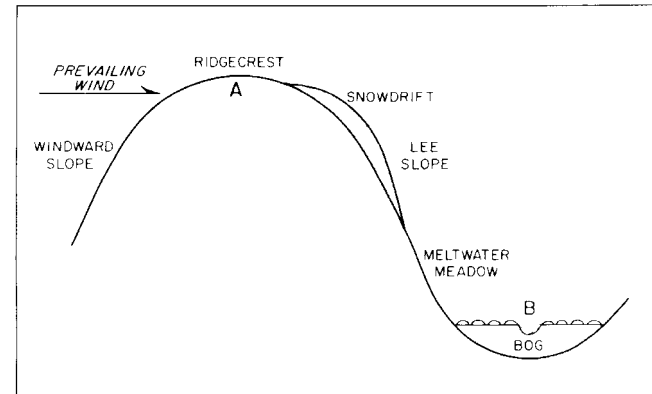


Figure 13.4. Diagram of a typical alpine mesotopographic gradient (adapted from Billings 1973).

From: "Alpine Vegetation," by W.D. Billings (Chapt 13, in: M.G. Barbour & W.D. Billings. *North American Terrestrial Vegetation*. Cambridge Univ Press.)

Treeline vs. Latitude

Rocky Mountains:

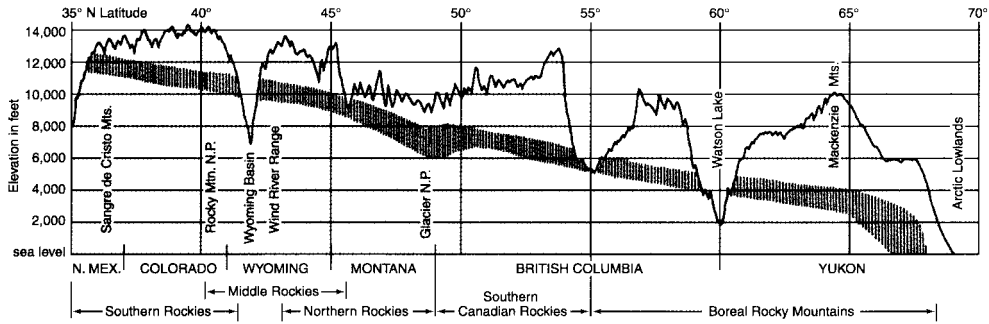


Figure 2-5. Graph showing the relationship between timberline (shaded area), the alpine zone, and latitude in the Rocky Mountains.

From: "Song of the Alpine," by Joyce Gellhorn (2002, Johnson Books, Boulder)

Global:

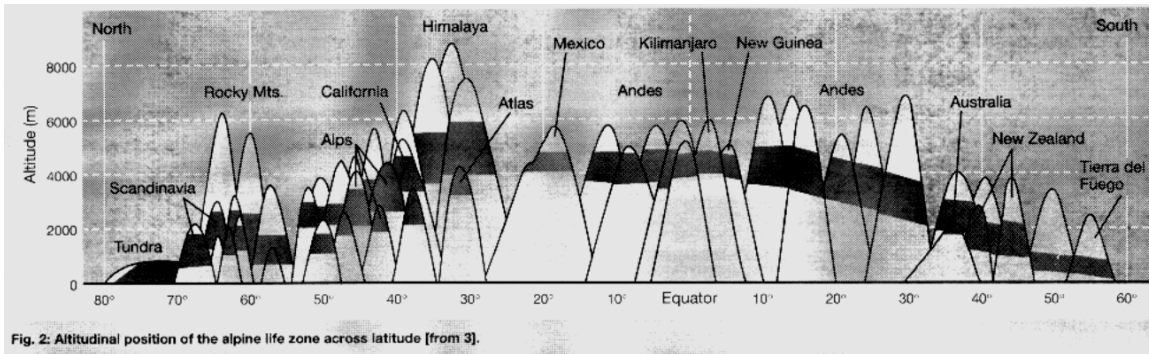


Fig. 2: Altitudinal position of the alpine life zone across latitude [from 3].

From: "The Ecology of Alpine Streams," by J.V. Ward (2001, *EAWAG News*, 54:3-5)

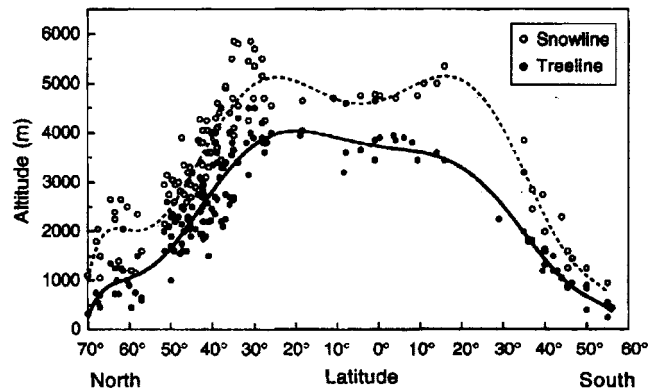


Fig. 1 The latitudinal position of treeline and snowline taken from a worldwide survey by Hermes (1955), supplemented by data from various other sources

From: "A Re-assessment of high elevation treeline position and their explanation," by C. Körner (1988, *Oecologia* 115:445-459)